WORLD ORGANISATION FOR ANIMAL HEALTH
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Guidelines for Wildlife Disease Surveillance: An Overview[1]

Purpose of Wildlife Disease Surveillance

Wildlife disease surveillance can be a useful and complementary component of human and animal disease surveillance, monitoring, prevention and control programmes, as well as conservation efforts. In the context of animal health, wildlife disease surveillance may provide information of domestic and wild animal morbidity and mortality, identify changes in patterns of disease occurrence over time, and assist in early detection of disease outbreaks, including those linked to emerging diseases. Many of the pathogens on the OIE List can infect and be maintained for long or short periods of time in wild animals. Since there are many species of wildlife, there are varied risks of bi-directional disease transmission in different regions or areas, which are dictated by the wildlife species and types of livestock interfaces present. Thus, national wildlife disease surveillance programmes are crucial for understanding local risks to animal health and potential zoonotic disease transmission.

"Wildlife disease surveillance" may also refer to pathogen surveillance in wildlife, given that infection with pathogen(s) may not always produce visible clinical signs associated with disease in a given species or at a given point of time. The objective of a surveillance programme should be clearly defined as to whether it is aimed at disease or pathogen detection.

Data collected for the OIE's non-listed pathogens and diseases in wildlife are not used to shape international trade policy in any way.

Distinctions from Domestic Animal Surveillance

Whereas farmers, animal handlers and veterinarians will commonly recognize illness in domestic animals, in most situations wild animals do not have this close observational vigilance and monitoring, which can limit detection and reporting of diseases in wildlife as well as access to data collected from other sources (*GTAHS, p. 32*). In addition, some diagnostic tests may not be validated for wild species in terms of specificity and sensitivity (OIE Reference Laboratories can provide guidance to help address this challenge) (*Focal Point Manual, p. 34*). There are also different stakeholders and participants; for example, wildlife biologists and ecologists should be engaged in the development, analysis, interpretation and communication of results for a wildlife disease surveillance programme. Additionally, hunters, wildlife managers or rehabilitators, conservation managers and other stakeholders may be key collaborators in acquiring specimens. While there are not always clear solutions for management and control of diseases in wildlife detected by surveillance efforts (*GTAHS, pp. 41-43),* knowledge of the occurrence of specific diseases and pathogens in wildlife can be used to reduce health and economic risks to domestic animals and people.

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[1] This document makes reference to two key resources that can be consulted for further information:
- World Organisation for Animal Health (OIE). Training manual on surveillance and international reporting of diseases in wild animals (*Focal Point Manual*). 2nd OIE Training Workshop for Focal Points on Wildlife. 2015.
- World Organisation for Animal Health (OIE). Guidelines for Terrestrial Animal Health Surveillance (*GTAHS*). 2014.

Similarities with Domestic Animal Surveillance

With a few modifications based on the differences above, much of the diagnostic, information management, and communication capacity in existing animal health surveillance programmes (Chapter 1.4. *Animal health surveillance*[2]) can be used for wildlife disease surveillance programmes. Like domestic animal disease surveillance, wildlife disease surveillance programmes should be implemented as an ongoing, continuous activity providing actionable information.

Core Components

There are four essential core components of all disease surveillance programmes (*Focal Point Manual, p. 13)*. Specific considerations for wildlife are noted below:

1) Detection of pathogens and diseases: These efforts may require broad participation from many stakeholders to gain access to samples. Training of stakeholders can greatly improve detection.

2) Identification of pathogens and diseases: Many pathogens infecting wildlife are readily identified by diagnostic capacity of well-equipped veterinary diagnostic laboratories established for domestic animals. Some wild animal pathogens or diseases may be rare or new to science, and their identification may require follow-up analysis (e.g. genetic sequencing). Detection and identification of pathogens of importance in wildlife may justify investment in targeted surveillance efforts to acquire more detailed information.

3) Analysis and communication: Review of information obtained from surveillance and analysis in various ways requires input from epidemiologists, wildlife biologists and ecologists (*Focal Point Manual, pp. 21-22*). The validity and accuracy of test results should be carefully considered, especially if the sensitivity and specificity of the diagnostic tests used have not been validated in wildlife (*Focal Point Manual, pp. 36-40*; Guideline 3.6.7. *Principles and methods for the validation of diagnostic tests for infectious diseases applicable to wildlife*[3]).

4) Information Management: At least a minimum level of data should be collected; for example, data should be recorded on the disease incident or sampling event, date, latitude and longitude coordinates, observation of mortality or sickness, specimen identification numbers, animal species, laboratory identification numbers, and diagnos(es) with associated detection method (*Focal Point Manual, pp. 23-26*). Feasible data collection requirements should be determined before a programme is initiated, as additional information may provide further context, but requires greater effort and may not always be necessary to achieve surveillance goals. Some of the information routinely collected from domestic animal surveillance may not be available in wildlife disease surveillance. OIE Member Countries are highly encouraged to submit data produced from wildlife disease surveillance to *WAHIS-Wild* as part of the OIE's voluntary notification of specific wildlife diseases that are not on the OIE List.

These critical components are independent activities carried out by different groups of people. Therefore, constant coordination across all four critical components is crucial; roles must be clearly designated, with frequent communication across the surveillance network.

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2 OIE *Terrestrial Animal Health Code*, http://www.oie.int/en/international-standard-setting/terrestrial-code/access-online/

3 OIE *Manual of Diagnostic Tests and Vaccines for Terrestrial Animals*, http://www.oie.int/en/international-standard-setting/terrestrial-manual/access-online/

Surveillance Programme Strategies

There are two main categories of wildlife disease surveillance (*GTAHS, pp. 65-72*). Both are designed with the same four essential components, but have the following distinctions, which largely affect sample collection methods:

1) General or Scanning wildlife disease surveillance (sometimes referred to as "passive" surveillance) is *aimed at detecting disease and pathogens in wild animals*, rather than obtaining statistical data on one or a few pathogens, such as pathogen prevalence estimates. A wide range of stakeholders (such as hunters, wildlife rangers, conservation organisations, etc.) might be involved in an opportunistic disease detection network for general surveillance. Anatomical pathology is an especially important capacity for general wildlife disease surveillance to determine cause of death and disease (*Focal Point Manual pp. 16-26 and pp. 34-35*).

2) Targeted wildlife disease surveillance (sometimes referred to as "active" surveillance) is focused on *one or more particular pathogens* in *one or more wild animal species*, typically is used to obtain statistical data on prevalence, age and sex distribution of infection, or geographic distribution of the pathogen. Although there are often challenges in getting a representative sample base, this approach can more precisely estimate prevalence or incidence, (*Focal Point Manual pp. 34-57);* unique field methods (such as radar tracking or mark-recapture efforts) may be necessary to estimate population size and structure (*GTAHS, pp. 51-52*). Specific decisions must be made regarding, sample size, sampling times and places, specific species, and number and type(s) of samples to collect in targeted surveillance programmes (*Focal Point Manual pp. 55-57).*

The determination of whether to use general or targeted surveillance depends on the goals of each programme, as well as the resources available. Programmes may also employ a mix of general and targeted wildlife disease surveillance.

Risk-based surveillance approaches may also be used (*GTAHS pp. 82-91*), which may be informed by targeted surveillance data (*Focal Point Manual, pp. 34-35*). This may be an especially important priority for initiating wildlife disease surveillance in settings where resources are limited.

The lack of validation of some diagnostic tests in wild animal species may present unique challenges in selecting tests for specific pathogens. In these cases, tests should be selected on a species-specific basis, in addition to considering the capabilities of laboratories available to conduct the testing, cost, and recommended sample type. OIE References Laboratories can be consulted to advise on such considerations for pathogen-specific screening methods in wildlife (*Focal Point Manual*, p. 36).

The specific goals of a wildlife disease surveillance system should be clearly defined.

However, wildlife disease surveillance systems, like any surveillance system, also benefit from flexibility (*GTAHS*, pp. 22-24). This is especially important as more information is generated that can improve understanding of wildlife disease risks and help refine surveillance strategies. Flexibility is also important given that priorities may change; for example, an influenza outbreak in poultry originating from a wild bird strain may demand enhanced wild bird surveillance. Having wildlife disease surveillance capacity in place that can be scaled up rapidly as needed can help achieve early detection, and inform response, and control measures.

Where possible, surveillance of wildlife at sites where human or domestic animal surveillance is also occurring may help provide information on cross-species disease transmission risks.

Non-lethal sampling of wildlife is encouraged to support biodiversity conservation goals (and killing of certain wildlife species may be prohibited by national or regional endangered species listings). However, this should not be to the exclusion of samples provided by hunters, or samples from wildlife mortality events, where available and appropriate. For a select number of diseases, animals exhibiting suspected disease may require culling to obtain samples for disease screening (for example, as seen with infection with rabies virus).

Wildlife Disease Surveillance Authorities

There is not always a defined government authority/ministry responsible for wildlife health in a country. In this case, OIE Member Countries are encouraged to initiate or join discussions among competent authorities such as veterinary services, ministries representing livestock services/agriculture, human health, and wildlife/forestry/environment to determine the appropriate authorities(s) for overseeing wildlife disease surveillance. Such collaboration is crucial to ensure constant coordination across the four core components of a surveillance system (*Focal Point Manual, pp. 16-18*). Ongoing discussion between these ministries (as well as others, such as tourism or finance, as relevant) should be undertaken to encourage data sharing and interpretation and to refine surveillance systems as needed. A wide range of other stakeholders can also be engaged for a robust wildlife disease surveillance network (*Focal Point Manual, pp. 18-22).*

Role of the OIE Focal Points for Wildlife

The OIE National Focal Points for Wildlife provide a key resource to OIE Member Countries on several aspects of OIE priorities, including supporting the development and success of wildlife disease surveillance programmes. A country's Focal Point must join and often coordinate a network of people and institutions to participate in wildlife disease surveillance, promoting effective collaboration and reporting, and identifying needs for national capacity building.

Wildlife Disease Surveillance Budget Planning

Development of a designated budget for wildlife disease surveillance is important as part of a national programme. Budgeting for a wildlife disease surveillance programme should include the main cost categories in an animal health surveillance system: Personnel, Infrastructure, Communication, and Training (*GTAHS, page 26*), although these may be incorporated into complementary budget planning frameworks, such as the four main components of a surveillance system (detection of pathogens and diseases, identification of pathogens and diseases, analysis and communication, and information management). Budget planning should consider the intended number of specimens per budget period, and the cost of the diagnostic procedures to be used (autopsy and additional laboratory tests for general surveillance; specific tests for pathogens or antibodies in targeted surveillance) since that will determine resource and capacity requirements and associated costs. Typically expected items within the broad cost categories may include:

Personnel*:* Salaries and benefits/contractor fees and insurance. Team members are likely to include veterinarians and veterinary assistants or technicians (sample collection and information recording), animal capture teams, laboratory personnel, administrative personnel, and information managers.

Infrastructure*:* Specimen collection may include cost items such as personal protective equipment, transport of dead animals or samples to the laboratory. Samples from live animals may require vehicles, capture equipment, pharmaceuticals for capture and sedation (as relevant), and specimen collection supplies such as cryovials, virus transport media and sampling needles. The use of a helicopter for wildlife capture may be needed in certain situations where terrestrial capture is impractical or dangerous. Sampling and specimen logistics may include cost items such as vehicle and fuel costs or other mode of transport to and from field sites and laboratories, cold chain resources such as freezers, dry ice, liquid nitrogen, special packaging and shipping. The cost of these items may vary greatly depending on local conditions and sites, distance and time required for sample movement. Laboratory screening may include cost items such as physical laboratory space, equipment, primers, per-test cost, refrigerators and freezers, personal protective equipment, and electricity. Data recording and analysis tools may include cost items such as GPS data collection and site mapping tools, field notebooks and computers for data recording and database costs for longer-term data management.

***Communication**:* printing materials, teleconference lines, websites, hosting of or travel to meetings with stakeholders, including for coordinated planning, data review and interpretation.

Training: Capacity building resources (such as information workshops, hands-on training, text books). Additional costs may include fees for laboratory certification, continuing education, and consultations with reference laboratories.

Budgets can be developed for a general national wildlife disease surveillance plan, or for disease-specific targeted surveillance (for example, a specific programme targeted for highly-pathogenic avian influenza in wild birds). Basic budget templates can be found in Appendices I-II.

Budget Considerations

Many existing resources often can be used for wildlife disease surveillance, which may provide substantial cost-efficiencies. For example, specimens collected from wildlife disease surveillance may be tested at existing human or animal health laboratories, rather than developing a separate laboratory. Such an integrated approach is highly encouraged to 1) reduce duplication of efforts and unnecessary investments, and 2) promote collaboration between wildlife and domestic animal and/or human health authorities.

Practical Considerations

- As with domestic animal disease surveillance programmes, continual assessment of the performance of the programme is important for refining and improving wildlife disease surveillance programmes (*GTAHS, pp. 15-29*);

- For OIE Member Countries initiating wildlife disease surveillance programmes, emphasis should be on establishing a strategic baseline system that meets defined goals, rather than aiming to be comprehensive from the start. Effective systems can be scaled up or otherwise modified based on surveillance findings and resource availability.

Appendix I, II and III: Budget Planning Templates

The following templates provide examples of frameworks that could be used for budget planning for wildlife disease surveillance. Appendix I and II show broad framework categories. Appendix III provides an example with costs and quantity (for illustrative purposes only).

Appendix I: Budget Planning Framework by Cost Items

This template provides an example of a budget planning framework based on the four broad cost items of surveillance systems. It could be applied to a country's general wildlife disease surveillance programme, or tailored to surveillance for a specific pathogen, animal species, or population.

Wildlife Disease Surveillance: Budget Template			
Budget Period:			
Purpose:			
Item	**Cost per Unit**	**Number of Units**	**Total (Cost Per Unit * Number of Units)**
Personnel			
[Insert more rows as needed]			
Infrastructure – including physical infrastructure and consumables			
[Insert more rows as needed]			
Communication			
[Insert more rows as needed]			
Training			
[Insert more rows as needed]			
Total			

Appendix II: Budget Planning Framework by Surveillance System Components

This template provides an example of a budget planning framework based on the four broad components of surveillance systems. It could be applied to a country's general wildlife disease surveillance programme, or tailored to surveillance for a specific pathogen, animal species, or population.

Wildlife Disease Surveillance: Budget Template			
Budget Period:			
Purpose:			
Item	**Cost per Unit**	**Number of Units**	**Total (Cost Per Unit * Number of Units)**
Detection of Pathogens and Diseases			
[Insert more rows as needed]			
Identification of Pathogens and Diseases			
[Insert more rows as needed]			
Analysis and Communication			
[Insert more rows as needed]			
Information Management			
[Insert more rows as needed]			
Total			

Appendix III: Budget Planning Example

The following hypothetical budget is provided as an example of specific aspects that might be taken into account when completing a budget plan.

Wildlife Disease Surveillance: Budget Template			
Budget Period: January 2015 - December 2015			
Purpose: Foot and Mouth Disease Surveillance in Buffalo			
Item	**Cost Per Unit**	**Number of Units**	**Total (Cost Per Unit * Number of Units)**
Detection of Pathogens and Diseases			
Field personnel	16525	2 full-time employee X 3mos	8262
Per diem for employee(s)	15	2 employees*40 sampling days	1200
Sampling supplies	10	40 sampling days	400
Vehicle rental and average fuel per sampling trip	40	40 sampling days	1600
Helicopter use (pilot, fuel, etc.)	1000	20 sampling days	20000
Capture team hire	500	40 sampling days	20000
Dry ice	50	40 sampling days	2000
Sample shipping	50	40 sampling days	2000
Identification of Pathogens and Diseases			
Laboratory personnel	16525	1 full-time employee	16525
Testing equipment	10000	1 PCR machine	10000
Testing supplies	5	200 samples	1000
Fixed testing rate	10	200 samples	2000
Analysis and Communication			
Personnel	12000	.5 full-time employee	6000
Teleconference system	20	12 cross-ministry calls	240
Data recording material	2	40 sampling trips	80
Annual report	100	1	100
Information Management			
Personnel	12000	.5 full-time employee	6000
Equipment	5000	1	5000
Software	2000	1	2000
Total			103007