A best practice guide for monitoring illegal killing and taking of birds

3rd edition

Illegal mist-netting of birds in Cyprus © BirdLife Cyprus

BirdLife INTERNATIONAL

Partnership for nature and people

Executive Summary

Detailed guidance is widely available on methods for monitoring bird population abundance, but little information is available on methods to monitor illegal killing and taking of birds. BirdLife International has developed a guide to provide the principal elements of each aspect of such monitoring, illustrated by a series of case studies describing different approaches applied in selected countries.

Overexploitation, in particular illegal killing and taking, is one of the main threats driving birds towards extinction globally. Many stakeholders have a strong commitment to addressing this issue and are collecting relevant data, but very few do so as part of a systematic monitoring scheme generating reliable quantitative estimates of the number of birds killed/taken per year. **This guide, relevant for all stakeholders, aims to facilitate expansion of new monitoring and increase the robustness of existing schemes**. The guidance covers the following points, among others:

- **Monitoring illegal shooting** by recording indirect evidence, such as the number of poachers seen, shots heard, cartridges/decoys/carcasses found, may be easier than recording direct evidence. The number of individual birds illegally shot can be then estimated using data on shooting 'success'.
- **Monitoring illegal trapping** by recording length of mist-nets or the number of traps may be the most appropriate way to monitor trapping methods for which visible evidence remains. The number of individual birds illegally trapped can be then estimated using average success rate per trap per unit time and average species composition of the catch. For traps that leave no visible evidence when they are not in use, interviewing may be a more appropriate method.
- **Monitoring illegal poisoning** may be possible using surveillance patrolling in known poisoning areas, during the period of targeted bird presence, to record all the direct and indirect evidence, such as the number of poison baits, number of carcasses or remains found, identity of the species targeted etc.
- **Monitoring illegal bird trade** by visiting markets should allow the number of individuals and species in trade to be monitored. If traders feel free to discuss, extra information from vendors and customers can be also gathered through informal interviews about the processes of the trade.

The principal elements of each aspect of a monitoring scheme for surveying different types of illegal activities are summarised in the Guide, illustrated by a series of case studies describing different approaches applied in selected countries. Whether data collection by regular monitoring is possible or not, casual records of illegal activities are also useful if systematically documented. The Guide promotes the use of consistent, replicable approaches, but no single method can be applied in all countries, and all may need to be adapted to country-specific conditions. It is worth also considering where in the 'supply chain' it is most efficient and effective to concentrate effort, from poachers in the field to sellers in illegal trade.

It is a priority to implement monitoring of the illegal killing and taking of birds using systematic sampling protocols and to manage these data systematically to generate robust data on trends in illegal activities over time and to help stakeholders prioritise conservation actions to address this international conservation problem.

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Relevant contacts within the BirdLife Partnership

To contact individual BirdLife Partners who may have relevant experience and resources on monitoring illegal killing of birds that they can share, see http://www.birdlife.org/worldwide/partnership/birdlife-partners.

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1. Introduction

1.1. Aim of the Best Practice Guide

Recent work led by the BirdLife Partnership [1, 2] showed that many BirdLife Partners and other organisations have a strong commitment to addressing the illegal killing and taking of birds in Europe and the Mediterranean Basin and are collecting relevant data. There is however at present little systematic, coordinated monitoring of the illegal killing and taking of birds currently in place in these regions. This Best Practice Guide has been prepared to address this gap. It aims to facilitate expansion of monitoring, increase the robustness of existing and new schemes, and support the development of a more coordinated approach. It is aimed primarily at BirdLife Partners but has considerable relevance to other stakeholders in Europe and the Mediterranean, as well as elsewhere in the world. Specifically, the Guide:

1. Provides a **checklist of the minimum steps** that should be considered in monitoring the illegal killing and taking of birds.
2. Presents relevant **sampling design and survey method considerations**.
3. Presents **overarching considerations** related to monitoring of illegal killing and taking of birds.
4. Describes **recommended methods** and **detailed case studies** with **examples of protocols** currently implemented by BirdLife Partners and other stakeholders.
5. Provides **information on how to train, enthuse and communicate with a network of surveyors**.
6. Highlights some of the opportunities and considerations for using the monitoring data for **advocacy and communication**.
7. Lists some of the **key references and relevant sources of additional information**.

The Guide is designed to promote consistent, replicable approaches for monitoring illegal killing and taking of birds. However, it also recognises the need to retain the flexibility to adapt to country-specific conditions.

1.2. Defining illegal killing and taking of birds and the need for monitoring

Globally, overexploitation is one of the main threats driving birds towards extinction globally, and much of this is illegal. The illegal killing and taking of birds is known to remain a major threat on a

[1] BirdLife International (2015) *Assessing the scope and scale of illegal killing and taking of birds in the Mediterranean, and establishing a basis for systematic monitoring*. Cambridge, UK: BirdLife International (report available online here).
[2] BirdLife International (2017) *Review of illegal killing and taking of birds in Northern and Central Europe and the Caucasus*. Cambridge, UK: BirdLife International (report available online here).

global scale. However, there are few quantitative data on the species and countries involved. Implementing standard methods for monitoring the illegal killing and taking of birds would allow robust analysis of trends and comparison of the scale and intensity of the issue between geographic areas. The results of monitoring are useful for advancing advocacy and communication campaigns, providing data to influence legal frameworks, and targeting and determining the impact of conservation actions addressing the issue.

The **illegal killing and taking of birds is defined here as any form of deliberate action that results in the death or removal from the wild of an individual bird (regardless of whether it was the target of this action or not), that is prohibited under national legislation.** The illegal killing and taking of birds occurs, for example, when game species are killed during the closed season, when prohibited methods are used , when protected species are killed, and/or when killing or taking of birds occurs in protected areas in which such activities are forbidden. Species can be killed or taken illegally for a variety reasons, such as for food, trade, sport or to be used as caged pets or decoys. Hereafter the term "illegal killing" refers to both illegal killing and taking, and covers all the types of illegal activity, such as illegal shooting, trapping, poisoning, egg collecting, etc. (see **Appendix** for further details).

1.3. Overarching considerations for schemes that monitor the illegal killing and taking of birds

In this section the minimum steps required to design and implement a monitoring scheme on the illegal killing of birds are outlined:

1. **Gather information on the context of this issue at the national level:**
    - Information on what is legal and illegal in the country, e.g. existing laws and regulations about hunting and taking of birds, derogations from EU Nature Directives, etc. If there are no hunting or taking laws in place, consider participating in the development of draft legislation and a law enforcement strategy.
    - Information on the relevant authorities (e.g. who are they and what do they do? what are their legal duties and legal rights? what do they need to tackle the illegal killing of birds?), the law enforcement (e.g. information on court decisions), the correct procedure to report illegal activities to authorities.
    - Information on the type of people carrying out illegal activities (e.g. local community, foreigners), when the illegal activities are happening and the process from illegal activity to the end user, on targeted species and known worst locations for the illegal activities.
2. **Identify all the stakeholders involved and any existing sources of data:**

- Monitoring/data collection by other stakeholders (e.g. NGOs, wildlife rescue centres, hunting federations, police records, authoritiy report), accessibility of such data (are stakeholders willing to share data?).
- Information on how ongoing data-collection efforts could contribute to an effective monitoring scheme on the illegal killing of birds.
- Assess which stakeholders could contribute what (manpower, funding, security, technology, etc.).

3. **Involve relevant stakeholders in development of a monitoring scheme on illegal killing of birds:**
   - Participation of all stakeholdes in a meeting/workshop.
   - Cooperation with all the stakeholders for data sharing and capacity building, sharing of financial and manpower resources (e.g. joint enforcement patrols).
   - Agree the aim of the monitoring: survey of the scale of problem (numbers, trends, target species, locations of worst areas), motivations for poaching (socio-economic drivers), effectiveness of law enforcement, protected area management, etc.
   - Assess how a monitoring scheme on the illegal killing of birds could interface with law enforcement.
   - Strong cooperation between BirdLife Partners and authorities is therefore highly recommended
4. **Based on available capacity and funding, design appropriate sampling regime and methodology (see Chapter 2):**
   - Verify the robustness of the sampling design.
   - Pilot at a few sampling units, refine if needed, and then implement more broadly.
5. **Train, enthuse and communicate with participants of the monitoring scheme (see Chapter 3).**
6. **Collect, manage and analyse data (see Chapters 4 and 5).**
7. **Communicate results to tackle the issue (see Chapter 6):**
   - Raising public awareness to put pressure on government.
   - Using international policy mechanisms to apply pressure on government.
   - Educating hunters, bee-keepers, fishermen, etc.
   - Lobbying for changes in national legislation if needed
   - Communicate regularly with collaborators/stakeholders in the monitoring scheme to ensure their continued support.

Illegal killing activities appear to be chiefly a male activity, although women and children may be involved in some activities in some countries. In some countries, hunting/trapping/egg collecting/etc. is considered as an old tradition that is dying out and the younger generation do not support it,

whereas in others, many people practice it on a small scale throughout the country and so it has broad-based support. In some cases, a relatively small but powerful sector of society may be involved in some acitvities. All of these subtle differences will influence decision-making on the most effective way to tackle illegal killing.

Dos and don'ts

The top ten aspects to consider in implementing effective montoring of illegal killing of birds and ten potential pitfalls to avoid are summarised in this box

'The 10 best suggestions'

1. Define survey objectives at the outset and stick to them
2. Keep things simple – since complexity often adds only marginal benefits and has associated costs
3. Aim high and be ambitious, but not too high
4. Learn from others – there is a wealth of experience and knowledge out there
5. Follow the basic principles of good survey design – as set out in this guide and elsewhere
6. Talk and listen to stakeholders: the surveyors, expert ornithologists, technical experts, and the people who will using the ouputs
7. Incorporate a pilot phase of a monitoring scheme and use that experience to revise the methods and/or sampling strategy
8. Store data in a database and archive the information properly
9. Report the results on a regular basis to a range of audiences – newletters to volunteers, leaflets for policy makers, and scientific publications
10. Design a survey that can be expanded in size or scope if more resources become available. Monitoring should be viewed as an adaptive and ongoing process

'The 10 things to avoid'

1. Repeating mistakes other people have already made
2. Being unrealistically ambitious and trying to do several things at once
3. Collecting information that is not compiled and never analysed
4. Forgetting to look after, nurture and train the skilled surveyors, on which much good monitoring is based
5. Forgetting to thank the surveyors and funding bodies on a regular basis
6. Believing that no birds/traps are missed when data are collected
7. Not knowing the statistical difference between accuracy and precision
8. Changing monitoring methods part way through a survey
9. Failing to analyse data and write up the results – failing to tell the world what you have found and why it is important
10. Failing to use the information to tackle the issue of illegal killing of birds

2. Survey design

Illegal activities are by their nature often hidden and difficult to track. Monitoring the illegal killing of birds therefore requires additional considerations to those for monitoring bird abundance or distribution (see Chapter 4). However, some of **key points and caveats to bear in mind in the design and establishment of protocols** are similar. This section outlines how to go about planning a survey, including considering the sampling strategy (choosing where to count) and field methods (choosing how to count), which both influence each other, and in turn may influence the survey objectives (Figure 2.1).

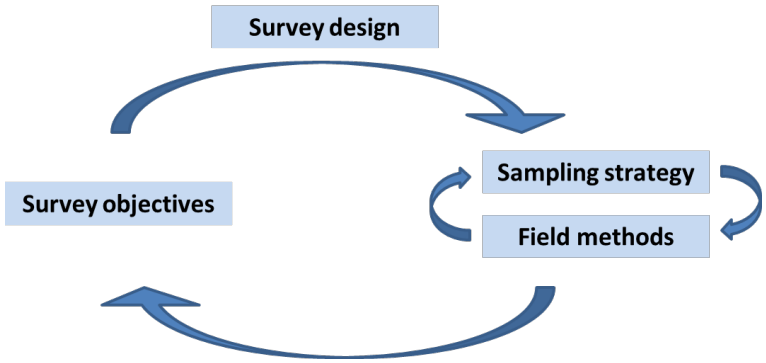

Fig. 2.1 *Feedback loops operating in survey design between the survey objectives, sampling strategy and field methods (from Gregory et al. 2004)*

All decisions made when designing monitoring programmes interact to affect the strength, efficiency, and reliability of information gained during implementation. The resulting programme will represent a balance between practical challenges associated with meeting monitoring goals and sampling efficiently, and logistical and financial constraints. In practice, **survey design often involves a compromise between the 'ideal' approach scientifically and the reality imposed by constraints, resources and practicalities** (Steidl 2001). However, whatever monitoring programme emerges from this compromise should use consistent methodologies that enable direct comparisons of data between years and between different geographic areas in order to allow calculation of trends over time.

Where financial and capacity constraints are severe, partnership with other organisations/authorities is even more important. Before deciding that constraints mean that starting to monitor illegal killing of birds is not possible, it is worth considering what regular activities are underway that monitoring of illegal killing could be added to in order to reduce costs and time and make efficient use of capacity (e.g. national park patrols by authorities, monitoring of Important Bird and Biodiversity Areas (IBAs), wintering waterbird censuses, migration counts, etc.). Bear in mind that **some well-designed monitoring on a small scale is better than no monitoring**. Monitoring of the same small subset of sites in a consistent way will allow you to establish what the trend in illegal killing activity is at those sites over time, even if the broader picture for the country is incomplete.

2.1. Monitoring goals and objectives

The **goal of most monitoring efforts is to detect changes and quantify trends in characteristics of a parameter** (e.g. number of birds, trend in illegal activities). Changes can be defined as the difference in the value of this parameter between two time periods (e.g., a 3% change between years 1 and 5), and trends defined as continuing directional change in the value of this parameter (e.g., linear regression slope of -3.0 parameter units/year) (Steidl 2001).

Before designing and implementing a monitoring programme, it is **very important to define clearly the aims of the survey and review resources**. A common mistake is to be overambitious and try to collect much more information than is strictly required, to the point where this compromises quality. A useful technique is to list your goals, the data required to fulfil them, the time required to collect these data, and revisit and prioritize your aims (Gregory *et al.* 2004). Questions that should be asked before setting up a monitoring scheme include:

- **What questions is the monitoring intended to answer?** (E.g. how many individuals are illegally killed, which species are involved, which illegal methods are used, where are the worst locations, who is involved, how are the trends changing over time, how effective is law enforcement, how successful have conservation efforts been, what are the root causes?)
- **What data do you need in order to answer these questions?** (E.g. numbers of individuals of each species illegally killed/trapped, trends in illegal activities)
- **Who is involved in illegal killing of birds?** (E.g. local or foreigner poachers)
- **Who will be engaged in monitoring illegal killing of birds?** (E.g. volunteers, NGO members, Park management staff)
- **Who will use the results and how?** (E.g. conservation NGOs for communication, local authorities for law enforcement, international conventions for prioritising action)

2.2. Direct or indirect measures?

The **first key decision to take is to choose which measures(s) will be recorded**. Most measures can be divided into two groups: *direct (or absolute) measures*, where the target being monitored is itself measured (e.g. number of birds illegally killed), and *indirect (or relative) measures or indices*, where feature related to the target is measured (e.g. number of persons engaged in illegal killing, number of traps, numbers of shots heard, etc.). If an index is used, it must reflect short-term changes in the target and provide a direct relationship to the true status of the target (e.g. if fewer traps are counted, fewer birds are being trapped; Steidl 2001). Direct measures of illegal killing of birds are very valuable and

allow more sophisticated analysis, but indices may be less time-consuming to measure (e.g. number of shots heard in 30 min from a sample point = index for number of birds being killed). To be able to extrapolate absolute numbers from index, the relationship between the two have to be known. This is the *calibration of the index* and it is undertaken by simultaneously measuring both the index (e.g. number of shots fired, number of traps found) and the actual species and numbers of birds killed/trapped. Then, number of birds killed from other sample units in which only indices have been obtained can be estimated.

2.3. Survey boundaries

The next decision is about **where to undertake the survey**, which should guide the setting of *survey boundaries*. These boundaries are largely self-evident if you want to obtain an estimate of the number of birds killed in a discrete habitat area, such as a specific forest or wetland, or in a particular geopolitical (e.g. country) or geographical (e.g. island) area. Survey efficiency, however, can be greatly improved if you further refine the boundaries within the area of interest, as it is likely that the illegal activities will not be present everywhere. It would be inefficient to cover large areas of clearly unsuitable habitats, but conversely little confidence could be placed on a study that excluded suitable habitats. It is often necessary to collect data over a wider area than expected, although it is sensible to sample at a much lower intensity in peripheral areas. This is the basis of *stratification* (see **section 2.5.4**). Paradoxically, it can be also important to confirm that an illegal activity does not occur in an area (and record a nil count; Gregory *et al.* 2004).

2.4. Census or sample?

The next decision is **whether to undertake a *true census* by attempting to count all birds illegally killed within the survey boundary, or to count in only a *sample* of areas within the survey boundary**. While it might be tempting to census the whole area for the sake of completeness, it is often considerably more effective to census representative samples and to extrapolate the results to obtain a total figure with estimates of the likely error (Gregory *et al.* 2004).

2.5. Sampling strategy

If a sample survey is undertaken, the *sampling strategy* has to be very clear. **Areas counted have to be representative of the area within the survey boundaries**. If they are not, the final estimates or index may be biased in an unknown manner (Gregory *et al.* 2004). Strategies based on *random*, *random*

stratified or *regular sampling* (also known as *systematic sampling*) outlined below are likely to be more robust.

2.5.1. Sampling units

***Sampling strategy* defines the method by which sample locations are chosen and *sampling unit* defines the size, shape, number, and spatial arrangement of units at each sample location**. The appropriate size for a *sampling unit* very much depends on the monitoring method selected. Line transects (e.g. detecting illegal traps) might be walked across a square of 1 km^2, whereas surveillance from vantage points (e.g. counting gunshots) might cover several km^2. It is essential that all the *sampling units* counted in a sample are comparable. The best way to do this is to base them upon regular units, such as grid squares, rather than irregularly shaped sites such as wetlands or particular areas of forest. The use of grid squares has many advantages, particularly in the planning and coordination of schemes, and in the analysis of data (Senyatso *et al.* 2008).

The number of samples surveyed will, largely, depend on both availability of surveyors and/or equipement/logistics (i.e. binoculars, transport, etc.), and the method used. As a general rule, it is desirable to have as many as samples as possible; many samples taken using a quick and easy method are preferable to only a few with more detailed and time-consuming methods (Senyatso *et al.* 2008).

Which *sampling units* to count is probably the most critical decision, as failure to use an appropriate *sampling strategy* could invalidate the results. There is a tendency for surveyors to visit areas they expect to be good for their target species. *Free choice* of this kind can lead to a bias toward particular types of sites; whereas sample must be representative of the whole area of interest to extrapolate the results to areas that are not visited (Gregory *et al.* 2004). There are **number of approaches to ensure sampling is representative, with the two that produce the best results being based on either *random sampling* or *regular sampling*** (Figure 2.2). Both require the study region (e.g. country or worst area for illegal killing of birds) to be divided into standard recording units, and then a number of units chosen for survey depending on surveyor capacity. The *random sampling* selects sites entirely at random from the entire sample, whereas the *regular sampling* selects survey sites based on a regular grid approach (every 10^{th}, 100^{th} square or other appropriate proportion; Senyatso *et al.* 2008). In the real world, it may be very difficult to sample totally at random, for example, because of the remoteness and land ownership of some areas. A more pragmatic approach is *semi-random sampling*, where sampling units are randomly selected within a predefined area. For example, each square of the survey area can be classified as either a 'possible bird trapping area' or 'unlikely bird trapping area', based solely on the presence or absence of suitable habitat. A certain number of squares are then randomly selected each year only among the 'possible bird trapping area' squares.

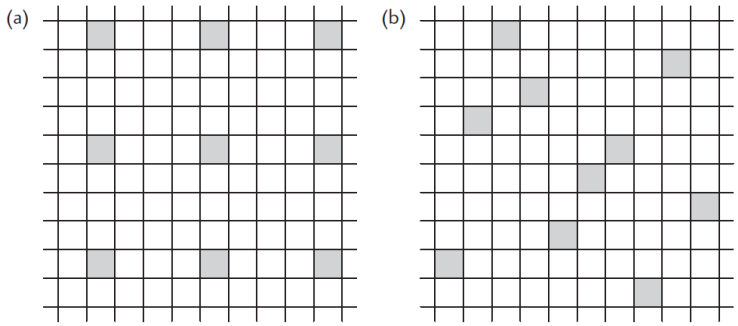

Fig. 2.2 *Example of (a) regular and (b) random sampling method, survey squares are shaded (from Gregory et al. 2004)*

2.5.2. Using stratification

Prior knowledge about an illegal activity or an area to be surveyed can often be used in order to sample more effectively. An important refinement is *stratification*, where the area of interest is broken down into different sub-areas, known as *strata* (Gregory *et al.* 2004). For example, there is prior information that the illegal activity is largely absent, or at least very rare, in the southern part of a given region. Randomly sampling across the whole region might, quite by chance, result in selecting a high proportion of samples in the area where the illegal activity is largely absent. This would lead to an imprecise and inaccurate estimate and might lead to other problems, such as reluctance by surveyors to visit these areas because they expect to see so little. As an alternative, it can be predetermined that 80% of samples are drawn at random from the area where the illegal activity is largely present and only 20% of samples from that though to be absent (**Figure 2.3**). As illegal activities may shift location over time, hence it is needed to monitor even the places with currently low levels of illegal activity. Samples can be *stratified* by habitat, climate, altitude, land use, accessibility of survey sites, administrative or geopolitical boundaries, etc. *Stratification* is highly recommended because it can improve both precision and accuracy (see **section 2.7**) and it ensures proper habitat coverage.

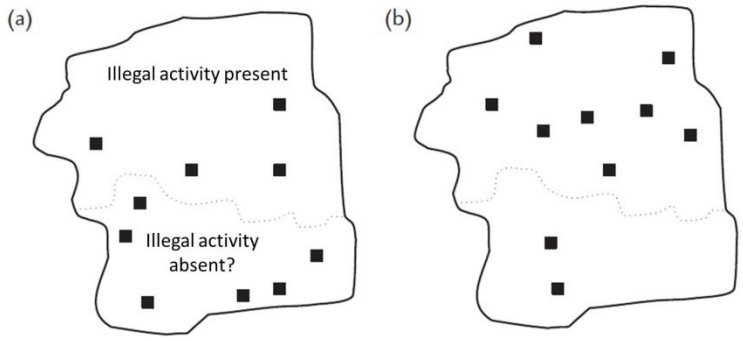

Fig. 2.3 *Imagine a survey of an illegal activity in an area divided into two distinct habitats. The filled squares represent survey plot. (a) A pure random sample of the whole area could, by chance, result in 60% of samples failing in the southern habitat – which may have very little, if any illegal activity. This would be wasteful of time and resources. (b) Far better would be to use prior knowledge to stratify the sample: 80% of the random samples are taken from the habitat where the illegal activity is known to be present and 20% from the habitat where the illegal activity may be absent. Note that, although the sample is smaller in the southern area, it is still vital that it is surveyed (from Gregory et al. 2004)*

2.6. Field methods

The next decision is about **which *field methods* to use to count birds/traps/etc**. within each *sample units*. The **choice of the *field methods* is as important as the choice of *sampling strategy***. The three principal methods, *spot mapping*, *line transects* and *point counts* (Figure 2.4), are outlined in this section.

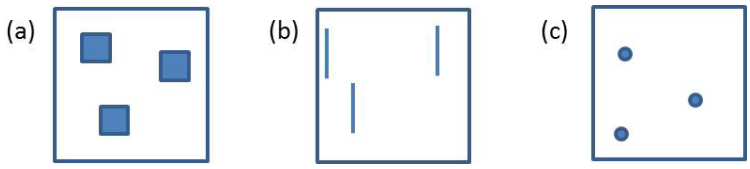

Fig. 2.4 *Principal field methods for monitoring: (a) spot mapping, (b) line transects and (c) point counts*

Whatever the method chosen, it is important to standardize fieldwork as much as possible, in order to ensure comparability between surveyors and comparability over space and time. Here after some general issues to consider in planning fieldwork:

- **Season of the year and time of the day** the survey is carried out: this should be the best time for detecting illegal activity.
- **Size of survey plots**: if they are too small, they will yield only imprecise data, if they are too large, surveyors may be reluctant to undertake the work or may carry it out with insufficient care.
- **Number of visits** to be made to each sample plot or area and recommended search effort, for example, walking speed (for line transects) or count duration (for point counts), and general counting protocol for the surveyors.
- **Recording units** to be noted, e.g. number of traps, number of individual birds shot.

2.6.1. Spot mapping

This method consists of **searching all the evidence of the illegal activity in the selected sample units** (e.g. all the traps). An obvious advantage of the method is that it produces a detailed map of the distribution of the illegal activity, but it may require a high level of surveyor skill to detect evidence of the illegal activity (e.g. trap, mist-net ride, bird feather, and blood stains).

2.6.2. Line transects

This method involves **traveling a predetermined route and recording evidence of the illegal activity on either side of surveyors**. The distance an item of evidence is seen or heard from the transect line is normally recorded as an absolute measure, or in distance bands (distances should be estimated

perpendicular to the transect line). The *sampling strategy* chosen for a particular survey determines the *sample unit* to be surveyed, but there is still choice of the *line transect routes* within this area. There are several options, and some flexibility is advisable. For example, a regular or systematic approach could be used with parallel transects orientated north to south, or a series of transects oriented along the long axis of the study area. A random approach, for example, with starting points and directions of transects selected randomly, could be used. In reality, topography, watercourses, roads, certain land uses, and access permissions, might all limits access, so that the actual routes counted will differ to some degree from the ideal routes – but such deviation cannot be avoided.

2.6.3. Point counts

Point counts **differ from line transects in that the surveyors stop at predefined spot and then record targeted unit for a predetermined period of time**, e.g. the number of shots heard or the number of birds recording being shot. There are again choices in deciding where to site point counts within the study plot. One could select individual points at random, or by a stratified random design, and access each of them individually. As with line transects, practical barriers might limit the degree to which the ideal point counts can be reached, but equivalent points can be substituted with little care.

2.7. Reliability: accuracy, precision and bias

The ***reliability*** **of a sample-based estimate of numbers (or change in numbers over time) is a matter of both *accuracy* and *precision***. The terms *accuracy*, *precision* and *bias* have specific meaning when applied to scientific data. It is extremely important to understand these terms at the outset and to use them appropriately when survey results are reported. **Survey design essentially revolves around the twin aims of increasing accuracy and precision and reducing bias** (Gregory *et al.* 2004):

- ***Accuracy*** **is a measure of how close the estimate is to the true value**. Of course, the problem is that the actual value is usually not known and so it is extremely difficult to measure *accuracy*. The only practical way to measure *accuracy* would be to carry out very intensive work in small areas and to calibrate the findings with a wider survey – but such studies are very time-consuming
- ***Precision*** **is a measure of how close replicated estimates are from each other** (and so it is unrelated to the true value). This is the same as asking how much error is there around a mean estimate. Unlike *accuracy*, *precision* can be measured in statistical terms (e.g. as a range, variance, standard error, 95% confidence limits) by looking at the differences in counts between the sampling units. Multiple counts can be obtained by counting the same study site repeatedly

in the same season, or by counting multiple sites once. The first option tells us about the temporal variation at sites within a season, the second about the spatial variation across sites – both may be important depending on the study aims.

- ***Bias* occurs when the estimates are either systematically larger or smaller than the true value**. A whole range of factors could lead to *bias*, for example the field method, effort and speed of surveying, the habitat, the time of the day, the season of the year, the observer's skills, etc. The challenge is to recognize all the potential sources of *bias* and to standardize survey methods to reduce it as much as possible.

2.8. Analysis

Thought must be given to how a dataset will be analysed before a monitoring scheme is launched. Data need to be entered into an appropriate database (section 5.1), and then analyses conducted. In the first year of a scheme, these will be simple descriptive statistics (e.g. numbers of individual bird killed/trapped, number of traps located, etc.). After three or four years, it will be appropriate to calculate trends in illegal activities. The production of trends depends on looking at changes in a variable at each site between years and can be done through a number of approaches (section 5.2).

3. Implementation on the ground

Once the survey design has been decided (see Chapter 2), **practical considerations must be made for running the scheme**. As the employment of professional surveyors is rarely possible, such monitoring may rely, at least in part, on volunteers. Hence, it is vital that good management practices are employed to recruit and retain volunteers, by ensuring their involvement with the scheme is enjoyable and rewarding. In addition, it is important to ensure that there is sufficient support, guidance and training, so that data collected are robust and reliable.

There may be **considerable advantage to keeping the monitoring method simple** and it may be entirely **possible for non-specialist surveyors to be of considerable help**. With minimal training, non-specialist observers should be able to identify and count traps/shot, and, where identification of trapped/killed birds is required, surveyors could take pictures or video (easily possible now on most mobile phones) for a specialist to identify later. Even with larger trap types (like mist-nets), a non-specialist surveyor could simply photograph or video the contents of a net or pre-agreed area of net for later counting and identification of contents by a specialist.

3.1. Recruiting surveyors and maintaining involvement

The issue of recruiting scheme coordinators and surveyors for monitoring illegal killing of birds is closely tied to that of recruiting support for many other conservation projects. Often, monitoring illegal killing of birds may compete with other projects for the time of potential participants (volunteers, tourists, protected area staff, rangers, etc.). **Surveyors need to be encouraged that the scheme they contribute to is important and valuable, and that their own individual contribution is valuable**. New monitoring schemes typically start by recruiting experienced observers known by the monitoring coordinators. The skills, time and effort of such observers are valuable, and taking time to explain the objectives and anticipated outputs of the scheme will help encourage their participation. It is worth highlighting the scheme's relationship with the other conservation programmes, including IBA monitoring, threatened species recovery work and membership activities. Additionally, the participation of skilled observers often provides the opportunity to gather valuable feedback on the practicality of the methods, which may be incorporated into the survey design. If necessary, in the early stages of the scheme (after the end of the first year for instance) this may lead to a revision of techniques to accommodate relevant feedback without compromising the robustness of the scheme.

Monitoring illegal killing of birds can be undertaken by a range of different stakeholders, including individuals from government agencies and authorities, national and international NGO volunteers, local people etc., but there are many potential benefits to multi-stakeholder collaboration. It is

therefore important to consider working with partners and building on/complementing any existing efforts/related work. It is also important, when possible, to involve the local community to increase buy-in and decrease antipathy to monitoring efforts. Incentives can encourage wider participation and commitment. However, this can pose problems for long-term sustainability though raising expectations. Analogies can be drawn with BirdLife's Local Conservation Groups, whose source of motivation will vary from site to site, though generally, they appear to be keen to engage in activities that provide benefits to themselves and the community, including activities that build their individual capacity, activities that earn the group local, national and international recognition and acclaim and/or opportunities to deploy traditional knowledge and skills possessed by the local community.

Although time-intensive, when it comes to maintaining the interest and involvement of volunteers, there is no substitute for regular personal contact. This is particularly true for small, new schemes where every surveyor is very valuable. When schemes grow and the numbers of surveyors increase, it is worth considering establishing a network of regional coordinators, each with the responsibility for maintaining contact with surveyors within their regions. Without frequent contact and regular reporting, volunteers may desert the schemes. Regular contacts allow informing surveyors about any training opportunities, ensuring that data are submitted to coordinator, giving a sense of collective endeavour (individual surveyor may carry out surveys alone, and it is only through good communication that they can really feel part of a team), feeding back results, and increasing understanding of how surveyor efforts are contributing to tackling of illegal killing.

3.2. Training surveyors

Good training is an essential component of successful monitoring schemes, in order to build capacity for designing surveys, managing volunteer networks, analysing data, communicating results and using them for advocacy. This is likely to involve both face-to-face training (workshops, joint field session with experienced surveyors training new surveyors) and the dissemination of training materials. Training workshops should aim to:

- **Describe the situation in the country regarding the legislation** (what is legal and illegal about killing of birds), the mission of the monitoring coordinator.
- **Describe the rationale behind establishing a monitoring on illegal killing of birds** and its value for conservation.
- **Give a basic grounding in the survey design** being employed and methods.
- **Explain methods to be used in the scheme** (steering observers away from potential pitfalls). Note it is extremely important to give surveyors exact instructions as to how to conduct their surveys, but if instructions are too detailed, surveyors may not bother to read them properly.

- **Include sessions on filling in forms correctly** and **securities issues**.
- **Exchange experience** and **opinions**.

To cover all these aspects fully, a workshop is recommended as early as possible at the commencement or development of a scheme, involving monitoring coordinator staff, potential key surveyors, government counterparts and all the stakeholders who are or could be involved in tackling the illegal killing of birds in the country. Workshops should then be repeated when needed (typically once a year for annually repeated monitoring).

3.3. Security

Safety of surveyors is paramount and all surveyors should receive training/guidance on how to minimise risk and what to do in the event of an aggressive situation arising. According to the situation of the country, those carrying out illegal activities may or may not be aggressive towards surveyors. **Security issues should, however, always be considered, and surveyors should be well-briefed for their own safety**. The following security rules should be considered and adapted as appropriate:

- Where appropriate, **surveyors should be covered by insurance**.
- It is highly recommended that **monitoring in the field is performed by at least two individuals per location at any time**, and/or accompanied by police/security if appropriate. Where appropriate, mixed team (male and female) are laso recommended.
- **Surveyors, or at least one of a field team, should be knowledgeable regarding bird identification, familiar with local area, speaking the local language and procedures to deal with illegalities**, so as to ensure the relevant expertise is present. Strong cooperation between BirdLife Partners and local communities is also highly recommended, not only to make use of local knowledge, but also to encourage the local community take some ownership of the issue and reduce the sense that external entities are imposing unwanted views on the community.
- Surveyors need a **list of what they should and should not do when they encounter illegal activity**. Rules and procedures should be developed to advise on how to handle potential situations in which surveyors' property is damaged (e.g., car tyres and windows, cameras etc.) or in which surveyors are intimidated, provoked or attacked by those carrying out illegal activites.
- In case of *undercover* monitoring (section 4.2), surveyors need **to avoid detection if possible, in order to minimise confrontation** and in order to be able to complete the survey (binoculars can be used to scan areas before approaching). Surveyors need also to have a cover story in case people ask what they are doing in the area.

- If confrontation with those carrying out illegal activities is risky, **consider avoiding monitoring activities at the peak of the illegal activity**, and adjusting the survey design and analysis to take account of the bias this will introduce.
- **All illegal activity should be reported to the authorities following correct procedures** (e.g. providing photographic and video evidence that can be used as evidence if the case is brought to court) regardless of the outcomes, and all surveyors should receive training and information on this. Any vandalism etc. directed at surveyors and their equipment should also be reported to the authorities with appropriate evidence.

Case study: Safe removal of illegal infrastructure for waterbird poaching in Croatia

Ivana Šarić Kapelj (Association BIOM /Birdlife Croatia)

BirdLife Association Biom has in cooperation with government institutions since 2017 removed as much as 22 illegal structures used in waterbird poaching on two locations – the Neretva Delta and Dubrava hydro-accumulation lake. During field research on the river of Neretva, members of Biom detected illegal infrastructure used for poaching, while information about structures at the Dubrava accumulation lake was reported to us by a nature lover, who is also one of our members.

We have cooperated with government institutions, primarily public institutions managing the protected areas, on the removal of those structures. These institutions have also engaged a range of other institutions which participated in the removal as well – the nature protection inspection, fire departments, the police and even the Croatian Mountain Rescue Service.

What was the exact procedure from detecting a structure to its removal? In the field, we first recorded the exact locations of the structures and then photographed them, as well as the evidence of illegal hunting (e.g. used cartridges, lures). This was followed by one of the most important steps – since both sites are protected areas, we contacted the local protected area rangers. They are among the most important stakeholders in combating illegal bird hunting.

After this, the rangers took over. They first checked the legal status of a structure – is it recorded in the game management plan, i.e. is it a legal hunting hide with all the necessary licenses. Unfortunately, all the structures we reported were illegally constructed. The rangers then submitted a report to the State Inspectorate to get approval for the demolition of the structures. An illegally built structure can also be reported to the local authority, i.e. the responsible bylaw enforcement officer who is authorized to order removals of basic structures built illegally.

After this we started the joint removal of the structures. Depending on the position and complexity of the structure, it was necessary to carefully plan the equipment and capacities for its removal. The following equipment was used at the Neretva Delta and Dubrava accumulation lake:

- a motorboat
- dismantling tools (hand saw, chainsaw, hammers, crowbars etc.)
- utility and protective clothing (boots, fishing pants, gloves, helmets, safety glasses etc.).

Apart from the equipment, it was very important to plan the number of people necessary to conduct the removal and to establish if these people have a license to operate a boat, if they have been trained to operate a chainsaw etc. Police protection is desirable in order to prevent potential attacks on the people removing the structure.

It is also necessary to arrange the disposal of the removed structures which have been transported to land. In both locations, this was done by a local utilities company.

And finally, materials from which illegal infrastructures are built can be reused! Thus, on Neretva Delta, Association Biom, together with local children, made bird feeders from the remains of the illegal shooting stands.

3.4. Supporting materials

In order to recruit enough surveyors, monitoring coordinators may consider targeting those members of the public who might be keen to help, but who have limited surveying experience, or even relatively limited birdwatching experience. The survey design needs to be appropriate to the capabilities of the surveyors. For example, some observers may not be confident/competent in identifying birds captured

in a mist-net, but they could instead photograph them for a more experienced observer to assist with identification later. Materials can be produced to facilitate the active participation of less experienced people, reducing errors (e.g. bird misidentification) and bias (e.g. facilitating the participation of more people enables more area to be covered during surveys, increasing accuracy in the results obtained). Some of the materials that could help with this include:

- **Data capture forms** – which should be easy to read and allow for all the required data to be recorded on them easily in the field. Include: surveyor's details (name, address, etc.), date, time and duration of visit, location of visit, weather, areas covered, surveyor's comments and observations.
- **Equipment** – such as telescopes, cameras, video cameras, binoculars and/or sound recording device.
- **Survey protocols** – which would describe the full detail of the methods to be used so that everyone understands what is to be done, and data collection is consistent.
- **Guidelines** to carry in the field – covering in bullet point form what to do and what not to do when illegal activity is encountered.
- **Field guides** – if these are too expensive, modified identification kits illustrating only the species most likely to be encountered can be considered. If appropriate, local and vernacular names can be included to facilitate greater use of resources.
- **Additional information** (in electronic or hard copy format) – such as reports, scientific articles, case studies, so that those who need additional information on monitoring illegal killing of birds can easily access it. Country-specific materials can be also added, such as district maps, road networks, etc.

Case study: Briefing volunteers at the beginning of a camp in Malta

Nick Piludu (BirdLife Malta)

BirdLife Malta (BLM) has been organising monitoring camps in spring (Spring Watch) and autumn (Raptor Camp) since 2007. Every season new participants join the camps in addition to a group of returning camp veterans, and briefing them is a key component of fieldwork. Depending on camp structure, volunteers are briefed in a group or during a one-to-one meeting with the Camp Coordinator.

The briefing consists of the following sections:

- The current situation – the derogations that allow hunting and trapping in Malta, the political climate, and updates on BLM's work on this front.
- The season-specific hunting and trapping regulations – dates for the hunting seasons, hunting hours, permitted species, and restrictions. This is discussed in detail to make sure new volunteers are able to identify illegal behaviour on the field.
- The camp objectives – over the years camp objective included recording wildlife crime, monitoring the migration, hunting effort and enforcement, engaging the public and so on; volunteers are briefed on what is priority and what should not be given particular importance.
- The daily schedule
- The field methods – volunteers are assigned a role (e.g. driver, cameraman, phone user, data collector) during each shift and are briefed on what responsibilities they will have (e.g. the driver is supposed to know how to reach their destination). Volunteers are instructed to make sure phones and cameras are easily reachable in case they are needed (to call the police or record illegalities), and to park the car with the front facing the road in order to be able to leave the area quickly if needed. Volunteers are instructed to check the ground for nails, pieces of glass etc. Volunteers are instructed never to trespass into private property – if they suspect or are told (even if they are clearly been lied to) land is private property, they should not enter. Provocation and confrontation with hunters is absolutely forbidden and volunteers are instructed to leave the area in case of tension. Conversely, interaction with the public is strongly encouraged, and volunteers are instructed on what to say when engaging with them.
- The equipment – volunteers are briefed on using datasheets, important phone numbers, how to use cameras, scopes etc.
- How to react to wildlife crime – volunteers are instructed to record everything with a camera as soon as they witness crime, paying attention to swearing and inappropriate comments that might end up on video. Volunteers are also briefed on when to call the police and when not to, depending on the likelihood of the police being able to intervene. Volunteers are also instructed to contact the Camp Coordinator before contacting the police.
- Finishing the shift – volunteers are instructed to check with the Camp Coordinator before leaving an area, refuel the car on the way back if needed, and to pass on all data and footage to the Camp Assistants. If sufficient footage of crime was recorded, volunteers are instructed to prepare an investigation report that contains information for the police, which will be attached to any footage of illegal behaviour.

Case study: How volunteers are mobilized to support monitoring of the illegal killing of birds in Lebanon

Ghassan Ramadan Jaradi (SPNL/BirdLife Lebanon)

Volunteers of SPNL are selected among young people that have sufficient energy to cover study areas within a short time and with motivation. Students are also another type of volunteers. Some students will work for SPNL to add the experience to their resume when they graduate. Other students get college credit. Since mobilization and motivation are an inside job, SPNL have stimulated these inner mobilization and motivation in young people to collect the necessary data from the field on the illegally killed birds using the following stimulators: feedback, recognition, conferences-seminars-workshops, free food and fun.

Each volunteer has been requested to collect data on regular bases from its village and the immediate surrounding areas. This request is based on their love to birds, their access to the local hunting groups, including their parents and their community knowledge, and their desire to feedback to SPNL and compete with other volunteers from other villages. In return, SPNL provides those who are feeding back with certificates of recognition as an incentive to maintain their motivation at a high level and to mobilize them to perform short and mid-term monitoring of IKB. It is worth mentioning that the collection of information on illegally killed birds within the village is safer for the volunteer, especially for girls, because the risk of getting harmed is higher outside the village for the volunteer due to the possibility of meeting unstable and hostile shooters. However, this doesn't mean that some volunteers are limited in their work to their villages.

In most cases, the volunteers have been asked for information on illegally killed bird species from the shooters themselves. Some others may obtain a permission from the shooters to photograph their shot birds that are hanged on the strings, and sending those photos to the experts at SPNL for identification purposes. This procedure of feeding back and re-feedback constituted an excellent stimulation of the inner mobilization and motivation of volunteers.

In order to maintain volunteer's high motivation level, SPNL organizes conferences, seminars and workshops where staff meets with the volunteers to discuss positive and negative matters, focusing on the importance of volunteers' findings; to eat together as this will go a long way in motivating and encouraging volunteers and to have fun together. The latter is crucial since fun is considered as stress buster, breaking ice between paid staff and volunteers and finally a source of mobilization and motivation.

In addition to the above, SPNL collects data through its local conservation groups established at its IBAs/KBAs/Himas spread in different Lebanese districts. Further, Birdtalk Lebanon which is an email group for birdwatchers is another source of information.

Finally, SPNL partnership with Sayd Magazine which addresses hunters in Lebanon is another resource for information directly from hunters.

All these resources collectively help in providing an overview of the situation of the illegal killing of birds in Lebanon.

Case study: Developing a volunteer network for monitoring quail poaching in Croatia

Ivana Šarić Kapelj (Association Biom/BirdLife Croatia)

Association Biom undertakes monitoring of illegal quail hunting in Croatia since 2017. It is estimated that around 40,000 quails per year fall victim to illegal hunting with electronic tape lures in Croatia. In fact, every year from the beginning of August until the end of October the illegal electronic quail call can be heard at night on numerous farm plots. The sites on which the lures are placed are perceived by quails as safe resting sites, which is why they gather there in large numbers. Instead of five or ten individuals that are shot during a regular legal hunt, poaching with lures results to ten times more birds illegally killed.

In just 28 days of field work conducted from 2017 to 2021, Biom recorded 43 cases of using quail lures where a total of 95 prohibited devices were used. We found lures in all of the seven counties in which we have conducted our research (out of 21 Croatian counties in total).

To broaden our research, but also to raise public awareness of this threat to birds, we decided, as part of the Life Against Bird Crime project, to develop a network of volunteers who monitor how intensively lures are used in the region they live in. This way, the volunteers involved actually become guardians of their region. During this period, as much as 30 highly motivated volunteers joined our fight against poaching. Some of them were employees of public institutions responsible for managing protected areas.

Before we started our work with the volunteers, we had developed a description of the volunteers' position so that potential volunteers would know what to expect if they joined the activity. We had also decided on the locations to be covered by monitoring. We chose to work in two counties in which we had not done any research before, but also another two counties for which we know to be hotspots for quail poaching.

Then we organised a two-day education for the volunteers. On the first day, we presented to them the fieldwork methodology as well as the safety rules. On the second day, the and Biom staff searched for lures in the field. After this, the volunteers started to work on their own – supported by Biom, of course – which included:

- Visiting 5–8 sample plots. The plots were located on main, paved and easily accessible roads.
- Video recording on locations where sounds from lures could be heard,
- Notifying the police about poaching activities if the volunteers felt ready to do so (directly through the emergency number 112 or anonymously via an application),
- Filling out a short field report.

As a token of appreciation, the volunteers were given a gift set, certificates of recognition for their contribution to the research and further education about birds. Another big thank you to all of our dedicated and enthusiastic volunteers. Here are some impressions of the activity by one of them:

"*I signed up for monitoring quail poaching to help protecting the quail population. Poaching does not comply with the principles of true hunters because in this way too many quails are shot and their populations become endangered. Visiting hunting grounds by night was an interesting and unique experience, there's a calm atmosphere at that time interrupted only by the lures*."

4. Collecting data on illegal killing and taking of birds

In general, there is **no single approach or method for monitoring illegal killing that can be applied in all countries**. Each country is a unique and specific case and should adapt as appropriate the methods and approaches described below. However, consistency over time and between areas within a single scheme is essential. It is the role of scheme coordinators to pick the methods that best fit their circumstances, conditions and needs. A common and very sensible approach is to build on estabished methods because their strengths and weakness are well known (Voříšek *et al.* 2008).

Below we describe **methods to monitor the main types of illegal activities, which can be adapted to address other types of illegal activities as appropriate**. As far as possible, monitoring of illegal killing should generate species by species data, or at least ancillary data that be used to produce these. The same protocol should be adopted by all observers.

Note that, although it may seem paradoxical, **enforcement activities (such as alerting authorities, filming illegal activity, removing birds from nets, closing down nets etc.) should preferably not take place in monitoring squares** because 1) this will take up time that observers should be spending monitoring illegal activities and 2) enforcement activity may affect the likelihood of detecting future illegal activity in that location (which could lead to recording a declining trend in illegal activity when in fact the indiviuduals killing birds illegally have just moved location). It is important to brief surveyors on what they should and should not do if they find live birds in traps. Many surveyors will feel a strong desire to release such birds or destroy/disable traps. Whether this is advisable or not will depend upon the approach of the organisation, but as noted above there are good reasons why combining monitoring and enforcement may not be advisable.

Also note, that an important difference between monitoring illegal activities and monitoring bird population abundance is that the **individuals carrying out illegal activities are often keen not to be detected, identified or recognised, and may be antagonistic or aggressive to surveyors**. Hence monitoring of illegal killing needs to be tailored in accordance with the local situation.

4.1. Direct or indirect measures?

A crucial question that should be answered prior to setting up monitoring of illegal killing of birds is what type of evidence (data) on illegal activity are to be collected (see Chapter 2): *direct evidence* (e.g. numbers/species of birds illegally killed, poisoned or trapped; identification of poachers), or *indirect evidence* (e.g. signs of illegal activity such as shots, cartridges, traps, etc.). Collecting *direct evidence* of illegal activities implies that monitoring should be carried out at the same time as illegal activity is occurring (or at least close enough to be able to collect data with sufficient quality), which in turns increases the chance for direct encounters with poachers and raises safety issues. Collecting

indirect evidence does not require synchronisation of monitoring with illegal activities, and thus encounters with poachers are less likely.

4.2. 'Visible' or 'undercover' monitoring

In practice, depending on whether *direct* or *indirect evidence* on illegal killing activities is collected, it is necessary to decide between the *visible* or *undercover implementation of monitoring*.

***Visible monitoring* means that the monitoring scheme, place and date of its implementation on the ground are publicly and widely announced**. Monitoring primarily takes place during the day and the persons involved are visible to others (including local people and poachers). The advantage of this approach is that surveyors' presence in the field can be used for raising awareness and it can discourage illegal activities during monitoring. A disadvantage is that poachers, informed by surveyors' arrival, can hide evidence of crimes, and thus monitoring could under-estimate the frequency of illegal activities. *Visible monitoring* is more applicable for the collection of *indirect evidence* of illegal activities (e.g. shots heard, etc.). It is advisable that this type of monitoring is carried out together with interested stakeholders (game wardens, protected area park rangers, hunting associations etc.) for educational purposes.

***Undercover monitoring* should generally be applied when *direct evidence* of illegal killing is collected**, either to prove the crime, identify poachers or to calibrate the data collected indirectly (e.g. how many shots on average lead to a bird being killed). By definition, *undercover* means collecting information in secret that could eventually lead to the prosecution and conviction of those engaged in illegal activities. The advantage of this type of monitoring is that it can lead to better quality evidence on illegal killing of birds, including identification of bird criminals. The disadvantage is that it may be more risky from the safety point of view. Thus, this type of monitoring should be carried out only by trained individuals.

In the worst areas for illegal killing, it would be **advisable to use both monitoring approaches, often by different monitoring teams**.

4.3. Monitoring illegal shooting of birds

4.3.1. Overarching considerations

Several traits inherent to illegal shooting make this activity very hard to assess and monitor. The shooting generally happens in a small time window as it is strongly linked to the peak migration phenology of the target species, and this varies between years mainly due to prevailing weather conditions. It may be highly localised and occur only when the conditions are right and the opportunity arises. Therefore, discovering active poachers may be a matter of chance. Absence of this practice on

the other hand is almost impossible to verify. Since it is illegal, no bag records are kept by governmental or hunting organizations and in most cases the offenders are not helpful in providing data either.

Illegal shooting may occur in two different contexts: occurring in a country either where hunting is legal or banned. This impacts how illegal shooting can be monitored, because indirect data collection (particularly counting shots) is more challenging if it is difficult or not possible to discriminate between legally or illegally fired shots. Illegal shooting occurs if the targeted species is protected, or illegally shot during the closed hunting season, or hunted with illegal weapons or using illegal methods (e.g. lures, decoys), or hunted inside protected areas (i.e. locations where such activities are forbidden), or outside the authorised periods (e.g. during the night), or when bag limits are exceeded, or when it is done by unauthorised persons (without an official licence or permit). Often several of these forms of illegal shooting occur simulataneously.

Illegal shooting may often increase during legal hunting periods, especially if there is a perception of weak law enforcement (e.g. bag limits may be exceeded, or protected species killed alongside huntable species). Illegal shooting may also concentrate in certain areas, where the geography and topography (e.g. large water bodies, high mountains) create a so called “migration bottleneck”, where migrants concentrate through a narrow corridor to avoid crossing these barriers. For example, migratory soaring birds are particularly vulnerable on migration to illegal shooting because they are large and relatively slow flying, and therefore obvious and easy targets. The daily passage of thousands of birds at single sites at predictable times provides poachers with an abundant and seemingly endless source of targets. Poachers targeting such species are likely to concentrate in these areas.

4.3.2. Recommended methods

Monitoring using line transects (along the dikes or roads) may be the most appropriate method to monitor illegal shooting. On the mountainous or hilly areas, illegal shooting monitoring could also be done from vantage points, using a point count method, covering a circle which may be up to several kilometres wide (recommend for migration bottleneck).

Once the sampling design has been determined (see **Chapter 2**), the number of sampling units covered and the frequency of visits are decided according to the period of presence of targeted species and organiser capacity, e.g. daily over a short period (3-4 weeks) for migrating birds, weekly over a long period (3-4 months) for wintering birds. **Recording indirect evidence, such as the number of poachers seen, shots heard, cartridges/decoys/carcasses found, may be easier than recording direct evidence.** These parameters can be used to measure the trend in illegal shooting activity over time. It is however necessary to determine which are the best proxies for actual number of birds killed, as different proxies may show different trends. To estimate the number of individuals illegally shot and the species involved, proxies need to be calibrated and the calibration checked regularly. For example, the number

of shots heard can be calibrated to estimate the number of individuals illegally shot using the shooting success of poachers. Point counts can be used to record by eye the number of birds shot and falling out of the sky (this requires highly qualified surveyors with good identification skills) to measure the shooting success.

In a country where hunting is banned, customs authorities may be able to provide the total number of cartridges imported in the country. By knowing the shooting success, the number of birds shot can be estimated. For example in Lebanon, 40 million cartridges are imported each year and 7 million are estimated to be locally made, 18 million of these are re-exported to neighbouring countries, and 19.5 million are estimated to be used for hunting (with the remainder used for target practice). The shooting success is estimated to one per 7 cartridges (per SPNL/BirdLife Lebanon), so it is estimated that 2.79 million birds are shot per year.

In cooperation with hunter associations and/or authorities, it is possible that reliable data on the illegal shooting of protected/non-huntable species may be obtained from monitoring hunting bags. This may be most effective when groups hunt together and bring their catch at the end of the hunting session to a place where independent checks can be carried out (e.g. hunting lodges). All species killed and their numbers should be recorded, as well as number of hunters engaged (from which hunting pressure or effectiveness can be calculated), number of dogs used (higher number of dogs increases the likelihood of finding the shot bird in the field), etc. If there is a likelihood that hunters would discard illegally shot birds, further field searches could be carried out immediately after the hunting takes place.

Shooting hides in Ulcinj salinas (protected area where hunting is banned), Montenegro © CZIP

Case study: Use of Acoustic Recording Units to detect gunshots in Greece

Nadia Sideri-Manoka (Hellenic Ornithological Society/Birdlife Greece)

Christos Astaras (Forest Research Institute, ELGO-DIMITRA)

Using passive acoustic sensors has several advantages that made us choose them over volunteers to monitor illegal gun hunting in Greece. To begin with, passive acoustic monitoring (PAM) gives us the possibility to record the total number of gunshots over an entire season instead of having few days as a sample. Moreover, climate conditions are not affecting sensors, which can record around the clock rain or shine. On the contrary, weather is a serious obstacle for volunteers. In addition, PAM data analysis is transparent. The results are available for review post-hoc by all interested parties. Also, acoustic sensors require little effort during the data collection stage. Once installed, researchers can dedicate their time on other project activities.

In establishing our passive acoustic monitoring grid, we used (semi-)autonomous acoustic recording units (ARUs), hence referred simply as "acoustic sensors". In our case, we bought ten SWIFT sensors (Cornell University, rugged version) with extra battery pack (500€/sensor including S&H and import tax). The sensors can record continuously but can also be scheduled to record certain hours per day. In our case, we programmed them to record from 6 am till 9 pm, as pilot analysis in 2019 showed that outside this time window there was no gun hunting in the study areas. Reducing the recording period to 15 hours meant that the sensors recorded for longer period given the available batteries, and that the analysis of the data was faster. The sensors were deployed outside the legal hunting season, hence all shots detected indicate illegal hunting (poaching). The data were stored in 128 Gb SD cards that can record 24/7 for ca. three months (41 €/card).

Generally, most acoustic sensors available in the market can record continuously for 1-4 weeks. The SWIFT sensor however, when operated with the 12 D battery capacity battery packs and good quality alkaline batteries (25€/set of 12 batteries), can record continuously for up to 3 months (longer when recording only 15 hours per day).

For the analysis we used the acoustic software program Raven Pro by Cornell University (400€/year for non-profit organizations). For short deployment and small acoustic grids, –detection of sounds of interest can - in principle - be done by manually reviewing the data (hand browsing). For even moderate volume of data though, it is in essence impractical. Therefore, we scanned the data with purpose designed detection algorithms, which flag sections of the data with putative gunshots. The algorithm was developed by Cornell University's Bioacoustics Research Program and is free to download and use. We used version DTD1.5.4 as in 2019 and 2020, with the same threshold value of 0.4. sound clips "flagged" by the detector need to be reviewed (visually their spectrogram and/or acoustically) so as to remove false positive from true positive detections. In addition, no detection algorithm is perfect (i.e. 100% recall rate). There will be some false negatives - gunshots that occurred but were not detected by the algorithms. For this reason, we manually examine a small but representative sample of the data and estimate what proportion of the true (manually counted gunshots) were actually detected by the algorithm. This step is important, as we adjust the final number of detected gunshots by those estimated to have been missed. For instance, if we have determined that 75% of gunshots are correctly recalled (found) by an algorithm, then our final gunshot number should be multiplied by 1.33.

The estimated range that a sensor can pick up from is -more or less- one kilometer, but it also depends on the geomorphology of the area, the wind patterns, and other parameters. Finally, we end up with Excel files that show the location (sensor), date and time of each gunshot. This can be used to estimate the peak of the illegal hunting period, the daily patterns and to compare the poaching pressure across sites and/or years. One of the challenges of PAM is to convert gunshots in animals killed or injured. To achieve this, we used a conservative educated guess based on field observations, discussions with locals and kill rates reported for similar species in international bibliography.

Case study: Monitoring illegal take in hunting bags in Croatia

Tibor Miskuska (Croatian Society for Bird and Nature protection)

Bird hunting is a quite common activity in Croatia. Mikuška *et al.* (2017) have been inspected hunting bags during five hunting seasons on two fishponds in the Pannonian Croatia. Waterfowl hunting was taking place from September until January during both two weekend mornings, with more time spent hunting during the Saturday than the Sunday. Hunting took place from sunrise until mid-day when hunters returned to their lodges. Shot birds were collected by the employees of the hunting grounds and brought to the place where the examiniation of shot birds was undertaken. Numbers by species and sex were recorded. During the five hunting seasons, 5,879 individuals of 23 bird species have been examined, of which 14 are strictly protected according to the Nature Protection Act (Table 4.1).

Table 1. *Species present in hunting bags during five hunting seasons, 2008-2012.*

Species	2008	2009	2010	2011	2012	Total	Protection status in Croatia	Croatian Hunting Law
Common Teal	210	817	800	590	340	2,757	Protected	Game
Mallard	160	564	273	441	228	1,666	Protected	Game
Eurasian Wigeon	25	104	134	94	20	377	Strictly protected	
Ferruginous Duck	3	150	76	32	1	262	Strictly protected	
Common coot	16	25	148	29	6	224	Protected	Game
Common Pochard	15	61	56	22	16	170	Protected	Game
Gadwall	41	33	46	20	7	147	Strictly protected	
Nothern Shoveler	5	29	31	18	10	93	Strictly protected	
Garganay	4	18	19	20	17	78	Protected	Game
Nothern Pintail	5	18	6	17	2	48	Strictly protected	
Tufted Duck	5	7	9	1	1	23	Protected	Game
Greylag goose		10	4			14	Strictly protected	
Northern Lapwing		3				3	Strictly protected	
Greater White-fronted Goose		2				2	Protected	Game
Common Goldeneye			2			2	Strictly protected	
Common Snipe	1			1		2	Protected	Game
Ruff	2					2	Strictly protected	
Great Cormorant	1					1	Not protected	
Red-crested Pochard		1				1	Strictly protected	
Smew		1				1	Strictly protected	
Dunlin		1				1	Strictly protected	
Common Woodpigeon				1		1	Protected	Game
Spotted Redshank					1	1	Strictly protected	
Hybrids		3				3		
Total	**493**	**1,847**	**1,604**	**1,287**	**649**	**5,879**		

Case study: Monitoring illegal shooting during migration count in France

Gwenael Quaintenne (LPO/BirdLife France)

Spring migration of birds is monitored at the Escrinet pass (Ardèches) from mid-February to mid-April since 1984, with interruption for 9 years (1991 and from 1994 to 2001) because of threat pronounced by poachers (illegal shooting activities at this location was very common during this period).

Since 2002, alongside the migration monitoring protocol, acts of poaching has been recorded: number of shots heard, targeted species, number of birds killed or wounded. Common Woodpigeon was the most targeted species by poachers (Table 4.2). This species is legally huntable in France from September to February (dates varying every year and according to regions) but was illegally shot at the Escrinet pass after the legal hunting season in February and March. Since 2009 illegal shooting has stopped at this site.

Table 1. *Synthesis of illegal shooting of Common Woodpigeon recorded in March 2003 at Escrinet pass (from Curial et al. 2003)*

Date	Number of shots heard	Number of birds killed
3 March	281	9
4 March	283	0
5 March	128	0
6 March	21	1
7 March	590	44
8 March	346	34
9 March	580	37
10 March	245	19
11 March	10	0
12 March	49	5
13 March	567	38
14 March	456	30
15 March	154	4
16 March	58	5
17 March	92	15
18 March	651	32
19 March	126	5
20 March	-	-
21 March	-	-
22 March	103	-
23 March	5	-
24 March	-	-
25 March	-	-
26 March	-	-
29 March	-	-
30 March	-	-
31 March	54	2

Using these data from monitoring, it is possible to calculate the % of birds harvested to the total number migrating

Harvest = (no. birds killed + no. birds wounded)/ no. birds migrating

In March 2003, the mean harvest % was 7.0% at the Escrinet pass, ranging from 0% to 40.5% according to weather conditions (wind speed and direction influencing harvest %).

All the reports of migration counts at the Escrinet are available at: http://www.migraction.net/index.php?m_id=1522&frmSite=31&mp_item_per_page=10&mp_current_page=1

4.4. Monitoring illegal trapping of birds

4.4.1. Overarching considerations

Illegal trapping covers a wide variety of activities (see Appendix), **and a similarly broad range of motivations drives the activities**. Some trapping methods catch individual birds, and the traps then need to be re-set, while others can catch many hundreds of birds simultaneously. Some methods are intended to catch specific species, while others are indiscriminate. Some trapping methods relies for its success in setting the traps in the right habitat at the right time to coincide with the target species, while others increase the capture rate by modifying the surrounding habitat (e.g. irrigating vegetation to create lush habitat to draw in birds to be trapped) or using taped calls or other lures. Some trapping capitalises on the geographical route and physiological state of migrating birds by, for example, focusing trapping on geographical areas where the birds concentrate in numbers, or capitalising on their exhausted state after making a long sea crossing.

The impact of illegal trapping may be chiefly on the target species, on many species if the method is indiscriminate, or on ancillary species if they are used as lures, for feeding to individual raptors used as lures or for feeding trapped raptors post-capture. Trapping may not have the same impact across a species population, as younger, less experienced birds may be more likely to be trapped and there may be differences in response to playback or lures by males and females. In some forms of trapping the target is killed during trapping, whereas in others the target is kept alive (e.g. for falconry, food markets or for the cagebird trade). In many kinds of trapping the target is injured, and then dies in the trap or is killed by the trapper on collection.

Trapping of various kinds has a long tradition in many countries and trappers may associate it with their cultural identity. In some countries, the legality of trapping, its scale, the methods employed, the groups of people involved or the motivations for trapping have changed considerably over time. In some countries, what was originally a means of subsistence and an important source of protein for local people with few alternatives has become a highly lucrative commercial enterprise with a relatively small number of wealthy beneficiaries who may have considerable political influence and power over, or alliances, with local law enforcers.

4.4.2. Recommended methods

A variety of methods may be required to monitor the wide variety of trap types in use (see Appendix), but **trap types can be split into those for which *visible evidence remains in place even when trapping is inactive* (e.g. mist-net rides, permanent pole bases for nets) and those that leave *no visible evidence when they are not in use***. For example, individuals (often children) trapping birds at oases in Tunisia may leave no trace of the trapping when they are not present, however they are generally happy to talk about their activities, so interviewing may be a suitable method for monitoring this activity (section 4.7). When lime-sticks are used, there is little proxy evidence of this traping activity

taking place unless the limesticks are detected *in situ,* apart from detecting evidence of trees pruned to maximise the deployment of lime-sticks.

Mist-netting – a suitable proxy for the number of birds trapped might include length of net (or area, if net height varies) per grid square (searched by a standardised number of people for a set length of time). Another alternative for monitoring mist-netting is to use transects of set length from randomly selected starting points. Suitable proxies could be derived from counting the number of times a transect line intersects a mist-net, or measuring the area of mist-net within a fixed distance (e.g. 10m) either side of the transect line. These kinds of data can be calibrated to estimate the number of birds captured by measuring the total area of every n^{th} mist-net intersected, and recording data on species composition of catch, and average capture success per unit area of net/unit of time. The latter can be obtained periodically through the season either by directly accompanying trappers if they are cooperative or by setting test nets if not. In calibrating the proxies, the length of trapping season needs to be estimated, as well as the mean number of hours per week that nets are set, and the seasonal changes in size and composition of the catch.

Trap types where evidence remains – suitable proxies would be the number of traps (or trappers) within a randomly selected grid square or intersected by a transect of set length or within a strip transect of n metres either side of the transect line. To calibrate, the average success rate per trap per unit time and average species composition of the catch at different points in the season would need to be known, as well as length of trapping season, the mean number of hours traps are set for and how often they are emptied and re-set.

Trap types where evidence does not remain – one could either base proxies on active traps encountered as above and/or use interview/questionnaire techniques to try to ascertain the average number of trappers operating within the area and average capture success/species composition (section 4.7). Knowledge of the spatial extent of the main trapping areas would also be important.

Illegal use of Stone crush trap in Dalmatia, Croatia © BIOM

Illegal use of Trammel nets in Egypt © NCE

Case study: Monitoring illegal mist-nets in Cyprus

Tassos Shialis (BirdLife Cyprus)

Survey area and sampling strategy

Trapping surveillance occurs in two areas identified as the worst for illegal trapping in Cyprus; Famagusta/Eastern Larnaca and Ayios Theodoros-Maroni area. The total survey area is 406 km^2 and each grid square is classified as either a 'possible bird trapping area' or 'unlikely bird trapping area', based solely on the presence or absence of vegetation suitable for setting lime-sticks or mist-nets. Monitoring is undertaken in the 'possible' squares only (301 squares). Each autumn (since 2002) and spring (since 2004), a sample of squares are surveyed. The random sample is stratified to ensure representative coverage of areas under the jurisdiction of the Republic of Cyprus and British Sovereign Base Area, as well as "joint" squares where the two jurisdictions meet.

Monitoring is undertaken by a two-man team that systematically searches for evidence of illegal trapping activity in the survey squares. The time taken to survey each square is recorded, as are weather patterns.

For safety reasons, the surveyors do not go out in the field at dawn, which is the main period of trapping activity, but carry out surveys between 09:00 and 17:00. Each sample square is surveyed only once each season.

Mist-netting activity monitoring

The survey team carries out a thorough search of all habitat patches that are suitable for the setting of mist-nets (i.e. all areas with bushes and/or trees) within each survey square. The surveyors record all direct and indirect evidence of mist-net and tape-lure use and of net-ride preparation and use (e.g. cleared corridors within vegetation for putting up nets, presence of pole bases) and calculate the total length of active net rides recorded within the survey area. The codes used for the various categories of mist-netting activity and tape-lure use are given in Table 4.2, as are the codes used for recording the type of habitat where trapping activity is detected. Net rides can be missed when set within fenced compounds to which surveyor access is not possible, however trapping activity can still be monitored in these compounds. The survey team make every effort to check for trapping activity within enclosed (fenced-off) areas, even though they never enter such areas. The surveyors note cases where they come across enclosed (fenced) areas that they cannot see into at all or cannot see well enough to survey fully. All the active trapping sites are reported to the competent authorities with GPS locations to take further action.

Table 1. *Survey codes used for the field*

Net code	Habitat code	Tape-lure code
O – old ride	A – acacia	P – tape-lure present, playing
P – ride recently prepared[1]	C – citrus	L – loudspeakers present
ANN – active no nets present[2]	E – eucalyptus	Y – tape-lure present, not playing
AUN – active unset net present[3]	F – fig	U – unknown
ASN – active set net present[4]	J – mulberry	W – electrical wires associated with tape-lures
IUN – inactive unset net present	O – olive	B – car battery present
	M – maquis	
	P – pomegranate	
	K – carob	
	Cy – cypress	
	L – lentisk	
	S – syrian plum	

[1] A net ride that is recently prepared and ready to be used (including vegetation clearing from ground, trimming of vegetation along net ride, laying of carpets).

[2] A net ride that from the evidence found e.g. bird feathers, blood stains, thrown pebbles, indicates that illegal activity was taking place the previous night / morning but no net **is present**. When recording a ride as 'active no nets' (ANN) instead of a 'prepared' (P) one, the survey team makes a note explaining their reasoning for doing so, in particular by cataloguing the evidence found that led them to make this classification.

[3] A net ride where the trapper has left the mist-net on the poles but it is furled i.e. the mist-net is not stretched up for catching birds but lowered down (or the net is placed e.g. under a tree).

[4] A net ride where the trapper has left the mist-net set on the poles and it is ready for catching birds.

4.5. Monitoring illegal poisoning of birds

4.5.1. Overarching considerations

Several aspects of illegal killing of birds by poisoning make it hard to assess trends and to determine the people responsible, in particular because it is extremely difficult to record the act of a person putting out poison. Several drivers for the use of poisoned baits have been identified. Birds may be targeted if they are seen as predators by racing-pigeon enthusiasts, game-keepers, livestock farmers, poultry farmers and fishermen. Birds are often victims of poisoning targeted at mammal predators by farmers to protect lifestock, hunters to protect game, and for pest control. Poison is often used to control rodents and other pests to protect crops, including orchards and vineyards (where even drinking water is poisoned). Feral dogs and cats are targeted with poisoned bait and birds can also be a victim of this. Conflicts between hunters (and between them and shepherds and other farmers) may also drive poisoning incidents.

Whenever cases of poisoning occur, a s**earch should be made of the following sources of information to find out the context**:

- **Government sources**: information on autopsies of wild animals where poisoning was indicated as the cause of death; information on the customs of poison use in certain areas; review of reports of alleged offences and poaching reports. Detection of traps, snares, and protected species (like raptors with gunshot wounds) might all be clues to the possible use of poison in the area.
- **Veterinarians**: veterinary clinics may have knowledge of the illegal use of poison and also of the pathology that might indicate the ingestion of poison in domestic animals. They will typically be aware of the importance of communicating to the authorities any case of the use of poison is suspected.
- **Animal owners**: e.g. if pet animals have been poisoned.
- **Local residents**: particularly those living near to hunting grounds, woodland and scrubland, etc.
- **NGOs and other organisations working to protect the environment**, especially mammals and birds. This includes hunting and farming organisations.
- **Internet**: specialist websites and forums.

4.5.2. Recommended methods

Surveying this activity is possible using surveillance patrolling in the worst areas, especially in known poisoning hotspots, during the period of targeted bird presence. Once the sampling design is decided (section 2.5), the number of sampling units to be covered and the frequency of patrols are decided according to the period of presence of the targeted bird species and organiser capacity, e.g. coverage of each sampling unit surveyed once per year. In a standard day, surveyors are present in one sampling

unit and record all the direct and indirect evidence of illegal poisoning activity, such as the number of poison baits, number of carcasses or remains found, identity of the species targeted etc.

Owing to the difficulty of finding poisoned birds/bait in the field, using trained dogs may be effective (e.g. to look for more baits when a case is detected). For example in one location in Hungary during a monitoring protocol (4 hours), a ranger found five poisoned Western Marsh-harrier and three poisoned eggs after the report of a local farmer. In the consecutive days the trained dog-unit (one dog and one ranger) surveyed the same area two times and it found further 13 poisoned Western Marsh-harrier, one Eurasian Buzzard, two Saker Falcons (latters digged underground!) and 13 poisoned eggs, which remained unnoticed by the traditional human survey.

Indirect information may also be very useful for monitoring illegal poisoning. Several sources can be used (see **section 4.7 and 4.8**) including:

- **Leaflets to highlight the issue in known poisoning hotspots** and promote reporting e.g. via a hotline number, website, officials
- **Intelligence of well-informed people** living in a community linked to drivers of poisoning
- **Rehabilitation centres** who may have knowledge on fatal dose levels for different poisons.
- **Satellite tracking** of birds of prey
- **Censuses of target species** to detect hotspots. For instance, in some countries, Common Buzzards are a common target for poisoning. Information on the age-structure of the population, and genetic monitoring may help in monitoring survival.
- **Customs and enforcement authorities** who control the import, export and possession of poisons like carbofuran.

Poisoned Spanish Imperial Eagle © SEO

Case study: Surveilling the illegal use of poison in the countryside in Spain

David de la Bodega (SEO/BirdLife Spain)

Illegal poisoning is undoubtedly one of the main threats to biodiversity in Spain. From 2005 to 2010, 4,395 specimens of various species killed by poisoned-bait were collected and analysed. Bearing in mind that only 7% to 10% of poisoned animals are everfound (WWF/Adena 2008), this means we could talk about 45,000 animals killed by poison in a period of only five years. This staggering figure, plus the fact that many of the species involved are highly threatened (297 Red Kites, 133 Cinereous Vultures, 30 Spanish Imperial Eagles or 13 Bearded Vultures were found poisoned between 2005-2010), shows the size of the threat posed by this activity to the Spanish biodiversity.

With the aim to tackle this situation, a national strategy against illegal use of poison baits in environment in Spain was approved in 2004. It has an ambitious objective: to halt illegal poisoning by means of three targets: increasing the knowledge and information on this problem, developing prevention and dissuasion techniques, and increasing efforts to prosecute crimes. The action plan has been developed and four procedural protocols and measures have been drawn up, dealing with surveillance and control, the collection of samples involving the presumed use of poison, toxicological analysis of these samples and the legal action to be taken in each case to boost efficiency in the fight against poison (de la Bodega Zugasti 2013):

Procedural protocol for law enforcement officials in charge of surveillance and preventive action against use of poison (Annex I of the action plan) recommend surveillance (inspection visit) of any property with a previous record of poisoning. This procedural protocol also recommends to collect all fauna carcasses or their remains found in the countryside and to take them to the wildlife rescue centre, government office or assigned laboratory, where the necropsy will be carried out to find out the actual cause of death and report same.

For cases with clear evidence of poison use, the following actions are recommended to be carried:

- Presence will be stepped up in the area concerned, with collection of vestiges and information outside the normal working hours of the law enforcement officials and preferably without uniform to avoid alerting the poisoner.
- Monitoring of "canary-in-the-mine" species like dogs and cats, scavenging birds, foxes, crows, etc, will be stepped up to detect any decreases in their numbers.
- A closer check will be kept of applications for restocking with hunting species, monitoring same.
- Suspect persons (managers, wardens, etc.), will also be under surveillance and followed.
- If any poisoned carcass/bait has come to light, attempts will then be made to work out the poisoner's modus operandi since they tend to repeat the same behaviour pattern and method year after year.
- Bait will be looked for in areas frequented by animals, zones close to water, fauna passageways, warrens, etc.
- A search will be made for any landmarks set up by the poisoner to find the bait and check whether it has been predated. These usually take the form of cairns, dry branches, thread or string tied to nearby branches or any other sign betraying the spot. Evidence about the person who placed the poison will also be sought, such as footprints, tyre marks, cigarette butts, etc.

Related with the mentioned protocol, police action proved to be highly effective and strongly recommended. For instance, in Andalucia, before the Regional Action Plan againts poisoning was implemented, investigators managed to solve cases only when the offender was busted in fraganti. Conversely today, 82% of all convictions were obtained by means of forensic and crime scene investigation methods some of them even solved and closed several years after the incident took place in the field. The use of modern techniques like fingerprints, ADN and other tools from police investigation procedures were applied to this particular field of wildlife ciminalistics and forensics. Motivation is relevant and essential to encourage the agents involved in the investigation and prosecution of poison and must be addressed correspondingly by specialized trainers. Other procedural protocols are also available in the action plan: law enforcement for officials in charge of collecting presumably poisoned fauna or bait and the preliminary investigation (Annex II), general legal protocol for administrative action (Annex III) and dealing with cases of poisoning in wildlife rescue centres and toxicology laboratories (Annex IV).

Case study: Employing a trained dog for gathering data on illegal poisoning in Hungary

Márton Horváth (MME/BirdLife Hungary)

In the framework of a LIFE+ project for conserving Eastern Imperial Eagle (http://imperialeagle.hu/), an anti-poisoning dog unit was formed in 2013 in Hungary, as this approach has already proven its effiency in Spain and Italy. The dog was trained during a 4-month training to check for carcasses and chemicals that are most frequently used to prepare poisoned baits the most frequently used (costs in Hungary for a pre-trained German shepherd dog was about 1,200 euros and for the training was around 4,000 euros).

The unit is now used for regular monitoring of 20 Special Protected Areas (SPAs, 3 days a week), but also as a quick reaction unit in case of poisoning cases reported by the members of the National Anti-poisoning Working Group, other stakeholders (hunters, farmers) or the general public. The dog finds buried carcasses and roams over longer distances than human surveyors, as shown in Figure 4.1.

The dog unit executed 265 field surveys in Hungarian SPAs and poisoning scenes in two years, meanwhile the leader walked more than 1000 km and the dog several times more. All together 1,500 carcasses and poisoned baits were found during the surveys, of which 103 were proved to be linked with bird crime cases and it was suspected for further 34 findings.

The dog can also be used for other monitoring purposes (remains under electric powerlines or windfarms, finding feathers for genetic monitoring, etc.) and also to help the investigation of other types of wildlife crime cases (i.e. finding the shooting location of an elsewhere found dead wolf).

Besides the clear technical efficiency of the dog unit, a working dog can be trained such way that it could remain friendly with people as well (like "Falco" dog of MME), and in this case such dogs can be the "embassadors" of bird conservations, because dogs are very popular and can be used effectively to increase public awareness in the frame of open events (e.g. bird festivals) or through the media.

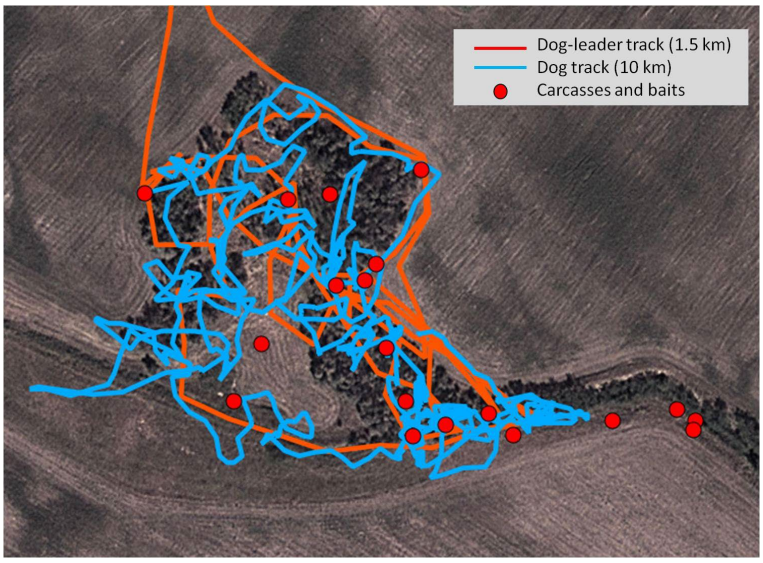

Figure 1. *Examples of monitoring tracklog and location of carcesses and baits found*

4.6. Monitoring the illegal bird market trade

4.6.1. Overarching considerations

It may sometimes be easier to monitor end users rather than individuals taking birds in the field, and it is worth considering where in the supply chain it is most efficient and effective to concentrate effort. For example, in monitoring illegal trapping for the cage bird trade, one could focus effort on monitoring trapping in the field, but monitoring the internet for people keeping, breeding, buying and selling illegal species as cage birds could also be informative, as could surveys of bird markets.

Wildlife trade is any sale or exchange of wild animal or plant resources by people. This can involve live animals or a diverse range of products used by people – including skins, medicinal ingredients and food products. Most wildlife trade probably takes place within national borders, but there is a large volume of trade in wildlife internationally. In some Mediterranean countries, mainly in North Africa and Middle East, virtually all towns and cities have bird markets. Most of the bird species in these markets are traded as pets, while a few species are traded for food, and to a far lesser extent, for medicinal and folk magic purposes. The scale of the trade can also be huge, e.g. in South-East and Central Europe, it is estimated that hundreds of thousands of birds are illegally shot and exported every year and seized birds are estimated to be worth EUR 2-3 million per year (TRAFFIC 2008); the industry as a whole was estimated to be worth around EUR 10 million per year in 2008 (TRAFFIC 2008).

Precise data on the wildlife trade, e.g. the number of individuals and species involved, and the drivers behind such activity can be collected from bird market surveys. The number of individuals counted is typically a low proportion of the total numbers taken from the wild, owing to mortality rates in the supply chain. One preliminary estimate is that for each wild animal traded alive, three to ten others may have died (Regueira & Bernard 2012).

Illegal trade of birds in the street in Morocco © GREPOM

4.6.2. Recommended methods

As for other types of monitoring illegal activities, the choice of sites to monitor should be based on previous studies and stakeholder information. Once sites (e.g. markets) have been chosen, numbers of visits and intervals between them should be decided, as well as whether to focus on the people who bring the animals to sell to the traders in the market, the traders themselves or the customers. Note that in some markets, there are middlemen who buy animals to sell them later at higher prices in other cities.

To collect data, two different strategies are possible: **1) surveyors act as potential buyers, without arousing any suspicion from sellers**, or **2) surveyors are open about their role, and are known in the**

bird market (this can be the only way to gain access to the more clandestine trade and receive accurate data from the market even when not present in person). In both cases, surveyors should be people known and trusted by monitoring coordinators. No wildlife should be bought so as not to fuel the trade, and only the first offered prices should be recorded to avoid showing too much interest.

In each market, surveyors should observe whether there is direct or disguised display of wild birds for trade. In each visit, time of arrival and departure, bird species and number displayed, their sex, age and physical condition, origin, destination, price, and the number and location of traders should be recorded. Pictures or movies with hidden devices should be also recorded if possible, as images can be later analysed for checking the accuracy of counting and bird identification. This kind of monitoring should aim at identifying the number of individuals and identify of species in trade at each market.

If traders feel free to discuss their trade, extra information from vendors and customers can be also gathered through informal interviews about the processes of the trade (see **section 4.7**). Building a relationship with traders in the bird markets could be a key element of the survey's success. Dealers could offer valuable information through informal interviews and conversations during repeated visits.

Case study: Monitoring a bird market in Jordan

Ehab Eid (RSCN/BirdLife Jordan & Royal Marine Conservation Society of Jordan)

Jordan is considered a passage for smuggling of animals to countries in the Arabian Peninsula and elsewhere in the Middle East. Trade is practiced through licensed animal pet shops and in streets, especially on Fridays, where vendors, hobbyists and hunters sell their animals in cages. The Eid *et al.* (2011) study was the first of its kind from Jordan and aimed at identifying the magnitude of the illegal animal trade at the Local Market in Amman, Jordan, in terms of species that are traded (including those listed on CITES Appendices) and the numbers of individuals.

A total of 10 visits to 'Local Market' were carried out between July and November 2009. These visits were conducted by a group of 3-4 researchers from the RSCN and BirdLife International. Visits involved an early inspection of the market, in order to identify all species present, the number of individuals of each species, and their prices. The origins of these animals were obtained when applicable.

Birds constituted the majority of animals in trade, involving 16,942 specimens of 54 species from 19 families. Prices ranged from as low as US$1.50 for Common Hoopoe and White-eared Bulbul to US$450 for Alexandrine Parakeet and US$525 for Solomons Corella. Local and cage-bred birds were the most common species traded (97% of specimens). Local birds were either captured from Jordan or Syria, and included Common Kestrel, Long-legged Buzzard and Temminck's Lark. Common Pheasant, Chukar and Ring Dove were bred in captivity for trading. Budgerigar, European Goldfinch, Island Canary and Zebra Finch were the commonest species encountered, accounting for 82% of individuals. These birds are imported legally from various countries, and some are locally cage-bred. Other local birds and some of the migrant bird species traded were taken directly from the wild, either trapped from the mountains of north Jordan or in the Jordan Valley as free-flying adults or taken as nestlings.

4.7. Monitoring illegal activities through socioeconomic study

4.7.1. Principles of socioeconomic study

Socioeconomics is the social science that studies how economic activities affect, and are shaped by social processes. It also analyses how communities and/or societies act according to their economic priorities. Socioeconomic studies involve attitudes and social interactions of individuals and groups within the same community.

A bird poaching socioeconomic assessment is a process of evaluating the social, cultural and economic circumstances of individuals and groups that are directly and indirectly associated with proposed conservation strategies, as it can help us understand the relationships between birds as a 'natural resource' and the users, through gaining knowledge of different issues to give an integrated picture of what happens on the ground. Thus, conservationists, decision makers and communities can identify the potential impacts of conservation policies and reveal the dynamics and patterns of bird poaching by local people. This helps planners and decision makers to develop objectives and conservation policies that balance conservation goals and the local communities' economy.

Assessment of bird poaching socioeconomics should:

1. Evaluate bird poaching dependency and social resilience,
2. Identify the spatial patterns and techniques of poaching,
3. Assess the communities' local knowledge and experience of birds,
4. Evaluate the communities' understanding of bird conservation policies,
5. Determine if the communities would consider further bird conservation strategies in the area.

4.7.2. Overarching considerations

If poachers are approachable and open to talking about their practices, interviews with them can be carried out to collect reliable information on the species involved and numbers shot or trapped using a *direct questioning technique*. Direct questioning is generally considered a cost-effective method to assess the harvesting of natural resources. However, interviewees may not be willing to discuss participation in illegal activities and may refuse to answer survey questions (St. John *et al.* 2010).

If poachers are not so easily approachable, a good method could be to interview a random selection of members of the local community with an *indirect questioning technique*. This gives a good estimate of the proportion of the population engaging in illegal activities, and trends over time. *Indirect questioning techniques* have been developed that minimize these sources of error in surveys. These techniques aim to increase the respondent willingness to answer and reduce bias by making it impossible to directly link incriminating data to an individual (Nuno *et al.* 2013).

As with other monitoring approaches, questionnaire and interview methods have to be well designed to ensure that they deliver robust information that can be analysed. Other disciplines (such

as psychology, criminology and health care) have developed methods for answering sensitive questions but so far these have not been widely applied in conservation and natural resource management.

4.7.3. Recommended methods

General methodology

To collect relevant and reliable information, it is recommended to conduct surveys within communities in the region. The survey should include:

1. A desk review of the relevant documents on the nature, economic and social situation of the target population within the region, for the purpose of the survey instruments design. Also, a literature review on indicators of resource dependency and resilience of other resource-dependent communities.
2. Conducting interviews with individuals associated with bird hunting activities, using a set of clear and understandable questions that are relevant to the survey objectives. The questionnaire should be divided into sections, each of which entails questions that cover one of the survey objectives. The questionnaires should entail:
    a. Socioeconomic aspects of the community members involved in bird hunting activities (e.g. age, having a family, main occupation, area of living/village…etc);
    b. Poachers' attitudes toward birds as a 'natural resource' (e.g. their poaching circumstances, what, how, where and when they hunt), materials used for poaching, their experience and previous incidents associated with poaching, etc.).
    c. Personal perspectives of poachers on conservation and bird protection (e.g. their opinion about conservation of birds, considering other conservation arrangements such as no take zones establishment, forming new laws by the government, different equipment or hunting techniques, etc.)
3. Holding group meetings with local people involved in poaching activities. These kinds of meetings give a clear image of their understanding of conservation issues and their way of thinking of sustainability. They also encourage brainstorming for ideas that can be taken into consideration while forming new bird hunting regulations/laws in the future. During those meeting the surveyors should focus on and promote bird conservation efforts by raising awareness of many relevant conservation issues.
4. Observation during the hunting season, which is the most effective way of collecting data, particularly on poaching techniques and types of birds that are most likely sought. It also gives a clear image on what happens on the ground, including observation of poaching techniques and attitude. Observation usually validates other techniques used in the same survey.

Direct questioning technique

There are different ways to ask direct questions, including through face-to-face interviews, phone-based interviews, and self-administered questionnaires. *Direct questioning* can provide information on the numbers of people violating regulations, the socio-demographic profile of potential violators, the incentives to violate, locations of illegal activities, the amount of birds taken illegally and short- and long-term trends in illegal activities (Gavin *et al.* 2010). However, it suffers from several sources of bias. Unless informants trust the interviewer, significant incentives exist to provide false or misleading answers. Respondents may fear retribution, including sanctions or public scrutiny. Careful choice of interviewers (i.e., with no link to regulating agencies) and survey design (e.g., sensitive questions at the end of questionnaires) can increase the reliability of responses to sensitive questions to a certain degree. Because questionnaire design and administration (i.e., consistent interview techniques) can greatly influence results, *direct questioning* requires focused training.

Indirect questioning technique

The *Randomised Response Technique* (RRT) is a survey method especially developed to improve the accuracy of answers to sensitive questions. There are a number of RRT designs described in the literature, 'Forced response' RRT is one of the most statistically efficient RRT designs. Respondents are instructed (rather than forced, as the name suggests) to either: answer a sensitive question truthfully or to say YES or say NO (irrespective of the truth), depending on the number they roll on a die. For example respondents may be told: if the die lands on one, two, three or four please answer the question truthfully (YES or NO); if the die lands on five, simply answer YES; if the die lands on six, simply answer NO. The result of the die is never divulged to the interviewer. By knowing the probability of respondents answering the sensitive question, and the proportion of respondents instructed to say YES, the proportion of the population with the sensitive characteristic (the number of truthful YES responses) can be calculated without any individual identifying themselves (St John *et al.* 2010).

The *Unmatched Count Technique* (UCT) has been developed to facilitate investigation of sensitive behaviours, by reducing the sources of bias associated with traditional methods of questioning. The standard UCT requires the study group to be divided into two sub-groups: a control group and a treatment group. The control group is shown a list of non-sensitive items (e.g. card C; **Figure 4.2**). The treatment group is shown the same list but with one sensitive item added, this being the item/behaviour of interest (e.g. card T; **Figure 4.2**). Respondents are asked to state the number of items that apply to them. By not stating which items apply to them, but simply how many, the method is expected to ensure the respondent's anonymity. As respondents are randomly assigned to each experimental group, the difference in mean responses is taken as a function of some respondents in the treatment group endorsing the sensitive behaviour, enabling prevalence estimates to be calculated (Nuno *et al.* 2013).

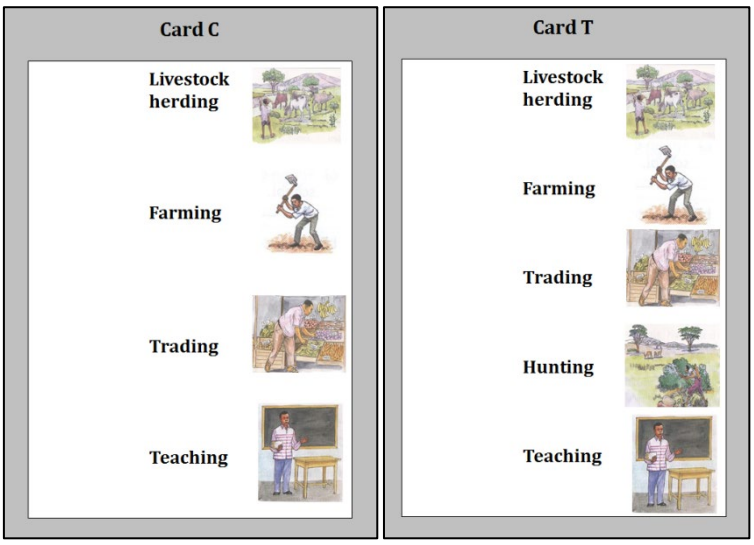

Fig. 4.1 *Card presented to control (C) or treatment (T) group (from Nuno et al. 2013)*

Sampling

In these kinds of surveys, where your target groups are identified, snowball sampling would be the most effective way of meeting local people involved in bird poaching activities. For example, your target would be local bird poachers, traders and hunting organisations. One of these interviewees would recruit future interviewees from among their acquaintances. Thus the sample group appears to grow like a rolling snowball and, therefore, your sample would cover all people involved in bird poaching.

Socioeconomic survey in bird market in Egypt © NCE

Case study: Collecting information from hunters/trappers in Egypt

Salwa El Halawany (NCE/BirdLife Egypt)

As a first step of an Action Plan for conservation of migratory birds, NCE undertook a socio-economic survey on bird hunting along the Mediterranean coast of Egypt. The data collected was essential for planning purposes to both national and international actors involved in bird conservation. The fieldwork was conducted by a team of 9 persons, including, park rangers, NCE volunteers and the lead investigator/consultant who was responsible for planning and supervision of primary data gathering, data analysis and compilation of the reports. All administrative work and logistics were performed by NCE staff and volunteers.

Objectives of the study

1. Evaluate the bird hunting dependency and social resilience
2. Identify and document the spatial patterns and techniques of hunting
3. Evaluate the communities' understanding of bird conservation policies
4. Determine if the communities would consider further bird conservation strategies in the area

Study area

The study area covered 20 communities and hunting sites all along Mediterranean coast of Egypt

Methodology

1. **Semi-structured interviews** with bird hunters were conducted, using a questionnaire that entailed set of clear and understandable questions, including information on socio economic variables, such as:
   a. **Socioeconomic variables** of the community members involved in bird hunting activities: age, education, marital status, number of people/children in the household, what do you do for living? How much (percentage) of your income comes from hunting? Do you live in this area? For how long? Do you own your house/flat?
   b. **Hunting techniques and attitude**: How many person goes to hunt with you? Does any of your family hunt (giving choices: father, son, brother, uncle)? What is your main method of hunting (giving options: nets, lime sticks, munsab, Eb, air gun, shot gun, others)? Do you use any of the other methods? When and why? What areas do you usually hunt in? Are there other areas you are interested in? If yes, where and why? What months of the year do you hunt? Do you need permission to hunt? Which authority do you obtain permission from? How happy are you with the process? How and where do you sell the hunted birds? Do you deal with certain traders? What are the types of bird you target? What are the type of birds that sell better?
   c. **Personal knowledge and perspectives on conservation**: Has the number of birds declined over the past few years? Aprox. how many years? What species have declined more? In your opinion, what are the reasons that might have caused this decline? Have you seen these birds (showing pictures of the endangered species) this season? Have you caught any of them over the past five years? If yes, roughly how many bird? Do you keep or sell them? Are they expensive to buy? Do you think we should protect our nature resources for the next generations? Do you think that we should conserve birds for the next generations? Do you think we can stop the declining of numbers of birds? In your opinion, what could be done? Do you think that hunters will abide laws regulating hunting? Why?
2. **Group discussions** were held with hunters and traders in many visited areas. Themes discussed were related to hunting as a source of income and alternatives, conservation issues and enforcement of environmental laws. Their perspectives on conservation and next generation's rights.
3. **Observation** was an effective tool to collect more information particularly on hunting techniques and types and numbers of birds that are most likely sought. Visits to markets were conducted to collect information on prices and trading process.

4.8. Recording casual data on illegal killing from different sources

Illegal killing is difficult to monitor owing to the illegality of the activity. Whether data collection by regular monitoring is possible or not, **casual records of illegal activity are also useful if systematically documented** (see section 5.1). Such records may come from:

- **Field data from monitoring** (on illegal killing or others, e.g. ringing schemes)
- **Citizen reports** via e.g. SOS phones/hotline numbers (works well but take long time to develop knowledge and experience. People call the hotline for other things, labour intensive work)
- **Internet sources** (posts on facebook and other blogs, website with complaint sheet, apps)
- **Enforcement agencies**: wildlife police report, regular police report and customs (in case of bird traffic or number of cartridges imported in a country)
- **Recovery centres or veterinarian data** (pathology, treatment)

Much information can be collected from casual data, such as species and quantity, exact location, date and time, circumstances (trap, net, shot, … in detail), motivation (if known), photos, what was done to the bird after finding (collection of specimen), was it reported to any authority and is there data on their response, other persons informed, search effort, name of reporter and contact details, habitat type and land use (private/public, fenced/unfenced), weather and migration (intensity of migration and pattern)

Quality of incoming data should also be ranked by their reliability, e.g. exact species, location and time is recorded, proof as evidence (photo, video) enclosed etc. vs. anonymous complaint via phone received without any proof of evidence, in order not to jeopardize the later analyse. It also important to check per country the privacy rules about this kind of data.

Raptors illegally shot in France © LPO

Case study: Protocol for recording data on incidental observations of illegal killing and taking of birds in the UK

Alice Tribe (RSPB/BirdLife UK)

The RSPB receives reports of potential wildlife crime incidents from several sources, which may include gamekeepers, police forces, other charities, or members of the public. In order to gather information on incidental observations of the illegal killing and taking of birds in the UK, RSBP ask the following list of questions to help the team to work out what, if any, action needs to be taken next:

- **When** did it happen?
- **Where** did it happen? – as much detail as possible, post codes and grid references
- **What?**
  - **Incident details** – what actually happened
  - **Evidence?** – photos/video footage/dead bird etc.
  - **Species involved?** – if known and how many
- **Who? Suspect details** – if known, name/physical description/vehicle registration etc
- **Why are they believed to be the suspect?**
- **Informant details** – name, phone number – did they witness the incident?
- **Have they informed anyone else, such as the police?**
- **Is the informant willing for their details to be passed to police if necessary?**

The potential risk to the informant needs to be analysed before taking any action or sharing the information with other agencies. For example, if the informant is the only one who could know about the incident, and the perpetrator could link the report back to the informant, that could put them at risk.

The RSPB also grades intelligence using the below table, which is the same table that UK police forces refer to. This table assesses the reliability of the source of the information on a scale of A to E. The extent to which the intelligence itself is known to be accurate is assessed on a scale of 1 to 5, while the handling code assesses the protective measures from 1 to 5. The form has become to be known as the 5x5x5, and this is how the RSPB shares intelligence with police forces and other NGOs, and vice versa. Sharing 5x5x5s with the relevant agencies allows the receiver to manage information which carries a risk with it. For example, a 5x5x5 can help assess the risk of exposure to the source, or how to proceed with an investigation.

Source Evaluation		Intelligence Evaluation		Handling code	
A	Always reliable	1	Known to be true without reservation	1	May be disseminated to other law enforcement and prosecuting agencies, including law enforcement agencies within the EEA, and EU compatible (no special conditions).
B	Mostly reliable	2	Known personally to source but not to officer	2	May be disseminated to UK non-prosecuting parties (authorisation and records needed).
C	Sometimes reliable	3	Not personally known to source but corroborated	3	May be disseminated to non EEA law enforcement agencies (special conditions apply).
D	Unreliable	4	Cannot be judged	4	May be disseminated within the originating agency only.
E	Untested source	5	Suspected to be false or malicious	5	No further dissemination: refer to the originator. Special handling requirements imposed by the officer who authorised collection.

The RSPB records incidents of bird crime on a database which allows the team to analyse long-term trends in wildlife crime, and identify hot spot areas of persecution. This data also gets analysed every year and is compiled together for the team's annual report, *Birdcrime* (https://www.rspb.org.uk/forprofessionals/policy/wildbirdslaw/wildbirdcrime/).

Case study: The RAPTOR (Recording and Addressing Persecution and Threats to Our Raptors) protocol in the Ireland

John Lusby (BirdWatch Ireland/BirdLife Ireland)

High profile raptor poisoning or persecution incidents have been documented in the media. Examples include shootings of Hen Harriers in Kerry and a White-tailed Eagle in Tipperary, attempted poisoning of Peregrine Falcons in Dublin, and numerous poisonings of Red Kites in Wicklow. There are, however, many other cases that were not highlighted in the media. Working together, the National Parks & Wildlife Service (NPWS), Regional Veterinary Laboratories, and the State Laboratory introduced a formal protocol for investigating bird of prey deaths in 2011. This is known as the RAPTOR (Recording and Addressing Persecution and Threats to Our Raptors) protocol. The RAPTOR protocol is a collaborative approach to systematically determine the extent to which anthropogenic non-habitat related impacts (for example poisoning, persecution, disturbance, collisions, etc.) are threats to Ireland's native birds of prey. The RAPTOR protocol entails a significant amount of effort between three Government departments in a range of activities including:

- Collecting and handling carcasses, injured birds, and evidence
- X-rays
- Post-mortem examinations
- Toxicological testing and follow-up investigations
- Data analysis, interpretation and reporting

The main aims and objectives of the RAPTOR protocol include:

- Monitoring anthropogenic non-habitat related impacts on birds of prey, including but not limited to poisoning and persecution
- Collection of evidence to support prosecutions for illegal persecution or use of poisoned meat baits
- Monitoring the incidence of anthropogenic non-habitat related impacts on other vulnerable species (e.g. Raven)
- Monitoring the incidence of poisoning in species vulnerable to secondary poisoning by rodenticides (in particular Common Buzzard, Barn Owl, Kestrel, Red Kite and Long-eared Owl)
- Maintaining a database of incidents to provide intelligence to counteract anthropogenic non-habitat related impacts on birds of prey in Ireland
- Providing evidence of the causes of death of other wildlife species where poison is strongly suspected
- Quantifying the use of specific poisons

NPWS maintains a database of incidents and the three departments undertake to publish an annual report (https://www.npws.ie/research-projects/animal-species/birds/raptor-protocol).

The projected beneifts of the RAPTOR protocol are to provide intelligence for an informed approach to address the impact of anthropogenic issues on our native birds of prey through education, law enforcement and forward planning.

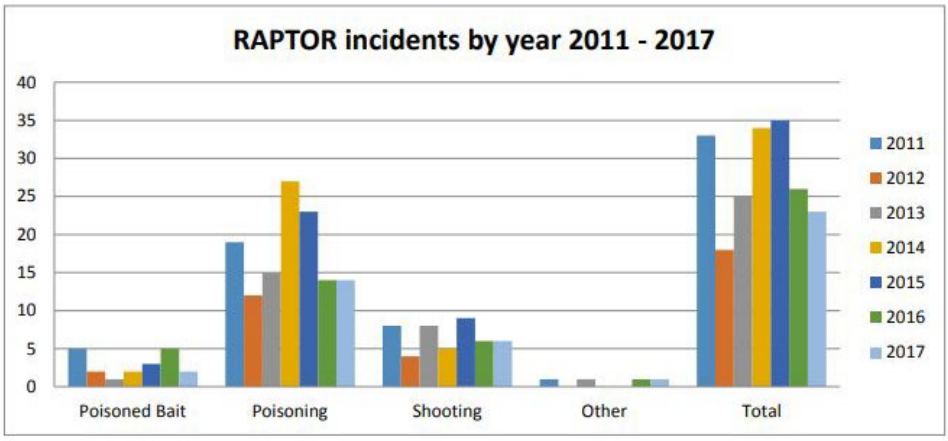

Fig. 1. Annual RAPTOR incidents 2011 to 2017 (from 2017 RAPTOR report).

4.9. Monitoring illegal activities using new technologies

Modern technology has become a vital part of enforcement and competent authorities and NGOs in different countries have started to use it to fight wildlife crime. The benefits of using such technology are many, including the gathering of evidence against wildlife criminals to use in courts, footage for media use, but also more efficient use of enforcement personnel time. Below we describe use of such technologies for monitoring and/or tackling the illegal killing of birds.

4.9.1. Drones

Drones, or Unmanned Aerial Vehicles (UAVs), can provide quicker, cheaper and easier methods of surveying large areas when compared to satellite imagery or ground surveys. Used in conjunction with standard surveying and monitoring methods, they can be an effective way to enhance the reach of conservation projects aimed at monitoring illegal activities. Drones can be used to count poachers or traps, track movements and record land use changes. They can also be combined with other technologies such as thermal imaging to record activity at night or satellite trackers to help monitor birds tagged in remote or inaccessible locations.

Care must be taken when considering using drones as there are a number of ethical and safety concerns when flying unmanned aircraft. The use of drones near breeding birds should be carefully controlled, as this may cause them to abandon their nests or fly and collide with the drone in the air, causing injury (Kakaes *et al.* 2015). They can also potentially cause injury to people on the ground and can be associated with private, military or civil applications so may cause mistrust or alarm in local communities not actively engaged in a project. These safety and ethical concerns mean that drones are subject to laws and regulations that differ from country to country, ranging from the need for a pilot's license or certificates of authorisation to outright bans. Cost of a drone can range from less than $1,000 for 'DIY' setups that can be operated by a small number of people to millions of dollars for complex systems run by teams of experts. The choice of drone will be a trade-off between cost and function, taking into account many factors such as the area to be covered and the duration of flights (Kakaes *et al.* 2015). These considerations and more must be taken into account to ensure the effective use of drones in a project (Sandbrook 2015).

Case study: Using drones to combat the illegal trapping in Malta

Alice Tribe, BirdLife Malta (BLM)

Bird trapping is a widespread and commonly practised activity across the islands of Malta and Gozo. Trapping is only allowed in the autumn. However, illegal bird trapping also occurs on a large scale, such as during the spring, using electronic callers, on unregistered trapping sites, and/or trappers catching more than their quota. The activity is very hard to monitor properly, as a lot of it is carried out on private land, on land that is hard to access/see and so on. Furthermore, there are currently 4,000 registered trappers; this equates to a large number of trapping sites that simply cannot be properly monitored by the numbers of police officers and NGO staff/volunteers available.

There is a big issue with public land vs private landownership across the Maltese islands. Vast areas of land are claimed as private, however, proving that this is the case is extremely difficult. As a consequence, anyone going out in the countryside will be greeted with numerous signs and notices, often hand painted, saying 'Private', 'No Entry', 'Tidħolx' (Maltese word for 'no entry'), or 'RTO' (Reserved to Owner). In addition to this, there are many high stone rubble walls, which makes visibility across areas impossible or problematic. Until recently, the only way of seeing some areas was by finding a vantage point nearby. Whilst this works in a few areas, in other places this means that investigators could be stationed at some distance from the site in question, and unable to clearly see what is going on.

Towards the end of 2017, BLM started using a drone to view trapping sites that were otherwise impossible to monitor any other way. This proved to be an effective way of ascertaining whether illegal bird trapping was occurring in areas where trapping was suspected to be happening, usually due to reports that were received by BLM. One such example where a drone was instrumental in detecting illegal finch trapping, and was subsequently reported to the police for investigation, was in the Buskett Gardens in Siġġiewi. In November 2017, BLM received a report of finch trapping within Buskett; a designated bird sanctuary. No hunting or trapping is allowed in bird sanctuaries, so BLM went to the area to try and see the site from the ground. However, the site was elevated and surrounded by high walls and vegetation, meaning that it was impossible to view the site from anywhere. Whilst there, BLM staff could hear finches calling and even saw two live birds in cages attached to wooden poles, so the decision was made to return later with a drone. The drone provided BLM with the evidence needed – the trapping site was clearly seen with nets on the ground. The live decoys were not present on that particular day, but there was enough evidence to pass onto the police. All of the equipment was dismantled and taken away afterwards by the police and the government entity Wild Birds Regulation Unit (WBRU).

Image taken using a drone over the illegal finch trapping site within the Buskett Gardens bird sanctuary © BirdLife Malta

There are a few downsides to using drones, such as monitoring quotas; it would still be difficult to know whether trappers are abiding to their quotas or not. In addition, the use of drones is very risky during the hunting season, due to the possibility of the drone being shot down. However, despite the challenges and limitations, this is new technology for BLM and the initial results are very promising.

Case study: Using drones to combat the illegal taking, shooting, trapping or poisoning of peregrine falcons in Northern Ireland.

From https://www.psni.police.uk/news/Latest-News/220517-psni-use-latest-technology-to-combat-crime-and-monitor-peregrine-sites-across-northern-ireland/

Peregrine falcons are persecuted around the UK by landowners and for the illegal trade in their eggs. This is likely contributing to their decline in some areas, including Northern Ireland.
In the summer of 2017 the Northern Ireland police service (PSNI) launched 'Operation Peregrine Watch', where drones fitted with specialist cameras were used to patrol nest sites and areas where birds are known to be persecuted during the breeding season. This has allowed hard to reach areas and crime hotspots to be more regularly monitored and suspected persecution incidents to be recorded, while acting as a deterrent to potential wildlife criminals.
This has shown to be a success, with the number of nests in Northern Ireland increasing from an average of 49 per year in 2016 to 55 in 2017. They have received the WWF 'Wildlife Crime Operation of the Year' award for their work in helping to protect peregrine falcons in Northern Ireland (https://www.wwf.org.uk/updates/wildlife-crime-awards-2017).

4.9.2. Satellite tracking

Satellite based tracking systems have been developed and used since the 1980s to study bird movement and behaviour around the world. Individual birds can thus be tracked over long distances for extended periods of time in remote locations and often does not need the animal to be recaptured to recover the tag.

In terms of monitoring illegal killing, satellite transmitters can be used to track individuals, record killing events or even prevent incidents and identify hotspots to focus conservation efforts (Burger & Shaffer 2008). Mortality has been tracked using satellite telemetry in migratory birds such as the Osprey, Marsh Harrier and Montagu's Harrier. The death of these birds could be identified and distinguished from transmitter or battery failure but finding the exact cause of death from tracking alone can be extremely difficult, so identifying cases of illegal killing using satellite tracking needs to be combined with on the ground verification (Klaassen *et al.* 2014). Note satellite tracking only provides information about the population tracked – extrapolation from what happens to satellite tracked individuals to a wider population depends on confidence these individuals are representative of that population. That caveat notwithstanding satellite tracking can provide useful information about the relative importance of different sources of mortality, including illegal killing, and therefore help with prioritising conservation action.

Satellite tracking data can also be used in public outreach to raise awareness of the movement of birds, but caution must be used when broadcasting the current location of high value or persecuted species.

Case study: Role of satellite transmitters in the discovery and the prevention of poisoning of Eastern Imperial Eagles in Hungary.

Márton Horváth (MME/BirdLife Hungary)

Satellite transmitters have been used during the HELICON LIFE project 2012-2016 on Eastern Imperial Eagles (http://www.imperialeagle.hu/). This method is especially important since knowing a bird's location and being able to follow it, play an important role in the discovery and the prevention of poisoning, which is the single largest threat to them nowadays in Hungary. Altogether 31 fledglings and eight poisoned but repatriated Imperial Eagles received transmitters during the project.

The tracked eagles covered huge areas in 28 countries of three continents, although they have spent most of their time in the Hungarian Plain. Out of those 15 tagged eagles that were proven to die during the project, six were poisoned, which contributed greatly to the discovery of these cases, thereby preventing further fatalities. The annual mortality rate of the satellite-tagged immature eagles decreased from 50% to 10-20% by the second half of the project, likely due to the conservation measures put in place.

Eastern Imperial Eagles tagged in Hungary © MME

4.9.3. Genetic techniques

Genetic and metabolic techniques can be used to study populations and individuals without direct contact, allowing for minimal disturbance. Samples such as feather, faeces or dead animals are collected and analysed to identify and track individuals, identify poaching hotspots, help in criminal prosecution and in many other innovative ways to help to tackle wildlife crime.

DNA barcoding has become a widely used and valuable tool in taxonomic research during the past three decades and its application is expanding to fields such as wildlife forensics (e.g. antipoaching

actions). DNA barcoding has proved to be an invaluable tool for researchers looking for an easy, quick and cost-effective diagnostic tool to identify species when morphological approaches fail. One of the major advantages of this technique is that it allows for species identification from largely incomplete, deformed or cooked samples and even from traces of biological material. These have the potential to be a tool with a high power of discrimination that can provide DNA evidence to help convict wildlife criminals.

Case study: High turnover rate revealed by non-invasive genetic analyses in an Eastern Imperial Eagle population in Hungary

Márton Horváth (MME/BirdLife Hungary)

Shed feathers contain enough DNA to create fingerprints individually. With the help of this, researchers could follow the breeding pairs and estimate their survival rate. This latter information is crucial for researchers to evaluate if the conservation efforts actually help their survival or not.

Villi *et al.* (2013) estimated the annual turnover rates, and so indirectly the possible maximum mortality rates of female Eastern Imperial Eagles in an expanding population. DNA was extracted from shed feathers collected in territories where at least three consecutive years of breeding occurred. As DNA samples could not be obtained at every studied nest in each year, minimum and maximum turnover rates were estimated. The calculated rates, 27.7% (minimum) and 35.5% (maximum), were much higher than what could be expected based on studies of other raptor species. According to previous studies, territory switching can occur frequently in an expanding population. However, Villi *et al.* (2013) found evidence of it in only two of the 46 studied territories, thus they assumed that despite the ongoing saturation some level of site fidelity was present in the population. Their findings suggested the high prevalence of mortality, most likely from poisoning and electrocution, but also predicted a large number of floater individuals that fill up the vacant territories.

At the end of the HELICON LIFE project 2012-2016 on Eastern Imperial Eagles (http://www.imperialeagle.hu/), the results of the genetic tracking showed that the estimated mortality of breeding individuals has decreased to 6-9% by the second half of the project, likely due to the conservation measures put in place.

Shed feather used in genetic analysis © MME

Case study: DNA barcoding of bird species in Cyprus, a tool for identifying bird species illegaly trapped.

From Dimitriou et al. (2017)

Each year on average, hundreds of thousands of birds (mainly small migratory birds) are trapped illegally in Cyprus, preserved in vinegar and/or cooked before they are served illegally in restaurants, as *ambelopoulia* (the local name for small migrating songbirds). The main target species is the Blackcap; however, more than 40 species are lumped together with the Blackcap under this collective term, such as the Lesser Whitethroat, Garden Warbler, various species of pipits, shrikes and warblers, as well as the two endemic species (Cyprus Warbler and Cyprus Wheatear). Trapping of these species is illegal (the only passerines that can be legally hunted are the Skylark and some thrushes). Consequently, reliable identification of specimens from tissues can be crucial for undertaking legal actions.

Dimitriou *et al.* (2017) carried out DNA barcoding of the large majority of bird species resident in Cyprus, plus several migrants, that were confiscated as evidence during anti-poaching operations and were used for this DNA barcoding. This work aimed to create a COI (Cytochrome Oxidase subunit I) sequence database of all bird species resident in Cyprus, as well as those most commonly trapped (both targeted and common by-catch species). The database could be used to identify confiscated or otherwise collected samples of tissue or whole birds, even when these samples have been processed (e.g. cooked), badly preserved or are not morphologically identifiable, enabling Cypriot authorities to prove guilt regardless of whether suspects were caught in the act or not.

Far beyond direct punishment of offenders, tools such as DNA barcoding allow also for the reduction of efforts needed to collect poaching evidence in the field. This, in turn, may result in a much lower risk for police officers or Game and Fauna Service personnel integrity, as genetic evidence is objective beyond any in situ dispute. Furthermore, the ability to identify processed or cooked birds can strongly contribute to the reduction of poaching and bird trapping as income, since restaurants are an important component of the illegal bird market. According to existing laws, restaurant owners who serve birds are breaking the law and are guilty of the offence of 'illegal offer of birds'. DNA-based specimen identification will allow for more effective investigation of local restaurant owners. Thus, the use of DNA barcoding as a forensic investigative tool may represent an effective deterrent for restaurant owners or other individuals that possess protected species.

According to existing laws, restaurant owners who illegally serve birds are considered guilty as are the trappers themselves. DNA-based specimen identification will allow for more effective investigation of local restaurant owners. Thus, the use of DNA barcoding as a forensic investigative tool may represent an effective deterrent for restaurant owners or other individuals that possess protected species.

Ambelopoulia, small migratory birds prepared for eating © David Tipling/Birdphoto.co.uk

4.9.4. Covert surveillance

For the purpose of surveillance of illegal killing of birds, it may be desirable for an "observer" to be able to see a poacher without the poacher being able to see the "observer". Thus, the "observer" need not be people but might be a camera or other light detecting device.

The RSPB (BirdLife in the UK) has been using this technology in the UK for many years, by placing hidden cameras at locations where crimes are taking place, or where it is suspected they will happen, e.g. for raptor persecution. Any evidence gathered, after being reviewed, is provided to the enforcement agencies for further action against any individuals that may be caught red-handed undertaking a wildlife crime. Subject to legal guidelines, the footage can potentially be submitted to the court as evidence as part of the prosecution. Having graphic footage of offences may assist the courts with a better assessment of the wildlife crime and its conservation impacts, and lead to improved sentencing, with stronger and more deterrent sentences. Upon the completion of a court case, any gathered footage can also be used for media work in order to highlight visually the illegal bird killing problem.

It is important to establish the legal situation in a particular country in relation to the gathering and admissibility of surveillance evidence and personal data. Some countries will not allow such footage to be used as evidence and it may even be an offence to gather this sort of material. In other cases, it would need the evidence to be gathered by a statutory organisation, such as the police, under the legal guidelines that are in place.

Case study: Use of covert surveillance to catch and to sentence trappers in Cyprus

Tassos Shialis (BirdLife Cyprus) and Guy Shorrock (RSPB/ BirdLife UK)

In autumn 2016, the Sovereign Base Area (SBA) Police worked with specialist RSPB Investigations staff, with the support of BirdLife Cyprus, and installed covert cameras at several key illegal trapping hotspots on the Eastern Sovereign Base Area (ESBA) in Cyprus. This was the first time this method of surveillance was used in Cyprus with the aim to catch illegal bird trappers in the act. The police obtained surveillance authorities which gave them the legal permission to gather this type of evidence.

The shocking footage that was obtained showed individuals removing the struggling birds from the mist nets, then killing them with knives before tossing the bodies into buckets. A total of 19 individuals were secretly filmed illegally catching birds in mist nets and have been successfully convicted with a range of fines, while 7 of them also received suspended jail sentences. The last case for 2016 was finalised in January 2018 and the two main offenders received substantial fines of 6,600 and 3,200€, and one also received a 20-month jail sentence suspended for 3 years. These are the most severe sentences for the 2016 operations. The same surveillance method was used in autumn 2017 and more cases are currently under investigation. Illegal bird trapping is a persistent problem, and these court sentences recognise that this is a serious wildlife crime.

Enforcement against illegal bird trapping can only achieve so much without the imposition of deterrent sentences from the courts. And the use of covert surveillance work has shown how modern technology can support and improve enforcement against illegal bird trapping in Cyprus. Moreover, it provides the courts with substantial evidence to hand out deterrent sentences, a key element in stopping wildlife crime.

5. Analysing and managing information on illegal killing and taking of birds

5.1. Data management

All the observations that are collected during monitoring or from casual observations (see Chapter 4), **should be compiled centrally as soon as possible, and collated in a database**. Spreadsheet software, like Excel, can be used to manage a simple database. According to data complexity and/or if more functionality is required (e.g. GIS compatibility), database management software (e.g. My SQL or Microsoft Access) could be needed. It is also highly recommended to have only one active version of the database and to back-up regularly off-site. For collaborative monitoring, it is necessary to decide which organisation will maintain and update the database. Key stakeholders involved in the project should have access to a regular updated version of the database (e.g. via a cloud system). Roles and responsibilities should be clear, and surveyors should understand where to send their data, in what form and how often.

All observations have to be recorded in a standardised way and minimum standards on what data must be collected have to be set, including:

- **Who?** e.g. name and address of the person who reported the observation, references of the report with the information
- **When?** e.g. date of observation
- **Where?** e.g. location of observation
- **What?** e.g. species and number concerned
- **How?** e.g. type of illegality

All the documents related to an observation (photos, reports) should also be stored in a standardised way in hard and electronic copy.

Case study: Managing data on bird crimes in a database in Hungary

Márton Horváth (MME/BirdLife Hungary)

Since 2006, when the first mass poisoning cases were reported in Hungary, MME gathers the data from relevant stakeholders about bird crimes into a single national database. This database was developed and extended together with field investigation, veterinarian and police investigation protocols in the frame of a LIFE Nature project (www.imperialeagle.hu). In the frame of a National Anti-poisoning Working Group the representative organizations of all relevant stakeholder groups (national park directorates, NGOs, veterinarians, police, hunters) are providing data for the database and getting back raw data or queries for they work. The basic structure of the database is listed below. Each record in the database represents a single specimen or bait, except when more specimens of the same species were found under the same circumstances (date, location, possible cause of death/injury).

Table 1. *Field name and explanations used in the MME bird crim database*

Field name	Relevancy/Legend
Record_ID	Different for each row in the database (e.g. sequential number)
Case_ID	Different for each detected case (this makes a link between the different specimens found in a given case). In our case it is created automatically as: National Park Directorate -Year- Case (e.g. HNPI-2014-08)
Year	
Month	
Day	
National Park Directorate (NPD)	All of Hungary belongs to one of the 10 NPD administrative region, which are responsible for conservation. So we use it also to identify the responsible authority and also as a regional code.
Settlement	Chosen only from a given list of settlements of Hungary
County	Generated automatically from the settlement name.
Settlement_X	Central coordinates of the settlement. Generated automatically from the settlement name. These coordinates are used for mapping the incidents in large scale.
Settlement_Y	
Type of the case	Chosen from a given list (predator poisoning, accidental poisoning, shooting, nest robbery, etc.)
Species	Chosen from a given list
Specimen	No. of affected specimens (see the top comment). Specimens found as poisoned baits are indicated differently, e.g.: "feral pigeon (bait)".
Fate	Chosen from a given list (e.g. found dead, died in captivity, alive in captivity, released).
Precision	Chosen from a given list (e.g. 25m, 250m, 2,500m, 10,000m).
X	GPS coordinates of the given specimens (specimens found in different locations are put in different rows!).
Y	
Type of the poison	It is only relevant in case of poisoning. Chosen from a given list.
Concentration	It is only relevant in case of poisoning
Note	Any notes related to the case/specimens
NPD_ID	ID of the National Park Directorate official report
NPD Notes	Copy of the official report of NPD
Vet_ID	ID of the veterinarian official report
Vet organization	Name of the veterinarian organization analysing the samples
Vet diagnostics	Copy of the official report of the veterinarian organization
Source	Name and contacts of the informant
Found by	Name and contacts of the person found the specimens
Accusation made by	Name of the organization/person made an accusation to the police.
Police body	Name of the police headquarter which got the accusation/started official investigation
Result of police procedure	
Court	Name of the court started the court procedure
Result of court procedure	
Group of specimens	Mammal/Bird/Bait
Protection status	Not protected/Protected/Strictly protected
Conservation value	In Hungary all specimens belongs to a protected species has a theoretical "conservation value", which explains the public how important is the given species.
Sum of conservation value	It is generated automatically (specimens x Conservation value)

5.2. Data analysis

5.2.1. Dealing with uncertainty

When scientists take a measurement or make a calculation from their data, they generally assume that some exact or "true" value exists based on how they define what is being measured or calculated. Scientists reporting their results usually specify a range of values that they expect this "true" value to fall within. The most common way to show the range of values is:

Measurement = Best estimate ± Uncertainty

Uncertainty is to do with the precision of a given measurement (see **Section 2.7**). It can be captured by placing estimates into bands, with a plausible minimum and maximum set to take into account the various sources of uncertainty. This may be multiplicative, yielding quite large ranges for the final answer. *Uncertainty* can be also measured in statistical terms (e.g. as a range, variance, standard error, 95% confidence limits) by looking at the differences in counts between the sampling units.

5.2.2. Descriptive analysis

Monitoring and casual data can be analysed easily to describe the number of birds killed, the worst locations, etc. The analysis doesn't need to be complicated and simple diagrams, figures and maps can present very striking results (e.g. **Figures 5.1, 5.2 and 5.3**).

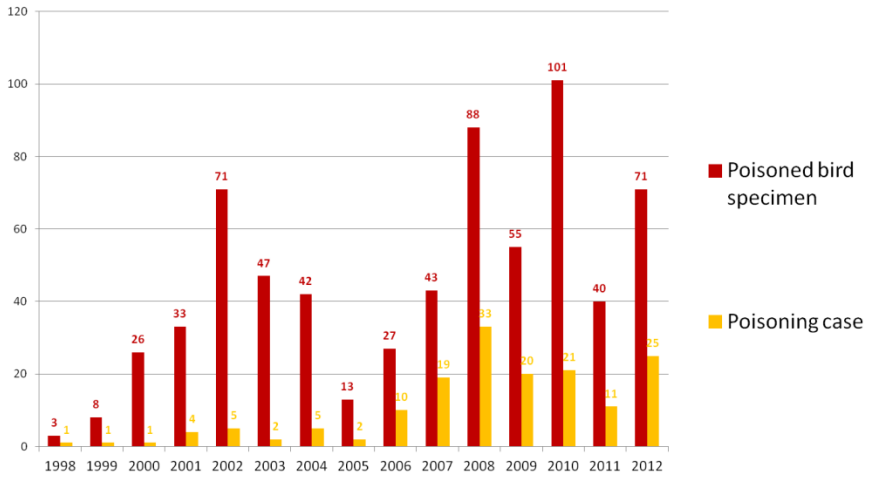

Fig. 5.1 *Illegal poisoning recorded in Hungary between 1998 and 2012 (from MME/BirdLife Hungary, unpub. data)*

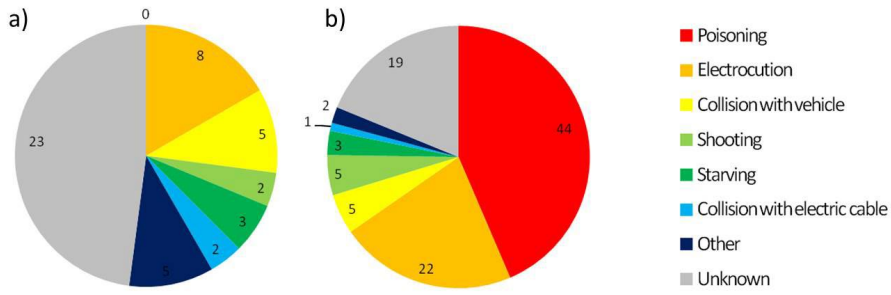

Fig. 5.2 *Changes in the causes of mortality of Eastern Imperial Eagle in Hungary between a) 1980-2004 and b) 2005-2012 periods (n= 48 and 101 respectively, from MME/BirdLife Hungary, unpub. data)*

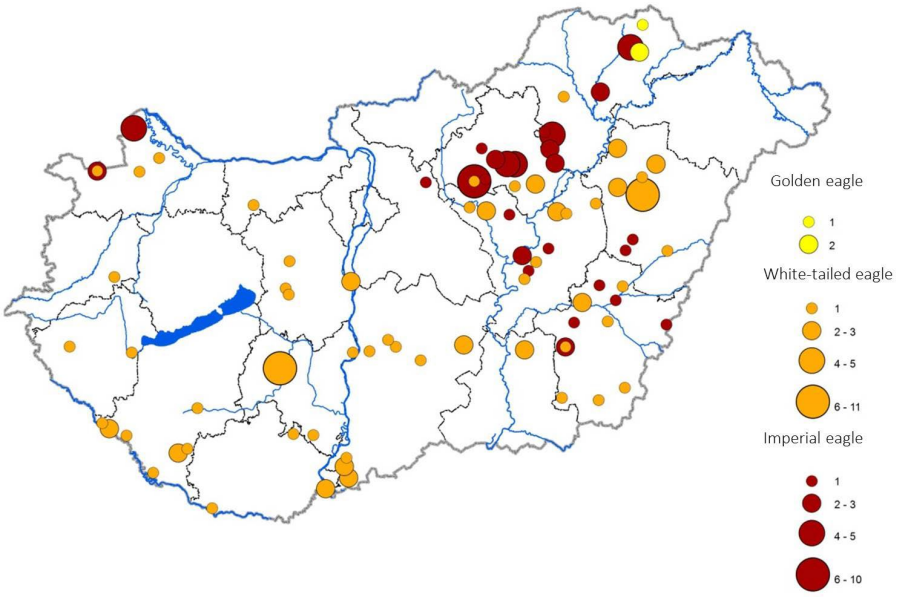

Fig. 5.3 *Locations of illegal poisoning cases of three eagle species in Hungary between 1998 and 2012 (from MME/BirdLife Hungary, unpub. data)*

5.2.3. Trends calculations

The production of trends requires analysis of counts at each survey location over time. At its simplest level, trends over time can be displayed graphically and/or simply categorised as increasing, decreasing or stable. Support available for calculating trends includes analysis software such as TRIM (TRends & Indices for Monitoring data, Pannekoek & van Strien 2001; freely available at http://www.ebcc.info/trim.html).

TRIM enables the analysis of a time serie of counts with missing observations. The program can be used to estimate indices and trends and to assess the effects of covariates on these indices and trends. TRIM analyses time series of counts, using Poisson regression, and produces estimates of yearly indices and trends. If observations are missing, TRIM estimates the missing values on the basis of changes observed on plots that were monitored. In other words, TRIM enables the use of data from all the sampling units, even though these sampling units were not all surveyed each season. The program 'fills

in' missing values for sampling units that were not covered in a particular year on the basis of the general trend derived from the data as a whole. The TRIM software is very widely used for analysis of field data from ecological or biological studies. It produces an index, setting the first year of a time series of data the value of 100 and showing changes in subsequent years relative to this baseline value of 100.

TRIM allows the user to select various models to undertake the analysis. A 'time effects model' estimates parameters for each year and should be chosen if one wants to assess indices for each year. A 'linear trend model' should be chosen if one is interested in testing whether a significantly positive or negative trend has occurred across a number of years, by selecting one or more years as changepoints. The linear trend model should also be chosen when the data are too sparse to run the time effects model.

5.2.4. Modelling

A number of more sophisticated modelling approaches are also possible. For example, illegal killing monitoring in one location can provide spatial data that can be used to create maps projecting the intensity and distribution of the illegal activity in a wider region, by modelling the association between the location of illegal killing activities and various environmental parameters (e.g. altitude, slope orientation, slope angle, ridge, distance from the sea, distance from a road, habitat type).

Case study: Estimating trends over time for illegal mist-netting in Cyprus

Tassos Shialis (BirdLife Cyprus)

See section 4.4 for more background information on monitoring illegal mist-netting activity in Cyprus

The TRIM program is used to analyse the survey data to produce trends in autumn bird trapping in Cyprus, from 2002. The metres of net rides that are active or prepared for trapping within each survey square are used as the response variable, with autocorrelation and overdispersion also accounted for. The TRIM changepoint model is used with a changepoint in every year (which returns the same results as a fully time-dependent model). The TRIM program is a good way of analysing these data and will produce a model of the change in trapping activity between a base year (2002) and each subsequent year of sampling. Figure 1 shows the results based on a stratified random sample of 104 squares surveyed during 2002-2014.

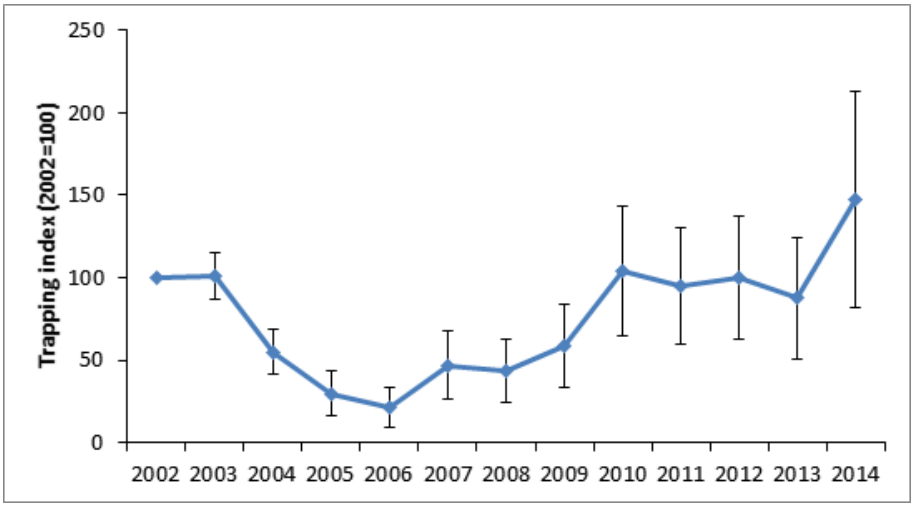

Fig. 1. *Trends in the intensity of autumn illegal bird mist-netting in Cyprus. Error bars show 95% confidence limits.*

The output from TRIM includes an overall trend over the time period and is the slope of the regression line through the logarithm of the indices. The output gives the multiplicative trend over the time period 2002 to 2014, of 1.061 (standard-error 0.017), which reflects the changes in terms of average percentage change per year. If the trend is equal to 1, then there is no trend. In this case, there is an increase of 6% per year. The TRIM output shows a significant moderate increase ($p<0.01$).

As shown in Figure 1, the trend shows a decline in autumn mist-netting activity between 2002 and 2006 of 79%, but an increase from 2006 to 2014 of 588%. A shallow decline in activity during 2010-2013 was followed by a sharp increase in autumn 2014.

Case study: Analysing the magnitude of raptor shooting in Georgia

Johannes Jansen (Batumi Raptor Count)

The Batumi-bottleneck is a crucial migration crossroad for the raptor populations of north-eastern Europe and west-Asia. Every autumn a huge concentration of soaring migrants gets funnelled in the narrow stretch between Black Sea's east-coast and the high mountains of the Lesser Caucasus. Recent monitoring has shown that up to 35 bird of prey species use this flyway and around 1 million individuals passed through in only two months in autumn (Jansen 2012). Illegal shooting of raptor being a common practice in the area, Jansen (2012) estimated here the magnitude of the raptor shooting using modelling approach. The presence of raptor shooters was fairly easy to verify: they usually discarded wings and other body parts at their shooting stand. This occurrence was then used to extrapolate the amount of casualties found in sample sites, to estimate the total number of casualties across the area.

To be able to predict the intensity and distribution of the raptor shooting along the bottleneck, a probabilistic distribution model MaxEnt was applied. 169 coordinates where raptor shooters were present or signs of raptor shooting have been found were used in the model. As environmental layers, several topographical characteristics of the area were used: altitude, slope orientation, slope angle, ridge, distance from the sea and distance from a road. Based on this extrapolation, a habitat suitability (hs) map was thus rendered, giving each pixel a suitability value for raptor shooting between 0 and 1 (Figure 5.5).

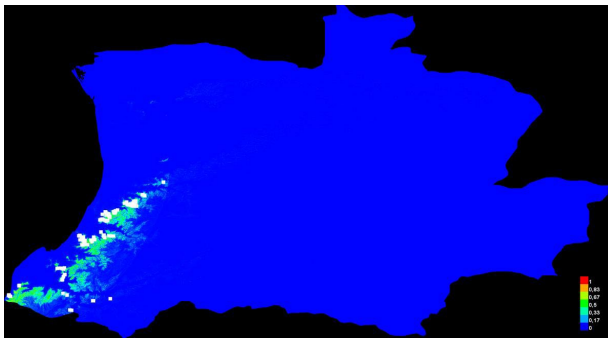

Fig. 1. *MaxEnt habitat suitability map for Adjaria and Guria (habitat suitability in colour scale between 0 in blue and 1 in red). White squares represent hunting presence locations.*

The number of casualties was then predicted using a Generalized Additive Model (GAM). The number of birds found per location was calculated by adding up the remains found of early migrants (surveyed in Aug-Sept 2011) and of late migrants (surveyed in Sept-Oct 2012). The GAM was validated and then applied to all the points predicted to be suitable from the hs-map. This rendered, per point, the total number of shot raptors expected to be found there. This was then multiplied by the number of raptors that were assumed to be shot, but where the remains were not found. This happens when a bird is shot but falls somewhere beyond the shooters' reach, or when a bird is taken home whole, without discarding feathers or other trace at the site. Shooters were observed directly, and the number of shots fired, birds hit, killed and found (recovered) were counted. Because of the lack of observed shots for several species, the overall success-ratio was used for all species.

The total number of raptor shot was estimated at 7,379 ± 1,021 individuals in 2011 and to 10,713 ± 1,482 individuals in 2012. On average, the estimated yearly toll for migrating raptors is 9,046 ±1,251 individuals killed.

6. Communicating results of monitoring illegal killing and taking of birds

Outputs from monitoring schemes can be used in a number of ways for nature conservation. **Three distinct audiences can be identified, all of which may require targeted communication**: the wider conservation community (e.g. scientists, hunting organisations, NGOs), government authorities (e.g. local and national enforcement authorities, government Ministries (e.g. of environment, justice and agriculture) and the general public (surveyors are an additional distinct audience covered in section 3.1). This chapter aims to summarize suggestions for the use of monitoring data for nature conservation and discusses the principles of communication and promotion of the results.

6.1. Communication challenges and opportunities

In common with other conservation efforts, the results of monitoring illegal bird killing should be publicised and communicated to a wide audience, but **may face a number of particular challenges**:

- **Low awareness about illegal killing (and more generally about birds)** among the public and authorities.
- **Potentially unreceptive audience among communities** in which a high proportion of individuals may be involved in the illegal killing of birds.
- Illegal activities may be seen as a **cultural right or part of cultural heritage and traditions,** and great care is therefore needed to ensure any communications are sensitive and culturally appropriate.
- **Avoiding antagonising local communities who may respond negatively to outsiders' views,** by tailoring messages to audiences and using local champions to communicate messages

There are also **several opportunities to communicate more efficiently results of illegal killing monitoring**:

- **Targeting younger age groups** who may have views that may be more sympathetic to conservation than older people.
- Harnessing the **popularity of famous individuals** within the country to get behind any campaign.
- Involving authorities by **offering them the opportunity to join forces and state their intention to scale up their efforts to tackle the issue,** rather than being the target of criticism.
- Supporting the **capacity building** of judges/police in using the results from monitoring of the illegal killing.

The results of monitoring the illegal killing of birds should be used effectively by proactively engaging with policy makers and the general public through regular talks, participation at strategic workshops

and meetings, regularly updated websites, newsletters, etc. This requires considering the needs of end-users, because without their support, monitoring is unlikely to be sustainable in the long term (Senyatso *et al.* 2009).

It may be necessary to explain the utility of monitoring data to potential users as well as to specify how the results from a monitoring scheme can be used most effectively. Such messages often need to be repeated and reinforced to remind policy- and decision-makers of the utility of the data and the importance of appropriate funding streams (often requring relatively modest amounts of money) to allow basic monitoring to take place (Voříšek *et al.* 2008).

Case study: Using the results of monitoring of illegal killing of birds to change local attitudes in Italy, Greece and Spain

Umberto Gallo Orsi (LIPU)

The BirdLife partners in Italy (LIPU), Greece (HOS) and Spain (SEO) have decided that transboundary action and a common approach are required to address the problem of illegal killing of birds and have obtained the financial support of the European Union through a LIFE + Information and Communication project. The project aims to radically change the attitude towards illegal killing in local communities at three hotspots: Sulcis (SW Sardinia), Ionian Islands (Western Greece), and the East of Spain (Catalonia, Valencia and SE Aragon).

The BirdLife partners, with the support of JWT, an international communication agency, have launched the 'Leaving is Living' campaign (http://www.leavingisliving.org/life/pdf/leaving-is-living-pdf.pdf), which advocates that migratory birds have the right to migrate, as this is a crucial part of their life cycle, that illegal killing of birds must stop and that this activity is no longer an acceptable tradition. The campaign unfolded in three developmental phases, which gradually engaged the audiences in a growing level of involvement with the aim of a public statement of support to the campaign by people. Communication tools include a user-friendly website, a set of inspiring press advertisements, radio spots targeted at local communities, a number of original and engaging videos and a nature documentary. "Leaving is Living" is supported by national celebrities, such as TV personalities, singers, actors and writers. Most importantly, the campaign targeted local communities in a creative, educational and non-confrontational manner. Public events involving local people, decision makers were organised where people openly expressed their views, a travelling exhibition in Greece and Spain caught the communities' attention. Education, being key to halting the recruitment of poachers, informed all activities with local schools in order to raise the awareness of almost 15,000 students about the illegal killing and its impact on local and European biodiversity. Finally, in order to push illegal killing issues up the political agenda, national and international workshops were held with Law Enforcement Agencies and experts in Greece and Italy to exchange expertise, share best practices and publicly recognise the environmental crimes that take place in these countries.

So far the campaign has amazingly reached over 20 million people. Along with the campaign, the partners continue their more traditional and direct anti-poaching activities, involving volunteers removing traps in Sardinia and identifying and sharing the location of the 'parany' (trapping technique) on a webpage in Spain through the collaboration of different NGOs, as well as the fight against those who try to turn a blind eye or even 'legalize' illegal killing activities.

6.2. National, regional and global fora where illegal killing monitoring data are useful

To maximise support from national stakeholders (especially statutory institutions), whether financial, technical, statutory, moral or publicity support, **it is important that monitoring of illegal killing of birds feeds results into national priorities and policy processes**. Consequently, at the outset, it is important to identify potential end-users of the data and ensure that their concerns and needs are adequately addressed by the scheme. This includes government departments, particularly those responsible for wildlife, habitats, protected areas and hunting regulation (issuing licenses etc.) Particularly important end-users to identify are those responsible for reporting to regional instruments like the European Commission Birds or Habitats Directives, or Multilateral Environmental Agreements (MEAs) such as the Convention on Migratory Species (CMS), the African-Eurasian Waterbird Agreement (AEWA), the Ramsar Convention on Wetlands and the Bern Convention on the conservation of European wildlife and natural habitats.

Case study: Scoreboard to assess progress in combating illegal killing of birds

CMS and Bern Convention Parties have officially endorsed a common 'Scoreboard' approach to assessing national and regional progress in tackling this issue. This development may encourage improved monitoring of the issue, as well as focus attention on effective action by government in many of the countries/territories of Europe and the Mediterranean.

The indicators framework has been developed with the view of offering to the national stakeholders a simple tool, easy to compile and interpret. The 28 indicators, organized in five areas, represent the critical areas to monitor in order to determine the effectiveness of a national response to illegal killing of birds (Table 6.1). The first group of indicators provides an insight into the extent of and knowledge of the scale of illegal killing of birds at national level looking at the number of cases prosecuted, as well as the number of birds illegally killed, taken or traded per year.

The scoreboard is described as a voluntary self-assessment process for national authorities. For maximum accuracy and objectivity, the assessment should be completed in a collaborative process with the participation of all national stakeholders (including BirdLife Partners) filling that out and commenting on drafts. It is important that results of monitoring illegal killing feed into this process.

Detailled information available at:

- UNEP/CMS/Resolution 11.16 (Rev.COP12) and UNEP/CMS/Resolution 11.16 (Rev.COP12)/Annex 1 http://www.cms.int/sites/default/files/document/cms_cop12_res.11.16%28rev.cop12%29_e.pdf http://www.cms.int/sites/default/files/document/cms_cop12_res.11.16%28rev.cop12%29_annex%201_scoreboard_e.pdf
- Recommendation on the establishment of a scoreboard for measuring progress in combatting illegal killing, taking and trade of wild birds of the Bern Convention Standing Committee http://rm.coe.int/scoreboard-to-assess-the-progress-in-combating-illegal-killing-taking-/168075f9da

Table 1. *The indicators in the Scoreboard (UNEP/CMS/Resolution 11.16 (Rev.COP12)/Annex 1)*

Indicator	*Indicator Group*	*Maximum Group score*
1. Status and scale of IKB 2. Number and distribution of illegally killed, trapped or traded birds (data) 3. Extent of IKB cases known to justice 4. Number of IKB cases prosecuted in the last year (data)	A. National monitoring of IKB (data management of scope and scale of IKB)	6 + data
5. National wildlife legislation 6. Regulated use 7. Prohibitions under national legislation 8. Exceptions under national legislation 9. Sanctions and penalties 10. Proportionality of penalties 11. Use of criminal law 12. Organized crime 13. Transposition of international law and commitment to national legislation	B. Comprehensiveness of national legislation	27 (24 if the score of indicator 12 is "N/A")
14. National Action Plan for combating IKB 15. Enforcement priority 16. Stakeholders and policy-making	C. Enforcement response (preparedness of law enforcement bodies and coordination of national institutions)	15 (12 if the score of indicator 16 is "N/A") + data
17. Staffing and recruitment 18. Specialized training 19. Field enforcement effort (data)		
20. Quality of judiciary processes 21. Sentencing guidelines 22. Judicial awareness 23. Judiciary training	D. Prosecution and sentencing (effectiveness of judicial procedures)	12
24. International cooperation 25. Drivers of wildlife crime 26. Demand-side activities 27. Regulated community 28. Public awareness actions	E. Prevention (other instruments used to address IKB)	15
TOTAL MAXIMUM SCORE		75, (72 or 69)

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Appendix. List of illegal activities and methods

Based on the document prepared by BirdLife International on behalf of the Bern Convention

The list of known activities and methods of illegal killing, taking and trade of birds is derived from national and international reports of enforcement authorities and NGOs. This list can serve as the basis of a database to exchange best practices to tackle activities and report on the different types.

1. Methods of live trapping and taking

It is recognised that many of these methods frequently result in the death or injury of birds but they are categorised here as live trapping methods simply because the target bird is not killed/ maimed at the point of trapping.

Nest collection of eggs or young

- *Egg taking for collection*: collectors build large collections of clutches of different species and trade with one another. Eggs of rare birds as well as those of common birds are collected.

In 2008, police and RSPB officers raided egg collector's home. Inside they found an extraordinary collection of more than 7,000 wild bird eggs ©RSPB

- *Egg or young collection for breeding*: collectors take eggs from nests or take young out of the nest before fledging. Many species are difficult to breed in captivity and taking eggs or young from nests in the wild overcome this problem. These young can be fitted with closed foot rings.

Live trapping of adult birds

- *Bal-chatri traps*: these are traps designed to catch birds of prey or shrikes. The cage is constructed using mesh wire with nylon nooses on top. Inside the cage, a visible live rodent, small bird or pigeon is placed as bait. The bird of prey that attacks the bait will be snared by its legs.
- *Noose harness:* A technique commonly used for capturing falcons in North Africa. Known as 'Sharak' in Egypt, the harness is made of thick cotton thread and designed to fit on a pigeon as live

bait for falcons. When a bird of prey tries to catch the pigeon, its talons are caught in thread nooses on top of the harness.

- *Cages*: There is a large number of cage types being used. Several of these cages are used with a decoy bird to attract individuals of the same species; a compartment next to the decoy is used to trap the birds. The size of the traps can vary from 30 cm to 2-3 meter. Larsen traps are one of the popular types of cages.

Cage used in Italy © LIPU

- *Mist-net*: mist-nets are typically made of nylon mesh suspended between two poles. The grid size of the mesh netting varies according to the size of the species targeted for capture. Net dimensions are approximately 1–4 m high by 6–15 m long. Also known as Trammel nets in Egypt.

Blackcap trapped in mist-net in Cyprus © BirdLife Cyprus

Trammel nets in Egypt © NCE

- *Clap net*: mechanism allowing poachers to trigger nets (several hundred square metres in area) to clap together over the birds, when enough individuals have landed in the trap area. Trap known as "Filets matoles" in France.

Clap net installasion on the Atlantic coastline (France) © CABS

- *Tape-luring*: With a type of recorder/ipod the song of a species or a mixture of several species is played in a continuous loop. Tape-luring is often used in studies of bird migration, and the technique can strongly augment the total number of birds captured. Tape-luring can increase the capture probability of birds already at site and attracting birds that normally would have overflown the site. Not all species react in autumn on tape-luring, but especially Blackcaps are known to be strongly attracted by the played song.
- *Munsaab*: trap used in Egypt composed of grass or sticks in a tent like structure to catch ground-dwelling birds seeking shelter (quail, larks, wheatears, corncrakes etc.).

Munsaab nets in Egypt © NCE

- *Eb nets*: trees and scrub are covered in large mist-nets to catch perching species, technique used in Egypt.

Eb nets in Egypt © NCE

2. Methods designed to kill birds

Traps designed to kill/ maim

- *Lime-sticks*: lime-sticks are twigs about 50-70cm long that are streaked with a sticky type of glue. These sticks are placed in open areas or gardens in bushes, or sometimes inserted into the ends of bamboo poles, to provide perches for birds. Any bird landing on a lime-stick gets stuck. Method known as “gluaux” in France.

Red-backed Shrike trapped on lime-stick in Cyprus © BirdLife Cyprus

Gluaux traps in France © LPO PACA

- *Snares or bow trap*: snares are anchored cables, wire nooses or made from horsehair set to catch wild birds. Birds are lured by berries to perch on the horizontal stick. This causes the bow to spring apart and the bird's legs are caught in the cord. They then hang head downwards with crushed legs until they are killed by the trapper. Snares are one of the simplest traps and most often used to kill the bird. Trap known as "tenderie" in France.

Horsehair snares used in France © LPO Champagne-Ardennes

- *Deadfall (stone) trap*: a deadfall is a heavy rock or wooden log that is tilted on an angle and held up with sections sticks. One of the sticks serves as a trigger. Trap known as "tendelle" in France and "stone-crush trap" in Croatia.

Stone-crush trap in Dalmatia (Croatia) © BIOM

Tendelle trap in Aveyron (France) © LPO Aveyron

- *Snap traps*: snap traps operate on the mousetrap principle - when a bird, lured by a worm or berry, brushes against the sensitive release mechanism, the clamp snaps shut and crushes the bird. Death is usually instant.

Snap trap used in Brescia region (Italy) © LIPU

Other methods of killing

- *Illegal use of firearms*: such as with silencers, night vision scope, automatic and semi-automatic guns.
- *Poisoned baits*: a poisoned bait may take the form of a bird or animal carcass or piece of meat which has been sprinkled or injected with poison.

3. Trade & transport

- *Birds of prey and waterbirds*: birds of prey and waterbirds are of particular interest to some bird keepers. Since they are in general difficult to breed in captivity, there is a significant illegal trade of these species.
- *Cagebirds*: popular cagebirds like finches are relatively easy to catch and are kept in captivity in large numbers.
- *Collections (trophy)*: taxidermy collectors will try to obtain birds from as many species as possible, preferably collected by themselves. To obtain certain species they might visit other countries.
- *Dead birds for food*: protected species are traded to countries like Italy where there is a high demand for wild birds as food.