



Prepared in cooperation with the Canadian Wildlife Health Cooperative

## Electrocution (Avian) Case Definition for Wildlife

Chapter 1 of  
Section H, Non-Infectious  
**Book 19, Wildlife Disease Case Definitions**



Techniques and Methods 19–H1

**Cover:** Immature *Buteo jamaicensis* (red-tailed hawk). Photograph by Jordi Segers, Canadian Wildlife Health Cooperative; used with permission.

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By Julia S. Lankton, Laura Bourque, Bridget B. Baker, and Jane Parmley

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## Contents

Acknowledgments .....	iii
Introduction.....	1
Scope of the Case Definition .....	1
Case Definition Criteria .....	1
Individual, Place, and Time Criteria for Diagnosis and Testing.....	1
Field Criteria for Diagnosis .....	1
Laboratory Criteria for Diagnosis.....	2
Laboratory Criteria Categorization.....	2
Supplemental Diagnostic Information.....	2
Epidemiologic Linkage Criteria for Diagnosis .....	2
Case Classification .....	2
Quality Assurance Review Schedule .....	4
Impact.....	4
References Cited.....	4
Glossary.....	5

## Figure

1. Diagram showing case definition criteria add up to the case classifications .....2

## Table

1. Case classification chart for electrocution.....3





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## Introduction

Diagnostic laboratories receive carcasses and samples for diagnostic evaluation and pathogen/toxin detection. The intent of a case definition is to provide scientifically based criteria for determining (1) if an individual carcass has a specific disease and the confidence of that diagnosis; and (2) if a pathogen or toxin is evident in a carcass or sample (for example, swab, tissue sample, skin scraping, blood/serum sample, environmental sample, or other). Using these criteria, cases diagnosed with a specific disease (diagnosing disease) will be classified as “confirmed,” “presumptive,” or “suspected;” and evidence of a pathogen or toxin (detecting pathogen/toxin) will be classified as “exposed” or “present/detected.” Classification is based on a combination of factors: individual, place, time, history, clinical signs, diagnostic observations, and (or) diagnostic test results. Case definitions can bring clarity and consistency to the evaluation process. Their use within and between organizations allows more uniform reporting of diseases and etiologic agents.

Case definitions are proposed for use in wildlife diagnostic laboratories and are not intended to replace regulatory standards provided by Government reporting agencies. Ideally, case definitions would be updated periodically as new information becomes available and new test methods are developed. Refer to the glossary for terminology definitions.

*Disease/condition.*—Electrocution (avian)

*Pathogen/toxin etiologic agent(s).*—Power/electrical lines, transformers, and poles

## Scope of the Case Definition

This case definition applies to all avian species.

## Case Definition Criteria

The case definition criteria are a concise summary of the current science regarding the clinical signs, history, gross and microscopic observations, and laboratory test results associated with a specific disease or pathogen. Various combinations of the criteria result in different case classifications representing the degree of certainty of the diagnosis.

### Individual, Place, and Time Criteria for Diagnosis and Testing

*Individual.*—Large avian species, of which immature or subadult Falconiformes ssp. (raptors) may be at increased risk, or species with large wingspans and preference for exposed perching or nesting sites, such as cranes (Thomas, 1999; Lehman and others, 2007).

*Place.*—Any location where electrical lines are above ground but most commonly in open habitats (for example, shrub or grasslands) with high prey visibility and (or) lack of natural perches/nesting sites (Thomas, 1999; Lehman and others, 2007).

*Time.*—No restrictions but is more frequent with rain/snow (because of increased feather conductivity) or windy conditions (because of instability in takeoffs and landings) (Thomas, 1999; Lehman and others, 2007).

### Field Criteria for Diagnosis

*History and clinical signs.*—Location is not definitive, but electrocuted birds are typically found dead near a power pole or beneath a power line. There may be evidence of a vegetation fire and (or) history of a local electrical power outage. The presence of modifications to protect birds does not eliminate the chance that a bird will be electrocuted (Thomas, 1999; Lehman and others, 2007).

*Other.*—Birds struck by lightning are not included in this case definition.

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## Laboratory Criteria for Diagnosis

*Gross examination.*—Diagnostically compatible postmortem findings that are specific to electrocution cases consist of charring or burns to the skin or feathers at the sites of contact with the electrical source, which are commonly the wings distal to the elbow, and lower legs and feet. Burns are also common on the ventral body or face, and red streaking may be present on the feet or legs. Burns can be small and obscured underneath feathers or can be mistaken for dirt or blood staining. Burned feathers, including rictal bristles, can have twisted or curled edges. The scales of the feet and legs may have dry blisters or focal areas with tan to gray discoloration. Severe burns can extend through the integument to cause lacerations; pockets of dermal-muscular separation; a dry and tan appearance to the surfaces of subcutaneous tissue and muscle; liquefied adipose tissue; fractured wings, legs, or digits with possible amputation; or rupture of organs. Electrical currents can cause vascular injury that results in right atrial rupture, hemopericardium, or hemocoelom. Internal injuries may occur with no or minimal external injuries. Non-specific findings consistent with blunt force trauma (for example, contusions, fractures of the liver, pelvic girdle, or ribs) may also be associated with cases of electrocution because of the fall to the ground after electrocution (Thomas, 1999; Kagan, 2016; Viner and Kagan, 2018).

*Histopathology.*—Histopathological findings at burned sites specific to electrocution cases include intraepidermal and subepidermal separation, epidermal coagulation necrosis, smudging of dermal collagen, loss of differential staining of affected layers, and elongation of epidermal nuclei (Kagan, 2016; Viner and Kagan, 2018).

*Diagnostic test(s).*—Not applicable.

## Laboratory Criteria Categorization

*Laboratory confirmed.*—Visible burns and (or) singed feathers. Electrocutation does not have a specific diagnostic test.

*Laboratory supportive.*—No clearly visible burns or singed feathers but has other compatible gross or histopathologic findings suggestive of electrocution.

*Exposed.*—Not applicable.

*Present/detected.*—Not applicable.

## Supplemental Diagnostic Information

*Additional diagnostic comments.*—Examination with an alternate light source (530–570 nanometers with red filter) may help to distinguish burns versus dirt or blood staining. Burned skin, feathers, and beak will exhibit red photoluminescence. For similar purposes, wet mounts of burned feathers may reveal broken barbs or vanes with melting or charring at the ends, whereas burned skin may have tan to gray discoloration and melting of the papillae (Kagan, 2016).

*Notifiable/reportable disease.*—Not applicable.

## Epidemiologic Linkage Criteria for Diagnosis

Not applicable.

## Case Classification

The sum of the criteria listed in the “Case Definition Criteria” sections (individual, place, time, field, laboratory, and epidemiologic linkage criteria) associated with a particular disease or pathogen/toxin in an individual animal or specimen add up to a case classification (fig. 1; table 1).

Depending on the confidence in the results, cases of a specific disease will be classified as “confirmed,” “presumptive,” or “suspected;” and evidence of a pathogen or toxin will be classified as “exposed” or “present/detected” (table 1; refer to glossary for definitions). A specific case classification may have more than one pathway to it. Not all classifications may be used for every disease. Although an epidemiological linkage may be present in all classifications, the “suspected” case classification requires compatible epidemiological linkage criteria are met. Individual disease and pathogen specific details are presented in table 1.

*Note.*—The field and laboratory criteria in table 1 reflect the typical presentation of electrocution. The exact presentation in an individual animal or specimen may vary from what is presented in table 1 but should still conform with the information presented in the “Field Criteria for Diagnosis” and “Laboratory Criteria for Diagnosis” sections.

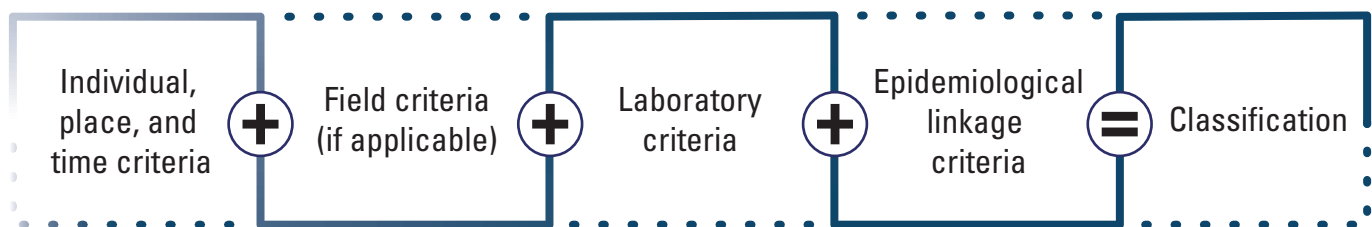


Figure 1. Case definition criteria add up to the case classifications. From Miller and others (2024).

**Table 1.** Case classification chart for electrocution.

The suspected case classification and the detecting toxin/pathogen case classifications (exposed and present/detected) are not applicable to this case definition.

Individual, place, and time criteria	Field criteria (if available)	Laboratory criteria	Epidemiological linkage criteria	Classification
Diagnosing Electrocution (Avian)				
Large avian, any place, any time	Found under or near powerline or pole	Meets laboratory confirmed criteria: <i>Gross examination.</i> —Visible burns and (or) singed feathers <b>and</b> <i>Diagnostic test(s).</i> — Not applicable	Not applicable	Confirmed
Large avian, any place, any time	Found under or near powerline or pole	Meets laboratory supportive criteria: <i>Gross examination.</i> — No visible burns or singed feathers but other compatible gross lesions e.g., ruptured atrium <b>or</b> <i>Histopathology.</i> — Epidermal coagulation necrosis or other compatible lesion <b>and</b> <i>Diagnostic test(s).</i> — Not applicable	Not applicable	Presumptive

## Quality Assurance Review Schedule

The Canadian Wildlife Health Cooperative and the U.S. Geological Survey National Wildlife Health Center staff plan to review this case definition periodically to incorporate new scientific information and test methods as needed.

*Planned date for next review.*—June 1, 2025

*Schedule.*— June 2025 and then every 3–5 years— or sooner if science about avian electrocutation changes substantially.

## Impact

Applying case definitions in diagnostic, surveillance, and research efforts can help standardize data, making it easier to understand and analyze within and between diagnosticians and laboratories. Laboratories are encouraged to store the case classification assigned to each specimen or sample in their data system so that it can be readily and reliably retrievable.

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## Glossary

**additional diagnostic comments** Any additional diagnostic notes pertinent to recording/reporting (for example, requests for strain/serovar/variant reporting, inconclusive/ambiguous results, or “not applicable”).

**case classification** The sum of the factors in the “Case Definition Criteria” sections of the case definition including individual (for example, species, age group), place, time, history, clinical signs, diagnostic observations, and (or) diagnostic test results, associated with a particular disease or pathogen/toxin in an individual animal or specimen. Depending on the confidence in the results, cases of a specific disease will be classified as “confirmed,” “presumptive,” or “suspected;” and a pathogen or toxin will be classified as “exposed” or “present/detected.”

**case definition** A consistently applied, scientifically based and clearly defined set of field, gross, histopathology, laboratory, or epidemiologic criteria used to classify an individual animal or sample to a specific disease or pathogen/toxin for surveillance or outbreak reporting purposes (based on the combination of the criteria and confidence in the results).

**confirmed case** The combination of individual (for example, species, age group), place, time, history, clinical signs, and laboratory criteria for diagnosis with the highest level of certainty for accepted diagnostic testing as stated in the case definition. Example: Cardinal with clinical signs, gross and microscopic lesions compatible with salmonellosis, and positive bacterial culture for *Salmonella enterica enterica* in the liver.

**diagnostic test(s)** Laboratory tests typically used to determine this diagnosis or detect the pathogen/toxin; for example, bacterial culture.

**diagnostically compatible** An animal that meets the individual (for example, species, age group), place, time, field, and laboratory criteria for a particular disease as stated in the case definition.

**disease** Any disorder of structure or function that may produce specific clinical signs; disease can be infectious or noninfectious.

**disease agent** Any pathogen, toxin, or other known cause of disease.

**epidemiologically linked** A case that has temporal, geographic, or other relevant linkages to one or more confirmed cases as described under “Epidemiologic Linkage Criteria for Diagnosis” in the case definition.

**exposed** Detection of a toxin in tissues or body fluids at a concentration above acceptable background levels but below the documented lethal threshold level for the species. This may apply to a toxin detected in the absence of documented lethal threshold levels. This category can also include serological evidence of infection in the absence of other information such as organism detection or disease diagnosis.

**gross examination** Gross necropsy observations in a carcass or sample that are diagnostically compatible with disease.

**histopathology** General microscopic observations in a carcass or sample that are diagnostically compatible with disease.

**history and clinical signs** Field observations and changes to behavior, appearance, or abilities in live animals/populations that are diagnostically compatible with disease. Photograph or video evidence may be used when appropriate.

**individual** The common age groups, species, or other characteristics that increase disease or pathogen/toxin suspicion.

**laboratory confirmed** The strongest degree of assurance in identification of a disease agent of interest and evidence of the associated disease based on one or more accepted laboratory methods. A test or combination of methods that has been scientifically accepted as definitive for a particular disease agent and the associated disease. Example: Positive bacterial isolation for salmonella plus compatible gross and histologic lesions for salmonellosis.

**laboratory criteria for diagnosis** The gross, microscopic, molecular, culture, analytical or other laboratory test criteria used to determine the presence of a specific disease agent and evidence of the disease itself. These are categorized based on the validity and performance of the test(s). Categories are “laboratory confirmed,” “laboratory supportive,” “exposed,” and “present/detected.” Where possible, references for the current accepted science for a given disease and pathogen are provided in the case definition. For some select new or emerging diseases the laboratory criteria may be based on the collective expertise of pathologists at the U.S. Geological Survey National Wildlife Health Center and the Canadian Wildlife Disease Cooperative or other institutions.

**laboratory supportive** Laboratory results that are less than definitive for a specific disease agent and the associated disease. A test or combination of methods whose results support the diagnosis or a particular disease but are not considered definitive; for example, a screening test. Test result interpretation may be based on the tissue tested (for example, culture of amphibian skin surface versus internal tissue) or postmortem condition of the sample. Example: Gross and histologic lesions compatible with salmonellosis (without laboratory testing).

**notifiable/reportable disease** A disease or pathogen that by law must be disclosed to State, Provincial, and (or) Federal agricultural or public health authorities.

**other (field criteria)** Additional pertinent comments about presentation (for example, potential for carrier status).

**place** Locations and other geographic features that increase disease or pathogen/toxin suspicion.

**present/detected** Laboratory detection of a potentially pathogenic agent in the absence of findings diagnostically compatible with the associated disease. Often used when tracking a known or suspected asymptomatic carrier state (for example, *Salmonella* or duck virus enteritis) or when documenting detection of an agent that is of increased diagnostic or epidemiologic interest, even in the absence of evidence of illness (for example, new or emerging disease or syndrome).

**presumptive case** The combination of individual (for example, species, age group), place, time, history, clinical signs and laboratory criteria for diagnosis that has a moderate degree of certainty as stated in the case definition. This uncertainty may be due to the test performed, postmortem decomposition of the carcass affecting observation or interpretation of gross and or histopathologic lesions, inadequate sample for testing due to scavenging or carcass size, inconclusive test results, or lack of a definitive diagnostic test. Enough information is available to conclude the disease is most likely present but not enough information available to conclude the disease is definitively present. Example: Raccoon with compatible histologic lesions for parvovirus without additional laboratory test results.

**scope** Indicates what species, when and (or) where this protocol applies; for example, specifics regarding the disease agent, animal class, sex, age group, location, season, antemortem or postmortem sample collection, environmental samples, and so on.

**suspected case** This is primarily based on a combination of individual, place, time, minimal or nonspecific field and laboratory information and a geographic and temporal (epidemiologic) connection to a confirmed case. Not enough information is available to meet the threshold in the case definition for a confirmed or presumptive case, but the diagnosis can reasonably be inferred by the close association with confirmed cases of a particular disease in other animals collected from the same general location and time. Example: A specimen with a geographic or temporal link to a confirmed case of a disease that is not tested but was examined and may have nonspecific gross or histopathologic findings that are compatible with that disease.

**time** The season(s), months, or other temporal factors that increase disease or pathogen/toxin suspicion.

**wildlife** Free ranging vertebrate species (mammals, birds, reptiles, amphibians, and fish).

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