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# Guidelines on Methods and Procedures for Ivory Sampling and Laboratory Analysis



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Laboratory and Scientific Section  
and  
Global Programme for Combating Wildlife and Forest Crime,  
Sustainable Livelihoods Unit  
UNITED NATIONS OFFICE ON DRUGS AND CRIME  
Vienna

# **Guidelines on Methods and Procedures for Ivory Sampling and Laboratory Analysis**



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## **Note**

Operating and experimental conditions are reproduced from the original reference materials, including unpublished methods, validated and used as per the list of references. A number of alternative conditions and substitution of named commercial products may provide comparable results in many cases, but any modification has to be validated before it is integrated into laboratory routines.

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## Abbreviations

CCPCJ	United Nations Commission on Crime Prevention and Criminal Justice
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CITES CoP16	Sixteenth Conference of the Parties to the Convention on International Trade in Endangered Species of Wild Fauna and Flora
CITES MA	CITES Management Authority
CND	Commission on Narcotic Drugs
DNA	Deoxyribonucleic acid
EDTA	Ethylenediaminetetraacetic acid
ETIS	Elephant Trade Information System
FTIR	Fourier transform infrared spectroscopy
GPWLFC	Global Programme for Combating Wildlife and Forest Crime
ICCWC	International Consortium on Combating Wildlife Crime
INTERPOL	International Criminal Police Organization
IRT	Incident response team
IRMS	Isotope ratio mass spectrometer
LSS	Laboratory and Scientific Section
MEGA	Molecular Evolutionary Genetics Analysis
MIKE	Monitoring the Illegal Killing of Elephants
MLA	Mutual legal assistance
NEST	National Environmental Security Taskforce
PPE	Personal protective equipment
PCR	Polymerase chain reaction
SCAT	Smoothed Continuous Assignment Technique software
SLU	Sustainable Livelihoods Unit
WCO	World Customs Organization
WIST	Wildlife incident support team
UNODC	United Nations Office on Drugs and Crime
USDA	United States Department of Agriculture
SWGWILD	Scientific Working Group for Wildlife Forensic Sciences





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# 1. Introduction

## 1.1 Background

Wildlife crime is a serious and growing problem worldwide. The illegal killing of elephants for their ivory is now at critically high levels. There is strong evidence of increased involvement of organized crime groups, and in some areas rebel militia, operating through well-developed criminal networks. This has changed the dynamics of combating this highly destructive criminal activity, and law enforcement authorities around the world are facing increasingly difficult and complex situations in their fight against wildlife crime. Illicit trafficking in wildlife is transnational, supplying consumption that often takes place thousands of kilometres from the source, frequently having transited several countries. It is taking place at such a large scale that it poses an immediate risk to wildlife as well as to people and their livelihoods.

Figures released through the Convention on International Trade in Endangered Species of Wild Fauna and Flora\* (CITES), Monitoring the Illegal Killing of Elephants (MIKE) and Elephant Trade Information System (ETIS) programmes highlight the critical situation that continues to be faced regarding the poaching of the African elephant and smuggling of its ivory, with more than 20,000 elephants illegally killed on the African continent in 2013 [1]. The overall weight and number of large-scale ivory seizures in 2013 exceeds that for any previous year in ETIS data. These figures, coupled with the data compiled from 60 designated MIKE sites across 30 African countries and 27 designated MIKE sites across 13 countries in Asia, demonstrate that current levels of elephant poaching in Africa is unsustainable and could lead to local extinctions across many African elephant range countries.

To combat wildlife crime effectively, it is vital that the law enforcement community deploys all available tools to ensure that the entire crime chain is addressed. More effort is required and new approaches needed, including increased use of science and technology. Wildlife crime is similar to “other forms of criminality, and the full range of forensic science, expertise and support can potentially be brought to bear from one end of the illicit trade chain to the other” [2].

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\*CITES regulates trade in close to 35,000 species of plants and animals.

The transnational and organized nature of this illicit trade necessitates a common and coordinated global response. The international community has recognized the severity of the problem, as is reflected in recent resolutions and decisions. The Conference of the Parties to CITES, at its 16th meeting (CoP16, Bangkok, 2013), adopted a number of strategic and operational decisions on enforcement matters that provide a strong basis for Parties to take concrete action to put an end to the current high levels of illegal wildlife trade, and encourage the increased use of forensic technology to fight wildlife crime (see annex 2).

In addition, CITES Resolution Conf. 10.10 (Rev. CoP16) on “Trade in elephant specimens” “urges Parties to collect samples from all large-scale ivory seizures (i.e. a seizure of 500 kg or more) that take place in their territories, and provide these to relevant forensic and other research institutions in support of enforcement and prosecutions” [3].

The United Nations Commission on Crime Prevention and Criminal Justice (CCPCJ), at its twenty-second session (Vienna, 2013), specifically addressed the increasing involvement of organized crime in wildlife crime. Member States strengthened the mandate of UNODC in the field of wildlife and forest crime by adopting a resolution on “Crime prevention and criminal justice responses to illicit trafficking in protected species of wild fauna and flora” (ECOSOC resolution 2013/40, see annex 2). The resolution encourages UNODC, in cooperation with members of the International Consortium on Combating Wildlife Crime\* (ICWC), “to continue its efforts to provide technical assistance to combat illicit trafficking in wild fauna and flora.”

Building upon this political momentum, UNODC, as a member of ICWC, was given the lead for the development of guidelines to address the challenges posed by this crime and provide support to law enforcement operations through the use of forensic technology and laboratory data.

The use of laboratory analysis to generate intelligence data to identify the areas where seized wildlife specimens originated can increase efficiency of law enforcement responses by ensuring that resources are directed to those areas where the most significant poaching of elephants or illegal ivory harvesting occur. In recent years, advances in deoxyribonucleic acid (DNA) analysis have provided a powerful tool to assist crime investigators and prosecutors. Determining the origin of large ivory seizures can assist authorities in identifying current and potential poaching “hotspots”. Such knowledge can, in turn, assist law enforcement responses by ensuring that resources are targeted more effectively to the areas where the most significant poaching of elephants or illegal ivory harvesting is likely to occur. Moreover, prosecution data gathered through forensic investigation can also greatly assist authorities in linking seized wildlife specimens to crime scenes and suspects,

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\*ICWC is the collaborative effort of the CITES Secretariat, INTERPOL, UNODC, the World Bank and the World Customs Organization, working to bring coordinated support to the national wildlife law enforcement agencies and to the subregional and regional networks that, on a daily basis, act in defence of natural resources. For more information see <http://www.cites.org/eng/prog/icwc.php>.

facilitating their identification, arrest and successful prosecution. Furthermore, knowledge of the use of forensic techniques in wildlife and forest offence investigations can also have relevance to crime prevention, as it may also deter some would-be offenders [4].

However, law enforcement officers responsible for the investigation of cases involving large-scale ivory seizures are often confronted with the challenge of identifying the most appropriate way to collect and submit specimens to appropriate wildlife forensic facilities. The investigation often stops at the point of the seizure, ignoring the valuable information that can be garnered from the seizure through laboratory analysis for both prosecution and intelligence gathering to identify the areas where seized wildlife specimens originated. Such efforts are especially important for large ivory seizures, as these seizures most likely involve organized crime that severely damages wildlife populations.

## 1.2 Purpose and scope of the *Guidelines*

In order to ensure that forensic data are credible and admissible, appropriate methods and procedures must be used throughout the entire investigation process, from crime scene and sample collection to shipping, analysis, interpretation of results and database maintenance.

These *Guidelines* were developed as a guide to best practices and procedures. They are intended for worldwide use, with the aim of facilitating the use of forensic science to the fullest extent possible in order to combat wildlife crime, and in particular, to combat the trade in illegal ivory. They provide guidance on procedures and methodologies for ivory sampling and analysis by different laboratories with appropriate facilities, to support transnational criminal investigations and law enforcement operations. It is hoped that the use of the *Guidelines* will lead to more timely, thorough and effective investigations, resulting in an increased number of successful prosecutions and a reduction in this illegal trade. The *Guidelines* cover the whole chain of custody, from the crime scene to the courtroom. The target audience ranges from first responders to the scene of the crime, crime scene investigators, law enforcement officials, forensic scientists, prosecutors and the judiciary. Some sections contain information that is more specific to certain audiences. For example, laboratory analytical methods and procedures are more relevant to research and forensic institutions. The *Guidelines* also make reference to standard regulations and operational procedures to support forensic investigations and design specific law enforcement measures. It considers mechanisms for international cooperation and capacity-building.

The *Guidelines* are not intended to replace the many useful treatises that discuss the use of forensic science to combat wildlife crime and assist the associated investigations. Rather, it outlines a process for responding to a particular challenge: the use of forensic methods and procedures for the investigation of ivory seizures. While

the emphasis in the *Guidelines* is on the use of forensic technology to combat illegal ivory trade, similar considerations may apply in the investigation of wildlife crime offences involving other species.

The *Guidelines* are divided into four parts. They are collectively intended to provide integrated tools for gathering and processing evidence on wildlife crime and performing laboratory analysis in support of prosecution and for intelligence purposes.

Part I focuses on crime scene management. It describes general crime scene management practices, including how to ensure that the scene is thoroughly explored, not contaminated and that the evidence gathered is admissible in court. It also advises on how to sample ivory seizures for forensic analysis.

Part II provides information on available methods and procedures for the identification and analysis of ivory specimens, to determine species, age and geographical origin as well as to link samples to individual elephants. The information included in this section is technical and aimed at laboratory analysts with expertise in specific areas, for example, DNA analysis.

Part III provides guidance on how to interpret scientific data and properly describe results to law enforcement and the judiciary. In order to facilitate understanding of forensic methods and results by the prosecution and judiciary, simple descriptions of relevant techniques are also provided.

Part IV discusses the importance of international cooperation in the fight against wildlife crime. It describes the challenges faced and suggests proactive initiatives and reactive responses for national authorities and the international community.

# Part I. Crime scene management

Crime scene management and analytical support for investigation of wildlife crime can be provided in two areas:

- Sample collection and analysis for criminal investigations, to link persons and items to the crime as well as to identify individual elephants; and
- Sample collection and analysis of the raw or worked ivory for identification of the species, age of the ivory, geographical origin, estimated number of elephants killed and date of killing.

Many of the techniques and best practice procedures used for seized ivory investigations will be the same for other criminal investigations requiring forensic support.

## 2. National capacity

The provision of forensic services is affected by the legal framework in place and includes issues related to entering the crime scene, conducting the investigation, handling evidence, analysis and others. The collection, handling, documentation and safe storage of items of evidence to avoid contamination requires policy guidance, systems to be in place and adequate secure facilities. Therefore, established national forensic protocols will provide a good framework that could be applied to ivory seizure investigations [5].

Technical and scientific advances in forensic sciences are meaningless without the necessary training of the officers who are first on the scene [5, 6]. All field personnel should be familiar with basic rules about what to do, and often more importantly, what *not* to do, when a suspected scene of a wildlife crime is detected [7].

The types of forensic examinations that can be conducted depend on the capability of the scientist involved and the available laboratory facilities and equipment. In locations where requisite expertise, equipment or facilities are temporarily or permanently unavailable, mechanisms to obtain or gain access to such expertise or equipment should be developed [4].

The following are some questions for authorities to consider when determining their country's national capacity to use forensic methods to combat wildlife crime [4]:

- Are dedicated crime scene investigation services available?
- Are first responders trained and equipped to isolate and protect scenes of wildlife crime?
- Who is called first when a potential offence is discovered?
- Is there a procedure for requesting technical expertise?
- Do investigators have access to crime scene investigation kits and material?
- Do investigators preserve crime scenes so that they remain suitable for forensic examination?
- Are investigators trained in what to look for and are they aware of the potential and limitations of forensic examinations and evidence?
- Are investigators familiar with forensic evidence gathering procedures, preservation of evidence and chain of custody? If not, can investigators access crime scene investigation training?
- Do responsible officers have a mechanism for sharing seizure information with INTERPOL?
- Are there national forensic laboratories and qualified staff to analyse the samples?
- Which agency conducts the analyses?
- Do enforcement officers, customs and the police responsible for wildlife investigations have access to existing forensic services and facilities?
- Are staff trained in the mechanisms of prosecutions and the presentation of evidence in court?
- Does the laboratory have a quality-management system in place and does it work according to accredited or recognized best practice standards?
- Are there external reviews and audits of laboratory work in order to ensure that techniques are implemented correctly?
- What forensic support is available? (For example, microscopy, ballistics, DNA, isotopic profiling, morphology, pathology, toxicology.)
- Are there national databases for forensic data from wildlife and forest offences?
- Do national budgets make provision for the collection and submission of samples to designated forensic laboratories?



### 3. International expert assistance

International expert assistance can be provided upon request, should a law enforcement agency lack appropriate capacity to deal with significant poaching, illegal trade in wildlife specimens, or in cases of a large-scale seizure of CITES specimens. Such assistance could include investigative support, evidence collection and/or assistance to pursue forensic analysis.

CITES CoP16 adopted Decision 16.40, paragraph A, directing the CITES Secretariat to establish wildlife incident support teams (WISTs) subject to available resources and in cooperation with its partners in ICCWC. WISTs consist of enforcement staff or relevant experts. WISTs are dispatched at the request of a country that has been affected by significant poaching of CITES specimens or that has made a large-scale seizure of such specimens. The WIST will assist, guide and facilitate appropriate follow-up actions in the immediate aftermath of such an incident (annex 2).

INTERPOL has to date deployed numerous incident response teams (IRTs) at the request of member States during crisis situations.\* For example, INTERPOL, on behalf of ICCWC, deployed a WIST to Sri Lanka in July 2013 to sample a large ivory seizure made in May 2012 [8]. Requests for the deployment of a WIST can be directed to the CITES Secretariat or to the INTERPOL General Secretariat via the INTERPOL National Central Bureau of the country concerned. It is of utmost importance that, should external assistance be required for sample collection, the seizure be treated as a crime scene and be appropriately preserved until arrival of the international expert assistance team.

### 4. Search guidelines

Officers undertaking the search should be briefed in advance to ensure that they are aware of the nature and purpose of the search and the evidence sought. These officers are responsible for complying with the law and ensuring that they do not search beyond the statutory limitations imposed. They must remember that the power to search is limited to the extent that is reasonably required for the purposes of discovering and securing evidence [9]. Search officers must also fully understand their powers of seizure.

Searches should include the search of containers and their cargo, vehicles or premises, particularly when looking for large consignments of ivory. The search method can

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\*For more information on IRTs see <http://www.interpol.int/INTERPOL-expertise/Response-teams/Incident-Response-Teams>.

vary according to the reason for the examination. Regardless, searches should be carried out methodically and thoroughly. Examining officers should always follow set procedures when searches are conducted.

Some countries and organizations might already have comprehensive search guidance procedures in place that law enforcement officials could draw upon. Access to such search guidelines is often restricted to the law enforcement community. Broad considerations for law enforcement authorities engaged in different types of searches are included in annex 3 [9].

The inspection search must stop at the first indication of a crime, for example, when the first tusk is uncovered in a container, vehicle, etc. (see annex 4). Officers are encouraged to use the information contained in the annexes to complement search guidance procedures that might be available to them through their respective organizations.

## 5. Discovery of the suspected illegal specimen

The first person on the scene, often an officer conducting an inspection, may not be the most experienced officer in the department. This is not a problem as long as the officer is trained to know when and who to call for assistance upon discovery of a suspected illegal consignment of ivory or other wildlife specimen [7].

In all investigations, the actions of the first person on the crime scene play an essential role in the preservation of the scene. The better preserved the crime scene, the more likely that reliable evidence will be located and be admissible in court. It should be noted that, in many cases at this stage, a decision to detain or release the suspected illegal specimens is to be made in a very narrow time frame. Preliminary identification of a certain portion of the specimens, followed by a more thorough examination, would facilitate a timely decision [7].

All operational personnel should be familiar with the protocol for actions to be taken upon identification of a suspected illegal consignment of ivory. This protocol will guide the response team and could include:

- Who to contact if a crime is discovered
- How to make that contact
- When it should be done
- What should be reported
- Why these actions are necessary

Ideally, a national law enforcement authority or authorities should be mandated to investigate wildlife crime offences. Information on the mandates and functions of these authorities should be made available to all operational law enforcement officials. This will assist the first person on the scene to alert the appropriate authority in a timely manner. It might be also advantageous to involve relevant wildlife experts as early as possible. The first officer on the scene should contact an investigator as soon as possible [7].

A single officer with the necessary experience and authority should be appointed to manage the investigation and control all activity at the crime scene. This investigator will be responsible for assigning tasks to other officers. All information should be channelled to this investigator, who will also be the liaison to the media and prosecutor [7].

In many cases, a multi-departmental team may need to be assembled to deal with the investigation, even at this early stage. In this case, a pre-existing forum, such as an INTERPOL National Environmental Security Taskforce (NEST), is invaluable to correctly address protocols and get the necessary work under way as soon as possible.

Some practical advice to be followed in the event of the discovery of a possible illegal ivory consignment is provided in the “Guidance for the first person on the scene” included as annex 4 to these *Guidelines*.

## 6. Crime scene recognition

The ultimate goal of the crime scene investigation is to determine whether or not a crime has been committed—and if so, to identify suspects and to preserve forensic evidence that is admissible in a court of law [5, 6].

Criminal law should be very clear about what acts are punishable so that people may understand what conduct is illegal and what the nature of the punishment may be for that conduct. The appointed investigator should have good knowledge and understanding of the applicable legislation. He should visit the crime scene to assist in deciding if and what crime was committed. The investigator should interview people, gather evidence and analyse the situation in order to develop theories as to what happened [7].

The investigator should determine from the people at the scene [7]:

- Who discovered the scene
- What was discovered

- Who visited the scene
- The names of any witnesses

In the case of large-scale ivory seizures, species identification is important. Large-scale ivory seizures are usually associated with raw ivory, although worked ivory could also be encountered. CITES resolution Conf. 10.10 (Rev. CoP16) [3] on Trade in elephant specimens states that:

*a)* The term ‘raw ivory’ shall include all whole elephant tusks, polished or unpolished and in any form whatsoever, and all elephant ivory in cut pieces, polished or unpolished and howsoever changed from its original form, except for ‘worked ivory’; and

*b)* The term ‘worked ivory’ shall be interpreted to mean ivory that has been carved, shaped or processed, either fully or partially, but shall not include whole tusks in any form, except where the whole surface has been carved.”

It is always important to identify the species for the proper investigation of the crime. Investigators can use visual means for initial species identification to establish a “probable cause” justification for seizure of the suspected illegal material. Use of an ivory identification guide can be of great assistance to investigators [10].

Note that while the use of visual analysis is reliable for the purposes of distinguishing the species source to establish a “probable cause” justification for seizure, a trained scientist must examine carved ivory objects in order to obtain a positive identification of the species source.

## 7. Crime scene investigation and physical evidence collection

A number of national and international guidance reports are available on the procedures necessary for crime scene investigation [4-6, 11]. The general principles involved in wildlife crime scene investigation are the same as those which apply to all crime scene investigations.

Crime scene investigation procedures include:

1. Securing and protecting the scene
2. Searching for and locating evidence
3. Photographing evidence
4. Documenting and mapping the scene

5. Collecting and preserving evidence
6. Preventing cross-contamination of evidence
7. Initiating a chain of custody

The crime scene investigator should follow this process in an attempt to gather information and link the seized wildlife specimen with a suspect and a crime [6].

## 7.1 Securing and protecting the crime scene

The first priority when securing and protecting the crime scene is safety of personnel. The second priority is to protect the crime scene from disturbance. Information about the contraband ivory can be processed away from the point of discovery to reduce the likelihood of contaminating evidence. Inexperienced officers may be inclined to search through the discovered items; however, *the golden rule is to protect the crime scene from disturbance until the investigating officer has taken charge of the scene* (see annex 4) [7].

Wildlife crime scenes may contain toxic chemicals, pathogens, and pesticides or poisons not expected in other forms of crime. Appropriate personal protective equipment (PPE) and safety considerations are critical in such instances.

Large numbers of recovered elephant tusks can attract a number of spectators. The more people at the scene, the more difficult it is to ensure that the scene is not interfered with before accurate observations can be made. The investigator should appoint an appropriate official to control access to the crime scene. Access should be granted with caution and only to relevant personnel. The appointed official must document the details of all persons entering the crime scene, including the initial investigator, all laboratory personnel and anyone else who enters the scene. The crime scene should never contain a large group of people; this increases the likelihood of overlooked, damaged or contaminated evidence. To avoid contaminating the crime scene, eating, drinking and smoking should be forbidden and gloves must be worn at all times [6].

## 7.2 Searching for and locating evidence

The crime scene is a crucial source of information and evidence. The primary reason to examine a crime scene is to use scientific methods to perform a systematic evaluation of the scene and to collect and preserve physical evidence that may help in the reconstruction of events in order to identify and link (or exclude) a suspect to the victim and/or crime scene for the purposes of solving the crime [6].

The fundamental principle of forensic science is that “every contact leaves a trace” (Locard’s Principle). When a person commits a crime, they leave a trace of themselves at the scene and take away a trace or part of the scene with them. The challenge in crime scene processing is identifying, collecting and preserving evidence so that it is available for further examination in a laboratory. Clues and evidence destroyed at the scene can never be replaced, and clues and evidence overlooked at the time of the first visit may not be there in subsequent visits to the scene. The investigation of a crime is a scientific process that requires a professional approach [5-7].

Physical evidence can vary, from extremely large objects (e.g. whole ivory tusks) to small items (e.g. cigarette butts) to microscopic traces (e.g. saliva, blood or fingerprints) [5]. A number of techniques can be used to link physical evidence or suspects to a crime. Ballistics can link bullets recovered from the crime scene to firearms seized from suspects. Bullet marks on tusks can determine whether the elephants were shot from the ground or air. Documents can reveal a suspect’s handwriting, fingerprints or DNA. Shipping paperwork, such as the bill of lading tied to a shipping container, can help determine the transit routes and persons involved along the entire crime chain. Minute traces of a suspect’s DNA (e.g. found in hair, saliva, blood) can be left at or on items connected to the scene of a crime. Fingerprints can be lifted from the surface of ivory. Fingerprints can also be found on other objects with smooth surfaces (e.g. bottles, cans, plastic bags, paper, envelopes) and used to link a suspect to a scene. In an ivory seizure, fingerprints can usually be found inside the lids of shipping boxes as well as inside the doors of shipping containers [6].

The hands, fingernails, hair and clothing of suspects may contain traces of debris, blood or firearms residue. Packaging or sacking can be traced to a particular country or place. Vehicles, containers and premises may hold remnants of material from a scene. Carved or cut ivory can reveal physical marks that may be linked to tools [4].

The investigator should observe, inspect and record as much as possible about the scene. The investigator may be assisted by other relevant persons in searching the scene. These persons must enter the area using the same route as the investigator and behave in an orderly fashion. They must be given direction as to what possible items to look for. Items found should be reported to the investigator and must not be touched [7]. Once an evidence item is chosen to be collected, a numbered placard is placed next to the item. The item is then photographed and mapped prior to collection [6].

### **7.3 Photographing evidence**

The evidence collection process should be documented using a recording device that provides admissible evidence, including photographs, videos or tape recorders [11]. Each country and legal system has its own rules of evidence. Digital evidence is

widely used by courts, but it should be noted that some jurisdictions may not allow digital photographic material. It is important to ascertain these rules in advance.

Photographs are probably the easiest way to collect and archive crime scene information. A careful, methodical approach is essential, resisting the natural impulse to rush to the object. A whole range of photographs should be taken, even if some appear to be of little or no relevance at the time. If more than one person is involved in the photography, record who took each picture. This is important because the photographer may need to be identified during court proceedings. As a general rule, avoid asking other people to take photographs at the crime scene, because they may be asked to testify [6].

## 7.4 Documenting and mapping the scene

A map of the crime scene should be created, for the following reasons:

- To accurately document the precise location where each evidence item was collected and the relationship of these to one another
- To illustrate the crime scene and the important features relevant to the investigators' hypotheses
- To prevent data loss in instances of camera or camera card failures

Note-taking, record-keeping, and crime scene documentation are thoroughly discussed in the forensic literature [12-15]. Investigating officers are encouraged to familiarize themselves with these reports.

## 7.5 Collecting and preserving evidence

Once evidence has been found, the investigator at the scene has two parallel tasks to perform:

- Accurate collection and recording
- Accurate preservation of the evidence

Evidence should be gathered, labelled and preserved in accordance with national legislation. It is preferable that only the investigator in charge handles the evidence, even though someone else might have directed him to the object. This might not always be practical when a large number of items need to be handled, as in a large consignment of ivory. In these circumstances, it is important that the team of assistants is instructed and managed by the investigating officer. Consideration should be given to appointing a dedicated exhibits officer to be responsible for all exhibits.

Detailed discussion of how to deal with particular non-ivory evidence types is beyond the scope of these *Guidelines*, but can be found in numerous references [5, 15-21].

All evidence should be accurately documented and sealed at the crime scene [5]. Each piece of evidence should be collected and marked separately with reference to a point on the crime scene where it was observed, numbered, photographed and recorded by the investigator.

The following information must accompany each piece of evidence individually:

- The date, time and place where the item was found
- The number of the point at which the item was located on the crime scene
- The name of the person who found it there
- A short description of what the object appears to be

Each individual item of evidence must be placed in a separate forensic evidence bag. If forensic bags are unavailable, small objects can be placed in separate plastic bags or envelopes. Blood on these objects must not be washed off as there may be a need to analyse the blood at a later stage.

Careful descriptions of items of evidence are essential. For example, any handwritten markings or codes written on the ivory must be documented exactly. These codes can sometimes provide information regarding the origin or destination of the ivory as well as the individuals involved and could be linked to particular groups.

Descriptions must be based on facts rather than opinion or hypothesis. For example, the description of a bullet recovered from a tusk must include only the relevant facts and should not suggest the *possible* calibre of the bullet.

Items collected in the field should be relevant to testing the crime scene investigation hypothesis. While some hypotheses may not be formed until further laboratory and investigative work is performed, judgement calls must still be made in the field regarding what items are deemed evidence and worthy of collection. The scene processors must document any items that are not collected and detail the reason for not collecting them. If there is any doubt about the relevance of an item, it should be collected [10].

Writing, scratching or painting on items of evidence by officers can reduce and jeopardize their evidential value. In the case of ivory, marks made directly onto the ivory when recording the evidence may hinder later inspections of pre-existing marks on the ivory. However, when cataloguing large ivory seizures, marks on tusks are required, but should be consistent and easily identifiable as part of the cataloguing process. See section 12 on ivory sampling for further information.



Safety concerns do not stop at the scene. If hazardous items are collected, care in packaging and labelling needs to be practised to ensure safe conditions for laboratory personnel. Postal and delivery companies also have very strict regulations regarding the shipment of potentially hazardous materials [10].

An inspection of the crime scene and subsequent recording of every item of evidence found on the scene of a large-scale ivory seizure will probably not include a comprehensive inspection of each tusk or piece of ivory. Detailed inspection and sampling of the ivory forms part of the follow-up investigation work. Subsequent information gathered from forensic analysis of the tusks will offer crucial information for the investigation of the crime. It is important to note that the subsequent forensic work conducted in the laboratory is contingent upon the quality of the work conducted at the crime scene.

If the crime scene investigation is incomplete at the end of the day, plans must be made to guard the scene and the seized ivory. If the scene has been fully investigated, the ivory may be moved to an environment suitable for safe keeping until it has been properly inspected and sampled [7].

## 7.6 Preventing cross-contamination of evidence

Protective measures are necessary to prevent cross-contamination of evidence. Failing to implement these measures can lead to irrevocable contamination of the scene, which could misdirect investigators and adversely influence the final result of the investigation. Cross-contamination may even prevent the solution of the case or result in a wrong conclusion [5]. In order to prevent this, the following should be considered:

- Immediate segregation and packaging of goods (e.g. in separate bags)
- Wearing and changing gloves for each search activity
- Using a colleague to search associated and other “clean” exhibits (and being able to state in evidence precisely the extent to which they participated in the search)
- Storing bulk goods (i.e. tusks) and trace exhibits separately at all times (including transfer to and from the forensic science service)

## 7.7 Chain of custody

A chain of custody is required for every piece of evidence gathered. This refers to the chronological and careful documentation of evidence to establish its connection to an alleged crime, clearly showing details of its seizure, custody, control, transfer, analysis, disposal, etc. From the beginning to the end of the forensic process, it is

crucial to be able to demonstrate every single step undertaken to ensure traceability and continuity of the evidence from the crime scene to the courtroom [5].

The chain of custody begins with the person who first picks up the evidence at the scene. Every time the evidence is transferred, the transaction should be recorded with the date, time and name (typically a signature or initials) of the persons transferring and receiving the evidence item. A chain-of-custody form should be used to maintain a running record of custody for every object collected from the scene. This form will also be of evidential use, as each person can be requested to sign for the respective receipt and release of each item. This ensures that the evidence item is under the control of a specified individual and in a secured location at all times in order to prevent unauthorized alteration, tampering or loss [10].

*The custody of evidence is a very important part of any investigation and serves as proof of who had what in their possession and when, as this will need to be clearly explained in court [7]. It is important that a cross-check can be easily performed to ensure all statements on the chain-of-custody form are present. This entails that, for every line on the form, the required records and information are indicated. An example of a chain-of-custody form is included in annex 5 of these Guidelines.*

If the evidence needs to be sent to a crime laboratory for analysis, every transfer should continue to be recorded with date, time, persons transferring the evidence and the storage location information for each item. In the case of large ivory seizures, it is important to ensure that the samples taken from the seizure are indeed the samples sent to the laboratory.

Articles sealed with an official seal and transported between two parties generally do not require signature by the carrier as a “link” in the chain of custody, provided that the dispatcher and recipient can attest to the integrity of the seal used. Legislation might, however, differ from country to country, and investigating officers are encouraged to consult their judicial authorities on the matter of transporting companies, if in doubt.

## 8. Marking of ivory

It is necessary that all tusks coming under government control, whether of legal or illegal origin, be marked with a standardized code that identifies the country, year of seizure and serial number.

CITES resolution 10.10 recommends that whole tusks of any size and cut pieces of ivory (over 20 cm in length and 1 kg in weight) be marked with a unique number. This number must be marked using punch-dies, indelible ink or another form of

permanent marking, using the following formula: the two-letter ISO code for the country of origin, the last two digits of the year/the serial number for the year/the weight in kilograms (e.g. KE 00/127/14). In the case of whole tusks, the number should be placed at the “lip mark” and highlighted with a flash of colour (see annex 2) [3].

These markings should be made prior to sampling, if possible. Alternatively, once the sampling has been completed and the ivory has been stored in the national stockpile, this marking process can be carried out.

## 9. Discrepancies and missing items

If an item of evidence is discovered to be missing, the investigative manager must be informed. All discrepancies should be followed up immediately while events remain fresh in the minds of officers. Every attempt should be made to locate missing property and establish where the item was last seen, to retrace the officer’s steps or actions, to examine the vehicle used to transport the item and to thoroughly check the area where the property was unloaded. A note of the circumstances and all attempts to recover the missing property should be retained in the case file.

## 10. Dealing with the media

A large-scale seizure of ivory can attract considerable media attention. It is important that all relevant information be shared with the countries of origin, transit and destination, as appropriate, before being released to the media. The release of information to the media should be done in consultation with investigators in the countries involved in order to ensure that investigations are not jeopardized. Officers should always be reminded not to release information of a sensitive nature to the media.

## 11. International cooperation

Good communication, collaboration and coordination at the national and international levels is essential. Prompt exchange of information is of paramount importance to investigations, particularly when more than one country is involved. Ivory seizures should be processed and sampled for laboratory analysis as rapidly as possible.

Large ivory seizures contain vital information and can provide intelligence to guide law enforcement officials. Timely cooperation in these circumstances maximizes the efficiency of law enforcement resources. The sooner ivory samples are turned over for analysis, the more quickly the information can be acted upon.

See part IV for further information on international cooperation.

## 12. Sampling of ivory for forensic analysis

The primary purpose of sampling tusks is to facilitate DNA and isotope analyses in order to determine: (a) species; (b) geographical origin; (c) age; and (d) how many elephants were killed.

Ivory seizures can range from one single item to hundreds of whole tusks and/or thousands of pieces of worked ivory. It is not always practical or necessary to sample every tusk for laboratory analysis. Instead, the aim is to collect a portion that is representative of the ivory seized, maximizing the chances of including samples representative of all locations in the consignment. A sampling procedure has been developed, instructing how best to select a representative sample of the seizure (see section 12.2).

These *Guidelines* focus on sampling procedures for large-scale ivory seizures and the challenges they pose. However, the same techniques can be applied as appropriate to small-scale seizures and consignments of worked ivory.

### 12.1 Large-scale ivory seizures

Large-scale ivory seizures (i.e. 500 kg or more) can include hundreds of tusks. The sampling procedure is used to reduce the number of tusks or ivory pieces to be selected for sampling and subsequent laboratory analysis.

To begin the process of selecting a representative sample, the seizure should first be halved in a manner that reduces the chances of sampling both tusks from the same elephant. In order to do this, tusks are arranged in order of size, and then every second tusk is removed. It is assumed that tusks from the same animal are similar in size, so each tusk is likely to be arranged next to its pair. In large seizures, many tusks of identical size can be present, so if possible, arrangement of pairs based on colour or appearance should also be considered.

The remaining tusks should then be divided into a number of common groups based on shared external characteristics, in an effort to group together tusks from the same

location. Examples of grouping characteristics might include: similarly coloured tusks (as though they were buried in the same soil); tusks with similar man-made markings on the outside, such as writing in the same colour ink; tusks cut into pieces in a consignment of whole tusks; or a large group of tusks that appear older or newer than the rest.

Tusks are then evenly sampled from each group to maximize the chances of obtaining a representative number of tusks. The aim is to be able to collect a sufficient number of samples for analysis by the laboratory, considering that, for example, with DNA analysis, approximately 40 % of samples may have to be discarded because little or no DNA can be recovered from them.

A step-by-step guide to selecting a representative group for sampling is outlined in section 12.2.1.

## 12.2 Sampling procedure

Collection of ivory samples for analysis can be broken down into three parts:

1. Selecting a representative number of tusks to be sampled
2. Cutting the sample
3. Preparing the samples for transport to the laboratory

Prior to sorting and cutting the tusks or ivory pieces, a dedicated work area must first be set up. This work area should be:

- Cordoned and secure; no unauthorized persons should be in this area
- Sufficiently large enough to lay out all the tusks
- Protected (e.g. from rain, sun and wind)
- Connected to an electricity supply for electric saws, lighting, etc.

Throughout the entire process of ivory seizure and analysis, documentation and recording of information is crucial. For the sampling procedure, detailed recording of information on a data sheet or “Ivory Inventory” is essential and should be organized at the outset. An “Ivory Inventory” sample and a blank template is included in annex 6. This inventory is used to record important details about the seizure, including who recorded the data (in case any questions arise after the data are received); the total weight of the seizure; the number of tusks; defining features of the tusks as well as length and circumference of each tusk. It provides a framework to help ensure that all steps are conducted in the proper order.

A list of equipment and materials needed for sampling can be found in annex 7.

### 12.2.1 Selecting a representative group for sampling

Remember: *Every person handling the tusks or ivory pieces should wear rubber or latex gloves.*

In order to ensure that a representative sample is chosen, the following steps for selection must be followed:

1. Start the “Ivory Inventory” by recording the following information:
  - (a) Name of person recording the data, their agency and contact details;
  - (b) Name of person who carried out the seizure, their agency and contact details;
  - (c) Date, time and location of recording;
  - (d) Date, time and location of seizure;
  - (e) Title of the case;
  - (f) Additional information on circumstances of seizure.
2. Lay out all tusks and ivory pieces. If the tusks are cut into pieces, try to reassemble each tusk into its whole. (In cases where there is a very large number of ivory pieces, this step might not be feasible.)
3. In a large area, align the tusks (including reassembled tusks) from smallest to largest.
4. Record:
  - (a) Number of individual ivory pieces in the seizure (cut and whole tusks);
  - (b) Number of whole tusks;
  - (c) Number of tusks that appear to be recently poached (e.g. relatively fresh tusks with, e.g., dried blood);
  - (d) Number of cut ivory pieces in the seizure:
    - i. Number of cut pieces with a base (end connected to the skull);
    - ii. Number of cut pieces with an apex (tip of the tusk);
    - iii. Number of middle-cut pieces (no base and no apex);
  - (e) Number of worked (carved) pieces;
  - (f) Total weight of the seizure.
5. Give each tusk a number.\* Write the number directly on the tusk with a permanent marker; all pieces of a reassembled tusk should be given the same number. The marks should be consistent and easily identifiable as part of the recording of tusks.

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\*Consideration should be given as to whether a unique number has already been allocated to the individual tusks as per CITES resolution 10.10. See section 8 and annex 2 for more information.

6. Photograph each tusk or reassembled tusk after it has been numbered. (In cases where there is a very large number of ivory pieces, this step might not be feasible.)
7. Record details of every tusk on the “Ivory Inventory”. Every tusk should have its own row. Record:
  - (a) The number of the tusk (the number written on the tusk);
  - (b) Length of the tusk;
  - (c) Circumference at the base of the tusk (widest point);
  - (d) Circumference at the middle of the tusk;
  - (e) Weight of the tusk.
8. Remove every second tusk (or one of an identified pair). This is the first step taken to reduce the number of tusks to be sampled for laboratory analysis.
9. For reassembled tusks, remove all pieces except for the piece that was closest to the skull of the elephant. Any additional pieces from the assembled tusk that have an external man-made mark should also be retained until step 10 is completed.
10. Group the remaining tusks into piles based on similarities, e.g. colour or man-made marks. Give each group a number. Groups can be divided into subgroups, e.g. samples with similar handwriting can be subgrouped by colour of ivory.
11. For every group and subgroup, record:
  - (a) Group/subgroup number;
  - (b) Identifying characteristics of the group/subgroup (e.g. Group 1 = all samples were similar in colour; Group 2 = all samples had similar handwriting in red ink).
12. Write the group number directly on the tusk with a permanent marker. Each tusk should be labelled with its individual tusk number (see step 5) and group number (e.g. 20-1A, where 20 is the number of the tusk and 1A is the number of the subgroup).
13. Select one sample (tusk/piece of tusk) from each group. This should be repeated for every group/subgroup until a suitable number for laboratory analysis has been selected. This number is dependent on different factors, including the purpose of the analysis, the capacity of the laboratory, the size of the seizure and its particular characteristics.
14. On the “Ivory Inventory”, record which of the tusks have been selected for analysis.
15. Label a vial or polyethylene bag for every sample of ivory retained, i.e. (Tusk #)-(Group #), using a permanent marker.

## 12.3 Preparing samples for analysis

### 12.3.1 Cutting the sample for DNA analysis\*

When cutting a sample for DNA analysis, the most important instruction is to *cut a piece from the base of the tusk (the end that was connected to the skull), if possible*. The DNA is most concentrated at the base, where the tusk was still growing. The piece should measure approximately 3 cm x 3 cm and 1 cm thick. Cutting a piece this size will ensure that the sample contains enough DNA to conduct the analyses. However, if the base of the tusk is very thin (i.e. paper thin), it is best to start the cut a few centimetres away so that the final sample is at least 5 mm thick. If the thin part of the base of the tusk was removed (sometimes dealers cut this off), cut a piece approximately 3 cm x 3 cm, starting from the base of the tusk so that it includes the outer surface of the tusk and is at least 1 cm at the thickest part.

Follow these steps:

1. Prepare a 10 % bleach solution (e.g. 100 ml bleach to 900 ml sterile water) to wipe off and clean the saw blade after cutting each sample.
2. Using an electric grinder with masonry wheel, a circular saw or a fine-toothed saw blade (if an electric grinder and saw are unavailable), cut a piece approximately 3 cm x 3 cm and 1 cm thick from each retained piece of ivory.
3. Immediately place the cut sample in its correspondingly labelled vial and screw on its lid. If multiple pieces were taken from the same sample (e.g. in order to equal the 9 cm<sup>3</sup> volume), they should all be placed in the same vial.
4. Label the lid "(Tusk #)-(Group #)" using a permanent marker.
5. Take a clean cloth and wipe and clean the saw blade or grinder wheel with the 10 % bleach solution before cutting the next sample.

### 12.3.2 Cutting the sample for isotope analysis

Sampling ivory for isotope analysis is quite simple, since the risk of contamination is almost negligible. Different sized samples are required depending on the analysis to be performed. Samples must be cut from the base of the tusk, closest to the skull. As the base is the youngest part of the tusk, it is assumed that the isotopic signal reflects the environment where the animal lived just before its death.

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\*An "Ivory Sampling Protocol" for DNA analysis has been translated by INTERPOL into English, French and Arabic and can be provided upon request.



For origin determination:

- Using a fine-toothed saw blade or a pincer, cut ivory fragments weighing at least 30 mg (size of a fingernail) from at least two different positions at the base of the tusk.

For age determination:

- Using a fine-toothed saw blade, cut a 15 gram (4 cm x 4 cm) piece of ivory from the base of the tusk.

For age and origin determination:

- If both age and origin are to be determined, only one 15 gram ivory sample is required (e.g. minimum dimensions of 4 cm x 4 cm or 3 cm x 5 cm or 2 cm x 7 cm).
- On the sample, mark the direction of the base of the tusk (proximal side) with a permanent marker so that determination of provenance can be conducted with the most recently formed material. To avoid contamination, the marking must be very small so that the laboratory still has enough material for the analysis without using this part.
- Wipe the saw blade or pincer before samples from other tusks are taken.
- Samples should be sealed in labelled (Tusk #)-(Group #) polyethylene bags or vials until further analysis.
- For worked ivory, the use of a planer or a drill is advisable for cutting.

### *12.3.3 Cutting samples for both DNA and isotope analysis*

If both DNA and isotope analysis are to be performed for the same seizure, it is important that the analyses be performed on samples from the same tusk. This will provide a cross reference and allow results of the two independent methods to complement each other. It is advised to take both samples from the same tusk at the same time. If the base of the tusk is very thin and not suitable for DNA analysis, the piece should be cut further up the tusk where it is thicker. The thin base can still be used for isotope analysis once the minimum required weight is ensured, for example, 15 grams for age determination.

Each laboratory must receive a copy of the “Ivory Inventory”. It must be ensured that all copies are legible. If samples are being transported between laboratories, recording all details is crucial, for example, in log-book form.

### *12.3.4 Special sampling requirements*

If the samples need to be sent abroad for laboratory analysis, the requirements of different countries should be considered and clarified with the laboratory performing

the analysis. Some countries require the samples to have been submerged in a buffer solution that kills any pathogens on the surface of the tusk. For example, samples to be sent to the United States of America must be washed in a pH10 buffer solution. In this case, samples that have not undergone this step will not be permitted into the country. Where a decontaminating solution is required, the laboratory performing the analysis should provide the solution. It should be sent to the sampling team prior to beginning the decontamination process. Depending on the number of samples to wash and the facilities available when cutting the samples, it may be easier to perform this washing step the day after all samples have been taken.

The following steps are required:

1. After the tusk sample has been cut and placed in its uniquely labelled vial, pour the provided liquid over the ivory until the level of liquid in the vial reaches approximately 1 cm high.
2. Close the vial lid tightly.
3. Shake the vial for at least 10 seconds to thoroughly coat the ivory with the liquid.
4. Let the solution sit for 2 hours, then pour off the liquid. (This can be poured down the drain if followed with running water.) Do not greatly exceed the 2 hours as this could have a negative effect on the laboratory analysis.
5. Tightly close the lid on the vial containing the ivory piece.
6. Documentation attesting to this sample treatment must be transmitted to the laboratory with the samples as required (see next section).

### *12.3.5 Requirements for transport of samples to the laboratory*

Special considerations are required when ivory samples are transported from the country of seizure to the country where the laboratory analysis will be performed. It is vital that the correct procedures are followed and precautions are taken, including obtaining the correct import and export permits (see annex 8) [22]. The following measures will help ensure that valuable samples do not get damaged, delayed, lost or refused entry into the analysing country:

1. Line each box with a plastic bag.
2. Place an absorbent liner inside the bag (newspaper or other paper products can also be used).
3. Place all samples inside the bag, ensuring that all vial lids are tightly closed.
4. Place a copy of the ivory inventory inside the box with the samples.
5. Externally reinforce the box with sturdy tape on all sides; the courier may request to see the contents, so only perform this step after the courier has agreed to accept it.

6. Place the laboratory name and address on the outside of the box.
7. It is critical that all required documentation is in an envelope marked “permits” and that it is secured to the outside of the package using a protective transparent sleeve, e.g. zip-lock bag, ensuring that the writing on the envelope can clearly be seen. Documentation must include:
  - (a) The original CITES export permit issued by the CITES Management Authority (MA) of the exporting country, indicating the exact number of ivory samples and their description (e.g. 200 ivory samples, each approximately 3 cm x 3 cm x 1 cm). Be sure to count these samples as individual pieces for the CITES forms.
  - (b) The CITES import permit issued by the CITES MA of the importing country, in original or copy as required.
  - (c) Additional documentation may be required depending on the destination laboratory and country.
8. Photocopy and scan all relevant documents and e-mail to the laboratory prior to sending to ensure they are correct, and in order to have a record in case of loss of documentation during transport.
9. Inform the laboratory via e-mail of the name of the courier and the tracking number for follow-up as appropriate.
10. Clearly label both the outside and inside of boxes and containers that hold the samples. Labelling the inside will guard against problems arising if the outer label is removed/damaged.

Regulatory requirements for CITES import/export permits are provided in annex 8.

## 13. Handling and disposal of seized specimens

The handling and disposal of illegally-traded specimens often pose a number of challenges to authorities involved, especially in the case of large-scale seizures. Countries are encouraged to develop a plan of action, in accordance with domestic law and policy as well as CITES guidelines, that can be executed in the event of such seizures.

The plan of action could, for example, identify means of securely transporting and storing the seized specimens in order to ensure that they are not re-entered into illegal trade. The plan could be used to clarify the roles and jurisdiction of government agencies and personnel with authority to make decisions regarding the seized specimens. The plan might also identify means of procuring funds to cover the costs involved.

Guidance on the handling, disposal and stockpiling of illegally-traded and confiscated CITES-listed specimens, as adopted by the CITES CoP, can be found in the following CITES resolutions (see annex 2\*):

- Resolution Conf. 9.9—Confiscation of specimens exported or re-exported in violation of the Convention [23]
- Resolution Conf. 9.10 (Rev. CoP15)—Disposal of confiscated and accumulated specimens [24]
- Resolution Conf. 10.10 (Rev. CoP16)—Trade in elephant specimens [3]

Seized ivory should not be disposed of until all forensic, evidentiary and research work has been completed. For example, this includes DNA analysis, which may be conducted some months after ivory samples are taken for analysis.

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\*Annex 2 includes the relevant sections of CITES resolutions Conf. 9.9, 9.10 and 10.10.

## Part II. Laboratory analysis

Laboratory analysis may provide a powerful means of confirming the species, age and origin of ivory samples, as well as to link samples to individual elephants. The steps in laboratory analysis may be different depending on the sample type and purpose of the analysis. This section is technical and aimed at laboratory analysts with expertise in specific areas.

### 14. Considerations for laboratory analysis

Ivory sample types fall into one of two broad categories:

- Raw ivory: unprocessed whole or sectioned tusk
- Worked ivory: sections of tusk such as carved ornaments, hankos (seals), ear-rings, pendants, etc.

The type of the ivory sample needs to be considered in taking decisions on the entire process and procedures to be used for the analysis.

The scientific methodology to be performed for testing the ivory samples depends on the question being addressed and the forensic/scientific capacity available, including appropriate equipment and skills. Typically, investigative questions dealing with ivory fall into the following categories:

- Is it ivory? If so, what is the species source?
- When was the animal killed? How old is the ivory sample?
- Where was the elephant killed?
- How many elephants were killed?

It is essential that all those conducting the procedures below understand the need for good laboratory practice. All processes should be validated and standard operating procedures should be in place. The laboratory performing the analysis needs to be confident that the methods are reliable, robust and reproducible. Method verification is required when a laboratory is using published, validated methods for the first time. This ensures reproducibility of results in another laboratory.

## 14.1 Methods for the identification of species

Ivory can come from several species. There is well-established and widespread trade in tusks other than elephant, therefore it is important to determine from which animal species the ivory originates. For this purpose, a number of tests can be used. The applicability of these methods to different types of ivory sample is outlined in table 1. The methods vary from the non-destructive and skill-based, to destructive, equipment-based tests.

### 14.1.1 Morphology

Morphology using a visual inspection may be all that is needed. The whole tusk may not require any further scientific testing. If the samples are sections of tusks presumed to be ivory, then microscopy can be employed as a first test. A guide for the identification of ivory through visual, non-destructive means has been developed. It includes information on ivory identification through examination of Schreger lines, which can be used to distinguish between ivory of different species [10].

### 14.1.2 Vibrational spectroscopy: Fourier transform infrared spectroscopy and Raman spectroscopy

Certain molecules, when exposed to infrared or laser energy, display diagnostic vibrational patterns. These patterns (bands) give a general indication of the composition of the material being studied. In ivory, these techniques have been used primarily for two purposes:

- To determine if a carved object is made from ivory or plastic
- To determine if a carved object originated from mammoth or modern elephant ivory

Fourier transform infrared spectroscopy (FTIR) and Raman spectroscopy are the best tools to distinguish ivory-looking plastics from genuine hydroxyapatite-based ivory. The vibrational spectroscopy techniques are non-destructive and quick to perform. However, these analytical tools cannot determine the exact species of the many animals that produce ivory [25-32].

### 14.1.3 Mitochondrial DNA

Mitochondrial DNA is used in many areas of taxonomy and forensic science, for both human and wildlife subjects. Mitochondrial DNA typing has the potential to identify a species and requires access to specific equipment. It is a destructive method; however, only a small-sized sample is needed for this analysis.

**Table 1. Applicability of methods of species identification**

Test	Tusk	Processed tusk	Tissue
<b>Morphology</b> <ul style="list-style-type: none"> <li>• Non-destructive</li> <li>• Little equipment required</li> </ul>	Based on the whole structure  Morphology can be used depending on amount of detail available	Based on the whole structure	Not always possible
<b>Raman spectroscopy</b> <ul style="list-style-type: none"> <li>• Non-destructive</li> </ul>	Can get to family or genus level depending on the quality of sample available		Not ideal
<b>FTIR</b> <ul style="list-style-type: none"> <li>• Non-destructive</li> <li>• Requires specific instrument</li> </ul>			
<b>DNA</b> <ul style="list-style-type: none"> <li>• Destructive</li> <li>• Requires equipment</li> </ul>	Mitochondrial DNA loci such as cytochrome b (cyt b) or cytochrome oxidase 1 (COI) are species-informative and can be analysed in all sample types		

## 14.2 Methods for the determination of age

Age determination can give an indication whether seized tusks are from recent poaching incidents by providing useful intelligence surrounding how recently an animal was alive. Furthermore, determination of age provides crucial information for CITES Management Authorities to decide whether ivory can be classified as pre-convention material, and thus whether the provisions of the Convention apply to that specimen. The applicability of methods to determine the age of ivory based on type of sample is outlined in table 2.

### 14.2.1 Morphology

In some cases, the physical characteristics of the sample can be used to determine age; for example, the presence of blood, the presence of a strong carcass odour, or carving in a style that is indicative of a specific era. However, care must be applied when providing an opinion of age based on appearance, as it is possible to make recent ivory look like an old sample.

### 14.2.2 Isotopes

A more definitive scientific method to determine sample age involves isotope analyses. Isotopes are different forms of an element that have dissimilar massing because of different neutron numbers in the nucleus. Most isotopes on Earth are stable, but some are radioactive and decay over a period of time characteristic of their half-life. Ivory is secreted at the margin of the inner pulp cavity of a tusk; therefore, the youngest ivory is found along this margin, becoming progressively older as the distance outwards from the margin increases. The transverse growth rate is approximately 5 mm per year and the longitudinal growth rate is approximately 5 cm per year [33]. Ivory consists of bioapatite (dentine) and collagen, with percentages of circa 70:30. The bioapatite and collagen in ivory do not exchange elements or isotopes once formed and therefore provide a time sequence of the isotope ratios [34]. For stable isotopes, this records a history of diet (C, N, S incorporated in food) or water (H, O in food and water) using natural abundances of these isotopes.

Radioisotopes can be used to determine the age of raw or worked elephant ivory. If whole tusks are available, the year of death can often be determined. The nuclear weapons testing of the 1950s and early 1960s almost doubled the concentration of carbon 14 ( $^{14}\text{C}$ ) in the atmosphere. Since then, the concentration has gradually decreased due to natural processes, primarily absorption and recycling in the biosphere and oceans. In 2014, it reached a level of about 4 % above the natural concentration. Because of the long half-life of radiocarbon (5,730 years), the well-calibrated “bomb curve” over the past 50 years is widely used for dating samples formed since the mid-1950s. Measured  $^{14}\text{C}$  concentrations in plants and animal tissues can be assigned an age of formation to within  $\pm 0.5$  years with appropriate sampling protocols. If the samples were taken along the active growing interface, the age of death can be determined [31, 33]. Thus, the “bomb curve” is useful for accurate dating from circa 1955 to the present.

However, the “bomb curve” had a rapid rise, peaking circa 1964, followed by a gradual decline. Thus, most samples from seizures are likely to be on the declining limb of the bomb curve. However, in certain cases, two findings of age may be obtained (one from 1955 to 1965; the other from 1965 to the present). One approach to verify the results is to use a different isotope with a history unlike that of  $^{14}\text{C}$ , e.g.  $^{90}\text{Sr}$ , as recent research suggests [35]. Another method is based on the relative uptake of radium (bio-available) compared to thorium (not bio-available). It determines the absolute time since the tissue was formed and is independent of either “bomb curve” [36].

In most cases, and until the concentration of  $^{14}\text{C}$  isotopes in the atmosphere reaches background levels,  $^{14}\text{C}$  can date ivory samples to within one year or less. Using accelerator mass spectrometry for  $^{14}\text{C}$  dating, the carbon content of the sample needs to be at least 5 mg, which usually corresponds to approximately 200 mg of raw ivory. Thus, samples taken along the inner margin of ivory, along the tusk-pulp interface, can be used to determine the date of death. In certain cases where the



problem of dual solutions of the ivory  $^{14}\text{C}$  bomb curve needs to be resolved, measurement of  $^{90}\text{Sr}$  or  $^{228}\text{Th}/^{232}\text{Th}$  ratios is required; a minimum of 10 grams of ivory is needed for these analyses [33, 37].

**Table 2. Applicability of methods to determine age of ivory sample**

Test	Tusk	Processed tusk	Tissue
Morphology, if there is an indication of aging or the sample appears very new	Whole structure	Whole structure Carving methods or styles	Not possible
Radio isotopes	Gives $\pm x$ years depending on combination of radionuclides ( $^{14}\text{C}$ , $^{90}\text{Sr}$ , $^{228}\text{Th}/^{232}\text{Th}$ )		Only useful for tissue that is metabolically inert

## 14.3 Methods for the identification of geographical origin

Identifying the geographical origin of the ivory can provide intelligence to law enforcement officers and help detect poaching hotspots. The applicability of methods to determine the geographical origin of an ivory sample is outlined in table 3.

### 14.3.1 DNA analysis

There are three DNA regions that can be used for identification of geographical origin: mtDNA, Y-chromosome STRs and autosomal (nuclear) DNA microsatellites. DNA typing using microsatellites is a proven method for geographical assignment. Other genetic markers, such as the use of mitochondrial DNA, are possible, particularly if there is insufficient DNA for nuclear markers, and Y-linked microsatellites might be used. However, origin assignment using mtDNA and Y STRs are of lower power of discrimination compared to the use of autosomal nuclear microsatellite markers. They also require very comprehensive sampling because of their sex-specific transmission. Shared presence of a haplotype may not infer origin if that haplotype is present in unsampled populations from other locales. Similarly, absence of a haplotype from a location could result from incomplete sampling and thus does not necessarily imply that the sample came from elsewhere.

Microsatellites on the Y chromosome have a specific advantage, as they are only passed from the bull to male offspring. Both mitochondrial DNA typing and Y-STR markers have a significantly lower power of discrimination when compared to the markers described [38].

### 14.3.2 *Isotope analysis*

Stable isotope analysis is widely used to determine animal diets. Isotope maps of geographic distributions are used to determine geographical origins of plant, animals and processed materials [39]. Study of provenance of wildlife is based on the inheritance of natural isotope abundance ratios based on local food webs (carbon), ecology (nitrogen), geology (strontium), geography (sulphur, including marine aerosols) and elevation (oxygen and hydrogen). Taken together, a combination of isotopes can produce an intersection of space that is limited in geographic space. Bioapatite in ivory can be analysed for carbon, oxygen and strontium isotopes; collagen in ivory can be analysed for carbon, nitrogen, and sulphur isotopes; oxygen and hydrogen in collagen can be analysed if precautions are taken for exchangeable isotopes.

Van der Merwe et al. and Vogel et al. showed that stable isotopes (carbon and nitrogen) could be used to distinguish different African elephant populations [40, 41]; van der Merwe et al. and Vogel et al. showed that the heavy isotopes, such as  $^{87}\text{Sr}/^{86}\text{Sr}$ , which are related to the geological age of local bedrock, can also distinguish elephant populations [42, 43]. Work by Lee-Thorp et al., Hall-Martin et al. and Hart et al. [44-46] was built upon by Emslie et al. (2001) and Amin et al. [47-49] and found that stable isotope-ratio chemical composition of rhino horn also varied from area to area and from species to species, reflecting both geological and rainfall differences. More recently, Ehleringer et al., Valenzuela et al. and Chesson et al. have mapped isotopes in water and humans across North America and showed that coherent patterns emerge due to local geology, diet and meteorological patterns [50-52]. These are termed “isoscapescapes” [39] and are becoming widely used in various wildlife studies. Ziegler et al. have developed “isoscapescapes” of elephant ivory to assist in the determination of ivory origin [53]. Cerling et al. have applied carbon, oxygen and nitrogen isotopes to determine elephant “isoscapescapes” in Kenya [54], and Ziegler et al. have shown that the measurement of multiple isotopes in ivory greatly improves the predictive power in provenance studies [55].

Stable isotope analysis can be useful in answering specific compliance questions, such as whether a sample comes from a specific region. Depending on the nature of the sample and the reference database, stable isotope analysis may be able to identify an unknown sample with a precise geographic source. The precision of any discriminating tool depends on the number and variability of measures used as well as the comprehensiveness of the geographically specific reference sample map used to make the assignments, which can provide complementary information on the geographic origin of ivory.

**Table 3. Applicability of methods to determine geographical assignment of ivory**

Test	Tusk	Processed tusk	Tissue
Nuclear microsatellites	Possible for all sample types, provided ~ 1 ng of DNA can be isolated		
Mitochondrial DNA	Possible for all sample types, particularly if less than 500 pg of DNA is isolated		
Y microsatellites	Possible for all sample types, provided ~ 1 ng of DNA can be isolated		
Stable isotopes	Possible for tusk and bone material if at least 30 mg material is provided for multiple isotope testing		Possible if reference data-base is established

## 14.4 Methods for the determination of individual elephant numbers

Linking ivory to individual elephants allows scientists to estimate the number of elephants killed. The applicability of methods to link ivory to individual elephants is outlined in table 4.

The minimum number of elephants from which ivory may have originated can be determined simply by counting the number ( $n$ ) of tusks and dividing by two if whole (or near whole) tusks are seized. However, this method may largely underestimate the real number of elephants killed when whole tusks are not present in pairs, and it is completely inapplicable when the tusks have been worked.

There is currently one scientific method available with the potential to determine individual elephant numbers, i.e. DNA typing (table 4) [56]. The microsatellites described in Wasser et al. and others can be used to link a seized sample to a carcass or to other seized samples in much the same way as DNA profiling is used in human identification [38, 57, 58]. Similarly, nuclear DNA typing using the RhoDIS system has been successfully used in rhino forensic investigations and as part of prosecutions in court [59]. Mitochondrial DNA—inherited by all, but passed down through the maternal lineage, and Y microsatellites—passed only through the paternal lineage, have a specific but complementary role in linking a seized sample to a carcass or other seized samples and can also play a valuable role in familial matching (matching tusks to their family members).

**Table 4. Applicability of methods of individual identification from ivory samples**

Test	Tusk	Processed tusk	Tissue
Minimum number of individuals	Possible if there are whole tusks, including reassembled pieces, using $n/2$	Not possible	Not possible
Microsatellites	Allows standard DNA assignment statistics and individual identification		
Mitochondrial DNA	Works on all samples, but only identifies the maternal lineage		
Y microsatellites	Works on male samples only and only identifies the paternal lineage		

## 14.5 Procedures

### 14.5.1 DNA analysis

#### *Sample pre-treatment*

Ideally all work should be performed in suitable facilities in order to minimize the opportunity for contamination of the samples, particularly from other ivory samples, from any elephant reference material and especially from polymerase chain reaction (PCR) products [60, 61].

There is limited DNA within ivory and potentially less from processed ivory. Human DNA is likely to be on the outer surface of the ivory. This human contaminant is best removed by washing the sample's surface, followed by swabbing with 10 % bleach (or with deionized water followed by 30 U/ml Benzonase® Nuclease). Once cleaned, it is important to handle the sample with gloves to prevent additional human DNA contamination. It is also necessary to avoid contaminating the material with DNA from other elephant material by processing at different times and places, or by ensuring a physical separation.

#### *Sample preparation and extraction procedure for genomic and mitochondrial DNA*

A standard method must be followed for DNA extraction. For DNA extraction from ivory, see Mailand and Wasser [62]. In addition, it is important to avoid overheating

the ivory when it is being pulverized for DNA extraction, as this can degrade the DNA. One way to avoid this is to use a freezer mill, which uses liquid nitrogen to freeze the ivory to  $-200^{\circ}\text{C}$  in order to facilitate pulverizing while safeguarding the DNA in the process. Whether mechanical equipment or a manual approach is used, it is important to ensure that chances of contamination from one ivory extraction to another are minimized. The apparatus needs to be cleaned thoroughly between each sample. Cleaning using 10 % bleach and ultraviolet light are options.

Approximately 200 mg of powdered ivory is needed per extract to ensure sufficient DNA at the end of the process. Ivory has relatively low amounts of elephant DNA encased in high amounts of minerals such as calcium. The ivory must thus be demineralized after being pulverized into a fine powder. Incubating the pulverized ivory powder in a high amount of ethylenediaminetetraacetic acid (EDTA) is a very effective way to remove calcium from solution. Incubate the powdered ivory overnight at  $4^{\circ}\text{C}$  in a solution of 0.5 M EDTA in a sterile tube, wash and repeat for another 24 hrs. It is ideal to perform two extracts on the same sample, because DNA is not evenly distributed in the tusk. Taking two extracts helps assure that you capture a reliable amount of DNA to maximize the chances of amplifying all the allele forms present in the sample [62, 63].

DNA is purified from the extraction buffer using a range of methods, including the use of commercially available products. Multiple extracts from the same sample can be pooled to increase the amount of DNA, but care must be taken to only combine samples that have been thoroughly demineralized.

### *DNA amplification by polymerase chain reaction*

Some ivory samples can prove difficult to analyse for a variety of reasons. If both extracts completely fail to amplify DNA while other samples worked fine, it may be best to discard that sample from further analyses if many alternative samples are still available. If one of the two extracts work and the other does not, it may be worth adding a third extract from that sample. If the majority of samples fail, then it is important to review all steps to make sure they are each being properly performed.

If there is DNA present, but the sample fails to amplify, it is likely that the sample contains inhibitors that are preventing the DNA from amplifying. There are a variety of sample clean-up techniques available to remove inhibitors. Sometimes, diluting the sample helps because it reduces the number of inhibitors in the extract. In this case, the DNA is also diluted. However, as long as the DNA primers are able to find the DNA, it can be amplified. Concentrating the DNA is also an option. Sometimes, it is best to try both procedures to see which method helps most in the specific case.

Amplification of DNA by polymerase chain reaction (PCR) has the tremendous benefit of being highly sensitive, but this sensitivity can be a problem if not

performed in clean facilities in order to minimize the chance of contamination. Reference material should not be analysed in the same laboratory space as DNA from seized items. Clean gloves are needed, along with the use of negative and positive controls [60, 61]. Negative controls replace the DNA with sterile H<sub>2</sub>O. (Blanks contain DNA-free, sterile water instead of the DNA solution.) For autosomal microsatellite amplification, DNA from one of the two African elephant species acts as a positive control. For mtDNA, DNA from each species acts as a positive control. In this case, the DNA from controls should also amplify the same product, which is identical to the known genotype of the added DNA from the control animal.

Because DNA is unevenly distributed in tusks, it is recommended that the microsatellite DNA is amplified from two or more extracts per sample, with each extract amplified in two separate reactions. Each heterozygous allele should be detected at least twice in order for the result to be confirmed. A homozygous allele should be detected at least three times in order for the result to be confirmed. This will help to prevent missing one of the two alleles per locus if the DNA is degraded (i.e. if it has a very small fluorescent peak on the genetic analyser, or a light band on a gel, multiple missing loci, and an excess of homozygous loci among those that do amplify). Further information on microsatellite markers can be found in Wasser et al. [38].

There are two main mitochondrial DNA loci used in species testing: either the cytochrome b (cyt b) or cytochrome oxidase 1 (COI) loci, as both have extensive reference data for comparisons. As an example, see Lee et al. [64]. These two loci have sufficient DNA sequences within the areas examined such that all the extant species of elephant can be separated from each other and from any other mammalian species, including the extinct mammoth. The work of the Barcode of Life Consortium\* has standardized a section of the COI locus and combines species assignment by DNA typing with taxonomy and knowledge based on morphology to assist in accurate species assignment.

Primer sets for both loci are available in the published scientific literature that will amplify, for example, a 400 base pair fraction of the cyt b locus or 645 base pair fraction of the COI locus. These are standard sections of the loci with ample reference data available for comparison purposes. Full details can be found in Linacre and Lee [65].

Sequence alignment of any DNA data from ivory to reference data can be performed using free software (such as MEGA v4). Differences between the Asian, savannah, forest and mammoth elephants are all greater than 2.5 % for either locus. Dissimilarity less than 1.5 % when comparing two samples from the same species may be considered as intra-species variation [66].

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\*The Barcode of Life Consortium supports the development of DNA barcoding as a global standard for species identification. DNA barcoding is a method that uses a genetic marker in an organism's DNA to identify it as belonging to a particular species. For more information, see <http://www.barcodeoflife.org/>.

## DNA fragment analysis procedure

The capillary electrophoresis equipment should be loaded with the software GeneMapper or Genemarker. A size marker such as Rox500 should be used as an internal lane standard. The DNA profile should be from a single source and not show any indication of being a mixture from multiple individuals (e.g. detecting  $\geq 3$  alleles per locus in the same sample). The negative control should be clear of any DNA profile. The positive control should generate the correct DNA profile.

## DNA data analysis

### *mtDNA sequence data analysis*

Sequence alignment of any DNA data from ivory to reference data can be performed using free software (such as Molecular Evolutionary Genetics Analysis (MEGA), Arizona State University) [67]. Differences between the Asian, savannah, forest and mammoth elephants are all greater than 2.5 % for either locus. Dissimilarity less than 1.5 % when comparing two samples from the same species may be considered as intra-species variation.

### *Autosomal microsatellite DNA fragment analysis*

Record the size in base pairs or data points and the height of each peak. The peak height data helps confirm that the data are reliable. The size data are essential for both individual assignment and geographical testing, for example, using the Smoothed Continuous Assignment Technique (SCAT) software.\*

The SCAT is used to identify samples as forest, savannah or hybrid subspecies [38]. SCAT uses a Bayesian method implemented with Markov chain Monte Carlo spatial smoothing to simultaneously estimate allele frequencies at any location in Africa [68, 69]. Allele frequencies are assumed to depend on all reference samples with a spatial correlation that depends on distance between populations. SCAT is then used to assign population of origin to all pure (non-hybrid) samples using the estimated allele frequencies of the same subspecies, forest or savannah. Multiple samples from the same subspecies are assigned independently using a uniform prior over all parts of Africa, or as a group using a Voronoi prior that capitalizes on genetic similarities between samples [63]. Group assignment assumes the query samples were sampled uniformly from the same region consisting of one or more polygons, not necessarily adjacent, identified by a process known as Voronoi tessellation [63, 70].

Locus inclusion requires both alleles to be confirmed. Ideally, samples with less than 10 out of 16 confirmed loci should be excluded from the statistical analysis. However, the analysis can still be reliably performed with a minimum of 7 confirmed loci.

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\*Software freely available for Windows and Macintosh at <http://conservationbiology.uw.edu/research-programs/tracking-poached-ivory/scat-win/> and <http://stephenslab.uchicago.edu/software.html> respectively.

## 14.5.2 Isotope analysis

### Stable isotopes

Ivory fragments of at least 30 mg should be taken from different positions at the proximal end of the tusk by using a small hand saw, or alternatively, a pincer. Thus, as this is the youngest part of the tusk, it is assumed that the isotopic signal reflects the environment where the animal lived just before its death. Samples collected from the pulp cavity margin will give the last 6 to 12 months of geographic information. Fragments should be sealed in polyethylene bags until further analysis. Samples from processed tusks can also be taken, but then the determination of provenance where the elephant died is less certain because the time between the formation of that piece of ivory and the time the elephant died is unknown, and the animal could have dispersed far away in that interim. This concern is particularly significant for males.

After pulverization in a ball mill made of hardened steel with the grinding jar continually cooled with liquid nitrogen at  $-196^{\circ}\text{C}$ , samples should be cleaned with dichloromethane to extract weakly bonded, adsorbed water on mineral and bone surfaces as well as apolar substances, such as tissue fat, and then allowed to air dry at  $60^{\circ}\text{C}$  for 36 hours. Samples should then be stored in a desiccator to avoid humidification. Isotopic measurements of subsamples (1-4.5 mg) of different stable isotope ratios of light elements should be carried out with high-precision continuous flow isotope ratio mass spectrometers (IRMS). Pulverized ivory can be measured directly, but conventional protocols suggest the separation of ivory into collagen and mineral components. This will allow for high-precision measurements of the isotope ratios for carbon and oxygen (bioapatite), carbon and nitrogen (collagen), hydrogen and oxygen (collagen), and sulphur (collagen). Stable isotope ratios (R) will be expressed in the delta notation ( $\delta$ ) in the conventional per mil (‰) unit, where  $\delta = [(R_{\text{sample}}/R_{\text{standard}}) - 1] \times 1000$ , and is interpreted as the difference, in parts per thousand, between the sample and the international reference standard. Quality control should be ensured with control samples of known isotopic composition as described by Valengula et al [50]. In order to assess precision of the analyses, at least two replicate measurements should be performed for each sample. Isotope ratios can be used to assign ivory samples of unknown origin to areas of presumed provenance by using expert opinion or spatial reference data that will be stored in the Ivory ID database. This web-based database will initially store approximately 600 ivory reference samples of verified origin from 25 African and 6 Asian elephant range States.

### Radionuclides

Samples should be collected from the proximal end of the tusk or the pulp cavity margin to estimate the year of death. Approximately 10 grams of ivory is needed using conventional  $^{14}\text{C}$  methods; ca. 200 mg of raw ivory is needed for acceleration mass spectrometry (AMS). Applying the combined radioanalytical method to



determine the specific activity of  $^{14}\text{C}/\text{C}$  and  $^{90}\text{Sr}/\text{Ca}$  and  $^{228}\text{Th}/^{232}\text{Th}$ , a minimum of 10 grams of ivory is necessary to realize sufficiently low values of lower limits of detection. The radioanalytical method consists of ashing, radiochemical separation and preparation of suitable detection samples. The analysis methods must be executed as efficiently and undisturbed as possible, realizing very low limits of detection. It is necessary to separate and concentrate the elements of concern without significant losses first and purify them from possibly interfering radionuclides like  $^{40}\text{K}$  and  $^{137}\text{Cs}$ . Different low-level nuclear radiation detection methods are applied to determine the activities of the radionuclides of interest. These are liquid scintillation counting (LSC) to detect  $^{14}\text{C}$ , beta counting by a gas-flow counter to detect  $^{90}\text{Sr}$  and alpha spectrometry by a silicon-surface barrier junction detector to detect the radionuclides  $^{228}\text{Th}$  and  $^{232}\text{Th}$ . To fulfil the qualification, a well-appointed radioanalytical laboratory must be available in addition to well-trained staff and low-level nuclear detection devices [33, 37].

## 14.6 Proficiency testing or concordant studies

Laboratories performing forensic analysis should be part of a proficiency testing scheme. It is an integral part of the quality management system of the laboratory and a requirement for accreditation purposes. Proficiency testing helps to identify analytical problems and to support laboratories in their efforts to improve the quality of their analytical results. Samples of known or unknown origin are tested by the laboratory and results returned to an administrator to determine if the correct results were obtained. A number of proficiency tests are available.



## Part III. Interpretation of results and use of data

The quality of analyses and interpretation of results have significant implications for the justice system, law enforcement and crime prevention, as well as international cooperation and exchange of information and data [71]. Certain critical requirements must be fulfilled; otherwise the data and their interpretation are meaningless.

### 15. Interpretation and communication of scientific results

The interpretation of scientific data in connection to forensic evidence or intelligence information is the process that links laboratory analysis to the investigative question. It is crucial that scientists clearly communicate the meaning and relevance of their findings to law enforcement officers, lawyers and the judiciary.

There are several principles that should be applied to the interpretation of results for all tests, to ensure clarity and minimize the risk of miscommunication or misunderstanding. These include:

- *Avoid the “prosecutor’s fallacy”.* Scientists should restrict their interpretation of results to commenting on the likelihood of observing the evidence under different scenarios, rather than presenting the likelihood of a scenario given the evidence. Doing the latter instead of the former, often referred to as the “prosecutor’s fallacy”, can be quite subtle, but is critical to the correct application of forensic evidence. For a full discussion, see Evett and Weir [56].
- *Always attempt to evaluate the evidence with respect to alternative propositions.* This helps ensure that the scientist applies an unbiased approach to result interpretation. One proposition is usually directed towards the scenario described by the investigator and is referred to as the “prosecution hypothesis”. For example, where the investigator asks, “Is this ivory from an African elephant?”, the appropriate prosecution hypothesis would be: “The ivory originated from an African elephant.” An alternative proposition

in this case, referred to as the defence hypothesis, would be: “The ivory originated from a different species.” The role of the scientist is to evaluate the probability of observing the forensic evidence under these alternative propositions [56, 72, 73].

- *It is essential that interpretation of results follows an approach accepted by the legal system of the prosecuting country.* The commonly accepted approach is to present evidence in the form of a likelihood ratio, which allows the likelihood of observing the evidence under prosecution and defence hypotheses to be directly compared. Care is needed in interpreting likelihood ratios, but DNA evidence can produce very large ratios. In certain countries, evidence may be presented as probabilities of a match (i.e. this profile occurs 1 in x of the population), rather than using a likelihood ratio.
- *Language used to communicate results should be unambiguous, concise and must not extend beyond the scope of the scientific method employed.* Forensic evidence that is not presented correctly will normally be rejected by the court.
- *Conclusions should be clear, conservative, and carefully worded.* Following the interpretation of results, scientists are often required to state their conclusions. Conclusions must not be based on assumptions; they cannot say more than the analysis allows. Although there will be considerable variation in conclusion statements, all statements should be conservative and clearly state the final result.

For each of the laboratory methods covered by these *Guidelines*, one or two examples of clear and concise conclusions are given below, considering the intended purpose of the applied method. They have been divided into currently accepted forensic methods and methods that can provide valuable information for investigative purposes.

## 15.1 Forensic methods

### 15.1.1 Ivory identification (morphology)

The morphological features of exhibit X are characteristic of elephant ivory. Exhibits were identified via macroscopic and microscopic morphological characteristics. Species identified in the report represent the species that most closely match the observed morphological characteristics. None of the observed characteristics contradict the conclusions.

### 15.1.2 Ivory identification (DNA)

The DNA sequence obtained from exhibit X is characteristic of those found in elephants. The sequence(s) identified in this report possess a higher degree of identity with the stated species than with sequences that have been reported for any other species.

### 15.1.3 Species identification (DNA)

The DNA sequence obtained from exhibit X is characteristic of variants found in African savannah elephants (*Loxodonta africana*). The sequence(s) identified in this report possess a higher degree of identity with the identified species than with sequences that have been reported for any other species.

### 15.1.4 Age determination (combined radionuclides)

Results from the radionuclide analysis show that the elephant was living after 1952. The most probable years of death are shown (1980-1985) with a 95 % confidence level.

## 15.2 Investigative methods

### 15.2.1 Origin identification (genetic markers)

The DNA profiles for the ivory in the identified exhibits (exhibits 1-100) were x times more likely to be seen if the elephants were African savannah elephants (*Loxodonta africana*) than if they were African forest elephants (*Loxodonta africana cyclotis*). Furthermore, this group of exhibits is estimated to have originated at location Y. The 95 % confidence intervals on the latitude and longitude of this location are (lower-limit latitude, upper-limit latitude) and (lower-limit longitude, upper-limit longitude).

### 15.2.2 Origin identification (stable isotopes)

The isotopic signature found in sample X is characteristic for reference samples from region Y with a 95 % confidence interval.

### 15.2.3 Individualization (microsatellite sample matching (a) or counting (b))

(a) The DNA typing profile produced by exhibit X (tissue from illegal kill site) matches the profile obtained from exhibit Y (blood from suspect's clothing). The presented evidence is 7 billion times more likely if the blood from exhibit Y originated from the elephant in question (exhibit X) than it is if the blood had originated from a randomly selected, unrelated elephant from the African savannah (*Loxodonta africana*) population.

(b) The observed DNA profiles from the submitted evidence represent a minimum of 20 individual elephants.

### 15.2.4 Kinship determination (microsatellites)

The DNA typing profiles produced by exhibit X (tissue from adult female elephant) and exhibit Y (tissue from male juvenile elephant) are 7 million times more likely to be observed in two individuals sharing a parent-offspring relationship than in two randomly selected, unrelated individuals from the African savannah elephant (*Loxodonta africana*) population or from the same species as inferred for the exhibit.

### 15.2.5 Species identification (microsatellite allele range differences)

The DNA typing profile obtained from exhibit X is 6 million times more likely to be seen if the exhibit is from an African savannah elephant (*Loxodonta africana*) than if it is from an African forest elephant (*Loxodonta africana cyclotis*).

## 16. Considerations for law enforcement, prosecutors and the judiciary

The purpose of this section is to provide simple descriptions of the relevant techniques, concepts and considerations in order to facilitate understanding of laboratory methods and results by law enforcement, prosecutors and the judiciary. A more comprehensive explanation of methodologies and techniques is provided in preceding sections of these *Guidelines* (see part II on Laboratory analysis).

### 16.1 Overview of techniques and relevant considerations

An overview of each method of analysis is provided, together with highlighted areas for consideration, including strengths and limitations of the techniques. These considerations should be seen in relation to the interpretation of results and conclusions by scientists as referred to in section 15.

#### 16.1.1 Forensic methods

##### *Ivory identification (morphology)*

This means of identification is based on visual perception and recognition of macroscopic and microscopic features that are diagnostic of elephant ivory. Ivory

can be identified as genuine and assigned to elephant rather than mammoth on the basis of natural physical markings visible within ivory. These markings, known as Schreger lines, allow a rapid, inexpensive identification to be performed by measuring the angle of Schreger lines in a piece of suspected elephant ivory [10].

Considerations:

- Although relatively simple to perform, the technique must be carried out by someone with training and experience, following a standardized protocol.
- It may not be possible to apply the technique to worked ivory products.
- The technique cannot differentiate species of elephant (e.g. African from Asian).

### *Ivory identification (DNA)*

As with almost all biological materials, ivory contains DNA that can be recovered and analysed to aid identification. A number of DNA analysis techniques can be used to identify whether or not ivory originates from an elephant (as opposed to walrus, whale, hippopotamus, etc.). The most widely used technique is DNA nucleotide sequencing of a mitochondrial gene region. The resulting DNA sequence is matched against a reference sequence database to infer the origin of an evidence sample.

Considerations:

- As with any species identification, the sequence should be compared against that from a known voucher specimen (see also section 18 on databases).
- Due to sequence variation within species, the DNA sequence of an evidence item may differ to the reference sequence of a species, without excluding it from belonging to that species. In such situations, the relative level of difference between the evidence sequence and different candidate reference sequences must be considered.
- Certain DNA analysis methods may only differentiate elephant from non-elephant. Providing that the method is validated for use and addresses the investigative question, this is acceptable.

### *Species identification (DNA)*

This method is the same as ivory identification discussed above, except with DNA sequence matching being made to a specific elephant species; either mammoth (*Mammuthus sp.*) (extinct), Asian elephant (*Elephas maximus*), African savannah elephant (*Loxodonta africana*) or African forest elephant (*Loxodonta africana cyclotis*).

#### Considerations:

- The authenticity of reference data used for comparison needs to be established (see section 18 on databases).
- Due to sequence variation within species, the DNA sequence of an evidence item may differ to the reference sequence of a species, without excluding it from belonging to that species. In such situations, the relative level of difference between the evidence sequence and different candidate reference sequences must be considered.
- While DNA sequence data do not yet exist for every species of animal, data do exist for most mammals. Given that variation in sequence follows evolutionary history, it is extremely unlikely that a sample DNA sequence matching that of an elephant would originate from any other species.

### *Age determination (combined radionuclides)*

Radiocarbon dating may be used to determine the age of raw or worked elephant ivory. It can determine whether or not an elephant was living before or after the start of atmospheric atomic bomb testing in 1952 and is therefore used to determine whether ivory can be classified as pre-convention material or if it derives from more recent poaching incidents. Where a claim is made regarding the age of ivory, this analysis can be used to support or disprove the claim. In certain cases where the problem of dual solutions of the ivory  $^{14}\text{C}$  bomb curve needs to be resolved (see section 14.2.2), measurement of  $^{90}\text{Sr}$  or  $^{228}\text{Th}/^{232}\text{Th}$  ratios is needed.

#### Considerations:

- The differentiation of ivory obtained from elephants living before or after 1952 based on  $^{14}\text{C}$  can be fairly accurate. Determining when an elephant died between 1952 and the present is less precise and should be treated as an estimate.
- Additional radionuclides ( $^{90}\text{Sr}$ ,  $^{228}\text{Th}$  and  $^{232}\text{Th}$ ) are suitable for precise dating of ivory after 1950.

### *16.1.2 Investigative methods*

#### *Origin identification (genetic markers)*

A DNA profile consisting of measurements at multiple DNA markers can be produced from an individual ivory sample. This DNA profile may then be assigned to geographic origin by comparing it with a database of geo-referenced African elephant DNA profiles. The data analysis estimates the geographic origin of the DNA profile.



Considerations:

- The DNA profile from the sample must be typed with the same markers as the DNA profiles in the reference database.
- Analyses conducted between laboratories require that allele size calls for all loci be calibrated to assure that allele size calls between laboratories are identical.
- The assignment of a sample is based on differences among DNA profile allele frequencies at different locations; it does not take any account of political (national) boundaries.
- The assignment result is not absolute, but rather gives the best estimate with the available data.
- As elephants are known to migrate, the exact kill site may differ from the genetic origin of the individual elephant by some distance.
- Simultaneous analysis of groups of samples provides more powerful assignment than single samples.

### *Origin identification (stable isotopes)*

Stable isotope analysis is a technique that relies on intrinsic tissue signatures to provide information on diet and often provenance of feeding. This technique can be useful in answering specific compliance questions regarding whether a sample comes from a specific region. It may provide reliable evidence of a geographic area as a sample's source or exclude a geographic area as a source or origin. Isotopic profiling can be produced from an individual ivory sample. Stable isotope analysis can be applied to samples that do not contain DNA. Isotope ratios can be used to assign ivory samples of unknown origin to areas of presumed provenance by using expert opinion and/or spatial reference data\* [74].

Considerations:

- Multiple isotope testing in ivory greatly improves the predictive power of using isotopes in provenance studies.
- The African elephant range is characterized by six spatial clusters or sub-regions which show distinct isotopic signatures [75].
- The assignment of a sample is based on nearest neighbours, which means that samples with similar isotopic signatures are likely derived from the same place of origin. Based on available data African continent-wide, 50 % of samples can currently be assigned within 250 km, and 83 % within 750 km of their place of origin [76, 77].

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\*See [www.ivoryid.org](http://www.ivoryid.org).

- The assignment is not continuous and sampling efforts of reference material from certain countries is still low. Thus, certain areas are statistically inert until comprehensive sampling has been undertaken.

### *Individualization (microsatellite sample matching/counting)*

A DNA profile consisting of measurements at multiple DNA markers can be produced from an individual ivory sample. The probability that two elephants carry the same DNA profile can be calculated and should be extremely low. DNA profiles can therefore be used to match an ivory sample to a poached elephant carcass or trace blood stain. Counting different DNA profiles allows a minimum count of elephants to be made, for example, from numerous processed ivory parts.

Considerations:

- The strength of evidence associated with matching DNA profiles is associated with the ratio of the probability that the profiles came from the same elephant to the probability that they came from different elephants and match by chance. The higher the ratio, the stronger the evidence for a true match.
- Close relatives have a much higher chance of sharing DNA profiles than two unrelated elephants. This should be considered when matching individual samples.

### *Species identification (microsatellite allele range differences)*

In closely related species or subspecies, identical microsatellite marker panels can often be used to produce DNA typing profiles. The profiles produced by the different species may be different enough to use as a diagnostic tool to identify species [78].

Considerations:

- When applying microsatellite marker panels developed on one species to create DNA typing profiles on another species, the panel should always be carefully validated on multiple individuals of the second species to make sure that all markers reliably identify all alleles at the loci being examined.

### *Kinship determination (microsatellites)*

Analysis of microsatellite DNA can also be useful in evaluating specific familial relationships. Related individuals will on average be more genetically similar to each other than to randomly selected individuals from geographically relevant populations of the same species [79].

Considerations:

- Kinship analyses are generally restricted to first-order relatives (up to first cousins). Very large numbers of loci are required to make reliable determinations of relatedness of more distantly related individuals, making such assignments impractical.

## 16.2 Overview of key forensic requirements

It is essential that prosecutors and the judiciary be aware of key forensic requirements in order for data to be significant and reliable. These requirements include:

- Chain of custody (or chain of evidence)  
Maintenance and demonstration of a secure, seamless chain of custody relating to evidence is fundamental to forensic science and must be established prior to including evidence in legal proceedings.
- Casework documentation  
Forensic casework must be documented and authenticated throughout the analytical process. This documentation forms the basis of forensic reports and should be available to the court. It should include details of:
  - Investigative request
  - Chain of custody (evidence receipt and control in laboratory)
  - Analytical methods
  - Analytical results
  - Results interpretation
  - Protocols used
  - Persons involved
- Quality assurance  
Quality assurance (QA) relates to the processes in a laboratory that are put in place to ensure laboratory results are accurate and that any sources of error are identified and reviewed. QA is usually implemented through a quality management system that consists of a documented record of the laboratory systems, protocols and control processes. A quality management system may be accredited to an internationally recognized standard (e.g. ISO 9001, GMP).
- Individual test methods should be controlled by standard operating procedures, which are documents that precisely define how a test should be performed and how the results should be analysed and interpreted. This should include consideration of possible sources of error and conditions that may affect the accuracy of the results.

- All individual test methods for wildlife forensics should be validated prior to use. Validation protocols and reports should also be available for inspection. Test methods should ideally be published in peer-reviewed scientific journals before use in forensic analysis. Test methods may also be accredited to internationally recognized standards (e.g. ISO 17025, GLP)
- Interpretation  
In order to reduce the risk of bias, forensic scientists are trained to comment on the evidence, rather than to make definitive statements about the results (see section 15). Both prosecutors and the judiciary need to be aware of this issue to avoid compromising the use of forensic evidence.

### Checklist of considerations when dealing with forensic evidence

- Does a comprehensive case file exist?
- Was the employed test fit for purpose and was it approved by a competent authority?
- Was the test performed by a competent person with sufficient training and experience in that type of test?
- Can the scientist demonstrate that sufficient controls were in place to ensure the security of the sample (chain of custody)?
- Can the scientist demonstrate that sufficient controls were in place to prevent contamination from affecting the accuracy of the results?
- Has the scientist considered alternative interpretations of the data?
- Has the scientist demonstrated any bias towards the prosecution in their presentation of the results?

## Part IV. International cooperation

The transnational and organized nature of the illegal trade in ivory necessitates a common and coordinated global response. The development of these *Guidelines* aims to provide support towards achieving a standardized approach that will underline and facilitate international cooperation in response to the challenges faced. This section covers requirements/needs and challenges/barriers and provides a framework of proposed activities (see the table in section 19).

Recent increases in the frequency and size of seizures of elephant ivory have focused global attention on a serious and worsening phenomenon. The international community has recognized the severity of the problem and this is reflected in a number of recent resolutions and decisions (see annex 2). These resolutions and decisions call for action not only by those countries where seizures occur but also recommend that elephant range States actively contribute to the further development of forensic methods to supplement law enforcement investigations, e.g. by providing samples of known geographic origin. International organizations such as the CITES Secretariat, INTERPOL, UNODC, the World Bank and WCO, working together as part of the International Consortium for Combating Wildlife Crime (ICCCWC), have a critical role to play in assisting this work, which requires the contribution of a broad range of expertise and the availability of appropriate capacity. A limited number of countries currently have access to national resources that can be deployed in support of successful criminal investigations and prosecutions related to ivory seizures, in particular to identify the source or age of ivory through forensic analysis.

These *Guidelines* recommend best practices for forensic laboratory methods and procedures of ivory sampling and analysis that facilitate international cooperation. In considering these *Guidelines*, countries should reflect on the following areas:

- How would my country respond to a major seizure of elephant ivory? Do we have the forensic and scientific capabilities to follow these best practices?
- If we cannot follow these best practices, what assistance can we obtain from international partners? Where can we get information about them and how do we approach them?

- What is our long-term plan for building the necessary national capacity? What organizations or institutions could assist us in creating and implementing a long-term plan for training and capacity-building?

## 17. Setting the stage for international cooperation

In order to enable international cooperation, multiple factors should be considered. These range from countries' effective response to major ivory seizures and their need for support, to the benefits of cooperation and barriers faced.

A number of elements critical for international cooperation specifically relevant to ivory sampling and analysis are outlined below:

- Access to the seized ivory or ivory of known geographic origin
- Access to animal products of known origin that can contribute to geographically specific reference maps or voucher specimens
- Expert forensic investigation of the seizure
- Securing all evidence derived from the seizure, not restricted to the ivory itself
- Technical expertise needed to take ivory samples for subsequent lab analysis
- Laboratory capabilities for DNA, isotope and other forensic analysis of the ivory
- Funding of sampling and analysis costs
- Permission to ship samples internationally—including CITES permits and, possibly, veterinarian, quarantine or other documents
- Permission to share data among domestic and international partners for purposes of analysis and interpretation, if necessary
- Access to reference databases needed for the interpretation of raw data
- Permission to share the interpretation of analytical results
- Assistance in international investigations
- Keeping the chain of evidence when transferring samples
- Secure systems of communication

Officials in a country involved in large-scale ivory seizures might encounter a number of challenges, particularly related to the size of the seizure, which could include:

- Securing the seized ivory to preserve evidence
- Adequate, secure storage facilities for the seized exhibits
- Extracting, documenting and processing forensic evidence
- Collecting ivory samples for forensic analysis
- Processing samples or shipping them to processing labs
- Adequate financial budgets to cover the costs of handling, shipment and laboratory analysis
- Subsequent investigations and prosecutions
- Considering the provisions for import and export of the samples, e.g. CITES permits
- Deciding about further actions, such as controlled deliveries or dispatch of targeted law enforcement to identified poaching hotspots

Challenges may also arise in connection with forensic method development and related research projects:

- Collecting ivory samples for forensic analysis, including documentation
- Processing samples or shipping them to processing laboratories in other countries
- Covering the costs of handling, shipment and laboratory analysis
- Considering the provisions for import and export of the samples, e.g. CITES permits

Motivations for countries to cooperate bilaterally at the regional or international levels include:

- Capacity-building and training from partnerships with advanced research institutions and crime investigation experts
- Possible financial support for sampling and/or laboratory equipment (instruments and manpower)
- Possible partnerships in research activities
- Mutual support for law enforcement operations to disrupt crime networks in the country (or countries)
- Assistance to address the challenging seizure event
- Support to elephant range States in protection of the species through joint conservation activities with relevant organizations and networks, e.g. through implementation of CITES CoP16 res. 10.10 (Rev. CoP16) (see annex 2)

While countries can benefit from international cooperation, there are potential barriers that can hinder the process, such as:

- National sensitivities or restrictions to accepting international assistance in general or from specific countries
- Reluctance to release laboratory results that might be perceived as having other intellectual property value
- Considerations on export or import of ivory as either scientific research objects or law enforcement exhibits
- Restrictions against releasing material from a crime scene to an institution in another country for forensic analysis
- Stricter domestic measures on national implementation of CITES adopted in some countries
- Delayed access to seized ivory for forensic analysis
- Sensitivities about loss of control over use of expatriated ivory samples
- Concern about destructive sampling of ivory
- Restrictions on international information-sharing about crime suspects
- Barriers to the international transfer of physical evidence
- Lack of relevant information related to a specific ivory seizure that can be shared for research activities

## 18. Databases

A database is a collection of structured data aiming to simplify the storage of and access to data. It is an indispensable tool for international cooperation. The availability of databases is essential in order to be able to use laboratory results from analysis in a meaningful way. They allow for interpretation of intelligence information, enabling links to a case or to an elephant population.

Examples of types of databases relevant to ivory are provided below:

- Species database

A database of species-specific reference DNA sequences that can be reliably used to distinguish all individuals of a species from any other species in the database. This should include actual voucher specimens that, when sequenced, match the sequence for that species in the database.



- **Individual database**  
A database of geo-referenced DNA profiles for all individuals that collectively includes enough loci of sufficient variability to reliably distinguish all individuals in the database.
- **Population database**  
A database of geo-referenced DNA profiles of multiple individuals from each location sampled across the species range that can be used to calculate location-specific allele frequencies used to assign unknown samples to those locations based on their genotypes.
- **Searchable profile data**  
A database of forensic case-related samples (e.g. DNA, fingerprints) of known individuals that can be searched for unique matches of unknown individuals (or close relatives in the case of familial matching) identified at a crime scene.
- **Stable isotope database**  
A database of geo-referenced isotope profiles of multiple individuals from each location sampled across the species range that can be used to assign unknown samples to those locations based on their isotope ratios.

The main requirements that apply to databases generally include:

- **Database input/quality control**  
The reliability of any database relies on strict controls over the type and quality of reference data being submitted. All data entries should be controlled by a protocol that describes how each piece of data is generated, controlled for quality and input to the database (see section 16.2, under Quality assurance).
- **Database curation/management/maintenance**  
Databases require ongoing administration and management. Any ivory database being routinely used to support forensic investigations should be managed by an officially identified party, following transparent database curation processes.
- **Ownership of data/intellectual property**  
Data ownership and custodianship need to be agreed on and documented by all parties prior to inclusion in a database. This includes agreements regarding use of all or parts of the data, or where certain aspects of the data must remain confidential.  
  
The use of data for forensic versus research purposes should be clearly delineated. Databases for forensic analysis must be strictly managed for that purpose. Any subsequent research applications should be managed separately, in line with data use agreements.

- Access, security, sharing

Databases must be secured against accidental or deliberate loss of data, copying, or uncontrolled data input and retrieval. Effective protocols must be in place describing access rights so that it is possible to determine which individuals are responsible for changes to the database and which individuals are able to access its content. Similarly, protocols should be in place to enable the database to be shared or accessed by third parties.

## 19. Planning framework

The following planning framework suggests both proactive initiatives and reactive responses that domestic agencies and the international community can have to ivory seizures. Recommended actions are individually listed for seizing country, forensic science and research institutions and international organizations, as relevant. They are divided into non-proprietary (table 5) and proprietary actions (table 6). Information generated by non-proprietary actions could be made available to the general public and widely disseminated following open access principles. Information generated by proprietary actions relates to specific seizures and is linked to a crime that is under investigation. This information must be treated as sensitive and proprietary.

Table 5. Non-proprietary actions: information widely disseminated

Recommended initiatives or responses	Actions to be taken by:			
	Seizing country	Forensic science institutions	Research institutions	International organizations (e.g. CITES, INTERPOL, UNODC, WCO)
<p><b>Development of an internet platform</b></p> <p>This could take the form of a database, providing relational access to relevant information.</p> <p>It would complement information currently available on ICCWC and other relevant initiatives, and could link with capacity-building materials.</p>	<ul style="list-style-type: none"> <li>• Provide information on:               <ul style="list-style-type: none"> <li>– What data are available</li> <li>– What data are allowed to be shared without personal data (national law)</li> <li>– Ownership of data</li> <li>– Informant management</li> <li>– Data collation</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Provide manuals/ guidelines with examples of best practices</li> </ul>	<ul style="list-style-type: none"> <li>• Provide description of the analytical method developed/used, including information on conditions necessary for this method to be used worldwide</li> <li>• Make reference to ISO standards, quality management, e.g. peer-reviewed publications or an index of available publications with web links (e.g. DNA, isotopes, radionuclides)</li> </ul>	<ul style="list-style-type: none"> <li>• Develop an internet platform to consolidate information provided, including information on:               <ul style="list-style-type: none"> <li>– Ivory and elephants</li> <li>– Databases with open access status, e.g. “ivoryid” database</li> <li>– Scientific literature and bibliographies, e.g. description of methods, laboratory requirements, possible costs of the analysis</li> </ul> </li> <li>• Identify an appropriate host for this internet platform</li> <li>• Link with currently available relevant initiatives, e.g. capacity-building materials in CITES Virtual College</li> </ul>

Table 5. Non-proprietary actions: information widely disseminated (continued)

Recommended initiatives or responses	Actions to be taken by:			
	Seizing country	Forensic science institutions	Research institutions	International organizations (e.g. CITES, INTERPOL, UNODC, WCO)
<b>Enabling/facilitating ivory sampling of large-scale seizures</b>	<ul style="list-style-type: none"> <li>• Consult sampling procedure as outlined in section 12 of the <i>Guidelines</i></li> <li>• Assess national capacity to perform these functions</li> <li>• Request external assistance as required, especially for large seizures, e.g. a WIST (see information in part I, section 3, on international expert assistance)</li> <li>• Use standardized data forms to be placed with sealed samples in tamper-proof evidence bags</li> <li>• Use standardized sample collection kits</li> </ul>	<ul style="list-style-type: none"> <li>• Respond to requests for technical assistance from seizing country</li> <li>• Provide advice to seizing country on the types of potentially useful forensic analyses available</li> <li>• Assist in providing access to ivory samples for forensic analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Respond to requests for advice and assistance regarding sampling of seizures</li> </ul>	<ul style="list-style-type: none"> <li>• Provide advice and information to seizing countries on qualified forensic science and research institutions</li> <li>• Assist with financial support for ivory sampling</li> <li>• Develop standard data forms</li> <li>• Develop sample collection kits (e.g. similar to what has been developed for rhino horn)</li> <li>• Consider development of a smart phone app for recording sample data (e.g. similar to what has been developed for rhino horn)</li> </ul>

<b>Performing laboratory analysis</b>	<ul style="list-style-type: none"> <li>• Assess knowledge and capacity required for laboratory analysis in the seizing country</li> <li>• Send samples to a suitable laboratory if capacity for these services is not available</li> <li>• Consider requirements for transfer of samples, e.g. CITES permits, requirements for material transfer agreement (MTA)</li> </ul>	<ul style="list-style-type: none"> <li>• Respond to requests for technical assistance from seizing country</li> <li>• Assess capacity for laboratory analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Respond to requests for technical assistance from seizing country</li> </ul>	<ul style="list-style-type: none"> <li>• Provide advice and information to seizing countries on: <ul style="list-style-type: none"> <li>– Laboratories qualified to perform analysis</li> <li>– Import/export requirements for transport of samples</li> <li>– CITES Management Authorities</li> </ul> </li> <li>• Facilitate financial support for analyses</li> </ul>
<b>Collection of information on available resources and capacity development</b>	<ul style="list-style-type: none"> <li>• Develop a plan of action for seizure response</li> <li>• Develop a long-term plan for training and capacity-building, including through the CITES Virtual College</li> </ul>	<ul style="list-style-type: none"> <li>• Register as a qualified forensic science institution for crime scene investigation and/or laboratory analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Register as a research-capable institution with specific analytical capabilities and access to relevant databases</li> </ul>	<ul style="list-style-type: none"> <li>• Create a clearinghouse of information, including associated training and technical resources, registries of qualified forensic science and research institutions</li> </ul>
<b>Awareness-raising on status of results and achievements</b>	<ul style="list-style-type: none"> <li>• Share results with international community (i.e. seizures/laboratory analyses, investigations)</li> </ul>	<ul style="list-style-type: none"> <li>• Share results with international community (i.e. seizures/laboratory analyses, investigations)</li> </ul>	<ul style="list-style-type: none"> <li>• Share results with international community (i.e. seizures/laboratory analyses, investigations)</li> </ul>	<ul style="list-style-type: none"> <li>• Encourage countries to share with CITES Secretariat results arising from forensic analysis of ivory samples, for use by the MIKE and ETIS programmes and for reporting to the CITES Standing Committee</li> </ul>

Table 6. Proprietary actions: sensitive information, not widely disseminated

Recommended initiatives or responses	Actions to be taken by:			
	Seizing country	Forensic science institutions	Research institutions	International organizations (e.g. CITES, INTERPOL, UNODC, WCO)
<b>Pre-seizure preparations</b>	<ul style="list-style-type: none"> <li>• Prepare plan of action, including consideration of:               <ul style="list-style-type: none"> <li>– Domestic participants</li> <li>– Staging area/ temporary location where ivory seizure and related items can be kept</li> <li>– Security to be provided</li> <li>– What can be done with local resources</li> <li>– What external resources will be needed</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Register in clearing-house, including information on:               <ul style="list-style-type: none"> <li>– Organization's capabilities</li> <li>– Access to relevant databases</li> <li>– Willingness to assist, including in crime scene investigations</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Register in clearing-house, including information on:               <ul style="list-style-type: none"> <li>– Institutions capabilities</li> <li>– Access to specialized research databases</li> <li>– Willingness to assist</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Create clearinghouse:               <ul style="list-style-type: none"> <li>– Promote registration by qualified forensic science and research institutions</li> <li>– Promote access by CITES member States. (see section A above). CITES Secretariat could provide such a platform and associated training materials (subject to funding, etc.)</li> </ul> </li> </ul>
<b>Reactive response to seizure</b>	<ul style="list-style-type: none"> <li>• Share information:               <ul style="list-style-type: none"> <li>– Notify relevant domestic agencies.</li> <li>– Notify international body, e.g. CITES, INTERPOL</li> </ul> </li> </ul>			

**Initial response to crime scene investigations**

- Use pre-seizure plan to prepare site, security, request international assistance (e.g. WIST)
- Consider relevance of forensic analysis; if necessary, request international assistance, e.g. in identifying a laboratory or requesting funding
- Consult *Guidelines* for information on crime scene management procedures and selection of sampling strategy, considering:
  - Can these functions be performed by seizing country or is external assistance required?
  - Are crime scene investigation kits available and can they be replenished?
- Respond to requests for assistance in processing crime scene and for information on best practices
- Deploy INTERPOL Investigative Support Teams (ISTs), as required
- Deploy ICCWC Wildlife Incident Support Teams (WISTs), as required

Table 6. Proprietary actions: sensitive information, not widely disseminated (continued)

Recommended initiatives or responses	Actions to be taken by:			
	Seizing country	Forensic science institutions	Research institutions	International organizations (e.g. CITES, INTERPOL, UNODC, WCO)
<b>Management and sharing of laboratory results</b>	<ul style="list-style-type: none"> <li>Grant permission to share forensic analysis results with CITES, INTERPOL, UNODC, WCO and involved countries (especially countries of origin and transit)</li> <li>Share forensic analysis results with national law enforcement authorities</li> <li>Use forensic analysis results as a basis for discussions with country of origin and to consider design of cross-border operations</li> </ul>	<ul style="list-style-type: none"> <li>Release laboratory data and interpretation of results to seizing country, and CITES, INTERPOL, UNODC, WCO, as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>Release laboratory data and interpretation of results to seizing country, and CITES, INTERPOL, UNODC, WCO, as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>Promote transfer of data to and from forensic science and research institutions</li> <li>Report on seizures at CITES Standing Committee meetings and at each CoP</li> </ul>
<b>Interpretation of results</b>	<ul style="list-style-type: none"> <li>Release results to crime investigators</li> </ul>	<ul style="list-style-type: none"> <li>Release laboratory data and interpretation of results to seizing country, and CITES, INTERPOL, UNODC, WCO, as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>Release laboratory data and interpretation of results to seizing country, and CITES, INTERPOL, UNODC, WCO, as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>Promote transfer of data to and from forensic science and research institutions</li> </ul>



## Investigation

- Use forensic analysis results to support ongoing investigations by national authorities
- Take advantage of opportunities for mutual legal assistance (MLA), and provide:
  - Accurate/itemized assessment of seized material
  - Collation of related transport material, e.g. bill of lading, invoicing, shipping instructions
  - Summation of investigation file, e.g. names, addresses, telephone numbers, associates
  - Formal requests for assistance
- Participate in MLA efforts
- Participate in MLA efforts, as required, following analysis of seized ivory
- Report on seizures at CITES Standing Committee meetings and at each CoP
- Support cross-border investigations
- Maintain databases on seizures, trafficking *modi operandi*
- Identify national focal points
- Make available INTERPOL-IST
- Provide assistance in contacting appropriate counterparts in foreign jurisdiction to facilitate the investigation

Table 6. Proprietary actions: sensitive information, not widely disseminated (continued)

Recommended initiatives or responses	Actions to be taken by:			
	Seizing country	Forensic science institutions	Research institutions	International organizations (e.g. CITES, INTERPOL, UNODC, WCO)
<b>Prosecution</b>	<ul style="list-style-type: none"> <li>Take advantage of opportunities for MLA</li> </ul>	<ul style="list-style-type: none"> <li>Participate in MLA efforts</li> </ul>	<ul style="list-style-type: none"> <li>Participate in MLA efforts, as required, following analysis of seized ivory</li> </ul>	<ul style="list-style-type: none"> <li>Coordinate and facilitate MLA in cross-border transfer of evidence</li> </ul>
<b>Law enforcement</b>	<ul style="list-style-type: none"> <li>Share information with source country for appropriate law enforcement action, e.g. targeting identified hotspots</li> </ul>	<ul style="list-style-type: none"> <li>Identify hotspots to prevent future poaching</li> </ul>		<ul style="list-style-type: none"> <li>Cooperate in joint operations assisting source countries to target major hotspots and support investigations</li> </ul>

## 20. Future considerations

The high level of illegal killing of elephants continues to give cause for serious concern. The poaching numbers in Africa are still at levels where more elephants are killed than born, resulting in an ongoing decline in African elephant populations. The illegal wildlife trade is now the world's fourth largest category of transnational organized crime, with the illegal ivory trade a being a major contributor. The demographic, ecological, economic and national security impacts of the illegal ivory trade require an urgent, concerted effort to respond to these serious challenges. Curbing demand is essential, and continued, enhanced law enforcement efforts are needed to stop current losses and ensure that all efforts are made to prevent such crimes. This can only be achieved through the collective efforts of source, transit and end-user countries and mutual assistance and collaboration among all stakeholders at national, regional and international levels.

Sophisticated tools are available that can contribute to achieving these objectives. However, if these tools are not used or if they are used improperly, their potential is not attained and their effectiveness jeopardized. These *Guidelines* provide a way forward by highlighting a range of tools and how best to use them. They offer a basis for a comprehensive approach in the use of forensics to identify and analyse ivory as an important component in the wide-ranging action to prevent, counter, effectively investigate and prosecute these crimes.



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## Annex 1. Glossary<sup>1</sup>

<sup>137</sup>Cs: Radioactive isotope of caesium, produced by nuclear weapons testing and in the nuclear fuel cycle (half-life of 30 years).

<sup>13</sup>C/<sup>12</sup>C: Ratio of the naturally occurring stable isotopes of carbon. Important dietary indicator relating to fraction of grass versus browse in the diet.

<sup>14</sup>C: Radioactive isotope of carbon (half-life of 5730 years). Frequently used to determine age of an object.

<sup>15</sup>N/<sup>14</sup>N: Ratio of the naturally occurring stable isotopes of nitrogen. Important dietary indicator that is related to the ecology, especially aridity in the local ecosystem.

<sup>228</sup>Th/<sup>232</sup>Th: Ratio of the radioactive isotopes of thorium and used to determine the age of a sample.

<sup>40</sup>K: Naturally occurring radioactive isotope of potassium (half-life of 1.3 billion years).

<sup>87</sup>Sr/<sup>86</sup>Sr: Ratio of the naturally occurring stable isotopes of strontium; relates primarily to the isotope ratio of local geology.

<sup>90</sup>Sr: Radioactive isotope of strontium produced by in the nuclear fuel cycle and in nuclear weapons testing (half-life of 29 years).

*Accelerator mass spectrometry (AMS)*: Technique for measuring the concentrations of isotopes of very low abundance (e.g. <sup>14</sup>C).

*Allele*: Name for alternative forms of the same gene or locus (same position on homologous chromosomes).

*Autosomal nuclear microsatellite markers*: Sequences defining the beginning and end of repeating sequences of 2-5 base pairs of nuclear DNA, also known as single tandem repeats.

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<sup>1</sup>Glossary produced in the context of the *Guidelines* and reviewed by Cerling, Espinoza and Wasser.

*Autosome*: Any chromosome other than sex chromosomes.

*Ballistics*: Science of the mechanics of projectiles.

*Barcode of Life Consortium*: An international consortium dedicated to developing DNA barcoding for species identification.

*Bioapatite (dentine)*: Mineralized tissue of animals that forms the main component of carved ivory objects.

*Bomb curve*: Refers to the anthropogenic (man-induced) history of the  $^{14}\text{C}$  concentration of the atmosphere due to nuclear weapons testing, principally in the 1950s and 1960s when concentrations peaked, and the subsequent decline to the present concentration. Also known as the “bomb spike”. Frequently used to determine age of an object.

*Calcium (Ca)*: An element that is essential to living organisms.

*Carbon 14 ( $^{14}\text{C}$ )*: See  $^{14}\text{C}$ .

*Collagen*: Any of a group of proteins that are components of whitish, rather inelastic fibres of great tensile strength, present in ivory and bone.

*CSI kits*: Crime scene investigation kits containing supplies and equipment for forensic crime scene investigation.

*Cytochrome b (cyt b)*: Main subunit of transmembrane cytochrome b1 and b6 of mitochondrial DNA. Frequently used for species or specimen identification.

*Cytochrome oxidase 1 (CO1)*: One of three mitochondrial DNA encoded subunits (MT-CO1, MT-CO2, MT-CO3) of respiratory complex IV. Frequently used for species or specimen identification.

*Deionized water*: Purified water with the dissolved minerals removed.

*Deoxyribonucleic acid (DNA)*: Molecule that encodes the genetic instructions for the development and functioning of living organisms.

*Dichloromethane*: Colourless, practically non-flammable liquid, extensively used as a solvent, favoured for its low toxicity and high stability.

*Discriminant function analysis*: Advanced form of statistical analysis, used to predict a dependent variable by one or more independent variables. Frequently used to make conclusions that are not apparent otherwise.

*Ethylenediaminetetraacetic acid (EDTA)*: A chemical used as a preservative as well as to remove minerals from bone and ivory.

*Fourier transform infrared spectroscopy (FTIR):* Variant of vibrational spectroscopy characterized by reduced measurement times and improved sensitivity.

*Half-life:* Time it takes for half a given amount of radioactive matter to decay. This information is used in traditional radiocarbon dating.

*Haplotype:* Group of tightly linked genes that offspring inherit from their parent.

*Heterozygous allele:* When the two homologous chromosomes each have different forms of the same gene at a given location.

*Homozygous allele:* When the two homologous chromosomes each have the same gene at a given location.

*Hydrogen (H):* Hydrogen isotope ratios are related to the isotope ratio of local meteoric waters, which has systematic variations across each of the continents.

*Incident Response Teams (IRTs):* Deployed by INTERPOL at the request of a member country during a crisis situation. An IRT is typically composed of expert police and support staff, and is tailored to the specific nature of the crime or disaster and the type of assistance INTERPOL is requested to provide.

*Inductively coupled plasma mass spectrometry (ICP-MS):* Analytical technique for measuring the concentration of elements. Multi-collector (MC) ICP-MS can be used to measure isotope ratios with high precision.

*Inhibitor:* Chemical that prevents the amplification of DNA.

*Introduction from the sea:* Transportation into a State of specimens of any species which were taken in the marine environment not under the jurisdiction of any State.

*Isotope:* Atoms of the same element, i.e. with the same number of protons, but with different numbers of neutrons. Frequently used to determine geographic provenance.

*Isotopic profiling:* Identifying the isotopic signature of stable isotopes within chemical compounds, to determine the origin of otherwise similar materials.

*Laser energy:* Concentrated beam of energy. “Laser” stands for light amplification by stimulated emission of radiation.

*Liquid nitrogen:* Nitrogen in a liquid state at very low temperature (–196°C).

*Management authority:* National management authority designated in accordance with article IX, CITES.

*Mass spectrometry (MS):* Technique for measuring the concentrations of isotopes by magnetic separation of the masses.

*Microscopy*: Viewing objects with a microscope.

*Mitochondrial DNA (mtDNA)*: DNA from mitochondria found in the cytoplasm of the cell. Frequently used for species or specimen identification.

*Morphology*: Study of the physical features of organisms.

*mtDNA*: See mitochondrial DNA.

*Mutual legal assistance (MLA)*: Two or more countries gather and exchange information in an effort to enforce criminal law across borders.

*National Environmental Security Taskforce (NEST)*: Task force bringing together appropriate representation from agencies identified as necessary to address environmental crime. The NEST can ensure national-level communication, coordination and cooperation between agencies and, through the INTERPOL National Central Bureau (NCB), act alongside other NESTs at the regional and international levels.

*Nitrogen (N)*: Chemical element that has significant variation in the environment, often with ecological implications.

*Nuclear DNA typing*: Identifying the length or sequences of nuclear DNA across loci.

*Nucleotide*: Building-block of DNA and RNA.

*Nucleus*: Positively charged central portion of an atom, which makes up most of the atom's mass consisting of protons and neutrons.

*Optical emission spectroscopy (OES)*: Method used to determine the concentration of different elements within a sample.

*Oxygen (O)*: Oxygen isotope ratios are related to the isotope ratio of local meteoric waters, which has systematic variations across each of the continents.

*Party*: State for which the present convention has entered into force.

*Pathology*: Study of the characteristics, causes and effects of disease.

*Personal protective equipment (PPE)*: Equipment worn to protect the body from harmful exposures.

*pH*: Measure of the acidity or basicity of an aqueous solution; pH 10 is basic and pH 4 is acidic.

*Polymerase chain reaction (PCR)*: Biochemical process of amplifying a piece of DNA, typically resulting in many tens of thousands of copies of the DNA fragment being amplified.

*Radiocarbon dating*: Determining the age of an object using  $^{14}\text{C}$ .

*Radioisotopes*: Radioactive isotope, i.e. an unstable isotope which decays to one or more daughter nuclei (e.g.  $^{14}\text{C}$ ). Frequently used to determine geographic provenance and age of a sample.

*Radionuclides*: See radioisotope.

*Radium (bioavailable)*: Naturally occurring radioactive chemical element in the uranium-series decay chain.

*Raman spectroscopy*: Further variant of vibrational spectroscopy, complementary to other techniques.

*Re-export*: Export of any specimen that has previously been imported.

*Rox500 (size marker)*: Internal lane size standard used to determine the length of DNA being examined on a genetic analyser.

*Sample*: Analytically (equivalent to specimen), it is a representative portion of the whole material to be tested. Statistically, it is a set of data obtained from a population.

*Schreger lines*: Unique markings on the cross-sections of ivory, also known as cross-hatchings, engine turnings or stacked chevrons.

*Scientific authority*: National scientific authority designated in accordance with article IX, CITES.

*Species*: Basic unit of biological classification; under CITES, this includes any species, subspecies or geographically separate population thereof.

*Specimen*: Analytically, equivalent to sample. In the context of this Glossary, any biological material for examination, study or analysis. Under CITES, any animal or plant, whether alive or dead. In the case of an animal: for species included in appendices I and II, any readily recognizable part or derivative thereof; and for species included in appendix III, any readily recognizable part or derivative thereof specified in appendix III in relation to the species. In the case of a plant: for species included in appendix I, any readily recognizable part or derivative thereof; and for species included in appendices II and III, any readily recognizable part or derivative thereof specified in appendices II and III in relation to the species.

*Strontium (Sr)*: Chemical element present in rocks, soils and waters. Variation in concentration and isotope ratios relates to geology of the bedrock.

*Sulphur (S)*: Sulphur concentration and isotope ratios are related to distance from the ocean (marine aerosols) and the local geology of the bedrock.

*Thorium (not bioavailable)*: Naturally occurring radioactive chemical element.

*Toxicology*: Study of toxins and their effects on organisms.

*Trade*: Export, re-export, import and introduction from the sea.

*Ultraviolet light*: Form of electromagnetic radiation that can damage DNA and is often used to prevent DNA contamination.

*Vibrational spectroscopy*: Chemical tool to compare and identify samples of interest such as ivory tusks based on absorption of different wavelengths of light.

*Wildlife Incident Support Teams (WISTs)*: Consist of enforcement staff or relevant experts. WISTs are dispatched at the request of a country that has been affected by significant poaching of CITES specimens or that has made a large-scale seizure of such specimens. The WIST will assist, guide and facilitate appropriate follow-up actions in the immediate aftermath of such an incident.

*Y-chromosome STRs*: Single tandem repeats (microsatellite DNA) on the Y-chromosome.

*Y-linked microsatellites*: See Y-chromosome STRs.

$\delta$ : Delta, notation for the abundance of an isotope relative to an international standard. The standard varies from element to element.



## Annex 2. Relevant mandates, decisions and resolutions

### Decisions of the sixteenth meeting of the Conference of the Parties to CITES

At its sixteenth meeting (Bangkok, 2013), the CITES Conference of the Parties adopted a number of strategic and operational decisions on enforcement matters (see Decision 16.40) that provide a strong basis for Parties to take concrete action to put an end to high levels of illegal wildlife trade and encourage the increased use of forensic technology to fight wildlife crime (see Decision 16.83).

The CoP16 decisions relevant to this manual are highlighted below.

#### *Enforcement matters*

##### **Decision 16.40**

Subject to available resources, the Secretariat shall:

- a) in cooperation with partners in the International Consortium on Combating Wildlife Crime, establish Wildlife Incident Support Teams (WISTs) consisting of enforcement staff or relevant experts. WISTs shall be dispatched at the request of a country that has been affected by significant poaching of CITES specimens, or that has made a large-scale seizure of such specimens, to assist it, and guide and facilitate appropriate follow-up actions in the immediate aftermath of such an incident. The Secretariat shall report on progress in this regard at the 65th or 66th meeting of the Standing Committee, as appropriate;

...

## *Monitoring of illegal trade in ivory and other elephant specimens*

### **Decision 16.78**

The Secretariat shall, subject to external funding:

. . .

- b) examine and advise about existing DNA-based and forensic identification techniques for sourcing and ageing ivory, identify relevant forensic facilities and research institutions, and consider the need for further research in these areas;

. . .

### **Decision 16.81**

The Secretary-General of CITES, subject to any guidance from the Standing Committee, shall cooperate with the United Nations Office on Drugs and Crime regarding:

- a) the levels of illegal killing of elephants in Africa and the related illegal trade in elephant ivory; and
- b) the national security implications for certain countries in Africa of this illegal killing and trade.

### **Decision 16.83**

Parties involved in large scale ivory seizures (i.e. 500 kg or more) should collect samples from the ivory seized within 90 days of the seizure and, if possible, from all large seizures from the past 24 months. They should submit the samples for analysis to begin immediately to appropriate forensic-analysis facilities capable of reliably determining the origin of the ivory samples, with the aim of addressing the entire crime chain.

## **Resolution Conf. 9.9—Confiscation of specimens exported or re-exported in violation of the Convention**

RECOMMENDS that:

- a) when specimens are exported or re-exported in violation of the Convention, importing Parties:
  - i) consider that the seizure and confiscation of such specimens are generally preferable to the definitive refusal of the import of the specimens; and
  - ii) notify as soon as possible the Management Authority of the State from which the specimens were consigned of the violation and of any enforcement actions taken concerning the specimens; and
- b) when the import of specimens that have been exported or re-exported in violation of the Convention is refused by the country to which the specimens are consigned, the exporting or re-exporting Party take the measures necessary to ensure that such specimens are not re-entered into illegal trade, including monitoring their return to the country and providing for their confiscation.

## **Resolution Conf. 9.10 (Rev. CoP15)—Disposal of confiscated and accumulated specimens**

### *Regarding the disposal of confiscated and accumulated dead specimens*

- e) Parties dispose of confiscated and accumulated dead specimens of Appendix-I species, including parts and derivatives, only for *bona fide* scientific, educational, enforcement or identification purposes, and save in storage or destroy specimens whose disposal for these purposes is not practicable;
- f) as a general rule, confiscated dead specimens, including parts and derivatives, of Appendix II and Appendix III species be disposed of in the best manner possible to achieve the purposes of the Convention, and steps be taken to ensure that the person responsible for the offence does not receive financial or other gain from the disposal;

## **Resolution Conf. 10.10 (Rev. CoP16)**

### *Regarding marking*

RECOMMENDS that whole tusks of any size, and cut pieces of ivory that are both 20 cm or more in length and one kilogram or more in weight, be marked by means

of punch-dies, indelible ink, or other form of permanent marking, using the following formula: country-of-origin two-letter ISO code, the last two digits of the year / the serial number for the year / and the weight in kilograms (e.g. KE 00/127/14). It is recognized that different Parties have different systems for marking and may apply different practices for specifying the serial number and the year (which may be the year of registration or recovery, for example), but that all systems must result in a unique number for each piece of marked ivory. This number should be placed at the 'lip mark', in the case of whole tusks, and highlighted with a flash of colour;

### *Regarding trade in elephant specimens*

URGES those Parties in whose jurisdiction there is an ivory carving industry, a legal domestic trade in ivory, an unregulated market for or illegal trade in ivory, or where ivory stockpiles exist, and Parties that may be designated as ivory importing countries, to ensure that they have put in place comprehensive internal legislative, regulatory, enforcement and other measures to:

(e) maintain an inventory of government-held stockpiles of ivory and, where possible, of significant privately held stockpiles of ivory within their territory, and inform the Secretariat of the level of this stock each year before 28 February, indicating: the number of pieces and their weight per type of ivory (raw or worked); for relevant pieces, and if marked, their markings in accordance with the provisions of this Resolution; the source of the ivory; and the reasons for any significant changes in the stockpile compared to the preceding year;

### *Regarding the traceability of elephant specimens in trade*

RECOMMENDS that Parties cooperate in the development of techniques to enhance the traceability of elephant specimens in trade, for instance by supporting research to determine the age and origin of ivory and other elephant specimens, by supplying samples for forensic research, and collaborating with relevant forensic research institutions;

URGES Parties to collect samples from all large-scale ivory seizures (i.e. a seizure of 500 kg or more) that take place in their territories, and provide these to relevant forensic and other research institutions in support of enforcement and prosecutions; and

DIRECTS the Secretariat, subject to available resources, to support activities that will enhance the traceability of elephant specimens in trade by: informing Parties about and evaluating relevant forensic facilities and research institutions; reviewing relevant developments and research activities, and advising the Parties and the Standing Committee accordingly; encouraging the sharing of forensic samples and data, including through existing DNA databases; and facilitating linkages with MIKE, ETIS and national and international enforcement activities.

## Resolution adopted by the Economic and Social Council on 25 July 2013

### *2013/40. Crime prevention and criminal justice responses to illicit trafficking in protected species of wild fauna and flora*

*The Economic and Social Council,*

*Recalling* its resolutions 2001/12 of 24 July 2001 and 2003/27 of 22 July 2003 concerning illicit trafficking in protected species of wild flora and fauna,

*Recognizing* the role of the Convention on International Trade in Endangered Species of Wild Fauna and Flora as the principal international instrument on legal trade in wild fauna and flora, and efforts made by parties to that Convention to implement it,

*Reaffirming* Commission on Crime Prevention and Criminal Justice resolution 16/1 of 27 April 2007 on international cooperation in preventing and combating illicit international trafficking in forest products, including timber, wildlife and other forest biological resources, in which, inter alia, the Commission strongly encouraged Member States to cooperate at the bilateral, regional and international levels to prevent, combat and eradicate illicit international trafficking in forest products, including timber, wildlife and other forest biological resources, where appropriate, through the use of international legal instruments such as the United Nations Convention against Transnational Organized Crime and the United Nations Convention against Corruption,

*Recalling* General Assembly resolution 67/189 of 20 December 2012, in which the Assembly expressed deep concern about environmental crimes, including trafficking in endangered and, where applicable, protected species of wild fauna and flora, and emphasized the need to combat such crimes by strengthening international cooperation, capacity-building, criminal justice responses and law enforcement efforts,

*Recalling also* its resolution 2008/25 of 24 July 2008, in which the Council encouraged Member States to continue to provide the United Nations Office on Drugs and Crime with information on measures taken pursuant to Commission resolution 16/1, which may include holistic and comprehensive national multisectoral approaches, as well as international coordination and cooperation in support of such approaches, including through technical assistance activities to build the capacity of relevant national officials and institutions,

*Recalling further* the Salvador Declaration on Comprehensive Strategies for Global Challenges: Crime Prevention and Criminal Justice Systems and Their Development in a Changing World, adopted by the Twelfth United Nations Congress on Crime Prevention and Criminal Justice, held in Salvador, Brazil, from 12 to 19 April 2010,

in which Member States acknowledged the challenge posed by emerging forms of crime that have a significant impact on the environment, encouraged Member States to strengthen their national crime prevention and criminal justice legislation, policies and practices in that area and invited them to enhance international cooperation, technical assistance and sharing of best practices in that area, and invited the Commission to study the nature of the challenge and ways to deal with it effectively,

*Recalling* its resolution 2011/36 of 28 July 2011, in which the Council invited Member States to consider making illicit trafficking in endangered species of wild fauna and flora a serious crime,

*Emphasizing* that, in its resolution 2011/36, the Council, concerned by the involvement of organized criminal groups in all aspects of illicit trafficking in endangered species of wild fauna and flora, strongly encouraged Member States to take appropriate measures to prevent and combat such illicit trafficking,

*Recalling* its resolution 2012/19 of 26 July 2012, in which the Council urged Member States to consider, among other effective measures, in accordance with their national legal systems, addressing different forms and manifestations of transnational organized crime that have a significant impact on the environment, including trafficking in endangered species of wild fauna and flora,

*Recalling also* decision 27/9 of 22 February 2013 of the Governing Council of the United Nations Environment Programme, entitled “Advancing justice, governance and law for environmental sustainability”,

*Recalling further* that, in its resolution 2011/36, the Council noted the importance of promoting public-private partnerships to address trafficking in endangered species of wild fauna and flora, especially as regards the adoption of preventive measures,

*Conscious* of the need to promote initiatives to stimulate legal trade,

*Deeply concerned* by the involvement of organized criminal groups in all aspects of illicit trafficking in protected species of wild fauna and flora, and underscoring in that regard the usefulness of the United Nations Convention against Transnational Organized Crime in reinforcing international cooperation in the fight against that crime,

*Expressing concern* that illicit trafficking in protected species of wild fauna and flora is an increasingly sophisticated form of transnational organized crime, and recalling that, in its resolution 2012/19, the Council recognized that transnational organized crime had diversified and represented a threat to health and safety, security, good governance and the sustainable development of States,

*Emphasizing* that illicit trafficking in protected species of wild fauna and flora can have a destabilizing effect on national economies and local communities, including

through the destruction of natural habitats and diminished revenues from ecotourism and legal trade in species, as well as the loss of human life,

*Emphasizing also* that illicit trafficking in protected species of wild fauna and flora poses a serious threat to a number of vulnerable and endangered wildlife species, increasing the risk of extinction of such species,

*Emphasizing further* that coordinated action is critical to reduce corruption and disrupt the illicit networks that drive and enable illicit trafficking in protected species of wild fauna and flora,

*Emphasizing* the importance of effective cooperation and coordination among international organizations to combat illicit trafficking in protected species of wild fauna and flora, and welcoming the establishment of the International Consortium on Combating Wildlife Crime and noting the Green Customs Initiative as examples of such partnerships,

*Acknowledging* the crucial role played by all relevant stakeholders, including civil society, in combating illicit trafficking in protected species of wild fauna and flora,

1. *Strongly encourages* Member States to take appropriate measures to prevent and combat illicit trafficking in protected species of wild fauna and flora, including the adoption of the legislation necessary for the prevention, investigation and prosecution of such trafficking;
2. *Encourages* Member States to undertake and promote bilateral, subregional, regional and international cooperation, including cooperation between law enforcement agencies, through joint investigations, including joint cross-border investigations, and exchange of information, inter alia information on legislation and law enforcement intelligence, with the support of regional wildlife enforcement networks aimed at more effectively countering illicit trafficking in protected species of wild fauna and flora, and, in particular, through encouraging and supporting cooperation with those States that contribute to the supply and demand for illicitly trafficked protected species of wild fauna and flora, as well as those States that serve as transit areas;
3. *Requests* Member States to fully utilize the United Nations Convention against Transnational Organized Crime and the United Nations Convention against Corruption to prevent and combat illicit trafficking in protected species of wild fauna and flora, and in that regard calls upon Member States that have not done so to consider becoming parties to those Conventions and calls for their full and effective implementation by States parties;
4. *Encourages* Member States to make illicit trafficking in protected species of wild fauna and flora involving organized criminal groups a serious crime, as defined in article 2, paragraph (b), of the United Nations Convention against Transnational Organized Crime, in order to ensure that adequate and effective means of international

cooperation can be afforded under the Convention in the investigation and prosecution of those engaged in illicit trafficking in protected species of wild fauna and flora;

5. *Strongly encourages* Member States to strengthen, where necessary, their national legal and criminal regimes and law enforcement and judicial capacity, consistent with international legal obligations, to ensure that relevant criminal laws, including appropriate penalties and sanctions, are available to address illicit trafficking in protected species of wild fauna and flora;

6. *Urges* Member States to strengthen efforts to afford one another, in accordance with their international obligations and national legislation, the widest measure of mutual legal assistance in investigations, prosecutions and judicial proceedings related to illicit trafficking in protected species of wild fauna and flora, including measures to identify, trace and freeze or seize illicit proceeds that are generated by or enable such conduct;

7. *Encourages* Member States to consider establishing a national interagency task force to coordinate actions of various agencies within the country in the area of wildlife crime enforcement and assist the authorities concerned in other countries and international organizations, in order to facilitate coordination and concerted action in combating illicit trafficking in protected species of wild fauna and flora;

8. *Also encourages* Member States to promote efforts to prevent illicit trafficking in protected species of wild fauna and flora, inter alia, through public information and awareness-raising campaigns;

9. *Encourages* the United Nations Office on Drugs and Crime, in coordination with other members of the International Consortium on Combating Wildlife Crime, to continue its efforts to provide technical assistance and training to combat illicit trafficking in protected species of wild fauna and flora, as well as to develop tools, such as the wildlife and forest crime analytic toolkit, in accordance with the rules and procedures of the United Nations;

10. *Requests* the United Nations Office on Drugs and Crime, in coordination with other members of the International Consortium, to support Member States in the implementation of the toolkit to analyse the capacity of national wildlife and forest law enforcement authorities and the judiciary in investigating, prosecuting and adjudicating cases of wildlife and forest offences, with the aim of developing technical assistance and capacity-building activities and enhancing the capacity of Member States to address transnational organized wildlife and forest crimes;

11. *Commends* the efforts of the International Consortium and its members, namely the secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the International Criminal Police Organization (INTERPOL), the United Nations Office on Drugs and Crime, the World Bank and the World Customs Organization;



12. *Notes* the launch of the toolkit by the International Consortium, requests the United Nations Office on Drugs and Crime to disseminate that instrument to Member States, and invites Member States to consider applying and utilizing the toolkit;

13. *Requests* the United Nations Office on Drugs and Crime, in consultation with Member States and in cooperation with other competent intergovernmental organizations, such as the secretariat of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the World Customs Organization, INTERPOL, the World Bank and the United Nations Environment Programme, to undertake case studies that focus on organized crime networks involved in the illicit trafficking of specific protected species of wild fauna and flora, their parts and derivatives;

14. *Invites* Member States and other donors to provide extrabudgetary resources for the purposes described above, in accordance with the rules and procedures of the United Nations;

15. *Requests* the United Nations Office on Drugs and Crime to report on the implementation of the present resolution at the twenty-fourth session of the Commission on Crime Prevention and Criminal Justice.

*47th plenary meeting  
25 July 2013*



## Annex 3. Guidance for search of containers, freight vehicles and premises<sup>1</sup>

This annex provides:

- General guidance for all types of search
- Guidance for searches of containers
- Guidance for searches of freight vehicles
- Guidance for searches of premises

The power to search containers, vehicles and premises is an essential evidence gathering tool. The procedures described here must be followed, otherwise the whole examination could become valueless.

Physical examination should always be carried out methodically and thoroughly with the expectation of discovering prohibited or undeclared goods and other irregularities.

When examining, use your own senses of sight, smell, touch and hearing, for they are invaluable.

If damage is caused during the search, it must be recorded and the driver or owner must be informed and told of his rights to complain or to compensation.

### *Legality*

Before conducting a search, officers must:

- Be certain of the provision under which they intend to search
- Be aware of any requirements or limitations which those provisions impose upon the exercise of the power of search
- Be certain of the authority they need to execute the search
- Be absolutely satisfied that any necessary authority has been obtained

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<sup>1</sup>Adapted from UK Border Force Enforcement Handbook (unpublished).

Failure to do so could render any evidence discovered during that search inadmissible. This may also leave the department and the officer open to criticism in court and liable to claims for compensation.

It is important that the use of any power to search is proportionate to the suspected offence and that there are sufficient grounds to authorize and “invade” a person’s privacy.

### *Risk assessments/health and safety*

Officers should be aware of the physical and environmental risks when searching. Health and safety are of paramount importance not only to you and your colleagues, but also to bystanders.

The officer in overall charge of the case must ensure that risk assessments are in place for each operation. All managers should have a comprehensive set of generic risk assessments to deal with all operational activities.

All officers involved in the search must have access to a copy of the risk assessment at the pre-operational briefing prior to deployment. This will ensure that officers are fully aware of any risks as well as their responsibilities. The assessment should be attached to the briefing sheet or a copy issued to each officer. If this is not practicable, officers must be orally briefed on its contents. Officers should, where a risk assessment supports this, comply with all decisions to wear personal protective equipment (PPE) (e.g. hard hats, gloves, goggles) in specific operational circumstances.

Shed floors and examination areas should be clean and there should be adequate space to store goods removed from containers and for use of X-ray equipment. Officers should be wary of other obstacles in sheds, e.g. tugs, forklifts, etc., and always:

- Wear the PPE provided
- Remove all jewellery and tie back hair
- Be aware of the location of fire extinguishers and first aid kits
- Have vaccinations against tetanus, hepatitis, etc.
- Try to keep the examination areas tidy to prevent the risk of accidents

### *Equality and diversity*

Where operationally possible, officers conducting searches should give due regard to the declared ethnic or religious status of the building or the person linked with the vehicle or premises being searched.

However, officers should not be put off searching items merely because it is claimed they have religious significance, especially where there are indications or suspicion that the said item or area is being used to facilitate a smuggling offence or to conceal evidence of an offence. Finally, officers should also be mindful that in some cultures it may be felt inappropriate for a male officer to question a female.

## *Security*

In view of the highly sensitive nature of operations it is imperative that any detection made is not discussed other than with those persons directly involved in the case.

Remember, someone may be watching you.

As soon as possible, the goods should be transported to the storage warehouse. It is recommended that the detecting officer (who will be exhibiting the goods in his witness statement) accompany them in order to clearly maintain the chain of evidence.

If in doubt when doing something, officers must seek the assistance of colleagues or expert advice.

## *Records*

It is essential that notebooks are maintained at the time of the examination so that the best evidence can be presented at any subsequent proceedings, including but not limited to the following information:

- Date of the search
- Address of premises searched, when applicable
- Times of entry and exit
- Officers present
- Other persons present (e.g. specialists such as locksmiths, engineers, etc.)
- Dogs used
- A sketch plan of the layout of the premises to enable the exact location of the property uplifted to be accurately identified, when applicable. Number the rooms on the plan from left to right and top to bottom, when applicable. (Whatever method is employed, it is essential that consistency is maintained throughout officers' notebooks)
- Small amounts of counted cash (including a list of the denominations of the notes)
- Persons present during specific parts of the search (e.g. when drugs are found or cash is counted)

- Witness statements
- Any existing damage to the containers, vehicles or premises
- Any damage caused by officers or the owner during the search
- Any complaint made by the occupants of the premises and any other details officers deem relevant

## Guidance for search of containers

### *Container selection*

When examining containers, the method (door check, partial or full unloading) can vary according to the reason for exam.

This is a non-exhaustive list of reasons to search:

- Random check, e.g. statistically selected percentage
- Local parameters
- Officers decision
- Special criteria, e.g. risk analysis
- Nature, quantity, origin or value of the goods
- Country whence consigned
- High freight cost
- Previous history, e.g. known containers
- Suspect operations
- Intelligence from other areas of HM Revenue and Customs, customs authorities, or other national and international agencies
- Freight selection hubs
- Joint targeting teams
- Profiling
- Search theory
- Irregularities in documentation

### *General*

Scanning a picture of the load may point to areas of anomaly and may also be useful in identifying additional health and safety issues, such as a shifted load

leaning against the doors. Be aware that the load may have shifted while being moved from the scanner site to the examination site.

When a container is first produced for examination, the following questions should be considered:

- How many people are required for the search?
- Is a dog available?
- Is there relevant documentation (bill of lading, import-export or transit declarations)? If the documentation indicates a hazardous load, you should consider obtaining specialist advice or assistance.
- Is a specialist required (locksmith, engineer, etc.)?
- What equipment is necessary to carry out the exam (X-ray, probe, etc.)?

Officers should be nominated for the operation of equipment, such as X-ray van, camera, bolt-cutters, etc.

Be aware of fumigation stickers and signs. All containers should be gas-checked for the presence of fumigants. If there is any doubt, vent the container until a nil reading is given.

In cases where the container has been approved for transport under customs seal, care must be taken to avoid breaching the standards of that approval when drilling or otherwise physically altering the structure of the container. If such a container is found to be “innocent”, any repair which is necessary must be made in accordance with the Container Convention Rules.

### *Loading and unloading of containers*

Goods in containers should normally be removed and repacked by the appropriate company or wharfinger on behalf of the importer. Only in exceptional circumstances (i.e. for anti-smuggling purposes) and with management approval should this be done by customs officers, taking into account manual handling considerations.

If nothing is found during the examination, the container should be repacked by the wharfinger and resealed as soon as possible.

### *Action if irregularities are detected*

The aim is to apprehend and successfully prosecute all offenders involved in the illegal importation.

On making a detection of prohibited or uncustomed goods as a result of a container examination, the following action should be taken: stop the examination immediately.

The detecting officer should remain with the prohibited items for chain of evidence purposes while another officer notifies the HQ of the detection. The HQ will notify an investigation team for further action. The officer should then wait to receive further instructions.

The examining officer will still play an important part in the investigation. The investigators will probably require photographic evidence of the method of concealment. It is therefore crucial that examining officers do not tamper with the consignment without specific instructions from the investigating team or case officer.

On discovery of a suspected concealment only a small sample of the substance should be removed for field testing. At this stage, items should only be handled by one person wearing gloves, as there may be a need for fingerprinting and other forensic analysis.

The detecting officer and possibly other examining officers will be required to write witness statements.

It is important to share basic information about seizures with Detection and Intelligence colleagues in other container ports, as this may enable them to identify similar consignments which may be imminent or already unloaded.

## Guidance for search of freight vehicles

### *Vehicle selection*

The criteria for container selection are also applicable for vehicle selection.

### *General*

Due to their size, heavy goods vehicles are made up of a number of natural and adapted spaces that can be used to smuggle goods. Through training and experience officers will learn how to identify where these voids and spaces are and how to access them safely.

Officers should establish what normal is and challenge the *abnormal*.

The following lists of reminders are not definitive.

Always:

- Ensure the parking brake has been applied.
- Chock the wheels of the tractor unit (preferably the rear wheels on the driver's side).



- Ensure the driver is out of the cab and the keys are removed from the ignition prior to commencing the search. The officer leading the search should control the driver and ask them to open any padlocks, trailer locks and lockers.
- Take care when entering and leaving the cab, always exiting backwards.
- Let your colleagues know if you are going to examine underneath the trailer. Where practicable, prior to commencing the search, ask the driver to apply the trailer parking brake.
- Ask the driver to open any doors and lockers.
- Vent trailers before entering.
- When dealing with refrigerated trailers, ask the driver to switch off the refrigerator motor.
- Attempt to examine air bags. When in doubt, consult more experienced colleagues or experts.
- Beware of moving vehicles and the driver's limited vision, especially when reversing onto the examination bays or sheds.
- Beware of the trailer's cargo, how it is loaded and the potential risks, including poorly stacked pallets and hanging garments.
- Beware of dangerous goods within the cargo. Do not open packages of chemicals, but seek expert advice.
- Beware of dust within cargo; fine dusts are invisible, easily inhaled and can cause respiratory problems.
- Beware of inflammable dust and liquid that could easily ignite.
- Beware of electronically operated vehicles such as forklift trucks.
- Beware of green loads (vegetables) that absorb oxygen within a refrigerated trailer.

Never:

- Smoke near vehicles and examination areas.
- Put your hands into areas where you cannot see.
- Touch any sensitive electrics in the cab.
- Use equipment for which you have not been trained or authorized to use.
- Touch the parking brake.
- Stand too close to trailer doors when they are being opened.
- Attempt to examine air bags. When in doubt, consult more experienced colleagues or experts.

- Climb onto vehicles. Use the approved steps provided.
- Go under the tractor unit cab until it is fully tilted.
- Go under the fuel tanks of the tractor unit (the air suspension on the rear axles may lower as the air pressure drops and there is a danger of being crushed).
- Touch frozen metal with your bare hands.
- Touch burnt vehicles or plastic. (Hydrofluoric acid is produced when certain plastics are burnt, which is very corrosive to skin and flesh.)
- Go into confined spaces.
- Walk behind hydraulic rams in glass carriers.
- Climb on top of vehicles and tankers without first conducting a health and safety risk assessment.
- Open the hatches of liquid tankers (because of the build-up of pressure).

## *Search procedure*

### *1. Initial questioning of the driver*

The following non-exhaustive list of questions may be useful when making an assessment of the vehicle or load:

- What route did the vehicle take?
- Did the driver see the goods loaded?
- Was the driver present when the vehicle was loaded?
- Has the vehicle stopped anywhere?
- Is the load a regular collection or delivery?
- Who owns the vehicle?
- Has the vehicle been left unattended for any length of time?
- Has the vehicle been subject to any repair work recently?

Officers should observe the driver's demeanour and response to questioning. Behavioural indicators that may give rise to suspicion could include:

- Avoiding eye contact
- Sweating
- Being evasive when questioned
- Being over-helpful or uncooperative

Officers should ask to see all paperwork in support of the load. Based on the initial assessment, officers should consider:

- What action is necessary
- Whether the vehicle requires further examination (to varying depths) until satisfied
- Enhanced credibility checks of the documentation

## *2. Search of interior of cab*

Before commencing a search of the cab interior, officers must establish whether all the contents of the vehicle belong to the driver and are reminded that the cab is the driver's living area as well as his or her workplace.

Officers must not:

- Remove their boots, but offer to protect the seats and floor by using, for example, disposable covers
- Wear dirty overalls when searching the cab

Officers must:

- Always enter the cab forwards and exit backwards using the handrails
- Search the cab systematically, ensuring that all areas are checked until satisfied

It is good practice to wear gloves in order to protect the driver's personal belongings and officer's personal safety. Should a detection be made, officers must wear gloves in accordance with the guidance.

Most modern tractor units are fitted with high-tech equipment such as airbags and GPS receivers. Computers and electronics are now commonplace in operating the vehicle. With training and experience, officers will be able to identify where the spaces are and how to access them safely.

When examining the cab, officers must consider examining the following areas in the following non-exhaustive list:

- Driver's baggage
- Lockers
- Cubby holes
- Top bunk
- Under the bed or bunk
- Seats and backrests

- Sidewall trims and panels
- Foot wells
- Refrigerators
- Dashboard

### *3. Search of exterior (tractor unit and trailer) and interior (trailer and load)*

Before commencing the search, officers should always check the wheel of the tractor unit, preferably the rear wheel on the driver's side. Officers should systematically search the exterior starting at a fixed point on the vehicle, either at the front or the back. Subsequently, the interior of the trailer and the load should be checked.

#### *Action if irregularities are detected*

The same actions should be taken as when irregularities are detected in containers.

## **Guidance for search of premises**

The main difference between searching containers and vehicles versus premises is that premises are never randomly selected for search. This type of search requires significantly more planning and additional manpower. Search of premises is a sensitive issue and it can be an unpleasant experience for the person whose premises are being searched.

#### *Preparation before a search of premises or crime scene*

During the course of an investigation it may be necessary to conduct a search of premises for evidence of an offence or for goods liable to forfeiture.

The case officer should be clear about the purpose and reasons for the search, the likely extent of the search, the practicalities involved and what might be found on the premises.

#### *Search teams*

The case officer or case manager, in consultation with the officer in overall charge of the investigation, should nominate an officer in charge of the search at each premises or crime scene. Ideally this should be an officer from the case team.

Officers conducting the search have to be carefully briefed as to the nature of the material for which the search is to be made and how the material is thought to relate to the investigation. This will give them a better understanding and help them conduct the search more effectively.

### *Designated property control point and property officer*

The case officer or case manager in consultation with the officer in overall charge of the investigation should designate a property control point where property will be brought following the search. In practice, this should be a locked room in the building from which the case team operates, where property can be securely stored and access to it can be controlled.

### *Scenes of crime examination*

You should consider at an early stage whether to invite a forensic adviser to the pre-knock meeting, since they can give advice on the type of evidence that may be available at the scene of a crime and how best to preserve it. The use of forensic support at this stage may avoid evidence being compromised or reduce the resources required to prove the crime at a later stage. For example, it may be possible to uniquely mark documents, consignments, etc. in the build-up to the knock. During the search, the use of scientific support to assist in the early assessment and interpretation of evidential materials can greatly speed up and enhance the investigation. The crime scene examination officer may also need to remove items to the laboratory to apply more sophisticated techniques for the recovery of marks, etc. in order to obtain the best evidence.

### *Digital forensics group*

If premises are known to contain computers or computer equipment or if it is suspected that relevant material may be stored on computer, you should consider whether it is necessary for a member of the Digital Forensics Group to:

- Give advice to officers at briefings on procedures and how to deal with specific items, etc.
- Be available to provide technical advice over the telephone to officers on the ground
- Accompany the search team to ensure proper interrogation of the computer records

### *Procedures for dealing with cash*

If it is anticipated that cash will be found in premises, officers should be briefed on procedures to follow.

## *Interpreters*

If it is anticipated that language could pose a challenge, an interpreter should accompany the search team, if possible. If officers plan to take an interpreter with them to a search of premises, it should be included on the search warrant application, if required by legislation.

## *Additional resources*

This may include, for example, the number of officers necessary to complete the search, the need for an accompanying arrest team, back-up or reserve team, dog handlers, photographer, police presence or armed response team/tactical team, fire brigade, custody officer and equipment such as knock kits, handcuffs, gloves, search documentation, plastic bags/tamper evidence bags, seals and specialist tools, etc.

## *Briefings before the search*

A formal briefing should precede every search of premises, once authority has been granted. Where time does not permit this, an informal briefing must be carried out. While the case officer can provide guidelines concerning the search (for example, the legal basis on which entry and search is to take place), it is the search officers who are responsible for complying with the law and ensuring that they do not go beyond the statutory limitations imposed. The officer in charge of the search must ensure that both the extent and limits relating to the search for and seizure of items are fully understood by the search team.

## *Third parties attending the search*

If it is necessary for a third party (e.g. a lawyer from the Solicitor's Office, a police officer, an interpreter) to accompany the team conducting a search using a search warrant, the person concerned must be identified by name or designation on the warrant and the reasons for their attendance must be given in the information. Failure to do so may result in a claim of trespass and any evidence obtained being ruled inadmissible.

Third parties attending a crime scene should not be placed in a position where their safety may be compromised.

## *Before the search begins*

A search of premises must be made at a reasonable hour, unless this might be detrimental to the purpose of the search.

The officer in charge must first attempt to communicate with the occupant or any other person entitled to grant access by explaining the authority under which entry to the premises is sought and ask the occupant to allow access, unless:

- The premises to be searched are known to be unoccupied
- The occupant and any other person entitled to grant access are known to be absent
- There are reasonable grounds for believing that to alert the occupant or any other person entitled to grant access by attempting communication would impede the object of the search or endanger the officers concerned or other persons

Where the premises are occupied, officers and people accompanying them must identify themselves. Where an interpreter is present, a brief statement is to be made in the search officer's notebook confirming that the interpreter explained the purpose of the search and the occupant's rights.

If the occupant wishes a third party to witness the search, that person must be allowed to act as a witness unless the officer has reasonable grounds for believing that the presence of the person asked would seriously hinder the investigation or endanger the officers concerned or other people. A search need not be unreasonably delayed for this purpose. If the officer in charge of the search refuses the occupant's request, the reasons for doing so must be entered on the search record.

### *Searches involving forced entry*

Where the statutory power allows, reasonable and proportionate force may be used, if necessary, to enter the premises where:

- The occupant or any other person entitled to grant access has refused a request to allow entry to the premises
- It is impossible to communicate with the occupant or any other person entitled to grant access
- The premises to be searched are known to be unoccupied
- The occupant and any other person entitled to grant access are known to be absent
- There are reasonable grounds for believing that to alert the occupant or any other person entitled to grant access by attempting communication would impede the object of the search or endanger the officers concerned or other persons

Before any forced entry is made, the officer in charge of the search must be satisfied that one of the conditions above is met and that the address is that which is specified in any warrant.

If there is a risk of serious injury to officers or members of the public during the execution of forced entry, officers trained in method of entry (MOE) using the appropriate equipment and protective clothing should be deployed. Only in exceptional circumstances, and with proper authority, may untrained officers without specialist equipment conduct forced-entry procedures.

### *Conduct of the search*

Premises may be searched only to the extent necessary to achieve the purpose of the search, having regard to the size and nature of whatever is sought.

A search may not continue under:

- A warrant's authority once all the things specified in that warrant have been found
- Any other power once the object of that search has been achieved

No search may continue once the officer in charge of the search is satisfied that whatever is being sought is not on the premises. This does not prevent a further search of the same premises if additional grounds come to light supporting a further application for a search warrant or exercise or further exercise of another power, for example when, as a result of new information, it is believed that articles previously not found or additional articles are on the premises.

### *Leaving premises*

If premises have been entered by force, before leaving, the officer in charge of the search must make sure they are secure by:

- Arranging for the occupant or his or her agent to be present
- Any other appropriate means

Any significant occurrence, including damage to premises or use of an occupant's property, should be recorded in a notebook and countersigned by the occupant.

### *Search team responsibilities*

The officer in charge of the search team is responsible for the search and for:

- Ensuring that the premises are controlled
- Ensuring that any persons present are under control
- Checking for any items that might cause harm and ensuring that these are dealt with properly



- Ensuring all property is returned to the designated property control point and that any items, such as drugs, cash, firearms or ammunition or other valuables or high-value goods, are brought to the attention of the property officer. If firearms are found, they should not be touched and assistance should be sought from the police.

Before the search commences, the officer in charge of the search must ask the occupant (if present) if there are any drugs, firearms, cash or valuables on the premises. These items should be secured and recorded in the presence of the owner or occupant before they are removed in order to limit the claim of theft, etc., and to prevent any possible discrepancies that might occur at a later date.

Each member of the search team is responsible for the continuity of the evidence. Officers should be objective and take their time about the property they uplift. They should try to sift property on the premises and uplift what is relevant based on the knowledge of the case, rather than sweep up material. In case of doubt, officers should consult members of the case team. This will reduce the problem of irrelevant material being uplifted which may have disclosure or resource implications later on.

### *Post-search debriefing*

A formal debriefing should be conducted following the search, with the aim of highlighting any good or bad practices identified.



## Annex 4. Guidance for the first person on the scene<sup>1</sup>

### Essential actions of the first person on the scene

1. Approach the scene **only** close enough to confirm that a possible crime has been committed.
2. **Mark** your approach route and leave by the same route.
3. **Do not touch** anything that you may find at or near the scene.
4. Leave two persons to **guard the scene** from a distance.
5. Only the **investigating officer** should be the next person to approach the scene.
6. Contact your **supervisor** as soon as possible.

To expand on the above steps, the following actions should be followed:

- The inspection search must stop at the first indication of a crime, for example, when the first tusk is uncovered in a container, vehicle, etc.
- Make initial observations from this point and try to determine if a crime has been committed. If the ivory has not been declared to the inspecting officer, he immediately knows that they are dealing with a crime. This means that the initial search does not have to continue and the matter should be reported to his supervisor.
- Remind all officers present that if they notice any item which may have been left behind by possible criminals, not to disturb or touch any such item, but only to report the sighting to the inspecting officer.

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<sup>1</sup>Potter, R. B. and Evans, W. W., "Rhino Crime Scene Procedures", unpublished training manual for the Advanced Rhino Crime Scene Training Course, 2013.

- If it cannot be confirmed at this stage that a crime has been committed, then two officers should guard the suspected contraband while initial enquiries are made, for example, to confirm legitimacy of related documentation.
- Supporting officers should stay in the immediate vicinity of the suspected crime scene. They should form a cordon around the area where the suspected contraband has been found in order to secure the scene from possible contamination by onlookers.
- When the investigating officer arrives, he should be briefed by the first officer on the scene about all relevant details.
- The investigating officer should then conduct his own observations in order to confirm the suspicions of the first officer on the scene. To do this, he should follow the same route to the suspected contraband as the first officer, in order to minimize the disturbance of the scene.
- The crime scene should be protected and guarded until the investigating officer concludes his work at the scene, even if this is the next day.

In the event of an arrest being made, use the following rules:

- **Remove** the person from the scene immediately, leaving the recommended two persons behind to guard the scene.
- If a person is arrested away from the scene, **do not** bring that person back to the scene.
- If more than one person is arrested, **keep them apart** and do not allow communication between them.
- **Do not discuss the crime with/near any of the arrested persons.** This is one way in which the arrested person is kept guessing about what you know.
- Any interviewing of the arrested person should be done in such a way that he imparts information to you and not you to him.
- The use of **open-ended questions**, which do not suggest to the person the answer expected by the interviewer, can encourage a person to reveal information.
- A literate person can be given a **pen and paper** and asked to write down their actions prior to the present circumstances.
- **Remove mobile phones** from the arrested persons immediately. Make note of which items are recovered from which person. Mobile phones contain a wealth of possible information and once seized, the information should be downloaded by a forensic expert as soon as possible. The investigating officer should endeavour to locate suitable chargers for the recovered mobile phones so that the battery does not become exhausted, as the person from

whom the phone is recovered may be reluctant to divulge the PIN number required to activate the phone.

### *Other considerations*

A truck, trailer, container, boat or any other means of transportation will dictate the specific response to the confirmed discovery of a crime scene. The means of transportation should be considered as part of the investigation and, as such, must be protected from further contamination of possible evidence relevant to the investigation. The means of transport should be impounded and guarded until thoroughly searched for any possible evidence.

If weather threatens to ruin evidence at the scene, every attempt should be made to protect the evidence rather than leave it exposed. This may involve, for example, the removal of the truck to a warehouse or placing a tarpaulin over a container.



## Annex 5. Chain of custody record

AGENCY:		FILE NO: INV.		
DATE AND TIME OF SEIZURE:		REGION:	EVIDENCE/PROPERTY SEIZED BY:	
SOURCE OF EVIDENCE/PROPERTY (person and/or location):  <input type="checkbox"/> TAKEN FROM: <input type="checkbox"/> RECEIVED FROM: <input type="checkbox"/> FOUND AT:			CASE TITLE AND REMARKS:	
ITEM NO:	DESCRIPTION OF EVIDENCE/PROPERTY (include seizure tag numbers and any serial numbers):			
ITEM NO:	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA:  <input type="checkbox"/> MAIL <input type="checkbox"/> IN PERSON <input type="checkbox"/> OTHER:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	

## Chain of custody record (continued)

FILE NO:

INV.

ITEM NO:	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA: <input type="checkbox"/> MAIL <input type="checkbox"/> IN PERSON <input type="checkbox"/> OTHER:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	
ITEM NO:	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA: <input type="checkbox"/> MAIL <input type="checkbox"/> IN PERSON <input type="checkbox"/> OTHER:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	
ITEM NO:	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA: <input type="checkbox"/> MAIL <input type="checkbox"/> IN PERSON <input type="checkbox"/> OTHER:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	
ITEM NO:	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA: <input type="checkbox"/> MAIL <input type="checkbox"/> IN PERSON <input type="checkbox"/> OTHER:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	
ITEM NO:	FROM: (PRINT NAME, AGENCY)	RELEASE SIGNATURE	RELEASE DATE	DELIVERED VIA: <input type="checkbox"/> MAIL <input type="checkbox"/> IN PERSON <input type="checkbox"/> OTHER:
	TO: (PRINT NAME, AGENCY)	RECEIPT SIGNATURE	RECEIPT DATE	



## Annex 6. Ivory Inventory (sample and template)

**Date of seizure:** 18 February 2013

**Location of seizure:** Entebbe Airport, Uganda

**Seized by (name & agency):** John Smith, Ports Authority

**Date of sampling:** 20 March 2014

**Location of sampling:** Ports Authority Warehouse, Entebbe

**Data recorder (name & agency):** Jane Smith, National Wildlife Authority

**Data recorder contact details (e-mail, phone):** jane.smith@wildlife.ug  
+12-345-678-90

**Case title/number:** HQB/1046/22-12

**Details of seizure:** Elephant tusks hidden in plastic scrap in 20 ft. container  
no. MEDI83Q

**Total number of pieces (cut and whole):** 468

**Number of whole tusks:** 418

- **Number of fresh whole tusks (with dried blood or tissue):** 14

**Number of cut pieces:** 50

- **Number of cut pieces with a base:** 25
- **Number of cut pieces with an apex (tip):** 25
- **Number of middle cut pieces (no base, no apex):** 0
- **Number of worked (carved) pieces:** 0

**Total weight of seizure:** 1,950 kg

**Number of groups:** 6 (divided into groups based on shared characteristics)

**Group 1:** markings written in green ink

**Group 2:** markings written in blue ink

**Group 3:** soil presence

**Group 4a:** carved markings

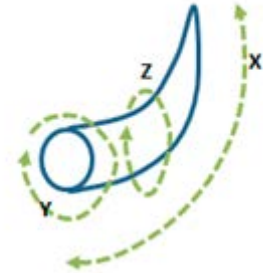
**Group 4b:** carved markings + soil

**Group 5:** no markings or soil

X (cm): Length of tusk measured on external surface

Y (cm): Circumference at the base

Z (cm): Circumference at the middle



*See section 12 (page 18) for further information on the Ivory Inventory and sampling procedure.*

## Ivory Inventory (template)

**Date of seizure:**

**Location of seizure:**

**Seized by (name & agency):**

**Date of sampling:**

**Location of sampling:**

**Data recorder (name & agency):**

**Data recorder contact details (e-mail, phone):**

**Case title/number:**

**Details of seizure:**

**Total number of pieces (cut and whole):**

**Number of whole tusks:**

- Number of fresh whole tusks (with dried blood or tissue):

**Number of cut pieces:**

- Number of cut pieces with a base:
- Number of cut pieces with an apex (tip):
- Number of middle cut pieces (no base, no apex):
- Number of worked (carved) pieces:

**Total weight of seizure:**

**Number of groups:**

**Group** (number and description)

**Group**

**Group**

**Group**

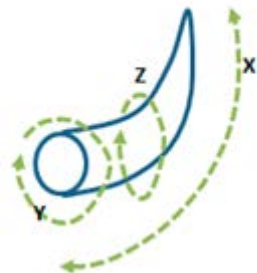
**Group**

**Group**

X (cm): Length of tusk measured on external surface

Y (cm): Circumference at the base

Z (cm): Circumference at the middle





## Annex 7. List of equipment and materials for ivory sampling

- Protective face masks
- Protective eyewear
- Disposable gloves
- Notepad or record book
- Clear plastic folders (to send the paperwork with samples)
- Waterproof marker pens (preferably ballpoint and not felt-tip)
- Duct tape (multiple rolls, for sealing the box and pairing/grouping ivory)
- Flagging tape of multiple colours (two rolls each of three different colours)
- Plastic liners/bags (to line inside the box)
- Plastic sheeting
- Plastic garbage (rubbish) bags
- Small heavy-duty plastic/zip-lock bags (for the ivory samples and or any other evidence)
- High-quality sample labels (to affix inside the bags)
- Erasable “white board” with dry-erase markers (for photographing samples with sample information)
- Paper bags or envelopes (for dry evidence)
- Camera with flash and tripod, if possible
- Hammer
- Chisel
- Scissors
- Pliers (“vice-grips”)
- Tape measure
- Ruler (to measure and photograph the size of evidence items)

- Handheld torch and batteries (to look inside tusk for other evidence or bullet holes)
- Small brush (to wipe ivory dust off the bench top)
- 5-10 cm wide paintbrush (for cleaning)
- Good-quality twine, at least 10 metres length
- Electric circular saw
- Handheld saw and replacement blades if manual sawing is feasible (hack saw with a “bone” blade is recommended)
- Plastic bowls for bleach and cloth
- Clean cloth or rag (for wiping saw blades and surfaces)
- Power source and extension leads (for electrical items)
- Bottled water (for rinsing)
- Household bleach
- Courier box (to send samples)

**Other equipment—optional but very useful**

- High-speed rotary cutting tool (e.g. Dremel) with tungsten carbide bits
- Two weighing scales: one suitable to weigh whole tusks (up to 20 kg) and a second to weigh smaller samples (1 to 1,000 grams)
- Vacuum cleaner

## Annex 8. Regulatory requirements for CITES import and export permits

- Detailed guidance on applying the provisions of CITES regarding permits and certificates is available in CITES resolution Conf. 12.3 (Rev. CoP16) on Permits and certificates. The resolution can be accessed through the CITES website.<sup>1</sup>
- States that ratify or accede to CITES are known as Parties. They implement the Convention<sup>2</sup> through their national legislation.
- In accordance with the provisions of the Convention, each Party must designate one or more Management Authorities (MA), competent to grant permits or certificates on behalf of that Party. It is important to note that only the MA that issued a permit or certificate is authorized to write on or otherwise alter the permit. In accordance with resolution Conf. 12.3 (Rev. CoP16), Parties should refuse to accept any permit that has been altered after the issuance, unless the alteration is authenticated by the stamp and signature of the issuing authority.
- Article XIV, paragraph 1, of the Convention<sup>3</sup> states that:

“The provisions of the present Convention shall in no way affect the right of Parties to adopt:

  - (a) Stricter domestic measures regarding the conditions for trade, taking, possession or transport of specimens of species included in Appendices I, II and III, or the complete prohibition thereof; or
  - (b) domestic measures restricting or prohibiting trade, taking, possession or transport of species not included in Appendix I, II or III.”
- Some Parties have put in place stricter domestic measures to regulate the import, export and re-export of specimens of CITES-listed species. For this reason, officials or persons who have collected samples from seized ivory in one country, for analysis at a forensic facility in a different country, are encouraged to interact with the national MA of both countries, as well as the MA of any country through which the samples might pass in transit,

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<sup>1</sup>See <http://www.cites.org/eng/res/12/12-03R16.php>

<sup>2</sup>See <http://www.cites.org/eng/disc/text.php>

<sup>3</sup>See note 2 above.

to determine whether any of these countries has applicable domestic measures stricter than CITES. This is to ensure that all relevant legal requirements are met prior to shipment. The contact details of CITES MAs can be accessed through the CITES website.<sup>4</sup>

- CITES import permits are only required for specimens of Appendix-I species.<sup>5</sup> The Asian elephant, *Elephas maximus*, has been included in Appendix I since 1975. The African elephant, *Loxodonta africana*, was transferred from Appendix II to Appendix I in 1989, but some populations were transferred back to Appendix II in 1997 (Botswana, Namibia, Zimbabwe) and 2000 (South Africa).
- In cases where the origin or age of seized ivory from which samples are collected is not known, the specimens should be treated as Appendix-I specimens.
- In accordance with the requirements of the Convention for export of Appendix-I specimens from the State of origin, an import permit must be issued prior to the issuance of an export permit. Some Parties require the original import permit before they will issue an export permit, while others will accept a copy of the import permit as proof that it has been issued. It is therefore advisable to check with the MA of the country of export on the requirements.
- The number (or quantity) and description of ivory pieces being sent should be the same on both the CITES export permit and the corresponding import permit. It is important to note that the number (or quantity) of specimens being transported must not be greater than the number (or quantity) shown on the export and import permits, otherwise all specimens could be seized. In any case, the customs officer who clears the shipment should indicate the actual number or quantity being exported or imported in the relevant section of the permit (box 14 on the standard CITES permit form).
- The number of pieces indicated on the permit refers to the total number of actual pieces covered by that permit. If a single vial contains more than one piece, each individual piece must be counted for the permit.
- A “purpose code” should be indicated on CITES import and export permits. The CITES MA that issues the permit will determine whether to use purpose code “S”<sup>6</sup> or “L”.<sup>7</sup> In the country of destination, the importing laboratory has to obtain the import permit and has to provide the necessary information on the purpose of the import to the MA.

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<sup>4</sup>See <http://www.cites.org/cms/index.php/component/cp>

<sup>5</sup>See note 2 above.

<sup>6</sup>S = Scientific purposes.

<sup>7</sup>L = Law enforcement/judicial/forensic purposes.



- The MA that issues the export permit should be requested to indicate on the CITES export permit, in the box for “Special conditions” (which is box 5 on the standard permit form), the words “Scientific samples for forensic analysis – no commercial value”. To facilitate a cross reference, the number of the accompanying CITES export permit, and the words “Scientific samples for forensic analysis – no commercial value” should be indicated on the bill of lading.
- The CITES Management Authority of some Parties may have introduced a system for simplifying issuance of permits, such as an import permit for multiple use to registered entities and under specified conditions. National legislation and regulations of the Party will determine the conditions applicable in these cases. In any case, an import permit for Appendix-I specimens must be presented at the time of the import of the samples, at the port of entry when the shipment is inspected and cleared. In the United States, for example, the CITES MA, in limited cases and only where specimens are to be imported for non-commercial use, may issue a multi-use import permit for specimens of an Appendix-I species to an entity that meets specific criteria set for this purpose.



1,500





# UNODC

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