

Wildlife Crime

A guide to the use of forensic and specialist techniques in the investigation of wildlife crime







PARTNERSHIP FOR ACTION AGAINST wildlife crime

FWG
Paw Forensic Working Group
www.pawfwg.org

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A guide to the use of forensic and specialist techniques in the investigation of wildlife crime

Produced 2014 by the Forensic Working Group (FWG), part of the Partnership for Action against Wildlife Crime (PAW). The Forensic Working Group aims to investigate and promote the practical application of forensic and specialist techniques in the investigation of wildlife crime.

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Further copies are available from the FWG – see Appendix A.

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Foreword

Crimes against wildlife encompass a wide range of offences, from the illegal trade in endangered plant and animal species to the persecution of birds of prey or the cruelty inflicted on some wild animals for sport. The investigation of wildlife crime has developed significantly in recent years with the setting of national wildlife crime priorities and the establishment of the National Wildlife Crime Unit (NWCU), which operates across the UK.

Combating wildlife crime is essential to preserve our natural heritage, and it threatens to tarnish Scotland's hard won reputation as a nation that cares about our natural heritage, and yet the investigation of these offences is complicated by remote locations and a lack of eye-witness evidence. Enforcement officers are increasingly turning to wildlife forensic science to answer investigative questions, and this field is constantly developing to provide new tools. This second edition of the wildlife crime forensic guide is an invaluable resource which introduces specialist wildlife forensic techniques, and illustrates how more traditional methods can be used. The guide has been substantially updated to reflect technological developments and new casework examples. Although written primarily for enforcement within the domestic context, many of the methods discussed will be of interest at an international level.

This guide was put together by the Partnership for Action against Wildlife Crime (PAW) Forensic Working Group. Particular thanks go to RSPB Senior Investigations Officer Guy Shorrock who has yet again taken the lead to update this important resource for wildlife crime investigators.

The uptake of wildlife forensic testing in Scotland and the wider UK has increased with the improved financial support through schemes like the PAW Forensic Analysis Fund. In Scotland we have recognised the increasing value of forensic testing for wildlife crime. In addition to Scottish Government funded pathology work for wildlife crime cases in Scotland, we have also provided free wildlife DNA forensic testing by the Science and Advice for Scottish Agriculture (SASA). Consequently, I was delighted to launch this valuable publication at the Scottish Wildlife Crime Conference in April 2014.

Mr Paul Wheelhouse, MSP, Minister for Environment and Climate Change, Scottish Government

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Chapter 1 Introduction

1.1 Background

This guide aims to be a handbook that will inform enforcement officers involved in wildlife crime investigation about specialist forensic techniques. Whilst the guide is written from the perspective of law enforcement in the UK, many of the described techniques will be applicable to wildlife crime investigation at an international level. All statutory agencies should ensure that they adhere to their own guidance and standards in relation to the collecting and handling of evidence and that any forensic methodology used will stand scrutiny under their legal process. In the UK, the Association of Chief Police Officers (ACPO –covering England, Wales and Northern Ireland) and ACPOS in Scotland have issued a number of guidance documents for police forces. Some of those relevant to UK wildlife crime investigation are listed at Appendix A.

The UK has a number of European and international enforcement obligations relating to wildlife crime. There has been a range of work and initiatives to improve the way these offences are investigated. The UK Police Wildlife Crime Officers' (WCO) network was initiated in the 1980's and seeks to provide police officers within forces with a better understanding of wildlife legislation to deal with reported incidents. A number of UK police forces have full time WCOs.

The UK Customs CITES (Convention on International Trade in Endangered Species) Enforcement Team was formed in 1992, and provides national assistance on all aspect of CITES controls and intelligence exchange. The team has developed extensive experience in this area of work and also assists with international training on CITES enforcement.

In 1995, the UK Partnership for Action against Wildlife Crime (PAW) was established. PAW UK's Steering Group sets the overarching objectives for tackling wildlife crime. The Steering Group is jointly chaired by the Head of Department of the Environment, Food and Rural affairs (Defra) Wildlife Species Conservation Division, and the Rural and Wildlife Crime Advisor to ACPO. PAW aims to reduce wildlife crime through effective and targeted enforcement, better regulation and improved awareness. PAW UK brings together the organisations involved in wildlife law enforcement, to make sure that their skills, experience and specialist knowledge are pooled (www.defra.gov.uk/paw). PAW UKs overarching objectives are:

- To facilitate effective enforcement to ensure that wildlife crime is tackled professionally;
- To influence the improvement of wildlife enforcement legislation; and
- To raise awareness of wildlife legislation and the implications of wildlife crime.

The establishment of the National Wildlife Crime Unit (NWCU) in 2006 to support the Police Wildlife Crime Officer's (WCO) network and other government agencies has improved the investigation of many areas of wildlife crime. Since its launch, the NWCU has carried out annual strategic assessments of criminality affecting UK wildlife. These assessments have been produced to inform the UK Strategic Tasking and Coordinating Group (UK TCG) meeting, from which decisions on forthcoming priorities and intelligence requirements are made. The response to the crime threats aims to be evidence based and seeks to be centred on prevention, enforcement and intelligence gathering to wholly understand each issue. There is a strong focus on the act of criminality and its impact upon wildlife. This process has included the setting of UK Wildlife Crime Priorities; these are set every two years by the UK Tasking and Coordinating Group.

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1.2 The PAW Forensic Working Group (FWG)

The application of modern technology to combat wildlife crime has been a rapid growth area. Forensic techniques are increasingly being applied and are often essential in proving beyond reasonable doubt that particular offences were, or were not committed.

In the UK, the PAW Forensic Working Group (FWG) aims to harness these technologies and apply them for use in countering wildlife crime. It keeps abreast of developments in this area and works to provide tools to assist enforcers in their investigations and advises on how forensic techniques used in other situations might be applied to wildlife investigations.

The FWG has been in existence since 1996 and its membership is made up of representatives from UK government departments, police, UK Border Force (UKBF), forensic laboratories and non-governmental organisations. FWG members are listed in the acknowledgements at the rear of this guide. The FWG has produced information about a number of tools and resources to assist law enforcement in combating wildlife crime, including summaries of current tests available, a record of wildlife cases using DNA and forensic evidence and information about an innovative funding mechanism, the Forensic Analysis Fund.

The Forensic Analysis Fund (FAF) offers financial support to police and customs officers seeking to carry out forensic analysis during a wildlife crime investigation. The fund has been established to encourage the use of forensic techniques to help solve wildlife crimes. WWF, TRACE, RSPB and Defra have all financially contributed to the scheme. Forensic analysis up to £300 may be fully funded; above this the scheme can provide match funding of up to 50% of the total cost of the analysis. Many wildlife cases which make use of forensic analysis would otherwise have failed to reach prosecution stage. Founded in 2008, the scheme has already provided money to help support a number of cases including DNA sampling of rhino horn to establish which species and individual the horn belonged to; handwriting analysis of falsified birds' egg data cards; radiocarbon dating to determine the age of elephant ivory being sold on eBay; and taxidermy examination of mounted birds of prey to ascertain cause of death. More information about the FWG can be found at Appendix A and at www.pawfwg.org.

This DNA sampling kit was put together by the Forensic Working Group to assist with the taking of samples during wildlife crime investigations.

1.3 The value of forensic and specialist techniques

The term 'forensic' refers to the use of science or technology in the investigation and establishment of facts or evidence in a court of law. The use of a range of forensic methods to tackle crime has become increasingly commonplace and the techniques available continue to grow more sophisticated. For example, advances in DNA technology in the last two decades have revolutionised the investigation of many offences. The use of these methods also has direct application to many wildlife related offences. Evidentially, there is no reason why a badger digging incident, or the placing of poisoned bait in the countryside, should be treated any differently than a burglary crime scene. Many of the standard techniques, with which enforcement agencies are familiar, can be readily utilised to investigate wildlife crime. However, the wildlife crime investigator often faces a number of additional problems. The legislation is often complex and may only apply to certain species in certain situations.

The investigation of any offence typically seeks to answer the questions of who, what, where, when, why and how. Issues which feature prominently in wildlife cases are:

- What is the identity of the specimen in question?
- What is the provenance of the specimen in question?
- What is the cause of death or injury?
- Can a suspect be connected to a wildlife crime scene?

This publication provides guidance on a range of methods potentially available to the wildlife crime investigator and is illustrated with actual case examples. The legislation is not referred to in depth unless needed for clarity in relation to what a forensic examination may need to establish. As has been demonstrated in many cases, forensic examination can provide high quality evidence, without which no prosecution would be possible. Such work can be expensive and the issue of costs will inevitably place limitations on what can be undertaken. However, financial support for the use of forensic techniques has improved in recent years. Particularly encouraging is the commitment from the Scottish government to provide free DNA testing for wildlife crime cases in Scotland.

Species regulated under CITES may be used to make a wide variety of products. Accurate identification of the species involved is an essential starting point of many investigations (*left to right* boots from skins of python, cobra and turtle).

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Veterinary pathologists can provide vital evidence in wildlife crime investigations such as this postmortem examination to determine the cause of death of a shot hen harrier.

Sections of this document dealing with the more standard types of forensic examination have deliberately been made not too prescriptive. Standard procedures are already in place and advice in relation to the handling, preparation and submission of samples is readily available from police Crime Scene Investigators (CSI), forensic science managers and forensic science providers. In other sections more detailed advice is provided and is intended to be of assistance primarily to the investigator, but may also be of general interest to those unfamiliar with the requirements of handling exhibits and providing evidence in a criminal enquiry.

1.4 Important considerations

1.4.1 Witnesses

Many wildlife crime investigations will rely on evidence from professional or expert witnesses. In the UK, there is no definitive legal definition of an expert. The Crown Prosecution Service (England and Wales) uses the definition:

'A person whose evidence is intended to be tendered before a court and who has relevant skill or knowledge achieved through research, experience or professional application within a specific field sufficient to entitle them to give evidence of their opinion and upon which the court may require independent, impartial assistance'

The court will decide whether a person is to be classed as an expert witness. The expert witness's primary responsibility or overriding duty is to the court, even if they are called and paid for by one of the parties to the case, and they must remain independent of their party's vested interest.

Where expert evidence is required for court a number of careful assessments need to be made. With any sort of forensic examination, it is essential that the person or agency undertaking the work is suitably qualified or experienced. An expert witness is expected to have a sound, current and practical knowledge of the subject matter, based on actual clinical or practical experience. Furthermore, they should be able to provide accurate and robust evidence that can withstand challenges that may be made in court. Increasing attention is being given by the court to the quality of work undertaken by forensic practitioners.

This issue is not usually a concern for investigating agencies when submitting routine evidential samples to established forensic service providers used by the police. However, where there is an intention to use other agencies or individuals in relation to specific issues in wildlife cases then consideration needs to be given as to whether the evidence provided will reach the necessary standards. In Scotland, there are further issues with the levels of corroboration that are required.

The Crown Prosecution Service has issued guidance for expert witnesses in England and Wales which links in with the Criminal Procedure Rules. In Scotland similar advice has now been issued by the Crown Office Procurators Fiscal Service (see Appendix A). In Northern Ireland further information can be obtained from the Public Prosecution Service for Northern Ireland.

A 'professional witness' is one who by reason of some direct professional involvement in the facts of a case is able to give an account of those facts to the court. Thus a professional witness is a witness of fact, who is also professionally qualified, such as a veterinary surgeon. A witness gives either evidence of fact or opinion evidence and there is no actual category of professional evidence. However, this can be a 'grey area' because the professional witness, in the course of carrying out their role, may have formed a professional opinion based on the observed facts, e.g. a view on the cause of death following a postmortem examination (necropsy). Consequently, there may be occasions when a professional witness will be asked to explain the reasoning which underlay their findings, this may lead them into expert witness territory.

Consequently, when preparing a prosecution case for court it is important to consider what issues may arise at court and what is the best evidence that can be obtained. A veterinary surgeon, as a professional witness, may be able to undertake a perfectly competent postmortem examination. However, the court may be best served by using a veterinary pathologist, perhaps with experience in a particular animal group, who is able to provide specific expert evidence. Consequently the choice of specialist or expert may need to be considered at a very early stage in an investigation.

1.4.2 Other issues

The proper collection of evidence and avoidance of potential cross contamination is an essential starting point in any forensic investigation. An assessment should be made to establish what would be the most useful type of evidence to obtain, subject to constraints of cost and time, in relation to the offence under investigation. The use of certain techniques and the order in which they are utilised may prevent other methods being used. For example the incorrect order of chemical treatment for fingerprints may preclude further chemical enhancement techniques from being used. Additionally, the initial treatment of documents for fingerprints may prevent subsequent examination for indented impressions. The use of the most appropriate method, or sequence of methods, needs to be considered at the outset. Many forensic examinations will grade the results on a sliding scale, for example:

- Conclusive;
- Very strong;
- Strong;
- Moderately strong;
- Inconclusive;
- None or elimination.

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Because an examination is not conclusive does not mean it is not valuable. It may corroborate other evidence, eliminate certain suspects or raise new lines of enquiry. In some cases, it may be possible to submit further samples, e.g. more specimen handwriting, to improve the weighting on the forensic examination.

Standard forensic service providers have a range of protocols in place to deal with samples and satisfy evidential and health and safety criteria. If considering the use of other agencies and individuals to undertake forensic or specialist work, who may have little or no experience of dealing with evidential samples, it may be necessary at the outset to consider whether the necessary protocols are in place. The use of standard submission forms used with recognised forensic agencies (e.g. in the UK the MG21 form), could also be adopted for work undertaken elsewhere. This would help set out exactly what is required in a standard format and assist with continuity of evidence.

When submitting items to other agencies and individuals there are a range of issues, which need careful consideration. These could include:

- Can the agency/individual undertake the work to a desired standard? It is important to establish exactly what evidence is sought, and it may be appropriate to adopt a similar sliding scale to grade results as used by recognised forensic science agencies;
- Can continuity and security of evidence be maintained throughout the case? Are they aware of any potential cross contamination problems?
- Do they understand the need for unique labelling of exhibits? For example, if samples are taken or separated from other exhibits;
- If they intend to take photographs have they been given appropriate advice on labelling, and how to handle film or digital images to ensure continuity of evidence is maintained?
- Are they aware of evidential issues such as unused material and the need to retain all notes, documents etc? Creating a file to hold all case information is a sensible system;
- Is the person undertaking the work prepared to attend court and would they make a suitable witness? Are they satisfied they can respond appropriately to cross examination or defence evidence, which might question the validity of methods used and results obtained?
- Are any health and safety issues covered (see Chapter 9)?
- Have costs been agreed with contingencies for extra work that may be necessary?

Chapter 10 provides more detail about selecting a suitable laboratory or agency to deal with forensic samples. This information can be passed directly to the agency/individual undertaking the examination. A laboratory checklist on issues to consider is also provided at Appendix C.

2.1 Crime scenes

'Wherever he steps, whatever he touches, whatever he leaves, even unconsciously, will serve as a silent witness against him. Not only his fingerprints or his footprints, but his hair, the fibres from his clothes, the glass he breaks, the tool mark he leaves, the paint he scratches, the blood or semen he deposits or collects. All of these and more, bear mute witness against him. This is evidence that does not forget. It is not confused by the excitement of the moment. It is not absent because human witnesses are. It is factual evidence. Physical evidence cannot be wrong, it cannot perjure itself, it cannot be wholly absent. Only human failure to find it, study and understand it, can diminish its value.' Professor Edmond Locard (1877–1966)

French scientist Edmond Locard was an early pioneer in forensic science. He believed that when two objects came into contact with the other, each of these objects would leave or transfer particles to the other. This became known as "Locard's Exchange Principle".

There are different types of crime scene, which may influence the value of different types of forensic evidence. For example, consider the illegal shooting of a bird of prey:

- The body may be found at the location where it was shot;
- The bird may not have died immediately and flown to another locus and died;
- The bird may have been shot and killed then transported by a suspect to another location where later found.

The first consideration at any potential wildlife crime scene is the health and safety of anyone visiting the location (see Chapter 9). Aside from physical hazards imposed by the terrain, weather and lighting conditions, with wildlife incidents there may be a range of additional risks associated with toxic pesticides, handling live animals, zoonoses etc. Some scenes may require the use of specialist equipment and personnel.

Assessing whether a criminal offence has taken place may not always be straight forward and other possibilities such as natural deaths, predation and legal hunting should be considered. On attendance at a wildlife crime scene, investigators should always be alert to the potential value of forensic evidence. There is now a variety of techniques available to try to link a suspect or a victim with a crime scene or to illegally held items. The strength of that link will vary according to the technique and the quality of evidence gathered. DNA analysis of human blood, body fluids and other material is now very sophisticated and can be performed on minute samples. Always consider whether the offender has cut himself, left behind cigarette ends or other sources of body fluid. DNA evidence is discussed further at Chapter 5.

Careful examination of a wildlife crime scene, such as this illegal pole trap set on a grouse moor, can provide important evidence.

In most instances, a police Crime Scene Investigator (CSI) will undertake the collection of this type of evidence. In the UK, since November 2013, National DNA Regulatory guidance requires all human DNA recovery to be carried out at the primary scene. CSIs and others will not be able to open and examine

any exhibits for human DNA away from a scene unless it is in a laboratory accredited to ISO 17025 standards. Similar procedures should be adopted where possible with seized items which require an examination for nonhuman DNA, and a suitable laboratory should undertake such work in controlled conditions.

As with all investigations, care should be taken not to cause cross contamination problems in relation to samples taken from a crime scene and dealing with a potential suspect.

Where CSI officers are not available the use of specialist sampling kits, such as the one developed by the FWG (see Appendix A), may still allow important evidence to be properly collected and stored. Wildlife crime investigators who may be dealing with wildlife crime incidents on a fairly regular basis should consider the creation of a 'field kit' in order to have everything readily to hand should attendance at a crime scene be necessary.

In order to maximise the evidential potential from wildlife crime scenes it is important to preserve the scenes and agree a strategy to ensure that all evidence types, utilisation of experts and the order of examination has been considered at the outset. Wildlife crime scenes usually need to be protected, and in some cases there may be value cordoning off an area or creating an exclusion zone to minimise the chances of evidence being damaged or destroyed. Minimising unnecessary visits and having an agreed access route (also referred to as a common approach path) for those needing to attend the scene should be considered. For example, in a badger digging case there may be a range of potential forensic evidence available. The scene may need to be visited by the investigating officer, perhaps in company with a reporting witness, a CSI officer, a badger expert and possibly other personnel. CSI officers should, where possible, have precedence over other parties. There may be value in the CSI officer being directly accompanied by individuals with specialist knowledge so that specific items can be drawn to their attention to record, collect and sample.

Box 2.1

© UKBF

A consignment of illegally smuggled birds of prey found at Heathrow airport

These birds of prey stuffed inside plastic tubes, most of them dead, were intercepted at Heathrow airport in the process of being smuggled from Thailand into the UK. A set of identical tubes were found stored near the main suspect's home. These were believed to have been used for a previous shipment of birds. The suspect's fingerprint impressions were found on these and helped to link him to the smuggling operation. He later received a lengthy prison sentence for smuggling and illegal trade in birds and other wildlife.

Chapter 2 Scenes of crime examinations

In 2013, Interpol produced a guide on Wildlife Crime Scene Investigation, which contains useful material for both CSI officers and wildlife crime investigators when attending wildlife crime scenes (Appendix A).

2.1.1 Scene recording

Photographs and sketch plans of the scene can be extremely useful in wildlife crime investigations. Video footage can also be considered. This is best undertaken by CSI officers who are experienced with this type of scene recording. Where CSI officers are unavailable, efforts to prepare sketch plans and take good quality images should be still made at the outset of the investigation and before any exhibits are seized or the scene disturbed. It is important to note any relevant guidelines relating to the handling, storage and copying of such images. Relevant

Box 2.2

© G Shorrock (RSPB)

Typical padded container used to hold birds' eggs

© G Shorrock (RSPB)

Four skylark eggs found in a container during a search of a suspect's vehicle

During a search warrant executed on a suspected egg collector, a container holding four skylark eggs was found hidden in his vehicle parked outside his home. The suspect denied any knowledge of the container or its contents. A fingerprint impression was found on the container matching the suspect. Further evidence was found on a digital camera in the home of the suspect (see also Box 3.5). He subsequently pleaded guilty to unlawful possession of the eggs.

images or video taken by members of the public should be secured to prevent potential loss or editing of material. At a crime scene consider a range of photographs:

- Wider range shots showing the surrounding landscapes. These might provide information about the type of land use and who may potentially be involved;
- Middle range shots showing the immediate environment of the crime scene, such as a badger sett or a pole trap situated at a pheasant release pen. Where items of interest are not easy to see on wider shots consider marking their location with something more obvious. CSI typically have numbered markers or small flags, but it should be possible to improvise an alternative;
- Close ups – often to show small items or specific points of interest. This could include footwear impressions, animal prints, discarded items, injuries to wildlife casualties, hair, blood, feathers etc. These should incorporate a scale ruler or item of known size.

Ensure time and date are accurately set and all photographs and video material should be retained, even if not intended for use in court. No images or file names should be deleted or altered in any way. In the UK, police forces have guidelines relating to storage of digital images and video material (see Appendix A).

Even if photographs are being taken, sketch maps should still be considered to highlight the location of points of interest. The location of an incident is often very important, particularly as the scene may need to be revisited at a later date. A GPS device can be extremely useful in precisely pinpointing a location. Where these are not available, consideration should be given to measuring or pacing from known fixed points, three if possible, to be able to triangulate the precise offence locus at a later date. The use of compass bearings to selected fixed points can also be helpful.

2.1.2 Scene searching

An effective search of a crime scene and surrounding area will often provide important evidence. Consider the type of offence under investigation and activities of those involved. Crimes may involve people visiting an area to commit offences, such as poachers, people digging at badger setts or egg collectors. Alternatively they may involve local people who regularly use the land, such as a wildlife poisoning case or illegal snaring and trapping. With ‘visiting’ offenders forensic evidence linking them to a crime scene may be particularly valuable. With suspected land user offences, there may be evidence of similar offences at other locations on the land. For example, if an illegal pole trap is found at a pheasant release pen, then efforts should be made to check as many release pens as possible as the same illegal methods may also be deployed.

Where offenders are suspected to be local land users then an initial low key visit may be beneficial to reduce the chance of alerting potential suspects. Police forces may use unmarked vehicles and civilian clothing to assist with this process. In the UK, powers of police and other government agencies when dealing with many wildlife crimes allow the taking of specialist staff or equipment where needed. These initial visits often form the basis for larger scale search efforts and possibly search warrants at a later date.

In offences such as wildlife poisoning cases, larger scale searches of land may be appropriate, and the use of specially trained police search teams should be considered. Where possible these should be assisted by specialist staff who are familiar with the types of offences under investigation, who can assist with the search effort and provide an assessment of whether items

found should be seized or sampled etc. Such people should remain under the direction and control of the statutory agency in charge.

2.2 Fingerprints

The use of fingerprints to identify individuals is a commonly used forensic technique. Suitable surfaces at crime scenes, or on items potentially handled by a suspect may be appropriate for this method. Items at outdoor scenes may need some protection from the effects of inclement weather prior to examination for fingerprints.

Box 2.3

Chris Gomersall (rspbimages.com)

The peregrine falcon is a regular victim of wildlife crime

A peregrine trapping site was discovered on a coastal headland designed to catch live peregrine falcons for the falconry market. It used a live pigeon tethered to a small stake with nets alongside. During observation of the trapping site a peregrine arrived, killed the pigeon and became momentarily caught before managing to escape. A while later, the suspect arrived and removed the items from the site. When searched by the police he was also found to have a bag holding a live pigeon, this was suspected to be another live bait for the trap. The suspect claimed it was an injured bird that he had found earlier that day and denied any involvement with the setting up of the trapping site.

A search of the suspect's house found a reel of thread. This was forensically compared with the thread used to tether the pigeon at the trapping site. This indicated there was a match between the fibres and helped to conclusively link the suspect with the illegal activity at the trapping site. He was later convicted of a number of offences.

2.3 Fibres, hair and fur

Fibres may be transferred from clothing or items used in the commission of an offence. Hair and fur comparison could include both human and animal samples. It is important at the outset to decide what evidence is sought. Forensic service providers may be able to do a physical comparison of samples, perhaps to link an individual to a crime scene, but if identification of the animal or plant is required then an examination may be needed by another agency (see Chapter 5). Examples where these techniques might be helpful could include:

- Clothing or rope fibres snagged on tree bark during an egg collecting incident;
- Deer hair found in the boot of a poacher's car or on a knife;
- Hair removed from the mouth of a dog following a badger baiting incident.

2.4 Footwear, tyre and instrument marks

Vehicles, tools and instruments feature in a range of wildlife offences. Examples could include:

- Footwear marks at a badger digging incident;
- Climbing iron marks left on a tree by an egg collector;
- Examination of close rings fitted to a bird which may have been tampered with;
- Examination of quad bike tracks at a wildlife poisoning scene;
- Comparison of pliers seized from a suspect with the cut ends of razor wire put around a tree to protect rare nesting birds;
- Where knives or instruments have been used to kill or injure animals and have come into contact with bone.

Box 2.4

Marks on section of trunk from a goshawk nesting tree compared with tree climbing irons belonging to a suspect

Persecution of birds of prey remains a serious conservation problem. Following the destruction of an active goshawk nest, involving the smashing of the eggs, it was realised the tree had been climbed using a set of treeclimbing irons. A set of climbing irons was later seized from a local gamekeeper who had been seen in the area in suspicious circumstances. The tree was felled to allow the marked sections of trunk to be taken away for forensic comparison with the irons. Though not conclusive, it provided moderately strong evidence that the marks on the trunk were made by the irons in question. This supported other evidence and the gamekeeper was subsequently convicted.

Box 2.5

© G Shorrock (RSPB)

Footwear impressions were found at a location from where a hen harrier had been shot

© G Shorrock (RSPB)

Casts of two sets of footwear found at and near the scene of a hen harrier shooting

Two men wearing camouflage clothing and balaclavas were involved in the shooting of a hen harrier on a grouse shooting estate in the early hours of the morning. Two sets of footwear impressions were found leading to and from the crime scene and one set next to where the corpse had been hidden. Two local gamekeepers were strongly suspected of being responsible and search warrants were executed. However, in this case, the matching footwear was not found and no further action could be taken.

Box 2.6

Precipitous cliffs on Mallorca, where eggs and chicks of Eleonora's falcons had been illegally taken and smuggled back to the UK

Climbing rope seized from a suspect

A number of chicks and eggs of Eleonora's falcons were believed to have been illegally taken from the island of Mallorca and smuggled into the UK. These were reared and then sold on the pretence of being captive bred. During a search of the suspect's home, flight tickets and a hotel receipt were found indicating he had visited Mallorca. The timing and location fitted with the breeding season of the Eleonora's falcon. An abseiling rope and a quantity of climbing equipment were found. Part of the rope was noticed to have been stained reddish brown by soil. The rope was sent for examination and a minute quantity of soil washed from the surface was forensically analysed. Samples were then taken from above the nesting cliffs in Mallorca, where the birds were suspected to have been taken from. A comparison was made between quartz grain structure, soil grain sizes, chemical composition and pollen. The soil on the rope showed a good correlation with the samples taken from Mallorca, and a particularly good match with one of the breeding sites. The suspect was later imprisoned for illegally trading in the birds.

2.5 Miscellaneous traces and glass samples

This covers a multitude of materials, which may have been transferred from a crime scene to a suspect or items in their possession or control. Items relevant to wildlife crime might include soil, plant materials and wood. Other items including paint, metal, plastics and petroleum based products, lubricants, adhesives, chemicals and building materials could also be relevant. Glass samples are more normally associated with burglaries and vehicle glass left at road traffic accidents but again could be relevant to particular cases. Always consider whether physical fits and identifiable tool marks may be obtainable. A range of examples could include:

- Soil and plant material transferred to a spade during a badger digging incident;
- Paint transfer or smashed headlight glass from a vehicle using in a poaching incident;
- Bark and lichen on clothing and tree climbing irons used during an egg collecting incident.

2.5.1 Forensic Palynology

Palynology is the study of pollen, plant spores, fungal spores, and microscopic remains of plants and animals. Pollen grains and plant spores range from about 20-100 micrometres in diameter whilst fungal spores can range from about 1-200 micrometres. Depending on visual acuity, it is possible to see anything above 100 micrometres with the naked eye but most samples are invisible. Over the last twenty years or so, palynology has been applied successfully to forensic investigation and, on many occasions, has contributed to the conviction of perpetrators of serious crime.

Box 2.7

This spade was recovered from the vehicle of a man suspected of badger digging

A badger digging incident was visited by the RSPCA and a trail of blood found across a field. The car of a suspect, who lived a considerable distance away, had been seen nearby. When his car was later searched two soil covered spades, one with hair attached, were discovered along with bloodstained rags. Forensic experts were able to match the palynological profile on the spades with two comparator samples obtained from the badger sett. Interestingly, there were spores of a truffle fungus on the spades and in the badger sett. Badgers had been collecting truffles from the roots of an oak tree about 100 m or so from the sett, and bringing them back. DNA analysis also confirmed the identification of badger hair from the seized spade. The suspect was convicted following trial.

Chapter 2 Scenes of crime investigations

Pollen grains are abundant in almost all environments, are very durable and may persist on surfaces and in soils for many years. Pollen can be highly differential and may indicate where a person or object has been. The composition of pollen grains at a crime scene can then be compared with samples taken from a suspect, clothing, vehicles, animals, tools etc. Even after washing clothes, pollen can remain in pockets or cuffs, which allows the evidence to be collected sometimes long periods after the incident. In the forensic context, potential sources of pollen could include:

- Suspects – hair, hands, under nails;
- Clothing, shoes, fabric and plastic surfaces, digging implements, ropes etc;
- Vehicles footwells, tyres, carpets, undersides;
- Dirt, mud, or dust recovered from a person or object;
- Hair, fur and feathers;
- Imported/exported goods – this may help verify the country of origin;
- Packing materials particularly straw or cardboard;
- Animal remains such as the soft tissues of the stomach and intestines.

Obtaining palynomorph samples can be time consuming and they need to be examined by a competent palynologist using high power microscopy, mostly using ordinary light or phase contrast. Examining size, shape, and morphology pollen and spores can sometimes be identified to species but, more often, only to genus or family. They also need to be quantified involving long periods counting at the microscope.

Palynology is not just useful for demonstrating contact between people, objects, and places, but also for describing unknown places that have been contacted by a suspect, an animal or objects. Vegetation varies from place to place and every location has a unique palynological profile. A skilled palynologist can envisage the kind of place from which the pollen has been derived. The time of year can sometimes be determined as some pollen is only released during certain seasons. Claims that pollen and spores were picked up at other places can be checked and potentially eliminated by taking comparator samples. Where such types of analysis are being considered the palynologist should be contacted as soon as possible to get the best possible advice relating to the taking of samples.

Chapter 3 Questioned documents and digital records

3.1 Questioned documents

Questioned document analysis has been used in a number of wildlife cases. This is typically in relation to documents that have been forged or altered to try and disguise the provenance of illegally held items. In appropriate cases, document examiners and CSIs can provide a number of services, which can:

- Compare handwriting samples to determine whether they were written by the same person;
- Compare questioned signatures with suitable reference signatures to determine if they are genuine or forgeries;
- Compare printed documents with the work of a particular printer (laser, dot matrix, ink jet, thermal) to determine if it was used to produce them;
- Compare typewritten documents with the work of a particular typewriter to determine if it was used to produce them. It may also be possible to produce transcripts from typewriter ribbons;
- Compare photocopies to determine if they were produced on the same machine;
- Compare inks on documents and in some cases identify entries written with a different pen;
- Compare papers and in some cases provide information about their origin and age;
- Examine documents of erasures and alterations;
- Examine documents to reveal indented impressions of writing;
- Reveal original writing under obliteration;
- Reassemble and preserve torn, shredded, burnt or damaged documents;
- Compare writing in terms of language used and peculiarities in writing style.

There are limitations and generally the document examiner cannot:

- Determine the age or sex of the author, although general stylistic considerations may give some clues;
- Link ink on documents to particular pens;
- Date inks;
- Effectively compare signatures in different names;
- Effectively compare writings in different styles e.g. block capitals with cursive ('joinedup') writing; where possible samples should always be 'like with like';
- Look for indented impressions on documents which have been treated for fingerprints.

The ability to compare handwriting samples can depend on:

- The amount of handwriting in question;
- The number of distinctive features in the questioned handwriting;
- The degree of disguise in the questioned or specimen handwriting;
- The suitability of the specimen handwriting obtained.

Chapter 3 Questioned documents and digital records

Box 3.1

© G Shorrock (RSPB)

A labelled container used for the temporary housing of birds' eggs

Collections of birds' eggs are often kept in 'safe-houses' to reduce the chances of them being discovered by the authorities. During a search warrant a large number of labelled containers of birds' eggs were found hidden in the loft of an elderly relative of a suspected egg collector. The suspect denied any knowledge of the eggs and refused to provide handwriting samples for comparison. An address book was seized from the suspect's home and samples were conclusively matched to the writing on the containers. The suspect later pleaded guilty to possession of the eggs and was heavily fined.

Giving the document examiner the best possible specimen handwriting, will maximize the possibility of obtaining a useful conclusion. Non-request specimens usually contain the suspect's natural handwriting and are often the most suitable specimens for comparison. Where possible 'like with like' samples should be sought. Suitable sources might include:

- Letters;
- Diaries, collecting records, packaging and address books;
- Application forms;
- Business papers and records;
- Cheques drawn on their own bank account.

Where a sample of specimen handwriting has to be obtained from a suspect, the statutory agencies normally have internal guidelines, which provide the appropriate information. These should be consulted before any request is made. If there is doubt as to the best way forward, always consider ringing the service provider for advice. The issues to typically consider are:

- the document type (plain paper, cheque, envelope);
- the amount of handwriting or signatures needed;
- the handwriting type (block capitals or cursive);
- the writing instrument to be used (normally a well used biro, but samples in other pens may also be necessary);

Box 3.2

© G Shorrock (RSPB)

Egg datacards in the name of 'B Park' indicating two clutches of golden eagle eggs were taken in 1952, prior to the relevant legislation

In addition to the finding and taking of birds' eggs, collectors like to keep meticulous records detailing the dates and locations when clutches were acquired. This creates a problem for the collector if the records are discovered. There have been several cases where collectors have compiled false sets of data, e.g. subtracting 30 years from the actual date of taking, to make it appear that the eggs predate the legislation and that no offences have been committed. There have also been cases of collectors matching recently taken eggs with genuinely old data. However, this may entail making some alterations, for example, if the clutch size of the eggs taken is different to that recorded in the old data. These alterations are often fairly crude and easily discernible on a forensic examination.

In this case, a set of 900 datacards, apparently signed by a 'B Park', indicated a large collection of eggs was taken prior to the relevant legislation. The suspect refused to provide handwriting samples but a comparison was made with other documents seized from his home. This showed there was very strong evidence of common authorship. The suspect later admitted at court to writing out the datacards. He was convicted of a number of offences of possession of birds' eggs.

Some of the datacards indicated eggs were taken in the 1930s. However, these were recorded in biro and the dates predated the use of this writing medium, indicating the cards clearly could not have been compiled when the eggs were alleged to have been taken.

- the manner in which the request is made to prevent copying of other samples in an attempt to disguise handwriting;
- Once samples have been obtained how these should be handled and packaged.

Situations where questioned document examinations may be useful might include:

- Examinations of records maintained by egg collectors to establish authorship, forgeries and alterations. Many bird and place names are often spelt incorrectly and may help link a document to an individual;
- Applications for licences and permits using false details;

- Forgeries and alterations of CITES documents;
- Falsified taxidermy records;
- False names used by egg collectors when signing visitors' books at accommodation or nature reserves;
- Examination of a vehicle's tachograph to establish the times and routes of an illegal importation or movement of wildlife products.

3.1.1 Video Spectral Comparator (VSC)

VSC makes possible the identification of alterations, substitutions and erasures in writing and printing on a variety of surfaces, particularly documents. Questioned items are examined under infrared and ultraviolet light which can reveal previously unseen features.

Box 3.3

© G Shorrock (RSPB)

The boldly marked eggs of the osprey are popular with egg collectors

These osprey eggs were recovered amongst a large collection of predominantly older eggs. The writing on the eggshell surface indicated they were illegally taken in Scotland in 1991 from a nest site that was known to have been raided. Prior to the eggs being taken, they had been marked with a code by a licensed ornithologist using an indelible marker pen to try and deter the activities of egg collectors. However, when seized, no such code was visible on the egg shell surface. The eggs were examined using a video spectral comparator. Under ultraviolet light most of the code written by the ornithologist, even though apparently removed by use of a solvent, could be visualised.

The person in possession of them denied any knowledge of these particular eggs claiming they must have been added to the collection, unbeknown to him, by his now deceased father. Though the curved surface and small quantity of handwriting made a comparison more difficult, the examiner was able to state there was strong evidence that the handwriting on the eggshell surface was that of the suspect. The collector was later convicted of possession of these and other eggs.

3.1.2 Electrostatic Document Analyser (ESDA)

This technique is used for the examination on indented impressions on subsequent pages of a notebook or pad produced by pens and pencils during writing. The method is fast and practical and generally gives good results on marks not visible to the naked eye. It provides a transparency record of the indented mark, does not interfere with any subsequent test and leaves the original material unmarked and uncontaminated.

Receipt books of wildlife traders or field notebooks of egg collectors where pages appear to have been removed may be suitable for this type of examination.

3.2 Digital forensics

The examination of digitally stored records and information is a rapidly developing area of forensic examination. There is a wide range of places where electronic information may be stored, and which can hold huge quantities of information. The different locations where digital evidence may be found may include:

- Locally on an end user device – typically a computer, mobile, smartphone, digital camera, satellite navigation system, USB drives and portable storage devices;
- On a remote resource that is accessible to the public, for example websites used for social networking, discussion forums, and newsgroups;
- On a remote resource that is private, for example Internet Service Providers logs of user activities, mobile phone records, webmail accounts and remote file storage.

Box 3.4

A graphic mobile phone image of a fox, trapped in a livecatch trap, being pitted against a terrier in a fight to the death

RSPCA and police conducted three search warrants and retrieved various electronic media including mobile phones and a memory stick. All media were forensically examined by a specialist company and in excess of 15000 images were found which had to be viewed and assessed. Where mobile phones and cameras were used they revealed dates, times and models of phones and cameras used to take images of cruelty offences. In addition, text messages revealed conversations that matched with images and videos. Also websites and frequency of visits provided further supporting evidence. As a result of properly interrogated and evidenced extraction of the data all three suspects pleaded guilty to a number of serious cruelty charges and all received prison sentences.

Chapter 3 Questioned documents and digital records

Information from these sources can provide important evidence and intelligence information. In the UK, there are guidelines in place for statutory agencies relating to the seizure and handling of computers and other electronic devices. ACPO has produced good practice guides for digital evidence and computer based electronic evidence (see Appendix A). The four main principles for computer based electronic evidence are:

- No action taken by law enforcement agencies or their agents should change data held on a computer or storage media which may subsequently be relied upon in court;
- In exceptional circumstances, where a person finds it necessary to access original data held on a computer or on storage media, that person must be competent to do so and be able to give evidence explaining the relevance and the implications of their actions;
- An audit trail or other record of all processes applied to computer based electronic evidence should be created and preserved. An independent third party should be able to examine those processes and achieve the same result:
- The person in charge of the investigation has overall responsibility for ensuring that the law and these principles are adhered to.

The investigator needs to consider the nature and purpose of the digital examination, investigations should be both focused and proportionate. When submitting to Digital Forensic Units, sometimes also known as HiTech Crime Units (HTCU), investigators should supply specific requirements to ensure the best evidence is located as it often not practically possible to examine every item of digital data. An initial review of the material may give a better understanding of the type of material held and identify lines of enquiry. This discipline especially benefits from initial specialist advice on potential evidence, and an agreed forensic examination

Box 3.5

© Warwickshire Police

This digital image showing four skylark in a nest was recovered from a suspect's camera

During a search warrant executed on a suspected egg collector a container holding four skylark eggs was found hidden in his vehicle parked outside his home. The suspect denied any knowledge of the container or its contents. His digital camera was recovered from his home address and a number of deleted photographs were forensically recovered. One image of four skylark eggs in a nest, which had been partially overwritten, had been taken just seven days before the search warrant. These eggs could be specifically matched by RSPB Investigators to the eggs seized from the suspect's vehicle. A fingerprint impression was also found on the container matching the suspect (see Box 2.2). He subsequently pleaded guilty to unlawful possession of the eggs.

strategy. A regular liaison between the investigator and digital forensic practitioner should help identify other issues which may emerge during the examination process.

Always remember to check diaries, notebooks and scraps of paper, which may contain passwords. The integrity of computer evidence needs careful attention. Any activity on a computer leaves a trace and files with dates after the seizure date may render the evidence inadmissible in court.

Box 3.6

This dog had received severe injuries from fighting badgers

During an RSPCA and police investigation a digital camcorder was recovered. This contained footage of 13 badgers being killed by dogs over a three month period, plus images of foxes and deer also being killed by dogs. The imagery did not contain identification footage of the offenders however their voices could be heard. A search warrant was executed at the home address of a suspect where two of the dogs shown on the video were recovered, one of which had sustained significant injuries to its face.

Forensic voice analysis was used to examine the audio recording contained on the video footage (questioned samples) and compare this with the audio recording of the suspect's interview. Five samples from the seized video footage showed such consistent features of range of accent, pitch and voice quality that it was concluded it was highly likely it was the same individual. The voice analyst found that the speech of the suspect recorded during interview was consistent with those of the questioned samples and had distinctive similarities that very few other speakers would be likely to share.

At the start of a trial, the suspect changed his plea to guilty after receiving confirmation of these findings from the defence voice analyst. He received a custodial sentence and a lifetime ban on keeping all animals.

Chapter 4 Firearms

As a key component in the Governments strategy to reduce firearms criminality the National Ballistics Intelligence Service (NaBIS) was created. The NaBIS database was launched across England and Wales in April 2008 and across Scotland in March 2010. This delivers a national database of all recovered firearms and ballistic material coming into police possession. This includes items such as complete rounds of ammunition, cartridge cases and projectiles. The database also links these ballistics items to tactical intelligence recorded by police forces and other UK law enforcement agencies.

Underpinning NaBIS are several new ballistics laboratories, the NaBIS Hubs. These are located in Birmingham, London and Manchester (staffed by forensic scientists employed by the Metropolitan, West Midlands and Greater Manchester police forces). A fourth NABIS hub, located in Strathclyde, covers Scotland. This is operated by Police Scotland and provides an essential link in ensuring that the whole of the UK is able to capture, share and evaluate ballistics information and associated intelligence.

The forensic scientists work in state-of-the-art laboratories. As well as traditional optical microscopes, workshops and range facilities, the four labs have access to comprehensive firearms reference collections and library facilities. In addition, there is the ability to make use of other colocated forensic capabilities such as fingerprint enhancement and the most sensitive DNA profiling techniques.

Critical to the service are the latest generation Integrated Ballistics Identification System (IBIS) comparators, capable of carrying out the automated linking of bullets and cartridge cases to both crime scenes and recovered weapons. IBIS technology is located at each hub and links in with the NaBIS Database, thereby providing police forces with the world's first integrated firearms intelligence capability.

The NaBIS Database is able to track a ballistic item from the moment it is recovered to the moment it is eventually destroyed after any relevant investigations and/or proceedings have been completed. This includes the progress of examination and testing that takes place by commercial forensic providers. Consequently Senior Investigating Officers (SIOs) are able to see what information or intelligence is available relating to any ballistic items recovered as a part of their investigation.

Firearms are regularly used in poaching cases, the illegal killing of birds of prey, and may be used to despatch illegally trapped or snared animals (see Chapter 7.5). The matching of recovered shotgun cartridges, other ammunition cases and air weapon pellets/projectiles to particular weapons can provide important evidence. A firearms examiner may be able to provide useful information about types of ammunition or weapons used, the range at which a weapon was discharged etc. There are obvious health and safety issues with the handling of firearms and ammunition and this should be left to people with appropriate firearms training.

When shotgun cartridges are recovered from a crime scene, attempts should be made to retrieve the wadding which is likely to be in the vicinity. Bullets and airgun ammunition may be recovered from the bodies of victims for comparison with weapons held by a suspect. Care must be taken not to mark these items, for example by the use of metal instruments during a postmortem examination. Instrument marks introduced to a bullet could prevent a conclusive identification (see Chapter 7.5.4).

In some circumstances, it may still be possible to recover bullets, which may have passed through an animal and perhaps embedded themselves in the ground or in a tree. A metal

detector may be useful for this purpose. Embedded bullets should not be prised out and need to be removed without causing damage.

Other weapons such as crossbows and catapults may be used to commit wildlife crime. Examination of these types of weapon will need to be done by forensic service providers, as they fall outside of the NaBIS remit.

Box 4.1

Live badger caught in an illegal self-locking snare

This was one of a number of badgers that had been deliberately caught by the use of illegal self-locking snares. Twenty of these snares were found on badger paths close to a pheasant release pen. The bodies of several animals were found hidden nearby and were suspected to have been snared. A postmortem examination confirmed the injuries were consistent with snaring and the animals had been caused unnecessary suffering. However, the animals had been finally despatched by the use of a firearm. The firearms from the two estate gamekeepers were seized and a comparison made with the bullet fragments removed from the badgers. In this case, it was not possible to obtain a conclusive match with the firearm from the chief suspect. However, the comparison did eliminate the weapons owned by the other gamekeeper. The chief suspect was later convicted of multiple offences relating to badgers and illegal use of snares. He received a custodial sentence.

Box 4.2

© G Shorrock (RSPB)

Fish eating birds, such as cormorants, are sometimes illegally shot because of concerns about potential predation on fish stocks

Following a suspected shooting incident, two cormorant corpses were submitted for postmortem examination. This confirmed the cause of death was due to shooting and bullets were recovered from the bodies of both birds. These were sent for forensic comparison with a weapon and ammunition seized from a suspect. The forensic examiner made the following conclusions:

'The first two containers supplied by the pathologist, each held a .22 inch calibre bullet of typically fired appearance having struck a hard flat surface whilst in flight. Examination disclosed the clearly defined marks of a rifling system along the circumference of each. This rifling system consisted of eight lands and eight grooves with a right twist.

The test bullets fired in the Anschutz rifle were compared one with another under low power magnification and we found that the rifling within the barrel of the gun had imparted the same repeated, individual, identifiable markings to the surface of each bullet passing through the barrel. Examination revealed a rifling system consisting of eight lands and eight grooves with a right twist. Similar comparisons carried out between a testfired bullet and the contents of containers 1 and 2, in turn, disclosed agreement in all cases for us to form the opinion that all had been fired in the same weapon. It therefore follows, that the .22 Anschutz rifle with sound moderator labelled as found "in possession of accused" fired the bullets labelled as found "in the bodies of two dead cormorants".'

A man later pleaded guilty to the shooting of both birds.

Box 4.3

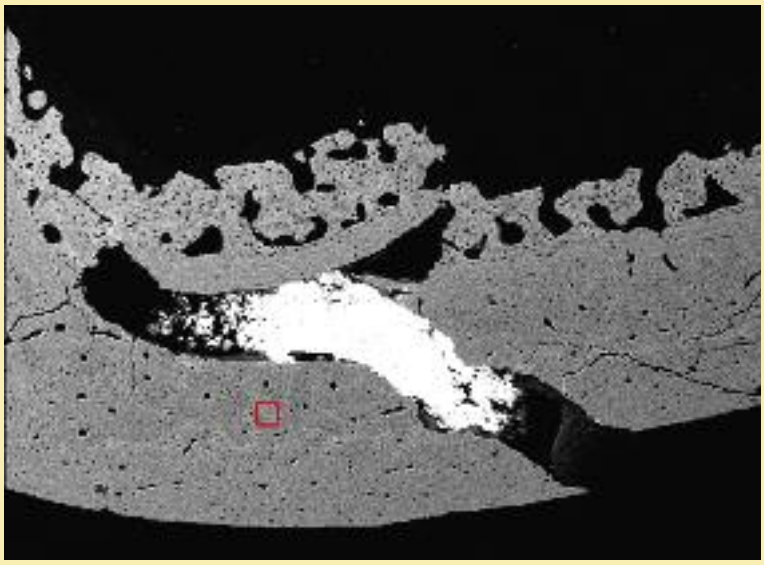
The hen harrier continues to be heavily persecuted on many grouse shooting estates

The shotgun is the most regularly used weapon for shooting birds of prey and used cartridges are sometimes recovered from crime scenes

An incident was witnessed in Scotland involving a number of men visiting a hen harrier breeding site and shooting the incubating female bird as she was flushed from the nest. The body was removed from the scene and never recovered. Shotgun cartridges were recovered at the crime scene. All the firearms from the gamekeepers working on the estate were subsequently seized. A comparison of cartridges discharged by these weapons with the recovered cartridges confirmed they had all been fired from the shotgun owned by one individual.

Box 4.4

This dead hen harrier fitted with a satellite tag was found dead on a grouse shooting estate in the north of England



A cross section through the tibiotarsus of a shot hen harrier confirmed the damage caused by a small particle of lead

A dead hen harrier was found on a grouse moor in northern England. An initial postmortem examination showed a fracture to the left tibiotarsus and three tiny radio dense particles (less than 2 mm diameter) at the fracture site, which were suspected to be metal from a projectile. There were also a number of broken tail feathers which were not consistent with natural wear and tear. These signs suggested the acute trauma and fracture were associated with the metal projectile, which could have arisen from a shooting incident. Further testing using a scanning electron microscopy (SEM) with energy dispersive x-ray analysis (EDX) revealed a section through the fractured leg bone. This showed the damage to the bone around one of the radio dense particles which was embedded in it, and that this was composed primarily of lead. This examination confirmed that the bird had been shot with a high energy projectile composed largely of lead.

Box 4.5

A number of dead mute swans recovered at the scene of a mass shooting incident

Bullet recovered following postmortem examination of one of the swans

Following a mass shooting of 29 swans, the bodies of six birds were taken for postmortem examination. In addition to confirming the cause of death, a complete rifle bullet was removed from one of the birds. Subsequent ballistic testing matched this to the firearm of a suspect. However, the case had to be later abandoned as it transpired the police had lost the relevant bullet used for comparative testing. This case clearly highlights that the value of any form of forensic testing is entirely dependant on the chain of evidence and integrity of exhibits.

Chapter 5 Specimen identification and provenance

5.1 General considerations

It is often essential during wildlife enquiries to be able to identify the species concerned. Much of the legislation applies to specific species and often in specific circumstances. With whole specimens, this process may be relatively straight forward. With parts and derivatives it can become increasingly difficult and in some cases a positive identification will simply not be possible. In addition to identification, issues of provenance are often critical in establishing whether an offence has been committed. Typical provenance issues in wildlife crime include:

- The age of the item;
- When it was prepared or worked;
- Where it originated from;
- Whether it was captive bred, artificially propagated or wild taken.

When dealing with specimens or derivatives it may be advisable to avoid specific identification unless absolutely certain. This prevents potential confusion if a specimen is then correctly identified at a later stage. Specimens will normally be provided with a unique case reference number so if a specimen is simply labelled as 'owl species Ref. AB1', or 'animal hair Ref. CD2' etc, this will be sufficient.

In the UK, there is a whole range of people available to assist with this process including forensic service providers, recognised experts and academics, officers from agencies such as RSPB and TRAFFIC, Wildlife Inspectors from the Animal Health and Veterinary Laboratories Agency (AHVLA), museum curators, botanic gardens, veterinarians, competent naturalists, licensed bird ringers, zoo keepers, aviculturalists etc. There is a large amount of literature and specialist identification guides available to the enforcement agencies. These may be very helpful during the investigative process but it is important to ensure the final identification reaches the evidential standards needed for court.

It may be necessary to have an appropriate person available at the outset of an enquiry, such as during a search warrant, when specimens and items need to identified in order that decisions about seizure can be made. It is important that someone experienced with the species likely to be encountered is available.

Native species are usually less of a problem than exotic ones. In some cases, it may not be possible to identify the specimen at the scene. A decision may have to be made whether identification may be possible from notes, photographs and video footage or whether the specimen needs to be physically seized and formally identified at a later time.

If specimens are likely to be seized during an enquiry, then suitable arrangements for handling and housing need to be made. Housing a fragile egg collection or finding a secure freezer for frozen specimens may not be too difficult. However, finding suitable housing for live raptors, plants, parrots or specialist wildlife may be more problematical and appropriate advice should be sought at the earliest opportunity. These specimens may have to remain in captivity or under expert supervision for some time until a final decision is made following court proceedings. In England and Wales, there are provisions under Section 66 of the Police and Criminal Evidence Act 1986, and associated Codes of Practice, to allow evidence to be left with the person holding it in certain circumstances. This may be appropriate in certain circumstances, for example when dealing with innocent purchasers of illegally acquired specimens or awaiting flowering of plants

to allow accurate identification. The disadvantage is that specimens are less secure and a decision must with full consideration of the circumstances. A sample proforma is included at Appendix B.

If is important to ensure that specimens are suitably marked to allow them to be identified at a later stage. With dead specimens and derivatives this can be done with appropriate labelling. With animal corpses and items being stored in a freezer it is a sensible precaution to ensure the exhibit label is protected inside a plastic bag to prevent it being damaged or destroyed. Live birds and certain animals may already be fitted with a numbered close ring or microchip. These details can be included with exhibit reference details, e.g. 'Live falcon bearing close ring V1234 on right leg. Ref.AB1'. Plants can potentially be labelled using a waterproof pen or metal tags.

If there is no unique marking it may be possible to use microchips and rings for certain birds to identify the specimens. Where possible, these issues should be addressed prior to an enquiry. The use of photographs and video can be used to help corroborate identification.

If live specimens have to be seized then all steps should be taken to ensure the housing facilities and the people dealing with them are suitable and that costs are agreed. Reliable marking should prevent confusion with any other similar specimens.

5.2 Animal and plant morphology

Morphology is a frequently used method for identifying animals and plants. If enough material is available, specialists are often able to identify the species from its physical appearance. In addition to macroscopic features such as form, colour and texture, microscopic features can also be used.

5.2.1 Museum services

Museums hold huge repositories of specimens and specialist staff, and are potentially able to offer valuable identification services and have assisted in a number of wildlife cases. Much of the identification process uses morphological techniques, aided by direct comparison with material in the reference collections. Whilst there is a broad range of identification expertise available within the museum service, a number of departments specialise in particular species. The Natural History Museum (NHM) based in London and Tring, Hertfordshire and the National Museum of Scotland in Edinburgh (part of the National Museums Scotland) hold the largest collections, but there are significant collections at other museums around the country. These collections include mammals, birds (and eggs), reptiles, fish and invertebrates. They include a range of parts and derivatives, including skeletons and skins. For example, the NHM's bird skin collection includes 95% of the world's bird species, giving excellent scope for precise identification.

5.2.1.1 Whole specimens

This can include live, dead, frozen and taxidermy specimens. If whole fresh/frozen specimens are to be subject to a postmortem examination prior to identification, it is important that the pathologist does not inadvertently destroy parts of a specimen that would aid identification. For example, opening a skull of a wildcat or polecat could render identification almost impossible. If there are identification issues consider arranging liaison between the pathologist and identifier to ensure that no essential information is lost. In relation to taxidermy specimens, they may be able to provide information on the provenance of the specimen based on the style of taxidermy, condition and materials used (see also Chapter 8).

Chapter 5 Specimen identification and provenance

Box 5.1

© P Summers (National Museums Scotland)

A tantalus monkey seized from a shop in London having been prepared for human consumption

The import of bushmeat for human consumption from West Africa has become a significant problem in recent years. This involves a wide range of species, including a number of CITES listed species such as primates. This tantalus monkey was involved in the first UK conviction for the illegal importation of bushmeat. Identification of the specimen was undertaken by National Museums Scotland using morphological examination of bones and remaining fur.

It may be possible to identify corpses of quite badly preserved specimens, but if a specimen is in too poor a condition, it may be more appropriate to extract its skeleton and work from that instead. Identification from photographs may also be possible, and it may be worth submitting suitable photographs for a provisional examination before transporting large numbers of exhibits.

5.2.2.2 Skeletons, skulls, horns, antlers, tusks (ivory) and teeth

A range of items from species which may have been seized can potentially be identified. A number of guides to identify skeletal remains, such as bears and cats, are being developed to assist the identification process. A morphological examination is usually sufficient to determine bone and identify hippopotamus, walrus, sperm whale, warthog, mammoth or elephant ivory, but will not differentiate between the Asian and African elephants. As all elephant species are listed under CITES legislation, this level of identification may be sufficient.

Most parts of bird skeletons can be identified to at least family level, even using isolated elements. However, more precise identification depends on the presence of sufficient distinctive features on the bone, and not all elements are equally diagnostic. Major limb bones, skull, pelvis, sternum and pectoral girdle are all suitable subjects, and even incomplete examples of these bones can still yield good results. As with skins, some families of bird are more difficult to identify with high precision than others, especially those showing little variation between genera or species. Under normal circumstances, with well preserved material, the majority of specimens can be identified to genus, and frequently to species.

Typically, most skeleton identifications will need to be undertaken by specialist staff with access to a reference collection. However, in relation to specific investigations it may be possible to produce illustrated identification keys that can be used in the field by less experienced individuals as an aid to initial assessment and seizure. In the event of any legal proceedings, identification will need to be confirmed by an appropriate specialist.

Box 5.2

© G Shorrock (RSPB)

Comparison of a seized eagle skull (middle) with Philippine eagle specimens held at the Natural History Museum, Tring

A major enquiry into the activities of an international dealer in parts and derivatives of dead animals resulted in the seizure of a large volume of exhibits. Many could be identified by use of experienced examiners and appropriate identification guides. Others items, including skulls, feather and skins, required detailed comparison with known reference material. The birds' skulls were identified by a specialist working for the Natural History Museum bird group, which confirmed the presence of a number of CITES listed species. The item of most concern was the illegally imported fresh skull of a Philippine eagle, shown here with museum reference samples. This species is listed as critically endangered with probably less than three hundred pairs in the wild. The dealer received a custodial sentence.

5.2.2.3 Other parts and derivatives

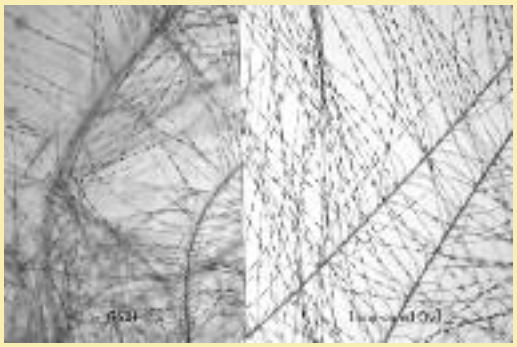
It may be possible to morphologically identify some parts and animal products. This can include fur made into coats and hats, feathers and parts of birds, products from reptiles such as crocodile handbags, snakeskin wallets, tortoiseshell boxes, turtle shells etc. Identification of feathers and birds' eggs is outlined in more detail below. There has been identification of some bushmeat products (even when dried or smoked) using fragments of fur or skeletal remains. Smaller items such as hairs present greater identification challenges and are only likely to be accepted in limited cases. Animal scats and footprint casts are not normally examined.

5.2.2 Feather identification

It may be possible to identify feathers by looking at size, shape and coloration and making a comparison with reference collections held in museums. Licensed bird ringers are often highly experienced in the identification of feathers from native species. In some cases, particularly with parts of feathers, a microscopic examination may be helpful to detect small variations in the makeup of feather structures between bird families. This type of identification work is undertaken by agencies such as the Bird Strike Avoidance Team at the Food and Environmental Research Agency (Fera) who identify the remains of species involved in aircraft collisions. The technique works best on downy material such as contour feathering, since flight feathers often lack the diagnostic structural details. Each contour feather has a central shaft with barbs coming from it. The downy barbs at the base of the shaft are subdivided again into barbules, and the length,

structure and pigmentation of these determine the identification. The microscopic structure of these feathers varies between groups of birds, for example pigeon species are different to geese or birds of prey. Even a tiny amount of such feather material can usually be identified to a family level. Whilst this identification is only down to family groups rather than individual species, it can provide useful evidence and may help exclude species which may be lawfully killed or taken. Further identification down to a species level may be possible by using DNA techniques.

Box 5.3



Microscopic comparison of seized owl feather (left) with reference sample (right)

A sample of a downy feather was removed from an illegally set pole trap. Microscopic examination was able to confirm it as an owl species. Further identification to species level in this case was also supported by DNA analysis (see Box 5.8).

5.2.3 Birds' eggs

The taking of birds' eggs is an unusual area of wildlife crime and is usually motivated by an obsession to collect purely for personal appreciation rather than a financial motive. Identification of birds' eggs can be a time consuming and difficult process. In addition to identification issues, there are a whole range of items associated with egg collecting which may need specialist examination and interpretation. These could include:

- Equipment used for collecting eggs;
- Equipment used to empty the living contents of the eggs, commonly known as an 'egg blowing kit' (see Box 5.10);
- Examination of notes, documents and coded entries;
- Comparison of seized photographs with eggs or determining the physical location of nest sites featured in photographs (see Box 5.4).

In the UK, the RSPB Investigations Section has extensive experience in this area of crime and can provide assistance and advice. It holds an extensive database containing information on known egg collectors, details of previous convictions and collecting activities. It also holds hundreds of known egg theft incidents from a range of sought-after species, which can be compared against seized eggs and documentation to assist with enquiries regarding provenance.

There are excellent reference collections held in museums and specialist staff may also be able to provide an identification service. These collections are accompanied by an archive of related

documents, including datacards and collectors' notebooks. Therefore, the collection can be used not only to identify specimens, but may also provide information on the provenance of potentially historic material. In simple cases, involving small numbers of eggs of relatively common species, ornithologists may be able to provide the necessary identification evidence.

Box 5.4

A photograph of lapwing eggs in a nest from a partially used film in a camera seized from an egg collector

A clutch of lapwing eggs found hidden in a secret compartment inside the suspect's bed, which could be physically matched to those in the photograph

The provenance of birds' eggs is an important issue as it is not an offence to possess eggs taken outwith the legislation. It is not normally possible to determine the age of birds' eggs. However, physical fits have been made in many cases between the markings on the shell of some birds' eggs and photographs of the eggs in the nest prior to taking. The quality of the match will usually depend on the variability of the markings on the eggshell surface and the quality of the photographs. Where the date of taking or development of the photographs can be established, even if only within a period of several years, this can be used to show the eggs were taken contrary to the relevant legislation. The matching of eggs with such photographs has assisted with a number of convictions (see also Box 3.5).

5.3 Plant identification

There are 400,000 flowering plant species in the world with approximately 30,000 plant species regulated under CITES. Plants therefore represent five times as many species than animals regulated under CITES. The Conventions and Policy Section coordinates the Royal Botanic Gardens, Kew's role as the UK's CITES Scientific Authority for plants and other plant related enquiries from enforcement officers in the UK, EU and internationally. Staff at Kew work closely with enforcement agencies to train officers, implement CITES at a national, regional and international level and assist with the identification of live plants and parts and derivatives.

Kew has approximately 19 different reference collections including living, dried and spirit material as well as an important DNA sample collection; together they comprise a unique global resource for the study of plants. The Herbarium at Kew houses more than 7 million specimens (mainly dried, pressed plant specimens) and the Living Collections holds about 85,000 live accessions representing more than 33,000 different taxa. The DNA Bank collections comprise more than 43,000 samples representing about 34,000 different plant species. The Millennium Seed Bank (MSB) houses nearly 2 billion seeds of more than 27,000 species of wild plants from 140 countries. With over 250 years of botanical expertise, Kew has the necessary resources to identify whole plants and parts and derivatives in trade.

Cases requiring identification may range from plants imported by holiday makers in their luggage, checking the ingredients in oils, perfumes and medicines, identification of large plant shipments imported by specialist traders for flower shows or for commercial purposes to determining the identity of native or internationally sourced plant fibres, seeds or other parts and derivatives. The botanical experts based at Kew use the following identification techniques:

5.3.1 Vegetative or flower characteristics

One of the key characteristics needed to identify a plant to species level is the flower structure. However, plants may not always be in a flowering state. It may be possible to compare other characteristics such as root/leaf/stem structure or DNA/chemical composition with samples in reference collections of herbarium, spirit or living material mentioned above. Staff with expertise in a particular plant group may be able to identify the plant to species level even if the plant is not flowering. With plants not easily identified without flowers, the plant can be grown on until flowering age, though this could take several years depending on the species and there are cost implications with maintaining collections for that length of time. Good quality digital pictures can also be sent to Kew to gain an initial assessment and identification of the sample.

Whether sending plant enquiries via email or by mobile phone for an initial identification it is useful to provide as much information about the plant or parts and derivatives (smell, colour, size, number) and where possible good quality photographs. Ensure the photographs are in focus, show the specimen as a whole and with close ups of any key features of the live or dead material (e.g. flowers, leafs, roots, stem parts, seeds) as this information can help determine the species. Also keep all packaging (collectors often write location details on this material) and provide this along with other relevant information (website addresses, invoices, bill of lading) as this can assist with identification and determining the source of the material.

5.3.2 Wood anatomy

With unrecognisable or difficult to identify plant specimens or derivatives, such as wood, other methods may be considered. Kew's Jodrell Laboratory has over 130,000 reference slides of a

Box 5.5

An officer from UK Border Force CITES Team (left) and the Plant Quarantine Officer at Kew examine a consignment of seized plants

A shipment of over 100 orchids (listed on Annex B of the EU CITES Regulations) was inspected to determine if the plants were of wild origin or artificially propagated. The plants showed signs of insect damage, companion plants from the wild were found amongst the roots and the plants were not of a uniform size as often seen with artificially propagated plants therefore indicating that the plants had been wild collected.

range of different plant parts (flowers, pollen, leaves), along with a comprehensive collection of wood samples, including species regulated under CITES. The Wood Anatomy section (Micromorphology) can assist with enquiries to identify wood or objects made from wood often using morphological characteristics either visible to the eye or with the use of a hand lens or microscope. These objects may have been found at a crime scene, offered for sale or seized during importation. A small sample can be taken from the object (preferably more than one cubic centimetre), finely sliced in the laboratory, stained and mounted on a slide. The anatomical features of the sample are then compared to the reference slides for that species. These features are usually sufficient to identify a product with certainty to family or genus level, but often not enough to distinguish to the species level. However, this may be sufficient in many investigations.

For example, a large commercial shipment of picture mouldings was seized by UK Border Force (UKBF) from a container port. These were identified by Kew as ramin (Gonystylus spp.), a group of Indonesian tree species listed on Annex B of the EU Wildlife Trade Regulations. Though identification was only to generic level, as all species are regulated under the listing this was sufficient evidence to prosecute. With some wooden specimens taking a sample may not be possible. Always check with RBG Kew to assess whether there are chemical tests available to identify a tree species, as in these cases much smaller samples may be sufficient (see Section 5.5 on ‘Other Analytical Methods’).

Chapter 5 Specimen identification and provenance

Regulating illegally sourced timber is a priority for the UK Government as shown by recent initiatives being implemented by the UK, such as the Forest Law Enforcement, Governance and Trade (FLEGT) Regulation and the EU Timber Regulation (see www.cpet.org.uk/).

International initiatives have also been launched to track timber from forest to finished product and certify forests as sustainably and legally harvested. These include certification schemes such as those under the Forest Stewardship Council (FSC) and the use of computerized bar codes, similar to those used by retailers, to track timber.

5.3.3 Traditional Medicines

According to the World Health Organization, traditional medicine provides health care to over 80% of the world's population. The Chinese Medicinal Plant Authentication Centre (CMPAC), coordinated at Kew, has developed a range of resources to assist both enforcement officers and the traditional Chinese medicine community with herbal identification, substitution, and related concerns of herbal quality and safety. Apart from using the packaging to identify which species are present in the medicine, CMPAC has collated a reference collection of some 650 species taking the form of over 3,700 samples, including CITES listed medicinal species. With readily recognisable medicinal specimens identification is possible from vegetative characteristics.

With more unrecognizable specimens it may be possible to compare them with samples from the CMPAC collections that have undergone anatomical, chemical and molecular analysis to create 'fingerprints' unique to that genus and species. For example, it is possible to differentiate between the three most commonly related species of ginseng, two of which are controlled under CITES. These 'fingerprint libraries' are an increasingly major part of CMPAC's authentication resource and have been used by the enforcement agencies with shipments of medicinal products imported through the mail, ports or in hand luggage. Increasingly, much of the data associated with these collections is being made available electronically and more information is available at www.kew.org.

Samples of 20-30g are usually appropriate for analysis (complete with packaging if possible). Staff at Kew can provide advice about submission of samples and the CITES Team at Heathrow Airport may also be able to assist with these issues.

Samples from the Chinese Medicinal Plants Authentication Centre (CMPAC) at the Royal Botanic Gardens, Kew. There are a number of important and highly traded medicinal plant species regulated under CITES including some ginsengs. CMPAC's purpose built '*materia medica*' collections, currently total over 1,500 accessions. These samples represent authentic drugs with corresponding herbarium specimens, collected by CMPAC staff from living plants in China. These unique reference materials are coupled with Kew's state-of-the-art laboratory facilities to deliver a high quality service, based on replicable techniques.

5.4 DNA testing in wildlife crime

The analysis of human DNA recovered from crime scenes has revolutionised criminal investigations. However, DNA is the building block of life and is therefore not limited to humans. DNA is present in animals, plants and fungi, and analysis of non-human DNA can provide crucial evidence in wildlife crime investigations.

5.4.1 Human DNA and the UK National DNA Database (NDNAD)

Wildlife crime scenes should be examined to look for potential sources of human DNA. These may provide a direct link to a known suspect or to an individual already held on the UK National DNA Database. A range of examples includes:

- Discarded cigarette butts, chewing gum and drinks cans;
- blood stains due to injuries received following the use of tools, climbing trees or handling animals;
- items which may have been handled and dropped such as tools, gloves, baseball caps etc.;
- saliva from envelopes or stamps, or the pipette of an egg blowing kit.

The UK's National DNA Database (NDNAD) was set up in 1995 and is the foremost and largest forensic DNA database of its kind in the world with profiles from around six million individuals. The database is populated by samples recovered from crime scenes, taken from police suspects and, in England and Wales, anyone arrested and detained at a police station. The likelihood of two unrelated individuals chosen at random possessing an identical DNA profile is less than 1 in 1,000,000,000.

Using patterns of inheritance between related individuals, the database can also be used to indirectly identify many others in the population related to a database subject. Whenever a new profile is submitted, the NDNAD's records are automatically searched for matches (hits) between individuals and unsolved crimestain records linking both individuals to crimes and crimes to crimes. Any NDNAD hits obtained are reported directly to the police force which submitted the sample for analysis. Over 20,000 matches per annum are currently being made.

Box 5.6

Badgers continue to be subject to offences with animals being killed or removed for baiting with dogs, and setts being destroyed or damaged

In at least two UK cases, suspects have been linked to offences at badger setts by obtaining human DNA profiles from discarded drinks containers and cigarette butts.

DNA profiling work has also been undertaken on badgers. This technique has the ability to identify remains and blood stains as those of badgers. In one case, following a badger digging incident, three defendants were caught close to the scene. Blood stains on clothing and a knife in their possession were sent for DNA testing and shown to be from a badger. All three received custodial sentences.

5.4.2 Wildlife DNA Forensics

Unlike human DNA profiling, where the aim is usually to link a suspect to a crime, wildlife DNA forensics is often concerned with proving that a crime has been committed in the first place, through identification of the animal or plant involved. This section will outline the procedure to maximise the effectiveness of wildlife DNA forensic analysis, and provides case examples from the UK where these analyses have been used.

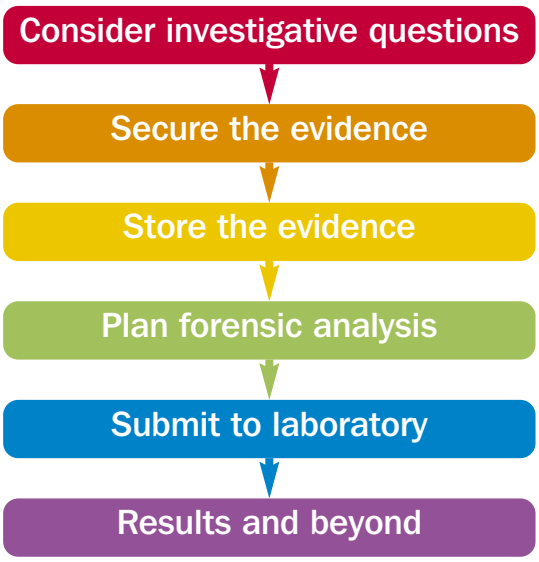
Forensic scientists should be part of the investigative process and it is important that communication links exist between enforcement officers and the laboratory. As wildlife DNA forensics is a specialist subject, investigators should find out if there is an established link between their organisation and a laboratory. If this doesn't exist, they should consider developing one (see Chapter 10 for how to find a wildlife forensic lab).

Ideally, the laboratory should be contacted as early as possible in an investigation for advice. For example, if a search warrant is being planned, consider contacting the laboratory before the warrant is executed to discuss what sort of evidence may be available for DNA analysis. See section 5.4.7 (Plan forensic analysis) for further information regarding laboratory communication.

DNA is present in a wide variety of evidence types; from blood, bone and feathers to powdered plant material, animal saliva and other transferable traces. The possibility of non-human DNA evidence should be considered in any investigation. In the UK, there are specific sampling powers within wildlife legislation, though for live birds and animals there is a requirement that these should be done by a veterinary surgeon. The following process should ensure the most informative results are obtained from the evidence. All steps assume detailed knowledge of chain of custody procedures.

5.4.3 Process for using wildlife DNA forensics

This schematic outlines the different steps in the process for wildlife DNA forensic testing to obtain the most informative results from the evidence. Each step is described in detail in the sections below.



5.4.4 Consider investigative questions – forensic techniques available

There is a range of techniques available to analyse DNA recovered during wildlife crime investigations. The test to apply depends on the question to be answered from the evidence, and it is worth remembering that not all tests are possible for all species.

5.4.4.1 Species identification

The most common question asked of nonhuman DNA evidence is *"What species has this come from?"* The answer to this question can be crucial evidence to support an investigation. For example, where illegal trade in endangered species is suspected but products of protected and unprotected species can look similar (e.g. Box 5.7 – rhino horn).

Box 5.7

© Czech Republic Enforcement Authority

These horn carvings were claimed to have been made from a rhinoceros horn trophy

Investigation type: Trade in endangered CITES species

Background: The illegal trade in rhinoceros horn is one of the most widely publicised wildlife crimes. It can, however, be legal to transport horn as part of a hunting trophy provided the correct documentation is present. In a follow-up investigation by the Czech Republic CITES Enforcement Authority after a rhino horn trophy had been legally imported, no mounted trophy was present and the owner claimed to have had the horn carved into smaller items.

Question for wildlife DNA forensic analysis: What species of animal do the small carvings come from?

Method: A DNA test that works with many species of mammal was used on a subsample of one of the small carvings.

Result: The carving was identified as originating from cow horn.

Outcome: This result demonstrated that the small carvings were not made of rhino horn, and suggested that the horns from the trophy were no longer with the hunter and may have been illegally sold. This is part of a much larger operation into rhino horn trade and is yet to be concluded (Dec 2013).

It is also important when trace evidence (e.g. blood) is recovered from a suspect's belongings or an item believed to be used by them that it can be shown to be from a protected species (e.g. Box 5.8 shorteared owl).

Box 5.8

Metal spring trap illegally set on a stump, and covered with moss, on a grouse moor in the north of England. Birds of prey and owls are highly vulnerable to such traps

Feathers and tissue were found on the jaws of the trap

Investigation type: Killing protected species.

Background: Following the discovery of a pole trap on a grouse-shooting moor, a man was seen at considerable distance to visit the site and apparently remove something from the trap. Later that day he was seen crouched down on another part of the moor. The buried corpse of a short-eared owl was later found at that location. When the police seized the trap, it was found to have traces of feather down and bloody tissue.

Question for wildlife DNA forensic analysis: What species of animal may have been caught in the illegal trap?

Method: A DNA test that works with many species of animal was used on the tissue samples recovered from the trap jaws.

Result: The DNA sequence produced from the remains removed from the trap were identified as originating from a short-eared owl. Further analysis from the trap identified DNA originating from tawny owl, suggesting this species may have been previously caught in the same trap.

Outcome: Two gamekeepers later pleaded guilty to illegal use of the trap and killing the short-eared owl. This case concluded in 2002 and is believed to be the first time in the UK that animal samples taken from an illegal trap were identified using DNA analysis.

Additional note: The feather samples were passed to the 'Birdstrike Team' at Fera. They undertook a microscopic examination of the feather down and identified it as an owl species (see also Box 5.3).

This type of test is available for most animal and plant species, and can work with trace amounts of DNA. It is important to let the laboratory know if there is a target species to identify or eliminate as part of the investigation as this can change the method of testing used. Some tests are very general and will work on a wide range of species, but where it is possible that DNA from a mixture of species may be present (e.g. on a trap or snare) a targeted test for the species of interest is more useful (e.g. Box 5.9 – egg collecting).

Box 5.9

The contents of an egg blowing kit, including blowing tubes, tweezers, and small drill bits. Arrows indicate the positions sampled for bird DNA

Investigation type: Wild bird egg collecting

Background: When an egg collecting kit was recovered as part of an egg collecting investigation, the officers made a list of all of the species from which they believed the suspect may have recently blown eggs. This list was based on eyewitness evidence the suspect was seen around a common gull colony where eider ducks also had nests. In addition eggs were found in his possession and identified by the RSPB investigators as Manx shearwater, meadow pipit and willow warbler.

Question for wildlife DNA forensic analysis: Can DNA from common gull, eider duck, Manx shearwater, meadow pipit or willow warbler be identified on the egg blowing kit?

Method: Based on the intelligence received, the wildlife DNA forensics lab developed tests that targeted the DNA from these five species, while it is possible that DNA from many bird species was present.

Results: DNA from three of these five targeted species was identified from different locations on the eggblowing kit ; this contributed to a charge of taking wild birds eggs.

Outcome: From this part of the investigation, the accused pleaded guilty to all charges against him, and received a six month custodial sentence. He subsequently received a lifetime ban on entering Scotland during bird breeding season.

5.4.4.2 Parentage

Another question posed during wildlife crime investigations is *"Is it captive bred?"* Laundering illegally taken wild animals through captive breeding centres to produce 'legally captive bred' animals is a particular problem for birds and reptiles. Where it is suspected that animals have

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A peregrine chick fitted with a close ring doesn't necessarily mean the bird has been lawfully bred in captivity. During the 1990s, the use of DNA profiling in a number of UK wildlife crime investigations confirmed significant numbers of wild taken peregrines and goshawks were being laundered into the captive market on the pretence of being captive bred. This resulted in a number of high profile convictions and jail sentences in some cases. It is believed this had a dramatic deterrent effect and is generally regarded as one of the best examples of the impact of a forensic technique in the investigation of wildlife crime in the UK

been illegally taken from the wild and are therefore unrelated to the parents named on captive registration documents, it is possible to use DNA parentage testing to investigate. Mismatches between parents and offspring can exclude one, or both putative parents from being related to the offspring (e.g. Box 5.10). This type of testing is species specific – contact the forensic laboratory to find out if the species being investigated is included.

In the UK, this technique has been successfully used in numerous investigations involving the illegal laundering of wild taken birds of prey. These cases have generally relied on having the appropriate DNA testing methods in conjunction with the bird registration records maintained for certain captive birds by the Animal Health and Veterinary Laboratories Agency (AHVLA). AHVLA is an executive agency working on behalf of the Department for the Environment, Food & Rural Affairs (Defra), Scottish Government and Welsh Government. These records ensure the target birds, their parents and other family relatives, are uniquely marked and can be physically located for testing. These records are only available for a very limited number of bird species. Without the information available under these types of legislative controls it may not be possible to locate and identify birds to undertake this type of DNA testing.

Box 5.10

DNA profiling confirmed this goshawk had changed its identity

Investigation type: Wild goshawk laundered into captivity.

Background: A falconer claimed that his female breeding goshawk had lost its identification ring and functioning microchip, raising suspicions that the original bird had in fact been swapped with an illegal wild caught replacement. Although no historic DNA sample was available from the adult female, the investigating team identified one of its offspring against which the identity of the current suspect female could be evaluated.

Question for wildlife DNA forensic analysis: Using DNA parentage testing, is it possible to exclude the suspect bird as being the parent of a registered captive bred goshawk, thereby proving a change in identity?

Method: Blood samples of the suspect mother, registered father and offspring were subject to forensic DNA parentage testing using a validated goshawk profiling system.

Results: The DNA profiles excluded a parent offspring relationship between the female and juvenile, demonstrating that the female bird was not the mother goshawk on the UK bird register. This was an interesting use of DNA profiling, as most cases have revolved around showing wild taken young birds are not related to parents lawfully held in captivity.

Outcome: The falconer pleaded guilty to possessing a wild goshawk, making false representations to register the bird, and to obtaining an Article 10 sales certificate. He was sentenced in to eight weeks in prison.

5.4.4.3 Individual identification

Human DNA recovered from a crime scene can link a suspect to a crime if their DNA profile is found to be a match. Similar techniques can be used with non-human DNA to answer the question *"Do they match?"* An example would be where dog DNA recovered from a coursed hare carcass was tested for a match with the suspect's dog (see Box 5.11). For use in forensics, these animal DNA profiling tests must be validated, and be linked to suitable population data to calculate the statistical strength of a match. In the UK this test is only available for a limited number of species, including dogs, badgers, rhinoceros and several birds of prey. Contact the forensic provider to find out if the species under investigation is included.

Box 5.11

© SASA

Coursed hare carcass. Arrow indicates area of fur sampled for dog saliva transfer

Investigation type: Hare coursing

Background: Three hares were recovered during a hare coursing investigation, and suspects were identified with two dogs. The investigating officers contacted the DNA analysis provider from the scene to ask about carcass recovery and storage to maximise the chance of recovering dog DNA from the hares. The hare carcasses were stored as advised, and brought for examination the following day, where swab samples were taken from matted areas of fur where dog saliva could be present.

Question for wildlife DNA forensic analysis: Can dog DNA be identified from the hare carcasses? If so, is there sufficient dog DNA for profiling to assess for a match with the suspects' dogs?

Method: Initial tests were carried out to identify the presence of dog DNA on the swabs. Once confirmed, dog DNA profiling tests were carried out on the case samples, and then compared to DNA profiles produced from the suspects' dogs.

Results: Dog DNA profiles were recovered from two of the hare carcasses. These profiles both matched one of the suspects' dogs, linking this dog to the coursing incident.

Outcome: The accused pled guilty to hare coursing and received a fine.

5.4.4.4 Other specialist DNA tests

Sometimes it is of investigative importance to answer the question *"Is this from a male or female?"* In the UK, this is most often used in deer poaching investigations where hunting seasons differ between the sexes (e.g. Box 5.12). Sex determination is available for many bird and mammal species.

When multiple similar crimes are suspected, and remains are recovered from an unknown number of plants or animals, *"How many?"* is a common question. This can be important for investigations into illegal trade in endangered species or poaching where the number of plants/animals that have been exploited will contribute to the strength of the case. DNA testing for this is only necessary where it is not possible to count the number of individuals from the physical evidence (e.g. blood spatter see Box 5.13).

Box 5.12

A deer carcase found with head, lower legs, genitalia and internal organs all removed

Investigation type: Taking deer out of season

Background: Five butchered deer carcases were recovered. Investigating officers suspected that some of these could be female and therefore had been shot out of season. The condition of the carcases prevented a morphological examination to determine sex of the deer.

Question for wildlife DNA forensic analysis: Can you confirm the species identifications from samples of five deer carcases and identify the sex of each animal?

Method: A mammal species identification DNA test and a deer sexing test were applied to all five samples.

Results: Two of the carcases were found to be from female fallow deer and based on the date of recovery had been shot during the annual closed season.

Outcome: The two accused pleaded guilty to offences relating to taking wild deer during the closed season and were fined.

"Where is it from?" – the location from where a plant or animal originated can be an important piece of evidence. A DNA test may be able to say whether it is likely to be from a wild or a captive population, or it could inform an investigation by tracing a plant or animal back to a particular location. This type of test is only available for a limited number of species, but techniques are being developed for example, for ivory, fish and timber.

Box 5.13

The cockfighting arena as recovered on the day of the search warrant. It was claimed to be only a dog bed, but blood staining was clearly visible on the side walls

Investigation type: Animal welfare – cockfighting

Background: During a Royal Society for the Prevention of Cruelty to Animals (RSPCA) Special Operations Unit investigation, an object was recovered which was believed to be a cockfighting arena, alongside other paraphernalia associated with cockfighting.

Question for wildlife DNA forensic analysis: Can you identify blood from male chickens (cockerels) from the arena and other items? Can you estimate how many different individuals may have contributed to the blood evidence?

Method: Fifteen separate areas of blood spatter on the arena were tested for the presence of DNA from male chickens (cockerels). Differences in the DNA recovered from the different areas on the arena, and from the other items enabled an estimate of the minimum number of contributors to this evidence.

Results: A minimum of six different cockerels and one hen had contributed to the DNA evidence recovered from the arena and other items.

Outcome: The DNA results contributed to a large volume of evidence linking the suspects to cockfighting. The two accused pleaded guilty to charges relating to cockfighting and received a disqualification order in relation to birds, 20 week custodial sentences (suspended for two years), community service and fines.

5.4.5 Secure the evidence

Strict chain of custody procedures must be followed at all times.

If possible, secure an entire item for examination and forensic DNA analysis (e.g. trap, snare, carving, hare carcass, packet of traditional medicine). However, there will be times where this is not possible, (e.g. animal blood evidence on a concrete floor) or practical (e.g. large slab of meat in a poaching investigation). In these circumstances, you should contact your CSIs and request their attendance to sample the evidence. Where CSIs are unavailable, it may be possible for enforcement officers to secure DNA evidence themselves. In the UK, the Forensic Working Group (FWG) has developed a sampling kit to help officers recover DNA evidence for wildlife crime investigations. Details of how to obtain these kits and instructions for their use are

provided at Appendix A. Similar kits have been developed and distributed in many countries.

"What evidence should be collected?" Discussion of the case with a wildlife DNA forensic analyst should help to secure the most useful type of evidence. For example, if you have some butchered meat which is suspected to be from a poached deer, the meat itself should be sampled, not a swab from the surface of the meat. Further information on the best sample types and how to preserve them can be found in the DNA sampling kit guide. Details of how to obtain the DNA sampling kit and the instructions for use can be found at Appendix A.

5.4.6 Store the evidence

DNA can deteriorate very quickly if samples are not stored correctly. As a rule of thumb if the sample is dry (e.g. whole trap, fur, ornament, powder) it should be securely stored dry at room temperature, however if the item is wet or damp (e.g. swabs, meat) it should be securely stored frozen.

There are exceptions to this rule, most notably an animal carcass that may require postmortem examination before DNA analysis. In this case, freezing the carcass would be best for the DNA analysis, but is not advised prior to postmortem examination, so contact the laboratory to discuss the best storage or sampling options.

5.4.7 Plan forensic analysis

All forensic analyses need to be planned in advance, both internally and with the laboratory. This can happen by phone or email, or may require a meeting. In any event it is important to contact the forensic scientist prior to submission of samples to discuss the case, identify the best type of analysis, and establish the costs. This will also allow the laboratory to prepare for the receipt of evidence. In the UK, details of communications with forensic service providers are usually disclosable during criminal proceedings, so it is important to ensure that information provided and requests for testing are accurate and clear.

The cost of the analysis will be an important consideration prior to submission. The laboratory will be able to give you an estimate of costs when they know how many samples there are, and what type of analysis is required. Below are some frequently asked questions regarding wildlife DNA forensic analysis.

5.4.7.1 Frequently asked questions

Q1. What DNA tests are available?

A1. This will depend on the type of evidence (e.g. fresh blood vs trace amounts in a processed traditional medicine) and the species it comes from. Some tests will not work on trace evidence, and some tests are only available for a limited number of species. Section 5.4.4 – 'Consider Investigative questions' provides some details on this, but contact the forensic service provider in this field to discuss the options for each case.

Q2. Can my local University lab can do this analysis for me? They have offered.

A2. Usually, no (although there can be exceptions to this). For reasons of security, chain of custody and the quality standards required for evidence it is strongly advised that research facilities such as universities are NOT used for forensic wildlife DNA testing. If you want clarification for your specific case, seek advice from the forensic science manager or, in the UK, contact the FWG (see Appendix A). Also see guidance in Chapter 10 to help you select your forensic testing provider.

Q3. How much will it cost?

A3. The cost will vary depending on the type of sample being analysed, the number of samples and the test being applied. For examples of costs associated with UK forensic tests to investigate wildlife see the FWG website at http://www.pawfwg.org.

Q4. I have found some blood on the knife of a suspect which I think may be from a poached deer. How long has the blood been on the knife?

A4. Unfortunately it is not possible to say how long trace DNA evidence has been present.

Q5. How long will the analysis take?

A5. This will depend on several factors including how many samples are being submitted, what type of testing is required and how busy the laboratory is at the point of submission. It is unlikely that turnaround time for forensic testing will be fast, so arrange to submit evidence for analysis as soon as possible, and discuss the time-frame for analysis with the lab in order to have the results you need before court proceedings begin.

5.4.8 Submission for analysis

Once authority is granted to submit the samples for analysis, a laboratory submission form is required. This form will include some details of the investigation, the question you would like answered from the evidence, and a list of each evidence item being submitted which will form the basis of the chain of custody at the lab. Each laboratory will have its own form, although the details required are likely to be similar to the standard UK MG21 form for forensic analysis. Once the form is complete, the evidence must be delivered either by hand, or by a registered courier service (signed for). Always contact the laboratory prior to sending samples to confirm that evidence can be received.

5.4.9 Results and beyond

The laboratory will provide you with a report, detailing the results of tests performed on the evidence submitted for analysis. It is important that the lab is kept up to date with the progress of the case. If new information comes to light which could impact on the interpretation of the DNA evidence, the laboratory should be informed and they may issue a revised report. Also remember the evidence may need to be returned to the custody of the investigator, witness statements may be required, and the analyst may be required to give evidence at court.

5.5 Other analytical methods

A wide range of analytical techniques are potentially available in particular cases. Once a specimen has been processed to any degree, identification can become increasingly difficult. If specimens have been highly processed and mixed with other ingredients, only sophisticated forensic techniques may be able to provide a definitive answer. Typically, the contents of manufactured traditional medicines are very difficult to determine because of the methods of manufacture and the large range of ingredients that may be mixed together. Under CITES it is not necessary to prove whether the species is actually contained within a processed medicine, as the offence is committed simply if the ingredients of the medicine claim to contain it. However, there may be a range of circumstances where accurate determination of contents is necessary. A range of methods, which may be appropriate, could include:

- Mass spectrometry;
- Thin layer chromatography;
- Xray fluorescence;

These can potentially be used to identify a range of products including musk, ivory, bear bile, ginseng, whale oil, caviar roe, and rhinoceros horn. They may also provide information on geographic origin, or to assess captive breeding claims. In the UK, the FWG should be able to provide further advice on whether any of these techniques may be appropriate in particular cases.

5.5.1 Radiocarbon dating

Radiocarbon is a radioactive form of carbon formed from nitrogen in the upper atmosphere. It is taken up as carbon dioxide during photosynthesis, entering the food chain, and labelling every living organism. Radiocarbon has a fixed rate of decay back to nitrogen, but levels in living organisms are kept constant by a continuous intake through the food chain. When an organism dies, the intake stops and by measuring levels of radiocarbon it is possible to estimate the time elapsed since death. From the early 1950s, nuclear weapon testing increased atmospheric radiocarbon. Any organism with a radiocarbon level higher than the natural level must have been alive after the early 1950s. This can be useful for trade in CITES species investigations where worked specimens are claimed to have been made prior to 1947, and so exempt from EU sales controls. If the radiocarbon signature is elevated to levels post nuclear testing in the early 1950s, the claim of a pre-1947 origin can be disproved as the original specimen must have been alive, and taking in radio carbon after nuclear testing began.

Box 5.14

Ivory figurines seized by Hampshire Constabulary during a trading enquiry

All elephant species are listed on Annex A of the EU CITES regulations and trade in any parts or derivatives is strictly controlled. Antique ivory products, such as ornaments, carvings and jewellery, may only be traded without Article 10 licences if they were prepared before 3 March 1947. Following advertisement of ivory being offered for sale on the internet a number of items were seized from a suspect.

A morphological examination was undertaken and it was suspected the ivory was of comparatively recent origin. Following consultation with the FWG, samples were submitted for radiocarbon dating. The analysis proved conclusively that the elephant(s) from which two of the pieces had originated were still alive in the 1950s. Whilst the case was unsuccessful on other legal issues the forensic evidence was accepted.

5.5.2 Chromatography and mass spectrometry

Box 5.15

This wood intended for guitars was identified as CITES listed Brazilian rosewood (*Dalbergia nigra*) from a test developed by the Royal Botanic Gardens, Kew

Microscopic examination can usually be used to identify woods to a level sufficient for CITES enforcement. The wood of *D. nigra*, however, is anatomically very similar to woods of closely related species that are not regulated under CITES. An additional chemical test for *D. nigra* has therefore been established which uses the finding that, among *D. nigra* and closely related species, only wood of D. nigra contains a compound called dalnigrin. The test involves extracting a few small wood shavings (about 25 mg) in methanol and using the analytical technique of liquid chromatography-mass spectrometry to determine whether the extract contains dalnigrin. In the case of the guitar veneers, microscopic examination supported the suspicion that many were made from *D. nigra* and this was confirmed by a positive test for dalnigrin.

Wildlife poisoning and pesticide analysis

6.1 The investigation of wildlife poisoning incidents in the UK

The use of pesticides can result in the poisoning of wildlife. This may be because of a misuse of the product, or by careless, accidental or wilful failure to adhere to the correct practice as specified for that product. Pesticides can also be deliberately and illegally used to poison animals. In the UK, all aspects of pesticide advertisement, sale, supply, storage and use are fully regulated under relevant legislation. Poisoning offences can also contravene several pieces of wildlife legislation.

The illegal placing of poisoned baits in the countryside remains a persistent and serious problem. Animals targeted typically include birds of prey, corvids, and foxes though the indiscriminate nature of these actions means that other wildlife and people are also potentially at risk. Companion animals, such as cats and dogs, are regularly poisoned as a result of illegal practice. The majority of incidents of deliberate pesticide abuse are associated with land managed for game shooting. However, there may be problems connected with the protection of livestock, the poisoning of peregrines by elements of the racing pigeon fraternity and occasional poisoning of pets arising from neighbourhood disputes.

6.2 The Wildlife Incident Investigation Scheme (WIIS)

In the UK, the Wildlife Incident Investigation Scheme (WIIS) makes enquiries into the death or illness of wildlife, companion animals and beneficial invertebrates that may have resulted from pesticide poisoning. The scheme has two objectives:

- To provide information to the regulator on hazards to wildlife and companion animals and beneficial invertebrates (bees/earthworms) from pesticides; and
- To enforce the correct use of pesticides, identifying and penalising those who deliberately or recklessly misuse and abuse pesticides.

Also included in the scheme are suspect baits, where it is thought that pesticides have been inappropriately applied or used, and spillages of pesticides where this poses a risk to wildlife or companion animals. The scheme is essentially a monitoring tool to inform the pesticide approval process. However, where there is clear evidence of a breach of pesticide law, enforcement action may be taken. Cases accepted for further investigation will usually fall into one of the following categories:

Approved use a pesticide is legally used in accordance with its conditions of authorisation and the poisoning incident has occurred as a result;

Misuse the product has not been used according to the conditions of its approval, but often just carelessly or accidently, without the intention of harming animals. Examples could include failure to clear up a spillage of slug pellets, incorrect storage of pesticides, incorrect dosage, use on a different crop or at the wrong time of year;

Abuse a pesticide has been deliberately used in an illegal manner to poison, or to try to poison animals.

Chapter 6 Wildlife poisoning and pesticide analysis

In some cases pesticides may be found in animal tissues on analysis but the origin of the substance is unclear and the cause of death will be unknown or unspecified.

A typical wildlife poisoning abuse incident. Victims such as this buzzard are often found in close association with the poisoned bait.

Where poisoning is suspected, a combination of field work, veterinary examination and chemical analysis is used to try to determine the underlying cause of death. The scheme is operated independently in all four countries of the UK using the same free phone number 0800 321600 for reporting incidents. Notifications of possible incidents arise from a large range of sources including referrals from RSPB, RSPCA, local authorities, conservation groups, calls from private vets and the Animal Health and Veterinary Laboratories Agency, as well as direct contact by landowners and the general public. There are two essential criteria for the acceptance of an incident into WIIS:

1 The incident involves the death or illness of wild animals, companion animals (pets), beneficial invertebrates, or the presence of a substance believed to be a pesticide (such as a spillage or a bait apparently laced with pesticide, with the potential to cause harm).

2 There is good reason to believe pesticides are involved in the incident. Some of the factors that may influence the decision include, for example:

- The number, location and species of mammals or birds involved;
- The finding of baits with identifiable material such as pellets or granules;
- A veterinary opinion, diagnosis or postmortem examination;
- Observations by the finder or owner of animals prior to an animal's death;
- The previous history in the area;
- Information that strongly suggests pesticides may be involved.

The range of chemicals involved in wildlife poisonings is wide but primarily offending substances are those involved in the control of vertebrates or insecticides. Groups of chemical compounds include carbamates, organochlorines, organophosphates, pyrethroids, anticoagulants and other rodenticides as well as individual compounds such as metaldehyde, chloralose, strychnine, paraquat and other compounds.

6.2.1 England

The Chemicals Regulation Directorate (CRD) of the Health and Safety Executive (HSE) has overall responsibility for the policy of the scheme which is run on HSE's behalf by Natural England (NE). Where incidents of suspected poisoned animals are reported the NE Wildlife Management Adviser decides, in consultation with others, whether an investigation should be started. This permits the screening out of incidents, which may not involve pesticides. A field visit may be made by the adviser in conjunction with other parties such as the police, or finder of an incident to identify the exact location of an incident and to gather information and to secure evidence.

Chapter 6 Wildlife poisoning and pesticide analysis

After acceptance of an incident, and a field visit, any suspected poisoning victims are taken to an Animal Health Veterinary Laboratories Agency (AHVLA) Centre where a postmortem examination may be undertaken. This may eliminate those cases due to disease, trauma and starvation and will report any findings that might help analysis. Bacteriological or virological tests may be undertaken to determine whether disease contributed to the deaths. If following postmortem examination and any other tests, a non-pesticide cause of death can be established, then no further investigation under the WIIS will normally be made.

In cases where the AHVLA believe poisoning to have occurred, the postmortem examination findings and relevant tissues from casualties are forwarded for chemical analysis to the Wildlife Incident Unit (WIU) at the Food and Environment Research Agency (Fera), near York. In some cases where there are no known casualties, or where samples from living animals are obtained (e.g. faecal or blood samples), Wildlife Management Advisers will arrange for such samples, baits and/or suspected pesticides to be sent directly to Fera. The results are collated and interpreted by Fera to assess the probable cause of the incident and whether any residues detected contributed to the death or illness of the animal. Cause of death is generally attributed to a pesticide if residues of a chemical or its derivatives are found above levels considered to represent lethal exposure. In some cases, the presence of residues in association with typical postmortem examination findings may be used to determine cause of death.

On receipt at the laboratory, potential residues are extracted from the tissues and are subjected to analytical tests. These involve powerful multi-residue and single compound methods and residues are measured and confirmed by definitive techniques. During the analytical process, care is taken to avoid the possibility of any cross contamination. The presence of low residues in tissues is not always indicative of poisoning as they may be caused by non-lethal exposure resulting in background levels. The interpretation of any residues found is based on expert knowledge from published information, experimental results, knowledge of similar incidents and associated clinical symptoms.

Two red kites poisoned by a bait laced with the banned pesticide mevinphos. The presence of many dead insects on the bait is often a good indication of the presence of a pesticide.

From the time when there is sufficient information to accept the case into the scheme NE will aim to conduct field enquires within four working days. If a postmortem examination is undertaken this will be normally be completed within two working days of the body being received at the AHVLA laboratory (or longer if frozen). The AHVLA will, where appropriate, dispatch tissue samples from the animal to the Wildlife Incident Unit at Fera for pesticide analysis, usually within three working days of the postmortem examination. The pesticide analyses at Fera will normally take up to 8-12 weeks. Some tissues will be analysed for specific compounds as a matter of priority, this will be completed within 10 working days.

If there is scope to pursue the investigation further enquiries may be made by the enforcing authority leading the investigation which may be the police, HSE or the local authority. It is therefore important to establish at the outset which enforcing authority is taking the lead in an investigation and who will take responsibility for interviewing the suspect and if appropriate,

taking the case through to prosecution. In the UK, most wildlife poisoning enquires are led by the police. NE may be asked to assist any enforcing authority to make further enquiries and each request is considered on a case by case basis in consultation with CRD.

6.2.2 Wales

In Wales the scheme is run by the Welsh Government with the analysis undertaken by Fera. The operation of the scheme is very similar to that in England.

The acute toxicity of the pesticides used means that birds such as this red kite may die directly during feeding and may have food still in the beak.

6.2.3 Scotland

The Scottish scheme is similar to those in England and Wales. Field investigations are carried out by Scottish Government Agriculture and Rural Delivery Division staff, located in area offices throughout Scotland, usually in close cooperation with the police. Animal samples or other relevant materials obtained during the field investigation are submitted to Science and Advice for Scottish Agriculture (SASA) for analysis. Veterinary support is provided by SAC Consulting. Veterinary Services and carcases should be submitted to one of their Disease Surveillance Centres for postmortem examination and collection of material for subsequent analysis at SASA.

6.2.4 Northern Ireland Scheme

The Northern Ireland scheme is slightly different. There are analytical facilities available in Northern Ireland, though at the time of writing toxicology tests in relation to WIIS are being undertaken by SASA in Scotland. The Police Service of Northern Ireland is responsible for the investigation of wildlife poisoning incidents.

6.3 Police guidance wildlife poisoning and forensics

In cases of suspected wildlife poisoning, guidance should be sought where possible from suitably experienced personnel. In most cases of suspected wildlife poisoning incidents (outside Northern Ireland) officers from one of the relevant government agencies will be in attendance, either independently under their own statutory powers or in company with the police. However, there may be circumstances where:

a) experienced individuals are not available and /or

b) it is necessary to prevent potential loss of evidence and/or to reduce the risk to other wildlife or people.

In addition to evidential concerns, a key consideration is whether items can be safely handled, transported and stored before a decision can be made whether the items can be dealt with under WIIS and transferred into the system for necessary postmortem examination and/or toxicology tests.

6.3.1. Initial reports

When taking initial reports, usually from the public, ensure as much detail is obtained as possible, particularly regarding the location. The finder may have GPS details from mobile phones or other devices. Internet based mapping systems and email can be used by the person reporting to very effectively give precise locations. If the person reporting is at the scene, encourage them to take photographs if possible. If there are risks to other animals coming into contact with suspected poisoned items, the scene can be covered temporarily with branches or vegetation to reduce the risk of further avian casualties. Accompanying the reporting person to the scene is sometimes the only way to ensure the location can be determined.

Intelligence checks should be made at the earliest opportunity as this may influence the most appropriate course of action. In the UK, the police should consider the intelligence databases maintained by National Wildlife Crime Unit and RSPB Investigations. Regional government advisers may also hold relevant information. Early contact with CSI staff might also resolve site assessment issues.

Attempts should be made to keep visits low key to avoid alerting local land users who may be involved or able to pass on information to suspects. Police should consider the use of unmarked vehicles and civilian clothing and how an area may be approached least conspicuously. In some cases, where there are reasonable grounds to suspect a wildlife poisoning incident has taken place, then further enforcement action may quickly take place, such as searches of land and outbuildings or the execution of search warrants (see 6.3.7 Subsequent searches). In other cases it may be necessary to wait a number of weeks for the results of toxicology tests. A prompt response is usually beneficial where possible as the initial seizure of suspected victims and baits may alert any persons involved leading to the removal or hiding of other evidence. There may also be other victims and baits in the area. In the UK, searches of land and non-dwelling premises may be under police or government adviser statutory powers. These powers allow them to take other parties with them to assist. Searches of dwelling houses of suspects will normally take place under the authority of search warrants.

Whilst rarely as obvious as this case, on some poisoned baits the presence of granular pesticides may actually be visible.

6.3.2. Scene assessment

On attending the scene of a suspected wildlife poisoning incident a careful assessment in relation to health and safety and potential evidence should be made before handling or moving any items. This should consider:

- any signs to suggest a poisoning incident has taken place. This could include an apparent victim lying next to potential bait perhaps with signs of food in mouth/crop; a cut open or staked down animal carcase perhaps with signs of discolouration or the presence of granular material; a punctured and discoloured egg. Note that even at high concentrations of abuse pesticides, there may be an absence of visual evidence. The presence of dead

flies or other insects on, under or close to a suspected bait may indicate that an insecticide is involved;

- any potential forensic evidence at the scene (tyre, footwear or spade impressions, discarded items etc);
- potential health and safety issues (and appropriate equipment for the safe handling, containment and transportation of items).

A detailed search of the area immediately around a suspicious occurrence may locate further victims or poisoned baits. For example, poisoned birds may have come to rest a short distance from a poisoning site, often downhill. Whilst most poison baits are laid on the ground, there have been cases of baits being elevated, such as on walls or in trees. There are also cases of small pieces of meat being laced with a pesticide and positioned on fence posts for predatory birds.

Box 6.1

A poisoned golden eagle on a grouse moor in Scotland, one of three eagles poisoned in the same area

Two dead golden eagles were found independently in Scotland. These were close to each other, one was on the edge of a forestry plantation the other on a grouse shooting estate. Police and RSPB staff undertook a field search and using experience from previous searches, visited a hill above the location where one of the eagles had been found. The carcass of a staked out red grouse was found, next to which was the body of a sparrowhawk. A third dead golden eagle was found nearby.

The dead birds and suspected poisoned bait were entered into WIIS for postmortem examination and toxicology tests. This confirmed the first two eagles and the sparrowhawk had been poisoned by the banned pesticide carbofuran, a substance also present on the grouse bait. The third eagle had also been poisoned by aldicarb, another banned pesticide.

A search of the estate outbuilding found, in a store used by the estate gamekeeper, a huge quantity of 10.5 kgs of carbofuran. This was the largest quantity of illegal poison ever seized in Scotland and capable of killing thousands of birds of prey. The estate gamekeeper was heavily fined for illegal storage of the carbofuran. There was insufficient evidence to link him to the deaths of the birds.

Always maintain a high standard of hygiene and do not smoke, eat or drink whilst handling samples. Wash hands thoroughly after handling any samples prior to undertaking any other activity. All cuts and abrasions should be cleaned and protected with waterproof dressings. Disposable equipment such as bags, boxes and storage containers must not be reused for other purposes. If a sample cannot be handled safely it should not be taken into possession. Keep exposure time of all hazardous items/materials to a minimum. Tetanus vaccinations should be kept up to date.

The most hazardous materials likely to be encountered are carbamate pesticides (usually in granular or powder formulations) and more rarely the solvent based organophosphorous compounds. These have the potential to cause the injury or death of humans. The route of entry into the body may be by skin absorption, by inhalation where there is a vapour phase of the pesticide, and possibly by direct ingestion. Less hazardous materials include rodenticides and molluscicides. However all samples must be treated with equal care, following relevant risk assessments and procedures. Other hazards associated with poisoning incidents include zoonoses, diseases transmissible from animals to man, which may be carried by any carcases (see Chapter 9). In addition there are risks from sharp claws and talons of animal victims or baits.

6.3.3. Forensic and other evidence

In addition to suspected poisoned victims or baits, consideration should be made of other evidence either at a crime scene or in the vicinity. Consider:

- Are there soil samples, footwear or tyre impressions which may provide information about who has visited the scene?
- Are there discarded items or perhaps items used to stake down or tie a bait which may provide potential sources of human DNA or fingerprints?
- Is the attendance of CSI required? Consider how this could be done in a low key manner to avoid alerting potential suspects;
- What is the surrounding land or area used for and could this indicate a motive for the laying of a poison bait?
- Are there other forms of predator control taking place in the area such as the legal or illegal use of traps or snares? The user of these items may be linked with unlawful predator control methods such as poisoning.

The majority of wildlife poisoning incidents are linked with land managed for game bird shooting, but poisoning can also be associated with the protection of livestock such as lambs, targeting raptors to protect racing pigeons or neighbour disputes involving pets.

The taking of photographs and preparing sketch plans of the scene can be extremely useful in these enquiries (see Section 2.1.1).

6.3.4. Bagging and labelling

Suspected poison victims and baits should be individually double bagged and close attention paid to labelling and continuity.

The main personal protection when handling animal carcases in a naturally ventilated field situation is the use of disposable nitrile gloves. Nitrile gloves give the necessary short term

protection against both zoonoses and pesticides. Double gloving will further reduce exposure risks when handling samples. The second pair of gloves is used to reduce risks of zoonoses following the initial handling when the outer glove will be contaminated.

Use a clean unused plastic bag or heavy duty bin liner that is large enough for the sample, including being tied. The best methods are to roll back the sides of the first bag so the specimen can be placed on the bottom of the bag or alternatively use the bag as an additional 'glove' and use it to pick up the item and then fold around the remainder of the bag.

Any excess air should be excluded; the end of the bag should always be away from the face to avoid inhalation of the excluded air and be held down wind. Avoid dropping carcases into bags as this could liberate aerosol, dust or other particulate infection.

If double-gloving, after the first bag is sealed it can then be placed on to a second rolled back bag and the outer contaminated pair of gloves removed and discarded into the outer of the two bags for disposal. Using the clean inner pair of gloves the second bag can be closed in the same way as the first, however before the second bag is sealed the second pair of gloves should be removed and placed inside the bag. The second bag must be cable tied and labelled to aid future identification and ensure continuity of evidence.

Primary bagging of a suspected poisoning victim. The first polythene bag is prepared by rolling back the sides. Wearing two pairs of protective nitrile gloves a suspected poisoning victim can be carefully placed into the bag. The sides can then rolled up and air carefully expelled before tying the bag.

The secondary bagging of a suspected poisoning victim. A second polythene bag is similarly prepared by rolling back the sides. The first tied polythene bag is lowered into this. The outermost pair of protective nitrile gloves are removed and also placed into the second bag. The sides of the second bag can then rolled up and the inner pair of protective nitrile gloves also dropped inside. Again the air is carefully expelled before tying and labelling the second bag.

6.3.5 Transport and temporary storage

If accepted into WIIS animal casualties will need to be transported to a veterinary centre to allow a postmortem examination to be conducted and for any toxicology samples to be taken. Suspected baits will normally be submitted directly to the toxicology laboratory. In the absence of the appropriate government advisers it may be necessary to transport items and hold them in temporary cold storage.

To minimise leakage or contamination in the transporting vehicle ensure that items are placed in a sturdy plastic/polypropylene box. Absorbent material should be placed in the base of the box in case there is any leakage of fluid.

Where short term storage is needed and no dedicated store for such items is available then a suitable lockable location should be sought. All temporary storage must be secure and have restricted access both for reasons of safety and continuity of evidence. Sheds or garages not connected with living or work areas may be appropriate, in some instances the most secure place may be the locked boot of a car. Where the location is shared with others care must be taken not to put them at risk. Entry to stores must be considered including risks to cleaners or maintenance staff. Storage containers should be labelled as a 'biohazard' and with a 'pesticide' warning sign.

Temporary storage areas should be ventilated before use by others. Animal casualties should be refrigerated or held in a cool place to allow an effective postmortem examination to be undertaken. Suspected poison baits can be frozen. Freezers or fridges used for temporary storage must not be used for other purposes such as storage of food for human or animal consumption. (Members of the public must be told that domestic fridges and freezers are not suitable storage locations for suspect poisoning samples.). Where possible these should be locked or otherwise secured against unauthorised access and labelled as for storage containers and that food must not be stored in them. Continuity labels can be sealed inside plastic bags to prevent damage by moisture.

6.3.6. Suspected gassing of badger setts/fox earths

These incidents require additional considerations. Fumigant pesticides, which give off a poisonous gas when brought into contact with moisture, can be legally used for the control of some mammals (rabbits, rats and moles). However, these products may also be used for the illegal control of species such as badgers and foxes. The illegal gassing of setts and earths often involves a larger quantity of the fumigant material than is used for legitimate gassing of rabbits. The range of compounds likely to be used is more restrictive than with poison baits.

A Government adviser from Natural England using specialist breathing equipment whilst attending a suspected gassing incident at a badger sett.

Aluminium phosphide and sodium cyanide (this latter product is no longer approved) are the two compounds most likely to be encountered. On reaction with moisture, phosphine and cyanide are produced as a gas. The gases are invisible and not everyone can smell them at low concentrations. Exposure to these gases can be fatal to humans as well as animals. Lower level exposure can result in nausea, headaches and breathing difficulties. HSE guidance in response to an emergency is the use of oxygen therapy combined with basic resuscitation and life saving skills. These measures have replaced the use of antidotes previously carried to deal with cases of cyanide poisoning. There are no specific antidotes for phosphine poisoning and patients are treated symptomatically.

Following the placing of the pesticide, the sett/earth is usually blocked with soil so the suspect material is often not visible. To prevent the soil covering the gassing compound it is not unusual to find a bag or newspaper as part of the blocking material. Consequently, where an illegal gassing incident is suspected the sett/earth **should not be opened up** as this can release a high concentration of the poisonous gas. Appropriately trained Government advisers with specialist equipment can safely test the atmosphere inside the blocked area for the presence of either cyanide or phosphine gas. This equipment can also be used to directly test the contents of containers suspected to hold fumigants during searches of premises.

Items used to block sett entrances, such as plastic bags, may be suitable for fingerprints. However, guidance should be taken from Government advisers about any health and safety risks associated with such items.

There are strict requirements regarding the safe and secure storage and use of approved professional pesticide products for use in agriculture etc. In wildlife poisoning cases, products being illegally used are commonly decanted into other containers and typically found in vehicles and outbuildings. An unmarked glass container (left) of the banned pesticide aldicarb was found inside a gamekeeper's vehicle following an incident involving the poisoning of two buzzards. The other container (right) of the banned pesticide carbofuran was found in a gamekeeper's firearms case.

6.3.7 Subsequent searches

Searches of land, outbuildings, vehicles and dwellings will typically take place following a suspected or confirmed wildlife poisoning incident. These may be under police or government adviser statutory powers to allow access to land and non-dwelling premises or under the authority of search warrants. The circumstances of the incident itself, and associated information, may well form the necessary reasonable suspicion to allow searches to be undertaken very promptly. In other cases it may be necessary to wait for postmortem examination and toxicology results before further enforcement action can be decided. Pesticides used for wildlife poisoning are commonly decanted into other containers – these are most

commonly found in outbuildings, vehicles and sometimes in gamebags or clothing, including that worn by a suspect. Gun cases and firearms cabinets have also been used to store these products.

In addition to looking for pesticides and related items consider potential forensic evidence. Consider how poison baits might be prepared and carried to a location. The use of a knife to cut open a carcase or the use of a syringe to inject a pesticide into an egg or carrion may be involved. Samples from knives, syringes, game bags and clothing could potentially reveal traces of pesticides. Sweepings taken from the foot wells and load areas of vehicles have also shown the presence of pesticides. Modern analytical techniques are extremely sensitive and issues such as potential cross contamination need to be considered.

The forward transit and storage of seized items should be considered in advance where possible. Government advisers will commonly undertake this task and arrange for the necessary toxicology tests. Fumigants can be tested on site with the use of specialist equipment.

Box 6.2

This large cache of pesticides (most of them banned) plus syringes was kept for the illegal poisoning of wildlife

This large cache of pesticides, most of which are banned, were found stored in an insecure outbuilding at a gamekeeper's home address. The presence of syringes is commonly referred to as a 'poisoner's kit' and used to prepare poisoned baits. A further container of pesticide with another syringe was found under the driver's seat of his pickup truck. Analytical tests on the syringes found the presence of the banned pesticide mevinphos (found in the product Phosdrin). The gamekeeper was heavily fined for a range of pesticide and firearms offences.

7.1 Introduction

Forensic veterinary pathology is the study of disease or injury to animals for use in legal proceedings. It includes all types of damage caused by agents such as trauma, poisons, malnutrition, heat, cold, infections and other natural afflictions. A forensic clinical examination of an animal, whether at a surgery, mortuary or during a search warrant, may provide important evidence in relation to a range of potential offences. In any investigation, the pathologist must determine whether the injury or death of the animal was the result of 'natural' events or caused by human intervention.

Forensic veterinary pathology may be able to provide essential information in cases of suspected illegal killings involving shooting, snaring, trapping, malnutrition/starvation, poisoning, drowning, hare coursing, badger baiting, other cases where dog biting may have occurred, badger digging, crushing of birds' skulls, pulling or 'drawing' of the neck and a miscellany of other circumstances that may have resulted from deliberate trauma.

In many cases, examination by a suitably qualified and experienced forensic practitioner will be essential if an incident is to be put before a court. During some search warrants, a veterinary practitioner may need to be present, for example, to take blood samples or to assess an animal's welfare and conditions of housing etc. The taking of samples for subsequent DNA analysis is discussed further at Chapter 5.

Postmortem examinations, such as the one undertaken on this snared badger, can provide vital evidence about the causes of injuries and death.

7.2 Sourcing forensic practitioners

The wide range of animals and birds that are submitted for examination presents a considerable challenge for the veterinary practitioner. Consequently, veterinary pathology is often divided into a number of loosely defined specialities with individual pathologists having particular expertise with certain taxa or areas of examination. When dealing with wildlife cases, the investigating agency needs to give consideration as to which individual or agency is best placed to undertake the examination.

Taking a suspected shot bird to a local vet, a professional witness, for an initial radiograph may be an appropriate way to start an investigation. However, if a case is likely to progress to court, and perhaps needs further investigative work such as a postmortem examination, consideration needs to be given as to who will be the most appropriate person to undertake this work and provide expert evidence at court. The veterinary surgeon providing the initial radiograph may be perfectly competent to give evidence, however he may be challenged in court by defence evidence from a specialist in a particular field. They need to be carefully informed as to what will be required, the time that may be involved in preparing reports and attending court, future court availability and the fees to which they are entitled. They should only accept to undertake this area of work if they feel competent and believe they can demonstrate to a court that they hold

the necessary credentials and relevant experience. In the UK, the FWG should be able to assist the investigator and put them in contact with an appropriate agency or individual.

Expert witnesses, such as forensic veterinary pathologists, whether acting on behalf of the prosecution or the defence, have two primary responsibilities to the court:

- Provision of a clear account of any damage or injury found;
- Presentation of a balanced, unbiased opinion on how this injury could have occurred.

The pathologist is not involved in 'proving' anything but merely in providing a report and an opinion that will help the court to arrive at an informed verdict.

Organisations such the Animal Health Veterinary Laboratory Agency, SAC Consulting – Veterinary Services, and many experienced veterinary practitioners are familiar with the handling of evidence and the need for appropriate labelling, continuity and security of exhibits. The investigator may need to ensure these matters and other issues outlined at Chapter 1 are considered before the start of an investigation. Some laboratories have comprehensive standard operative procedures that are accredited to internationally recognised standards (e.g. ISO17025:2005, see Chapter 10). In laboratories that run to these standards, the introduction of a small number of additional procedures to meet the needs of forensic examinations is straightforward and gives confidence that the specimens will be received, stored and handled correctly. In other organisations that do not take part in third party accreditation, it is appropriate that the person submitting the samples should establish that suitable procedures are in place before the samples are submitted and that these procedures are followed on each occasion (see Chapter 10).

7.3 General considerations

When submitting an animal for examination the investigator should provide a full history of the specimen. This needs to be an accurate and objective account so the examiner is not misled. Typical information will include:

- The details of when and where the animal was found or seized;
- The circumstances of finding, this may involve providing a snare or trap found with an animal;
- Identification details including sex and age if known;
- Any additional health and safety issues.

Specimens should be uniquely and securely identified by the use of reference or exhibit numbers for each specimen. Labels need to be sealed in plastic bags to prevent damage by body fluids or storage in freezers.

A thorough examination will record the condition and outward appearance, look for any obvious injuries or external signs of trauma, and should list all normal as well as any abnormal findings. Details of any rings, microchips, collars, jesses, tattoos etc should all be recorded. The recording of appearance, sex, size, weight and other biometric data may also assist with identification. Where possible records should be made during the examination and any notes, dictaphone tapes etc need to be retained. If samples are to be taken for further analysis, or photograph or radiographs taken, these all need to be appropriately labelled and handled to ensure continuity.

Photographs may be very useful, and need to be retained and securely stored.

Radiographs need to be appropriately labelled, usually by marking indelibly at the time of development, with species, reference, date and left/right markers. A number of radiographs may need to be taken, to cover dorso-ventral and lateral views, and to accommodate larger animals. Where there are areas of specific interest, closer views may be needed, this is particularly important in small birds where minor injuries to the wings may be unnoticed if only pictures of the whole bird are taken. The advent of digital radiography equipment in veterinary practices has further increased the usefulness of radiography as a forensic tool and will allow magnification of images and easy electronic storage. If an animal can be submitted for postmortem examination fairly quickly then refrigeration is preferable to freezing. If the carcasses are frozen, they will normally need to be thawed to obtain a decent radiograph. It may be worth discussing this in advance before taking frozen specimens for radiographs.

Box 7.1

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Pine martin shot in the chest by a rifle bullet. The metal probe shows the track of the bullet

This pine martin was recovered from a domestic freezer. A postmortem examination showed significant damage to the chest and head. It was concluded that the animal was fatally wounded by a rifle bullet that entered the right side of the chest and exited close to the left shoulder. A second shot was administered to the head shortly after death.

7.3.1 The analysis of samples

An analysis of a range of samples may assist with assessments of welfare and provide indications of injury or cause of death. For example, in welfare cases, analysis of blood samples may indicate an animal to be severely dehydrated. The presence of certain bacteria or parasites in blood or faeces can be indicative of the origin. In their original habitats, plants and animals often live together in complex communities. Many animals carry parasites such as worms or ticks that do not survive when their hosts are removed from the wild. The presence of such parasites may help counter claims of captive breeding or domestic origin. Analysis may also reveal the types of food recently ingested which can be useful in indicating whether an animal was in a particular place within the previous 24-48 hours. Saliva, regurgitated pellets or food (if they can be reliably linked to the animal in question) may also be evidentially useful.

Where the intention is for samples to be sent for diagnostic testing, consideration needs to be given as to which is the most appropriate laboratory and whether their procedures can satisfy the evidential criteria needed for court. Issues such as labelling, continuity and security need to be satisfied. Typically, a single sample should be collected, but then subdivided into two equal parts. Both parts being permanently identified, one part is submitted, directly or by registered postal service to a quality controlled diagnostic laboratory, whilst the other is maintained in secure storage.

There are a range of other analytical tests (see Chapter 5) which may potentially be conducted on samples to provide information on identification or provenance of an animal. All specimens and samples need to be retained in case examination by the defence is needed at a later stage.

7.3.2 Scenes of crime investigation

In addition to submitting animals for examination, there may be circumstances when veterinary practitioners are needed to visit crime scenes or assist with search warrants. This may be to assess welfare conditions of animals held in captivity or take certain samples, such as blood samples for subsequent DNA testing. Again, a suitably qualified and experienced individual should be used in relation to the animals to be examined. They need to be fully informed as to what is expected in order that all the necessary equipment can be brought. In addition to catering for the welfare of animals under investigation, they should be able to assist the enforcement agencies with health and safety advice. This could relate to the catching and handling of a specimen, potential health hazards posed by particular species or the conditions in which an animal is held.

The site where an animal is held may need to be treated as a crime scene. The observations of a veterinary practitioner and the collection of samples, such as feathers, faeces, pellets, food supplies, egg shells, may provide important evidence. The condition of the animal, stage of moult, length of claws, behaviour, condition of its housing etc may give some indication as to how long an animal has been held in captivity. An assessment of whether unnecessary suffering has been caused may need to be made and it may be necessary to seize animals for treatment and further assessment. Some animals will be more prone to stress and perhaps be of significant value. The veterinary practitioner should be able to advise on the capture, handling, sampling and care post seizure pending any subsequent legal proceedings.

7.4 Welfare and related issues

In the UK, legislation requires that any owner or keeper of an animal has a duty to provide suitable standards of welfare during daily management as well as in transit. Any animal can adapt, to some degree, to any situation or circumstance it finds itself in. When it reaches a point where it can adapt no further, its welfare requirements are likely to have been compromised and unnecessary suffering may have been caused. The assessment of when this point is reached and the collection of data, samples or other evidential material to support it, requires appropriate experience and training.

Protected wild animals may on occasion be legitimately held in captivity if they are suffering from a physical or mental injury, which is temporarily or permanently preventing their release back to the wild. There have been numerous cases of wild birds being illegally retained in captivity on the pretence they are not suitable for return to the wild, and even cases of deliberately causing physical or mental injuries. A clinical examination may be able to assess whether these claims

are genuine and whether an animal is suitable for rehabilitation. Release back to the wild might legitimately be delayed even if a bird is recovered, if the weather in inclement or extreme or if the time of year is inappropriate.

In relation to a psychological assessment, this requires significant skill and experience. For example a young bird of prey if reared by humans from an early age will become 'malimprinted' – effectively regarding itself as human and may not be suitable for return to the wild. If release back to the wild is not possible, an assessment should be made as to how this occurred and whether any different husbandry or handling would have resulted in a different outcome. This may have occurred through inexperience or been a deliberate and illegal act to debilitate the bird. It may be necessary for animals to be passed to other experienced handlers for a further period of assessment and rehabilitation.

The sex of some species may be difficult to determine and surgical sexing may be needed. This may also give an animal's state of sexual development and whether captive breeding claims are likely to be genuine.

7.5 Firearms injuries

Firearms are one of the major causes of death and debilitation in wildlife. Crucially the veterinary practitioner must determine not only whether the animal was shot, but also whether this led directly or indirectly to the animal's death or injury. A thorough examination, good radiography and a full postmortem examination may all be needed in determining whether the animal was unlawfully injured or killed.

7.5.1 Types of gunshot injury

Three types of firearms may be recognised through the use of radiography, examination of the wound and the type of shot. These are shotguns, air rifles, and rifles (rimfire and centrefire). The first two are the most frequently encountered.

7.5.1.1 Shotgun pellets

Shotguns fire a number of round pellets at speeds of approximately 500m/sec. The penetration and the damage done to the tissue is dependent upon the number, size and speed of the pellets as they hit the animal. As the pellets are of a relatively low velocity and mass, there is a good chance that they will be retained in the body. Shotguns are relatively short range, and so in most cases, but not all, multiple pellets are seen on the radiograph. However there is a significant variation in pellet spread which is dependent on distance, the choke used in the barrel(s) and the differing bore of shotguns as well as the type of shot (which varies in size and the number in a particular cartridge). Consequently, the number of pellets seen in the radiograph cannot be used to accurately define the distance to target, or the bore of shotgun used.

Lead is the most common shot pellet component, however pellets may also be made of copper-coated lead, steel, bismuth, and even tungsten. Pellets that deform, or produce fragments are typically made of lead or coppercoated lead, though bismuth and tungsten will also deform in this manner. In certain locations and for certain species the use of lead shot may be prohibited. As steel pellets remain intact and round, even when hitting bone, a radiograph may give an indication whether lead shot has been used.

Box 7.2

A postmortem examination on a shot barn owl found that a small feather had been drawn through the heart by a shotgun pellet

7.5.1.2. Low velocity gunshot wounds

These are caused by bullets such as from pellet guns, e.g. air rifles, and 0.22 rimfire. The most common finding is an air rifle pellet. These may pass through the body but often have insufficient energy to escape. The radiographic characteristics often show what type of bullet is lodged in the carcass, e.g. air rifle pellets, or occasionally very small bullet fragments, usually associated with a damaged bone. The wound path is characterised by a long single relatively narrow channel, with few or no metallic fragments associated. The tissues may be crushed or torn, but rupturing of organs is generally not observed.

Box 7.3

Entry hole made by shotgun pellet

Entry holes made by pellets and bullets are often difficult to find unless the feathers are plucked or the hair is clipped. Bullet exit holes are usually larger than entry holes because of the deformation of the type of ammunition usually used for hunting. However, solidnosed bullets, such as the .22 rimfire typically used for target practice, may pass through the body of small animals and birds with very little distortion.

7.5.1.3 High velocity gunshot wounds

High velocity bullets tear and shred tissue in a much larger radius around the path of the projectile. Most hunting is done with either hollow nosed or soft nosed bullets which are designed to deform in a predictable manner. This type of expanding ammunition increases the rate at which the energy transfer takes place and will create larger and more predictable permanent wound cavities than solid ammunition. The damage done to the tissue will vary depending on the type of firearm, the ammunition and the shooting distance.

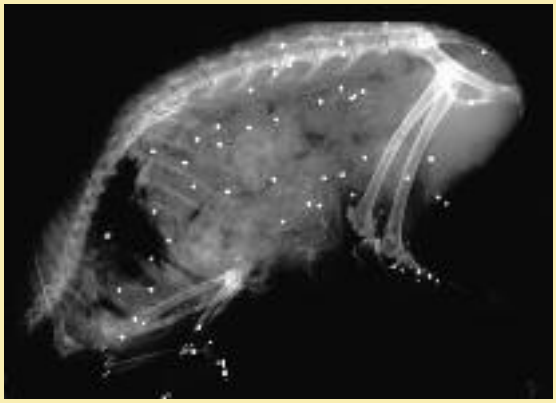
The entrance wound is normally small, with large, often multiple, exit wounds, depending on whether the bullet has mushroomed or broken up inside the animal. High velocity bullets will often penetrate through the animal, and then be spent in the environment. However, occasionally spent pieces of the bullet will be found opposite the entrance wound in the subcutaneous tissue, this is often comprised of pieces of the outer jacket of the projectile, and can give rise to confusion with shotgun fragments on radiographs.

7.5.2 Shooting distance

In most cases involving animals the weapon is discharged at a mid to distant range and there is no evidence of tissue damage related to heat, expanding gases and propellant residues. Frequently, the pathologist is asked to estimate the discharge distance when shotgun injuries are found. Shot of the same size can be fired from shotguns of varying calibre which can produce very different shot patterns from the same distance. Knowledge of the weapon used may assist with any assessment.

In birds and small animals, it is virtually impossible to give an accurate estimate unless the gun was discharged less than a few metres from the victim. At greater distances, the mass of shotgun pellets diverges to a degree that causes many of the pellets to miss the victim. Consequently, the full size of the pattern of shot cannot be determined and the discharge distance remains a matter of conjecture.

Box 7.4



© R Munro

Radiograph of rabbit showing widely distributed shotgun pellets. This pattern of pellets indicates that the discharge distance was ‘distant’ rather than ‘close’.

7.5.3 Examination of firearm injuries

Radiograph examination is invaluable in detecting injury caused by air rifle pellets, shotgun pellets, and rifle bullets. These are taken before the full postmortem examination begins so that

pellets or bullet fragments can be located and recovered. Pellets may be lying superficially in the skin or feathers or may be lodged under the skin and are easily lost if care is not exercised. Having specimens properly bagged will help prevent loose shot and pellets being lost and will reduce allegations of cross-contamination if they have been stored with other specimens which may also have been shot.

Box 7.5

Radiograph taken of the leg of a live buzzard brought into a veterinary surgery

Feather damage to the wing feathers of the same bird

A live buzzard was brought into a veterinary surgery suspected of having been shot. A radiograph confirmed a number of pieces of metallic shot present in the bird, which later had to be euthanized. The radiograph of the leg clearly shows the way the bone has fractured and the piece of metallic shot has started to disintegrate following impact with the bone.

In addition to the traumatic injuries, this bird also had characteristic feather damage consistent with the passage of shot (see also Chapter 8).

The finding of shot in an animal may not necessarily relate to the cause of death or injury. Many wild birds and mammals suffer non-fatal shooting injuries and it is vital that the forensic practitioner determines whether any bullet fragments or pellets are related to the cause of death or current injury, or whether they are the result of a previous incident. For example, lead shot may be found in the body, where it is not interfering with any vital functions and so may be of no clinical significance. The presence of shot may also raise concerns about the possible use of poisons (see Section 7.7 below and Chapter 6).

It is important to establish exactly where the pellet is located in the body so that the presence of incidental lead shot can be eliminated. Many wildfowl may carry shot in the tissues from previous shooting incidents or pick it up whilst feeding. This lead is often ground into thin discoid

Box 7.6

Exit hole of a shotgun pellet through the top of a hen harrier's skull

A postmortem examination may be able to establish the direction of fire, the angle of the shot and the animal's posture at the time of shooting (eg sitting, standing or flying). The damage caused to the hen harrier skull in this case was indicative of the bird being shot from below and was probably in flight at the time. Detail of this kind may help to determine the victim's position relative to the weapon at the time of shooting.

objects and may be recognisable on a radiograph. Birds of prey may ingest lead when scavenging on shot animals and this can remain in the gizzard for long periods of time, sometimes leading to lead poisoning.

7.5.4 Dealing with recovered bullets

In many cases it may be necessary to locate and remove shot or bullets and fragments for identification, or submission for further forensic examination (see Chapter 4). Using radiographs taken in two planes can help locate pellets or bullets prior to dissection. Whole or fragmented bullets may have rifling marks from the weapon they were fired and these need to be removed and handled with care. Careful dissection in the area of the object should allow the pathologist to feel the object. Contact between a scalpel or other metal instruments such as forceps, which may mark the object surface, should be avoided. The item can be removed with fingers or gauze covered forceps.

The bullets and fragment should be gently rinsed in cold water to remove blood and tissue, and dried as any dampness may cause oxidation of the surface and hinder further examination. Pathologists may dip them in 70% alcohol to remove any water residues and to disinfect them. Following air drying, these are normally wrapped in tissue (not cotton wool) and put in an appropriate rigid container to prevent damage, friction or crushing by movement during transport. CSIs will be able to provide appropriate advice about submission to ballistics experts.

Radiographs may also be of considerable value when examining shot animals later prepared as taxidermy specimens (see also Chapter 8). These may show traumatic injuries associated with the remaining skeletal structure and assist in the recovery of shot.

7.6 Snares and traps

In theory, snares that are correctly set should be free running and should only catch the species for which they were designed. Unfortunately, this is not always the case and snares can be poorly placed, indiscriminate in what they trap and not be free running due to poor maintenance or deliberate use of illegal self-locking snares. Where a non-target animal is found in a snare, the role of the forensic practitioner is to catalogue the injuries and to attempt to give an estimate of the duration of the entrapment.

Box 7.7

Multiple twists in the snare wire found around a badger's neck

Badgers caught in snares struggle vigorously and during this process the snare wire usually becomes markedly twisted preventing 'free-running' and loosening of the snare. With every twist the wire tightens progressively and cuts into the tissues. The marks caused by the snare can usually be identified, even in fairly decomposed badgers that have been removed from the snares and buried. Snared badgers are sometimes killed by shooting, and it is important that checks are made for gunshot injuries (see Box 4.2).

In the UK, cage traps may be legally used to take certain wild birds. They may sometimes be used with a live decoy bird, such as a crow, to entice other birds of the same species into the trap. Birds used as decoys or caught in such traps are at risk of death from starvation, dehydration or exposure if the traps are not run in accordance with the legal requirements and checked on a daily basis. Wild birds reduced into captivity in this manner are subject to welfare legislation and there have been convictions in relation to the mistreatment of decoy and trapped birds in cage traps.

Daily checks should release non-target species, such as raptors. Where such species are suspected to have been left in such traps for extended periods consider the presence of faecal material and regurgitated pellets which may give an indication of the length of captivity. The physical condition of birds in a cage trap (particularly where no food is available), along with damage to feathers or around the beak due to repeated collisions with the cage wire, may give an indication that a bird has been present for an extended period. Occasionally, there is deliberate injury to decoy birds, such as fractured wings, and the forensic practitioner may need to establish whether such fractures occurred before death.

Box 7.8

© R Munro

Spring trap injury to a buzzard's leg resulting in fracture of the tibiotarsus

Spring traps are sometimes illegally set out in the open in order to catch birds of prey. This may cause damage to one or both legs of the bird. The degree of injury may vary according to the type, condition and location of the trap used. The leg may be fractured in the non-feathered part and the foot may be considerably swollen. These injuries are not immediately fatal and the bird may struggle for an extended period, resulting in damage to the muscles and ligaments close to the hip joint. If the trap is set on a pole, then the trapped bird may end up hanging upside down and the head may show swelling and congestion with blood. In suspected trapping cases, where the jaws of the trap have been padded and leg injury is not immediately obvious, elimination of other causes of death, such as natural disease or poisoning, is essential.

Box 7.9

© RSPB

© M Thomas (RSPB)

(left) **Four goshawks and a buzzard were found dead in a wood in Devon**

(right) **This radiograph showed one of the goshawks had recently eaten. Later toxicology tests confirmed it had been poisoned.**

The remains of four goshawks and a buzzard were found dead in a wood in Devon. Radiographs were taken to see if there were any indications of a cause of death, these showed no signs of any of the birds having been shot. However, one of the fresher specimens showed clear signs of food in the distended crop. The crop is used to temporarily store food and this indicated the bird had eaten shortly prior to death. This is a classic sign of poisoning and as a result all the birds were submitted into the Wildlife Incident Investigation Scheme for toxicology tests (see Chapter 6). These confirmed all five birds had been poisoned.

7.7 Wildlife poisoning

This is discussed in more detail at Chapter 6. In most suspected poisoning cases a full postmortem examination will be conducted before submitting samples for toxicology. The postmortem examination will ensure that other evidence such as trauma or natural disease is not overlooked. The pathologist can collect and submit the appropriate samples to the toxicology laboratory.

Radiographs may indicate a bird has recently eaten and may cause suspicion that it has been poisoned. Where shot animals are used to prepare poisoned baits, then radiographs showing shotgun pellets in the gullet or gizzard may be indicative of illegal poisoning incidents.

7.8 Dog bite injuries

In the UK, the introduction of legislation to control hunting with dogs has given impetus to the recognition of characteristic dog bite injuries. In general, dogs' teeth are relatively blunt. As the dog seizes its prey, the skin stretches under the pressure of the teeth allowing extensive damage to muscles, bones and internal organs without necessarily puncturing the skin. Consequently, in such cases, when the outside of the animal is examined there may be little or no evidence of skin holes, bleeding or other external injury.

Hares, deer, sheep, badgers, foxes and other dogs may all be subject to attacks by dogs. More than one dog may well be involved in an incident. The type of dog involved also has a significant bearing on the type of injuries inflicted. A fox attacked by a lurcher or foxhounds above ground will have very different injuries to the predominantly facial and front end injuries received when faced with a terrier underground.

A postmortem examination may be essential to confirm or refute any allegations. This can provide detailed evidence in relation to the injuries and their potential cause. Estimates of the size of the mouth of the biting animal may be calculated by measuring the intercanine distance of 'bitepairs'.

With live animals suspected of being used to attack dogs or other animals, a detailed examination of injuries may provide vital evidence. Dogs repeatedly used for fighting may suffer characteristic and often severe facial injuries.

Chapter 5 (see Box 5.11) highlighted how DNA testing may be used to match saliva samples left on attacked animals back to individual dogs. Similarly the tissue or hair found between the teeth of a dog suspected of being used for fighting or attacking other animals may provide very important evidence. Such samples can potentially be identified by morphological examination or DNA testing, and in some cases linked back to individual animals held by a suspect.

7.9 Estimation of postmortem interval

The postmortem examination interval is the time that has elapsed between death and the discovery of a cadaver. Establishing this can be helpful in eliminating certain people from an inquiry or may provide strong evidence that statutory requirements have been ignored. Unfortunately, there are very few published data to help the veterinary pathologist establish the time of death in wildlife cases. For example, there are no validated temperature charts, applicable to British conditions, which plot the changes in body temperature against time.

Box 7.10

© R Munro

Major trauma to the ribs of a hare after a coursing incident

Hares are generally seized over the back and chest and coursing typically results in massive injury to the chest, back and abdomen. Multiple fractures of the ribs and massive haemorrhage into the chest are consistent features. No punctures to the skin may be present despite significant internal injuries.

Box 7.11

© R Munro

Dislocation of the neck of a roe deer

When attacking a deer a dog will typically bite whatever it can. Animals like roe deer typically suffer severe injuries to the hindquarters. If more than one dog is involved, they may also bite the hind end, or where the animal has been slowed by the initial attack, may also seize the neck and throat. Following a suspected poaching incident this animal was submitted for postmortem examination. The roe deer showed extensive, non-fatal dog bite injuries to the rear end. However, the neck of the deer was dislocated, presumably by the owner of the dog after the dog had caught the deer.

Experienced pathologists may be able to estimate this interval by observing the degree of postmortem examination change in the organs. However, significant variation in the rate of change is caused by factors such as the environmental temperature, wind exposure on a hillside, immersion in water, size of animal, body temperature before death and how much food is in the stomach. At best, the pathologist might estimate the time as falling into one of the following periods: less than 24 hours; several days; weeks; months or years. The state of vegetation around and under the body may also provide useful clues to the time the body has rested at one

place. For example, whether the grass is stunted or discoloured under the body, or there is evidence of fungal growth. Such changes take days if not weeks to develop.

Entomology can be very useful, as the degree of decomposition and any maggot or beetle infestation may be important in establishing an approximate time of death. By understanding the time and sequence of various stages as bacteria and insects attack the body, the entomologist can often make an accurate estimate of the time since death. In addition, many different species of insect attack a corpse at different stages of decay and even prefer different tissue types. Since some insect species are only found in certain geographical regions, climates or locations this may indicate that a body has been moved from another location. These items should be retained for examination by an appropriate entomologist. Advice should be taken at the earliest opportunity on how the items should be handled and transported.

Box 7.12

Snares not checked on a daily basis may cause prolonged suffering to animals

It is a legal requirement that set snares are checked on a daily basis in order that trapped animals can be humanely despatched to prevent prolonged suffering. In one case, a member of the public came across a live fox in a snare. While examining the animal, a gamekeeper arrived, despatched the animal with a shotgun and threw the corpse away. The member of the public was concerned that the animal may have been present for some time and took the animal to a Wildlife Crime Officer (WCO) who noticed that where the snare had cut into the animal's midriff that the wound was infested with maggots. Following a postmortem examination an entomological examination of the fly larvae took place. The report of the Veterinary Investigation Officer was as follows:

'The larvae were identified as third instar Lucilia sericata *(the sheep blowfly), third instar* Phormia terranovae *and second instar* Calliphoridae. *The age was estimated from the* Lucilia sericata *larvae with a presumptive dog body temperature between 37.5 Celsius (normal) and 40.0 Celsius (associated with wound pyrexia). The age of third instar* Lucilia sericata *larvae was estimated to be between 70.8 and 77.72 hours (c three days). To this period must be added the time before the flies laid eggs on the fox. Such flies would only be attracted once the wound became infected and had necrotic tissue, possibly after one to two days. In conclusion the total duration the fox was trapped alive in the snare is a minimum of five days.'*

The gamekeeper later pleaded guilty to causing the fox unnecessary suffering.

8.1 Introduction

Taxidermy involves the art of preparing, preserving and mounting the skins of animals so they have a lifelike appearance. Taxidermy may be undertaken as a hobby or as a commercial business, and the quality of the work may vary accordingly. The main legal issues with taxidermy involving protected species relate to the provenance of the specimen and whether any subsequent trade or commercial use is in accordance with the regulations.

Prior to preparation, the specimens will usually be stored in a freezer. The taxidermy process involves retaining the skin, and usually some of the skeleton (skull, wing and leg bones – which have been cleaned of meat/tissue) but removing the remainder. The body shape is usually manufactured from woodwool or similar material bound by thin thread into the body shape. Commercially made foam body manikins may also be used (especially with mammals). Glass eyes are inserted into the skull usually with the aid of clay or similar material. The skin is preserved and each limb (arm/wing or leg) and the neck is wired for support and then attached to the model body. The skin is then placed over the body and sewn up. The wire that supports the legs will typically protrude out of the foot enabling it to be attached to a branch, groundwork or base.

In the UK, the possession of most native birds and many animals is an offence of strict liability. This places an onus on the person in possession of the items to show they are of lawful origin. This normally requires showing that the specimen had not been killed or taken contrary to the relevant regulations or had been lawfully purchased. Specimens which have been lawfully acquired can be used for taxidermy, and may be traded subject to relevant regulations. Specimens of lawful origin would typically include natural fatalities perhaps due to traffic accidents or other collisions, captive bred specimens and species that may be lawfully shot in certain situations, such as game or wildfowl.

It may be important to establish whether a sale has actually taken place as taxidermists usually operate two systems. One is where they obtain a specimen, prepare it and then sell it to a customer. The second is generally referred to as commission work, and involves the customer bringing a specimen to the taxidermist, perhaps one they have found by the roadside.

A professionally prepared taxidermy specimen of a pine marten, a species protected under UK legislation. Taxidermists dealing with protected species need to ensure specimens are obtained from lawful sources and that any regulations relating to sale or trade are complied with.

The taxidermist is paid purely for his services in preparing and mounting the specimen. The specimen is then returned to the customer, who is charged for the service provided, this does not constitute a sale of a specimen.

Professional taxidermists will normally maintain records of all animals coming into their possession in order that the history of each specimen can be provided if needed. On receipt of a specimen a taxidermist will check it to see if there is any indication of the cause of death or any suggestion it may have been illegally killed, for example by shooting or trapping. A responsible taxidermist will not deal with specimens from such sources. However, there are individuals prepared to deal in these specimens. More attention should be given to specimens which may be difficult to obtain, or subject to high levels of persecution, such as certain birds of prey and fish-eating birds.

8.2 The use of professional taxidermists

There are a number of professional and experienced taxidermists who may be able to assist with investigations. The information they can provide includes information on age, provenance and likely causes of damage to specimens. These individuals can usually be sourced through the Guild of Taxidermists or a number of museums. In line with the issues raised in Chapter 1, it is essential for the investigating agency to ensure the person undertaking the examination has the necessary expertise and experience and is fully made aware of the all the implications of dealing with evidence, preparing a report or statement and giving evidence to a court. In the UK, the FWG can assist in locating an appropriate taxidermist to assist with an investigation.

8.3 Determination of cause of death and injuries

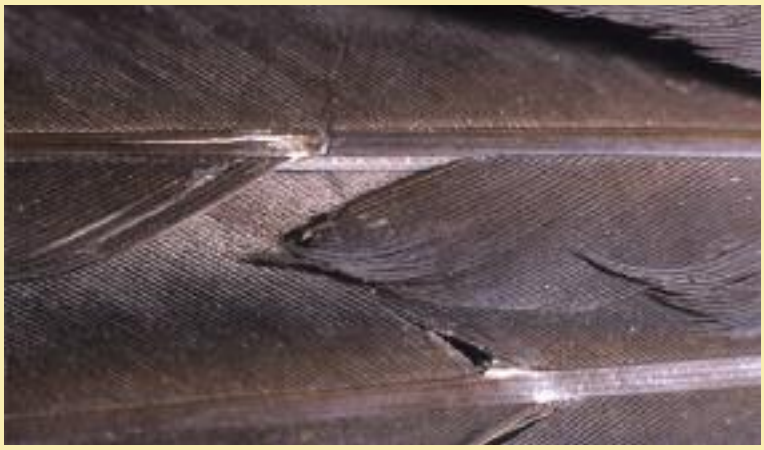
With suspect specimens found in a taxidermist's freezer prior to preparation it may be possible to ascertain the cause of death by a postmortem examination, radiograph examination and possibly toxicology tests (e.g. poisoned meat still lodged in the gullet of a bird).

Even when mounted, it may be possible to determine a definite or likely cause of death. For example, in shooting incidents involving the use of shotguns, an animal is likely to be hit by numerous pellets, depending on a number of factors including the weapon and ammunition used, range and size of animal. Even after preparation, pieces of shot may be retained and lodged in the remaining bones or skin. The use of a radiograph may be very helpful (see also Chapter 7) and show pieces of shot and associated fractures.

In other cases, once specimens have been prepared, there may well be virtually no evidence of an animal's cause of death. For example, when an animal is shot it may only take a single pellet lodged in a vital organ to cause death. Removal of all the internal meat, muscle and organs during preparation can make it difficult or impossible to establish the cause of death. This places limitations on the examination of some taxidermy specimens.

Examination of the specimen by an experienced taxidermist may provide vital evidence on the provenance of a specimen and support other evidence. Taxidermists are used to seeing shot animals, as they regularly deal in a range of species which may be lawfully shot, they may be able to comment on the damage to skin, feathers, bills, remaining skeletal structure etc. With birds, tell tale signs often appear in the feathers, most prominently in the flight (primaries and

Box 8.1



© G Shorrock (RSPB)

Typical damage caused by the passage of shot through feathers

When shot passes through a bird's feathers it can leave very characteristic damage. This is normally most prominent on the flight (primaries and secondaries) and tail feathers. This can including the stripping of barbs off the shaft, the splintering of the shaft itself and holes or 'chips' in the vane of the feather with a very sharp edge, as if nicked with a razor blade. There may also be tracks of the projectiles across the flat face of the feather. Some of these features are present on two flight feathers of a marsh harrier taxidermy specimen which was killed with a shotgun. It is quite common for a dozen or more shotgun pellets to hit birds and this can cause distinctive damage to numerous feathers.

secondaries) and tail feathers. Examination of feather damage by a professional taxidermist may corroborate radiograph results. It is important to note that indications that a taxidermy specimen has been shot may be revealed by one, both or neither of these examination methods.

8.2.2 Ageing and provenance

The age of a specimen has a significant bearing on whether certain legislation is applicable and whether offences may have been committed. For example, with birds it is an offence to be in possession of specimens taken contrary to the Protection of Birds Act 1954 or the Wildlife and Countryside Act 1981. Possession of a golden eagle may be an offence if shot in 1960, but not if shot in 1920.

Age is not relevant to sales offences under the Wildlife and Countryside Act 1981. Prior to the start of the Wildlife and Countryside Act 1981 (28th Sept 1982) there was little control on the trade in taxidermy specimens. Many specimens mounted prior to this date will carry little or no information on provenance.

Between 1982 and 1995 the Registered Sellers of Dead Birds Scheme (RSDB) was brought in for the sale of all wild birds under the Wildlife and Countryside Act 1981. All sales of birds required a Department of the Environment (DoE – now Defra) uniquely numbered sticker/tag to be displayed with the specimen. This was normally stuck to the base or case making it obvious which specimen the tag referred to. The DoE tags had to be attached to the specimen at the point of sale. A seller was obliged to inform the DoE of all specimens sold by way of an annual return. Those specimens mounted as a commission would not require a DoE tag unless subsequently resold. If a DoE tag is present, Defra should be contacted to see if the information

on the history of the tag is still available. This may include to whom it was issued, the specimen to which it was fitted, date of sale and details of purchaser. Bear in mind the DoE tag may have been lost or fallen off, though careful examination of the groundwork or glass may yield signs of one having been there.

In 1995 the RSDB scheme was replaced with a General Licence allowing anybody to trade in wild birds subject to a number of conditions. These included that the specimen was legally acquired, documentary proof of lawful origin is provided with each sale and a return be sent to Defra prior to the end of each year. Many professional taxidermists will attach the details of provenance to the base of the specimen to reduce the chances of it being lost by the purchaser.

In the UK, in addition to sales controls under the Wildlife and Countryside Act 1981 (and similar regulations in NI) there are also controls under The Control of Trade in Endangered Species (Enforcement) Regulations 1997 (COTES) on the commercial use of specimens included on Annex A of EC Regs. 338/97 (as amended). Some specimens will be covered by both pieces of legislation. Since the 1st June 1997, the commercial use of Annex A specimens requires a government licence, known as an Article 10 certificate). With sales of taxidermy specimens, these licences are normally only valid for one transaction.

As soon as a specimen is sold the original licence must be returned to the issuing authority. It is good practice for a photocopy of the licence or the issuing number to be passed on with the specimen. With COTES the issue of age can be highly relevant as the legislation does not apply to worked specimens (such as a taxidermy specimen or an ivory carving) prepared prior to 3rd March 1947, unless they have been substantially reworked. An antique buzzard taxidermy specimen from 1920 would not require an Article 10 certificate to allow sale, unless it had perhaps been repaired and remounted since 1947.

Many things are taken into consideration when attempting to age a specimen. Accumulation of dust and/or particles can generally be ruled out as this is dependent on the method of storage. A fairly modern specimen stored in an open dusty/damp atmosphere can take on the appearance of age more quickly. The eye of the specimen can give a clue to age. Modern taxidermists will now use eyes from Germany, Sweden or the U.S. These are either hard burned painted enamel or acrylic and have been available since the 1960s. Prior to this the eyes that were used can be distinguished by the diffused and irregularly shaped iris. If necessary, this can be confirmed by carefully removing the eye and checking the back, which will show the different method of paint application.

The general condition of the bill, legs and talons etc also aid in the inspection. Depending on how the specimen was stored, the bill and talons/claws tend to get more brittle as they age. Closer inspection of the body contents can also aid the observer. Thread used to sew the incision may be dry and old and the medium used for the body manikin may be revealing. Nylon threads, fine woodwool and commercially made foam bodies point to a modern mount.

The inspection should also include the base or case that displays the mount. Original uncased items prior to 1947 are rare; taxidermists of the pre-war years sometimes preferred preservatives laced with arsenic or mercurial potions necessitating the uses of cases. The habit of casing specimens originates from the Victorian period and although used extensively today, the construction of the case can help determine age. The taxidermist needs to consider if the base or case originally belonged to the specimen, or whether a modern specimen has been placed in an old case. The taxidermy method used, how the specimen is attached to the groundwork or base, and whether the imprint of the feet/or mount on the base matches the specimen may be useful indications. If all is in order the case itself often confirms the date within a few years.

Box 8.2

A marsh harrier taxidermy specimen seized by the police was examined by a professional taxidermist and a veterinary surgeon

Radiograph (dorso-ventral view) of the marsh harrier taxidermy specimen

This female marsh harrier was one of a number of bird of prey specimens seized during an enquiry involving an amateur taxidermist and a gamekeeper. Both were later convicted of possession of numerous illegally killed birds. Unusual specimens like this may well have been unlawfully obtained. This bird was examined by a veterinary surgeon and a professional taxidermist.

Veterinary Surgeon:

'Marsh Harrier, labelled 'female' Ref. WD1b

There are two radiographs, a dorso-ventral view of the body and a dorso-ventral view of the legs. The first shows extensive evidence of the bird having been shot in the left wing

(cont overleaf)

with evidence of eight, possibly nine, pieces of radio dense material consistent with metallic shot present in the ulna and radius. The ulna is fractured in the middle in two places and there is a possible fracture of the radius. The second radiograph shows no evidence of any metallic fragments. I have no doubt that this bird was shot.'

The radiograph also shows the internal wiring and pins used by the taxidermist.

Professional taxidermist:

'This is a modern, poorly executed piece of work. I would estimate that it has been prepared within the last thirty years from a fresh specimen. I inspected the bird and found the following damage to the feathers:

Tail: (counting from the bird's left) 5th, 6th feathers – barbs missing from the shaft

Left wing: (counting from the tip) 11th, 13th feathers – split shaft; 16th, 18th, 22nd feathers – barbs missing

Right wing: (counting from tip) 7th feather – split shaft; 15th, 16, 17th, 19th, 21st feathers – barbs missing

The damage to the feathers is consistent with the passage of shot from a shotgun through the feathers. I know of no other way a bird could sustain this kind of damage. It is my opinion that this bird was shot with a shotgun. I believe the taxidermist responsible for this work must have been aware of the nature of this damage.'

Box 8.3

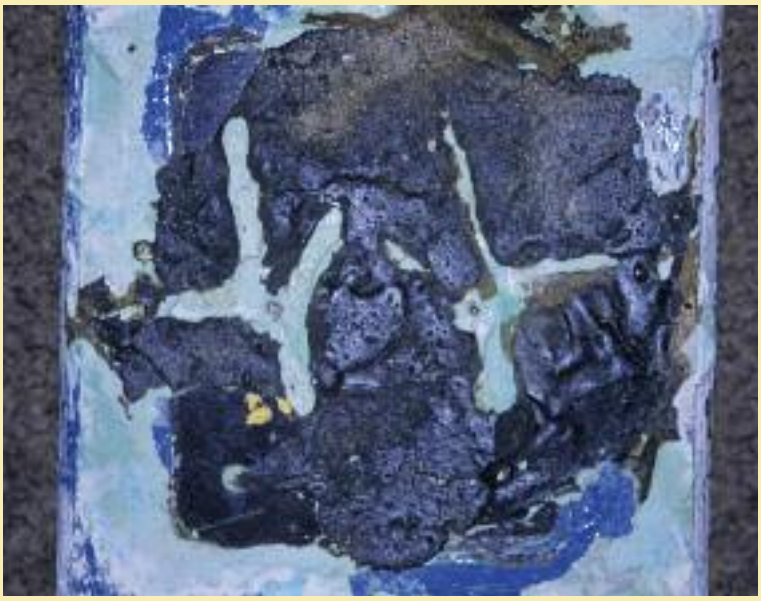
The foot of a falcon taxidermy specimen following removal of a piece of metallic shot, located by a radiograph

Radiographs can be very useful in locating metallic shot that may still be present in a taxidermy specimen. In this case, a radiograph of a merlin (a small falcon) taxidermy specimen indicated several pieces of metallic shot were still present in the bird, including the leg. Guided by the radiograph, it was possible to remove a piece of shot still lodged under the skin. In cases where there is uncertainty or dispute over the interpretation of a radiograph of taxidermy specimens, it may be necessary to physically locate pieces of metallic shot still present in a specimen.

The quality and type of the materials used in the case and the groundwork may give an indication of age. Other clues may include dated old newspaper hidden underneath the groundwork. Trade labels which either appear on the reverse of the case or inside on the backboard can often date a piece to within a few years. Thousands of taxidermists plied their trade in the early years of the discipline and often labelled their cases. Some of the work for example, cases by Rowland Ward, Spicer, Gunn etc may be easily recognised by an experienced taxidermist.

8.2.2.1 Style of taxidermy presentation

Box 8.4



The base used to mount a taxidermy specimen provided useful information about the provenance of the specimen

A shot bird of prey was recovered from an amateur taxidermist. He claimed he had not prepared the bird himself but had bought the bird from a second hand shop and remounted it on a new base. Examination by a professional taxidermist confirmed the style of work was consistent with other specimens known to be prepared by the suspect. Where the bird had been placed in the fresh plaster on the base, the feet had continued to dry out and shrink slightly, leaving impressions slightly larger than the actual feet. In an older specimen, this drying out process would have been complete and this shrinkage would not have been evident. This clearly indicated the bird had been mounted as a freshly prepared specimen.

Taxidermists, old and modern, often have particular ways of presenting and mounting a specimen. Although the amount of ways to present a piece is limited and often copied, the anatomy of the mount combined with its presentation often points to a specific taxidermist. The internal method of wiring specimens revealed by radiographs may also be helpful information to the taxidermist.

The type, style and construction of cases can often distinguish one taxidermist from another and this is not confined to modern work. A Rowland Ward Case from pre 1940 is obvious and that is without checking for a small ivorine disc with details inside the case. Providing the inspector is confident that the specimen belongs to the case, these specimens may be quickly discounted

from any investigation. It may be necessary to open cases to get specimens out for further examination or radiographs. Opening and resealing cases can be difficult, time consuming and potentially cause damage to specimens. Where possible, this should be undertaken by professional taxidermists.

8.2.2.2 Faking “antique” specimens

This is believed to be fairly rare, but some modern work may well be hidden under the guise of Victorian taxidermy. A shot bird of prey, prepared and mounted, may be artificially aged by displaying inside a Victorian case to try and avoid any sale and possession controls. On a similar basis, a fish mounted in an old case in the style of Cooper of London can hugely inflate the value and may constitute offences of criminal deception. Some fakes may be obvious to the trained eye, others may need a much closer examination.

Chapter 9 Health and safety issues when handling samples and animals

9.1 General precautions

Any agency involved in investigating a wildlife incident will need to assess the associated health and safety risks. Individuals should ensure their own health and safety risk assessment covers the situations that may be encountered. Individual assessments may have to be made in relation to specific enquiries. There may be particular risks associated with firearms, pesticides, handling animals and diseases. In all cases, efforts should be made to minimise risks by use of appropriate training, use of specialists, personal protective equipment etc.

The obtaining, handling and transportation of many forensic samples may constitute a health hazard. Where samples are passed to other agencies for examination or analysis the investigating agency should ensure they are apprised of all potential risks. The responsibility for the submission of hazardous materials in a safe condition lies with the investigating agency. Police forces should have their own procedures in place and forensic service providers can provide further advice. Hazardous materials could include:

- All liquid blood and body fluid samples, including toxicological samples;
- Any items stained with blood or other body fluid;
- Items infested with parasites or contagious disease;
- Pesticides and other chemicals;
- Explosives and explosive devices;
- Firearms and ammunition;
- Items with a sharp edge capable of causing penetration or injury;
- Plant sap, sharp or irritant spines/hairs, poisonous seeds or parts and derivatives sprayed with hazardous chemicals.

As a general rule, people involved with handling samples should not eat, drink, smoke or touch the facial area and should pay good attention to personal hygiene.

9.2 Packaging, labelling and transportation of samples

This must be done to the necessary standard to minimise any risk to those people handling samples, to prevent potential cross-contamination problems and ensure the integrity of any examination or analysis is evidentially robust. Depending on the sample, primary, secondary and tertiary levels of packaging may be necessary. If in doubt, seek appropriate advice first before sending samples.

In the UK, a range of detailed procedures and protocols are in place to deal with packaging, labelling and transportation of human DNA samples. With wildlife DNA samples see further advice at Section 5.4.6.

Where possible plastic containers should be used unless specific collection kits are available or certain solvent materials are involved. Glass containers should never be frozen as they may shatter on thawing. Adhesive tape on all edges should be used to seal sample bags, ideally with ‘Biohazard’ tape on biological samples or items bearing body fluids. Staples should not be used to seal sample bags.

Chapter 9 Health and safety issues when handling samples and animals

Experienced veterinary practitioners undertaking wildlife examinations or postmortem examinations should be familiar with the packaging requirements where samples need to be sent for further toxicological or biological testing.

Damp or wet items, such as clothing, should normally be dried. Care should be taken to avoid cross-contamination when drying a number of different items and where possible they should be dried within a cleaned forensic drying cabinet. Wet biological samples may decompose when stored and transported at ambient temperatures. If sample submission is delayed, then refrigeration or freezing may be necessary.

Commercial thick bleach can be used for spillages of biologically hazardous material. This should be left in contact with the contaminated area before rinsing and wiping dry. For general disinfection of work surfaces after handling biological specimens a one-in-ten dilution of commercial thick bleach can be used.

9.3 Transportation guidelines

CSIs, forensic service providers and veterinary laboratories can provide further assistance with advice on the transportation of biological samples. Where vehicular transport, other than commercial carriers, is used consideration should be given to placing packages in deep sided plastic boxes which will retain any spilled materials. Boot or load carrying liners may be appropriate and allow easier cleaning and disinfecting in case of spillages.

Diagnostic samples, which form the majority of forensic submissions, are currently defined as those thought unlikely to contain certain pathogens (Hepatitis or HIV) and may be sent by suitably evidentially acceptable postal methods once appropriately packaged and labelled. Specimens sent via the mail should be clearly labelled 'PATHOLOGICAL SPECIMEN FRAGILE HANDLE WITH CARE' as well as the words ‘Category B – UN3373’ which codes for non-hazardous biological substances. Full details for packaging such samples are summarised at www.hse.gov.uk/biosafety/biologagents.pdf

The outside should also be clearly marked with the address of the sender. A ‘This way up’ label or details of emergency contact telephone number may also be necessary. Samples suspected of containing infectious substances are subject to further packaging standards, should not be sent by mail or standard courier services and appropriate advice should be taken.

When transporting animals appropriate guidance should be taken to ensure facilities are suitable for the species in question. Veterinarians and a range of agencies, such as the RSPCA, can provide advice on this. When transporting live plant specimens due care should be taken as they can deteriorate over a short period unless packed and shipped correctly.

With live plants check to see if they require watering (succulent or fleshy plants are less likely to need watering). Watering is risky; plants should not be wet as fungal infections can thrive, especially if there is poor air flow around the plants and the plants are kept in warm conditions for too long. The roots can

RSPB staff assist North Wales Police at a wildlife crime scene. Specialist equipment may be needed to access some wildlife crime scenes such as this goshawk nest.

be wrapped in slightly damp moss or cotton wool, but with live plants it is important to act swiftly to ensure the evidence does not die. Damage to plants in transit can be avoided by packing them with sufficient padding to ensure they cannot move in the box during transportation. Do not store plants in hot conditions; cool and frost-free conditions are ideal. Where possible keep plants wrapped in their original packaging as it may contain important information relevant to the case (location details, source of the plants etc) and to the specimen it contains. Care should be taken if plants require watering that the packaging they are wrapped in is not damaged, as the water may wash away important information. Include packaging with the plants when sending to an expert for identification.

9.4 Additional risks associated with wildlife cases

Any wild animal, even if it is supposed to be tame, can cause injury to humans. Some plants may also need careful handling. All animals, whatever their state of health, should be regarded as potential health risks. This can be from a mild scratch to a potentially lethal bite from a venomous snake. The only guaranteed way to avoid injury is to avoid contact with an animal. However, this is not always possible. Where it is necessary to capture, contain or control an animal, then there is often a way to do this that avoids physical contact. For instance, snakes can be picked up with hooks and birds can be caught in a net. A number of animals are covered by the Dangerous Wild Animals Act and additional care should always be taken. Strict personal hygiene procedures must always be followed after handling animals.

When physical contact is unavoidable, it is important to act in order to minimise the risk of injury to investigators, the public and the animal itself. Appropriately qualified or experienced handlers should be used. In some cases, it may be appropriate to have suitably experienced veterinary practitioners present to provide guidance and assistance. Protective clothing, appropriate to the level of risk, must always be worn when handling animals or plants, and appropriate equipment should be used. Animals and plants have at their disposal an array of defensive weapons including teeth, claws, tails, venom, beaks, toxic skin, defecation, sap or spines.

The seizing and examination of many animals subject to investigations, such as this goshawk, will need suitably experienced handlers and appropriate equipment.

It is recommended that anyone handling live plants or parts and derivatives (even medicines) wears latex gloves as pesticides, fungicides and other toxic chemicals may have been used to treat the specimen prior to trade or transportation. Plants can also have fine hairs or spines or exude toxic juices, saps or latex that can cause mild to severe burns, irritation or inflammation so thicker gloves may be needed over latex gloves.

9.4.1 Personal protective equipment

A range of equipment should be considered, from professional products to items that are perfectly functional for their intended use. Any items needed should be available for the enquiry at hand. A range of items typically used for handling wildlife could include the following:

- 12”–16” bird net;
- Strong and pliable leather gloves/gauntlets for birds of prey;

- Facemasks;
- Surgical or padded gloves;
- Goggles;
- Snake hooks;
- Various blankets/ towels;
- Containers, e.g. bird carrying boxes, cloth sacks, dustbins or similar;
- Sturdy material to lift plants with spines e.g. folded up newspaper, cardboard, padded gloves.

Staff from Scottish Natural Heritage (SHN) assisting police with an investigation into damage to a freshwater pearl mussel habitat. The use of suitable clothing and safety equipment is essential for this type of enquiry.

Even with the utmost caution, there is always the possibility of an injury occurring. Any injury that causes a break in the skin is liable to infection. The infections caused from some non-venomous reptile bites can be worse than being bitten by a venomous snake. Bites from animals that eat fish are more likely to become infected. All penetrating wounds should be immediately irrigated with running water. If a wound subsequently starts to become inflamed then further medical treatment should be sought, and the specific cause of the injury notified to the medical practitioner.

9.4.2 Zoonoses

Zoonoses are infectious diseases which can be transmitted from animals to humans. The route by which the zoonoses may enter the human body includes ingestion due to poor personal hygiene or by inhalation of spores from an aerosol effect on disturbing a carcase. Abrasions or punctures could occur from handling carcases with sharp beaks, claws or talons, and previously broken unprotected skin can be a route of infection. It is also possible that the environment in which the incident has occurred may pose a risk from zoonoses. Examples include premises where bird droppings and associated detritus has accumulated and areas where rat infestations are present. There are many zoonotic diseases which should be noted. Here are a few of the most important:

- **Psittacosis** (also called pigeon fancier's lung, ornithosis or chlamydia/chlamydophila) is a respiratory disease that is carried in the faeces, respiratory secretions and feather dander of psittacine (parrot-like) species, pigeons and less commonly other species of bird. There are confirmed cases from parrots imported to the UK. The use of approved masks and gloves is recommended. This disease can be spread to humans as the faeces dry out and dust particles become airborne. The disease can affect people severely, from mild flu-like symptoms through to severe respiratory problems, hepatitis and even death in the elderly and immuno-suppressed. Psittacosis is a notifiable disease under the Psittacosis and Ornithosis Order 1953 if found in poultry (hens, gamebirds, ratites, waterfowl etc), but this does not apply to cage birds or pigeons kept for racing or as pets.
- **Tetanus** (Lockjaw), although not commonly seen due to widespread human vaccination, is a potentially serious risk. It is caused by toxins released from the soil bacterium *Clostridium tetani.* The disease can enter the body through a penetrating wound, cut or small break in

the skin, bite or scratch. Anyone who is likely to come into contact with animals, animal manure or soil containing it should be vaccinated against this potentially lethal disease.

- ***Toxoplasma gondii*** is a parasite causing flu-like symptoms which, whilst mild, are particularly hazardous to unborn children and may cause abortion. Care should be taken near dog or cat faeces or any rodent or ovine (sheep) or caprine (goat) tissue samples as the organism is common in these species.
- **Leptospirosis** (Rat or Weils disease) is a bacterial disease carried by nearly half the rats in the UK, it does not seem to harm them but can infect and be fatal to mammals such as dogs, cats, cattle and wild mammals all of which can pass the bacteria to humans. It should be noted that it may also be carried by many other rodents, particularly those close to fresh water. Care should be taken with surfaces that recently have been in contact with rodent urine.
- **Bovine Tuberculosis** (TB) in badgers. To avoid any possibility of contamination, heavy-duty PVC gloves must be worn when handling injured or dead badgers. Anything which comes into contact with the badger must be thoroughly disinfected. Extreme care should always be exercised when handling this species, especially if injured, due to its ability to inflict serious wounds.
- **European bat lyssavirus 1 and 2** (EBVL1 and 2). These are closely related to the terrestrial rabies virus, and although the latter is not currently seen in the UK, EBVL1 and 2 are common in native UK wild bats, particularly Daubenton's bats. Such animals should always be handled with extreme care to avoid biting or scratching incidents. Gloves should be worn and personnel likely to be dealing with such animals regularly should preferably be vaccinated for terrestrial rabies by their doctor prior to such work as the terrestrial rabies vaccine appears to offer some protection against EBVL 1 and 2. Bat biting incidents should always be reported immediately to the medical authorities to ensure post exposure prophylaxis and where a bat is suspected of carrying rabies the local office for Animal Health and Veterinary Laboratories Agency to ensure diagnostic tests are carried out.
- S**almonella** is a bacterium which can cause food poisoning and is the main concern when dealing with reptiles which generally do not carry many other zoonotic diseases. It should be noted though that any animal or bird may carry salmonella bacteria without necessarily showing signs of disease. It is easily prevented by efficient personal hygiene and investigators should always wash their hands after handling any animal.
- **Botulism** is a disease caused by the bacterium *Clostridium botulinum* which grows in anaerobic conditions. Gulls, swans and ducks are the most susceptible species commonly encountered. Gulls often pick it up from breaking open rubbish sacks in search of food on landfill sites. Any sick gull found must be treated with care and, where possible, handled with surgical gloves. Ensure good personal hygiene.
- **Avian influenza** is a zoonosis which may be contracted from any wild bird, particularly waterfowl such as ducks and geese. Many such cases may show no clinical signs of disease. Transmission is generally by aerosol spread but such birds often shed the virus in faeces as well. Care should therefore always be taken in dealing with wild birds, particularly waterfowl with suitable protective gloves, face masks and outer clothing worn as routine.

10.1 Laboratory selection criteria

This chapter is intended to provide guidance for enforcement agencies that require access to a professional laboratory or agency for the performance of forensic testing on wildlife samples. It is important to recognise that not all laboratories are capable of running tests to the standard required for presentation in court. This chapter provides a clear and concise means to determine if the laboratory will not only be able to undertake the testing but will be able to do so in a manner likely to produce results acceptable and defendable in a court of law. It is not intended to be exhaustive or prescriptive. Forensic analysis facilities are likely to charge for the tests or examinations they carry out, and they will also have a submission form to fill out to include background information on the case and to maintain the chain of custody.

In order to determine if a lab is suitable for a forensic investigation, there are certain criteria that must be met regarding:

- the quality of testing/examination;
- the competence of the staff;
- good forensic practice.

10.2 Quality accreditation and certification

Tests carried out by forensic analysis laboratories should normally be accredited to internationally recognised standards. Accredited tests have been rigorously validated to demonstrate that they are fit for purpose, reliable and repeatable, and the labs which are accredited will have a fully audited quality control system in place. The required standard of accreditation for many forensic tests is ISO17025:2005. Test results with 17025:2005 accreditations have been carried out to a prescribed standard, providing the level of quality assurance that courts require.

In the absence of accreditation for some specific techniques, wildlife forensic scientists may be certified by the Society for Wildlife Forensic Sciences (www.wildlifeforensicscience.org/). At present this certification scheme is only available for wildlife DNA forensic testing and morphological examination, however this is likely to be extended in due course.

There are many different accreditation and certification schemes for testing, not all of which will provide the quality assurance standard required for the presentation of evidence in court. Ideally, seek independent advice (e.g. from your forensic science manager, or in the UK from the PAW FWG) on whether the lab is suitable for carrying out the required testing, or ask them to fill out the checklist of questions provided in Appendix C.

10.3 Staff Competence

All staff involved in forensic testing at any level must have been suitably trained and possess valid qualifications appropriate to the work. Experience in the production of witness statements and court appearances are advantageous but not always possible. It is no use to submitting authorities if scientists who carried out the work are not available to defend the work in court, or are not competent to do so. Points to consider:

- Good communication is vital between submitting authorities and laboratories. Ensure you are satisfied with the manner in which your enquiries have been addressed;

- When submitting samples, ensure that both parties are aware of the case requirements and the ultimate use of the results. In the UK, use of an MG21 form or similar may be a useful way to explain exactly what needs to be established and assist with continuity of evidence;
- Be prepared to supply further details to enable the testing laboratory to select the most appropriate testing systems to ensure the best results.

10.4 Good forensic practice

10.4.1 General guidelines

These guidelines are intended for laboratories receiving wildlife samples for forensic investigation. Adherence to these guidelines will help to ensure the chain of custody as well as making as certain as possible that the results obtained will be acceptable in court.

1. ALL samples must be signed for on receipt.
2. Samples must not be left unattended in public areas. Record the following on receipt:

- details of the submitting officer and authority;
- packaging details, i.e. courier, seal numbers (check seals are intact);
- integrity of sample, i.e. is it leaking, etc.;
- official exhibit label number (if applicable).

3. Samples should only be opened in the designated sample reception area.
4. All samples should then be entered on to the appropriate laboratory information management systems with these details:

- lab ID code (must be a unique code);
- case identifier;
- reception date;
- submission officer;
- exhibit seal number;
- description of sample, i.e. feather, blood, tissue, etc.;
- analysis details, i.e. method, result, dates;
- conclusions (distinguish between fact and opinion);
- sample storage details.

5. Only one sample should be handled at a time.
6. Chain of custody records must be kept of sample movement between internal and external laboratories. This must apply to whole or parts of samples. The record should include:

- nature of the sample transferred;
- date and time of transfer;

- name and signatures of persons transferring and receiving the sample(s);
- date and time of return.

7. Samples should be stored in freezers, refrigerators or cabinets which are secure, either individually locked or in locked rooms with restricted access.

10.4.2 Sample Analysis

1. All work on exhibits must be contemporaneously recorded.
2. There may be value in critical stages of the work being witnessed and recorded by a second member of staff.
3. All documents including notes, chromatograms and spectra must be signed and dated on generation. Documents produced overnight should be signed and dated at the earliest opportunity.
4. Evidence demonstrating the validity of methods should be available in the form of published papers or internal validation documents. If the method in use is sufficiently different from published methods to be deemed novel, it must be submitted for peer review and accepted for publication prior to use in criminal casework.
5. A full record of all procedures carried out must be kept. These should include date and time, names and signatures of operators and any assistants. Any changes from established procedures must also be fully documented.
6. Samples should be tested in parallel with appropriate controls.
7. Analysis staff must have a demonstrable and documented record of competence in the appropriate techniques.

10.4.3 Witness Statements

When preparing witness statements for possible prosecution or defence cases, the following points must be followed:

1. The person preparing the statement will probably be the one called to court and as such must be aware of court procedures. It is highly desirable that statements are prepared only by staff experienced in this field or under their direct supervision.
2. All statements must be properly documented and signed and dated. Hard copies as well as computer records must be kept in the case file.
3. Where expert evidence and evidence of opinion is being provided, adhere to relevant guidelines (see Appendix A).

10.4.4 Document Disclosure

Laboratories must be aware that copies of documentation must be made available to such parties as directed by the court or to the defence on request.

The case file must contain the following:

- All communications with investigating officers and the defence team;

- All printouts, notes, draft statements and any relevant documentation;
- A statement containing details of databases or other background information used in the interpretation of a case;
- A record of an independent check by a competent individual of the critical findings.

The following should be available from laboratory records:

- All relevant calibration and maintenance records;
- Staff training records;
- Validation documents;
- Laboratory practices relating to decontamination procedures.

The UK Forensic Science Regulator has produced a "Code of Practice and Conduct" document for forensic providers and practitioners in the criminal justice system which provides more detail on the guidance listed in Section 10.4 (www.gov.uk/government/uploads/system/uploads/attachment_data/file/118949/codes-practice-conduct.pdf).

Appendix A Useful information

Main contacts for the PAW Forensic Working Group (FWG)

Kate RAMSEY
FWG Chair
Greater Manchester Police
Mobile: 07810 655313
Kate.Ramsey@gmp.police.uk

Stephanie PENDRY
FWG Coordinator
TRAFFIC
Mobile: 07768 825550
Stephanie.pendry@traffic.org

More information about the work of the FWG can be found at http://www.pawfwg.org

Information on this site includes:

- Details of current forensic tests available for wildlife crime investigations;
- Examples of costs associated with forensic tests to investigate wildlife crime;
- Spreadsheets of wildlife related investigations involving forensic methods;
- Summary of Forensic Analysis Fund (FAF) cases funded to date;
- Forensic Analysis Fund (FAF) application form;
- Royal College of Veterinary Surgeons recognized specialists in zoo and wildlife medicine contacts list;
- MG19 form – Compensation claim;
- MG21 form Submission of work for scientific examination;
- How to obtain a DNA wildlife sampling kit;
- Instructions on use of the DNA wildlife sampling kit.

Other useful websites and documents links

Work of the Partnership for Action against Wildlife Crime (PAW)
www.defra.gov.uk/paw

Wildlife Incident Investigations Scheme (WIIS)
www.pesticides.gov.uk/guidance/industries/pesticides/topics/reducing-environmental-impact/wildlife

National Wildlife Crime Unit
www.nwcu.police.uk/

CPS Guidance for Experts (England and Wales)
www.cps.gov.uk/legal/assets/uploads/files/Guidance_for_Experts_-_2010_edition.pdf

COPFS Guidance Booklet for Expert Witnesses (Scotland)
www.crownoffice.gov.uk/images/Documents/Prosecution_Policy_Guidance/Guidelines_and_Policy/Guidance%20booklet%20for%20expert%20witnesses.PDF

ACPO Good Practice Guide for Digital Evidence
www.acpo.police.uk/documents/crime/2011/201110-cba-digital-evidence-v5.pdf

ACPO Good Practice Guide for Computer-Based Electronic Evidence
www.7safe.com/electronic_evidence/ACPO_guidelines_computer_evidence.pdf

NPIA Practical Advice on Police Use of Digital Images
www.acpo.police.uk/documents/crime/2011/20111014%20CBA%20practice_advice_police_use_digital_images_18x01x071.pdf

Interpol Wildlife Crime Scene Investigation – Guide to evidence collection and management.
http://onep-intranet.onep.go.th/files/1_Wildlife%20Crime%20Scene%20Investigation%20Manual.pdf

Retention Of Property (England & Wales)

UNDERTAKING – RETENTION OF PROPERTY
Description of property

_____

_____

_____

_____

I have been informed by the below named police officer that the above described property, which is currently in my possession may have been obtained by some person in consequence of the commission of a criminal offence. I understand that if I dispose of it I may be liable to civil or criminal proceedings. In consideration of the police not seizing the said property today, I hereby undertake:

1. To retain the property in safe custody.
2. To permit the police to have access to, and possession of, the said property in the future for the purpose of evidence in any criminal proceedings.
3. That I shall not dispose of the said property without the prior consent of the police.

Signed _____

Name _____

Address _____

_____

Witnessed _____

Name _____

Rank/
Number _____

Station _____

Time _____ Date _____

Police and Criminal Evidence Act 1984 Section 66 (B7.4) refers

Appendix C Laboratory Checklist

1. What method(s) will you use to test the samples(s)?

2. Do you have copies of supporting literature to support the validity of the testing methodology?

3. What experience do you have in this field of testing?

4. Give references from other clients.

5. Do you have an audited procedure for testing? When was it last audited?

6. Give the names and qualifications of the staff who will be responsible for this work.

7. Are these staff experienced in this field and able to present evidence in court?

8. Are these staff listed in any expert witness directory (give details).

9. What accreditation awards do you have?

10. When was the last external inspection and by whom?

11. Are the results available for inspection (give contact details)?

12. Are you familiar with the standards recommended by the Society for Wildlife Forensic Science (SWFS)? www.wildlifeforensicscience.org/

13. Do you work to these standards?

14. Can you supply an example of a previous anonymised witness statement.

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FWG members
Kate Ramsey (Greater Manchester Police)
Stephanie Pendry (TRAFFIC International)
Chief Inspector Ian Briggs (Royal Society for Prevention of Cruelty to Animals (RSPCA))
Alison Clarke (Animal Health and Veterinary laboratories Agency (AHVLA))
Guy Clarke MBE (CITES Team UK Border Force (UKBF))
Chris Conyers (Food and Environment Research Agency (Fera))
Kam Dhillon MBE (Bedfordshire Police – Bedfordshire, Cambridgeshire and Hertfordshire SSU)
Dr Simon Girling (Royal Zoological Society of Scotland – (RZSS))
Madeleine Groves MBE (Royal Botanic Gardens, Kew)
Inspector Nevin Hunter (National Wildlife Crime Unit (NWCU))
Dr Rob Ogden (TRACE Wildlife Forensics Network)
Mark Rafferty (Scottish Society for Prevention of Cruelty to Animals (SSPCA))
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Supporting organisations

PAW Forensic Working Group
www.pawfwg.org

TRAFFIC – The Wildlife Trade Monitoring Network
www.traffic.org

The Royal Society for the Prevention of Cruelty to Animals
www.rspca.org.uk

The Royal Zoological Society of Scotland
www.rzss.org

Royal Botanic Gardens, Kew
www.kew.org

The Food and Environment Research Agency
www.fera.defra.gov.uk

TRACE – The Wildlife Forensics Network
www.tracenetwork.org

Scottish Society for the Prevention of Cruelty to Animals
www.scottishspca.org

The Royal Society for the Protection of Birds
www.rspb.org.uk

Science and Advice for Scottish Agriculture
www.sasa.gov.uk

Partnership for Action against Wildlife Crime
www.defra.gov.uk/paw

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