

Wildlife Camera Metadata

Standards for Alberta

2022

Version 1.0

Prepared by

Alberta Biodiversity Monitoring Institute

on behalf of the

Alberta Remote Camera Steering Committee

Wildlife Camera Metadata: Standards for Alberta

Published by the Alberta Remote Camera Steering Committee

Prepared by Alberta Biodiversity Monitoring Institute on behalf of the Alberta Remote Camera Steering Committee

Citation for this document:

Alberta Remote Camera Steering Committee (RCSC). 2022. Wildlife Camera Metadata Standards: Standards for Alberta. Edmonton, Alberta.

© Alberta Remote Camera Steering Committee

For more information about the Alberta Remote Camera Steering Committee, please email Anne.Hubbs@gov.ab.ca.

For further information about The Fisheries and Wildlife Management Information System (FWMIS), please visit the [FWMIS website](#).

For further information about WildTrax, please visit the [WildTrax website](#).

For further information or if you have questions about this protocol, please email Anne.Hubbs@gov.ab.ca.

Preface

This document was created by the Alberta Remote Camera Steering Committee (RCSC). The Alberta RCSC is chaired by Alberta Environment and Parks and comprises a group of wildlife camera experts from academia, government and not-for-profit organizations who aim to advance the science of wildlife camera monitoring and research while facilitating collaboration and knowledge sharing among wildlife camera users in Alberta.

The objective of this Wildlife Camera Metadata Protocol is to provide guidance on the types of data that should be collected and reported when using remote cameras (also referred to as camera traps) to detect wildlife in Alberta. The goal of the protocol is to support the creation of a consistent, consolidated wildlife camera dataset across Alberta. Consistent collection of wildlife camera data supports data consolidation and, accordingly, the creation of large spatiotemporal datasets on wildlife distributions across Alberta. This provides opportunities to answer research and monitoring questions across jurisdictions and ultimately at national and global scales. Aiming to align metadata collection standards across western Canada, this document heavily relied on the Wildlife Camera Metadata Standards developed by the province of British Columbia (RISC, 2019). This protocol follows a hierarchical structure that mirrors the British Columbia Standards (RISC, 2019) but includes explicit instructions on how wildlife camera data should be collected and documented in Alberta.

This protocol does not provide guidance on wildlife camera monitoring or research designs. However, documenting wildlife camera metadata following this standard will establish a robust foundation when developing a study design for wildlife camera monitoring or research. Careful consideration of the project objectives and data collection design for any wildlife camera project is encouraged. Recommendations for study designs that are appropriate to achieve various objectives are available in reports and the scientific literature.

Acknowledgments

We sincerely thank the Government of British Columbia for the use of their Wildlife Camera Metadata Protocol, which formed the basis for the Alberta Wildlife Metadata Protocol. The Alberta Biodiversity Monitoring Institute (Kat Villeneuve, Corrina Copp, and Monica Kohler) prepared this Alberta Wildlife Metadata Protocol, with guidance from the Alberta Remote Camera Steering Committee (RCSC). This document was greatly improved by reviewers from across British Columbia and Alberta. A special thanks to Lonnie Bilyk, Resource Data Biologist with Alberta Environment and Parks, for his insights.

All decisions regarding protocols are the responsibility of the Alberta RCSC.

This protocol was based on the foundational *Wildlife Camera Metadata Protocol: Standards for Components of British Columbia's Biodiversity No. 44* (RISC, 2019) created by the Province of British Columbia, which pulled concepts from *the Camera Trap Metadata Standards (CTMS; Forrester et al. 2016)*. All efforts have been made to align this protocol with these standards to increase the standardization of remote camera datasets across jurisdictions, ultimately at a national and global scale.

Table of Contents

Preface	ii
Acknowledgments	iii
1.0 Introduction	1
2.0 Protocols	2
2.1 Projects	2
2.1.1 Project Name	2
2.1.2 Project Coordinator	2
2.1.3 Location Description	3
2.1.4 Project Description	3
2.2 Study Area	5
2.2.1 Study Area Name	5
2.2.2 Study Area Description	5
2.3 Surveys	5
2.3.1 Survey Objectives	5
2.3.2 Target Species	6
2.3.3 Crew Members	6
2.4 Deployments	6
2.4.1 Deployment Name (Sample Station Label)	6
2.4.2 UTM Zone Sample Station	6
2.4.3 Easting or Longitude Sample Station	6
2.4.4 Northing or Latitude Sample Station	7
2.4.5 Number of Cameras	7
2.4.6 Deployment Feature	7
2.4.7 Sample Station Comments (Optional)	8
2.4.8 Deployment Start Date	8
2.4.9 Deployment End Date	8
2.4.10 Camera Days (Total Deployment Time per Unit)	8
2.4.11 Camera Make and Model	9
2.4.12 Camera Serial Number	9
2.4.13 Quiet Period Setting	9
2.4.14 Trigger Sensitivity Setting	9
2.4.15 Trigger Timing	9
2.4.16 Photos per Trigger Setting	9
2.4.17 Bait/Lure Type	9
2.4.18 Deployment Comments (Optional)	10
2.4.19 Deployment Area Photos (Optional)	10
2.5 Sequence/Image (Sequence Image Data)	10

2.5.1 Sequence/Image Start Date	10
2.5.2 Sequence/Image Start Time.....	11
2.5.3 Sequence/Image Temperature.....	11
2.5.4 Sequence/Image ID.....	11
2.5.5 Sequence Definition.....	11
2.5.6 Species	12
2.5.7 Count	12
2.5.8 Life Stage and Sex Classes	12
2.5.9 Behaviour (Optional).....	13
2.5.10 Animal ID	13
2.5.11 Human Transport Mode.....	13
2.5.12 Analyst	14
2.5.13 Comments (Optional)	14
3.0 Conclusion	14
3.1 Data Archival.....	14
References.....	15
Appendix 1	18

1.0 Introduction

The objective of this Wildlife Camera Metadata Protocol is to provide guidance on the types of data that should be collected when using remote cameras (sometimes referred to as camera traps) to detect wildlife (hereafter wildlife cameras). The overarching goal of this protocol is to support the creation of a consistent, consolidated wildlife camera dataset across Alberta. Such data is invaluable for monitoring wildlife across space and time.

This protocol does not provide guidance on wildlife camera monitoring or research designs. The breadth of wildlife camera applications for wildlife monitoring and research (e.g., the variety of taxa that can be monitored) makes it impossible to create a single design to achieve such diversity of applications. However, this protocol provides guidance on what data should be collected and documented when using wildlife cameras to detect wildlife and supports the development of robust wildlife camera monitoring or research designs.

Wildlife cameras are a valuable tool for detecting a wide range of wildlife species (Burton et al., 2015; Lahoz-Monfort & Magrath, 2021; O'Connell et al., 2010). Wildlife cameras consist of a digital camera with an external flash and/or passive infrared sensor (see Lahoz-Monfort & Magrath, 2021; Rovero et al., 2013 for detailed reviews). When animals pass in front of a camera, the sensor is triggered, and the resulting images are stamped with the date and time. Date and time stamps are valuable because combining image data with data from Global Positioning Systems (GPS) provides a permanent spatial and temporal record of wildlife occurrences. Although wildlife cameras are primarily used to detect medium to large-sized mammals, they have also been used to detect small mammals (e.g., (Lazenby et al., 2015; Mills et al., 2016; Tschumi et al., 2018) and birds (e.g., Kruger et al., 2018; Lynch et al., 2015; Suwanrat et al., 2015).

Wildlife cameras are typically used to obtain data on the presence/non-detection and relative abundance of wildlife (e.g., number of detections per camera day). They have been used to measure relative abundance (Carbone et al., 2001), density of marked (Karanth et al., 2006) and unmarked (Becker et al., 2022) animals, diversity (Ahumada et al., 2011), habitat use (Bowkett et al., 2008; O'Connell et al., 2006; Whittington et al., 2019), individual breeding status (Fisher et al., 2014), and the effects of human activity on distribution (Muhly et al., 2011) and behaviour (Holinda et al., 2020; Murray et al., 2016). In addition, wildlife cameras have been used to assess the response of animals to changes in local habitat features. For example, cameras have been used to measure wildlife use of linear features (Tigner et al., 2014) and response to linear barriers (Burkholder et al., 2018; Dunne & Quinn, 2009), highway crossing structures (Clevenger & Waltho, 2005) and resource extraction operations (Muhly et al., 2015).

There has been a global push to standardize the collection of wildlife camera data (Fegraus et al., 2011; McShea et al., 2020; Meek et al., 2014; Steenweg et al., 2017). Here, we developed a Wildlife Camera Metadata Protocol specific to Alberta by building from the existing British Columbia Wildlife Camera Metadata Protocol (RISC, 2019), which was created with guidance from the literature (e.g., the open Camera Trap Metadata Standard (CTMS) by Forrester et al. (2016)). The Alberta Wildlife Camera Metadata Protocol also builds on the experience of wildlife

camera users in Alberta, British Columbia and other jurisdictions and creates the opportunity for data from Alberta to be integrated with global wildlife camera datasets.

2.0 Protocols

This Wildlife Camera Metadata Protocol utilized Forrester et al.'s (2016) proposed hierarchical structure for wildlife camera data. This protocol aligns with BC's Wildlife Camera Metadata Standards, Alberta Biodiversity Monitoring Institute's remote camera tagging platform (WildTrax), and the Government of Alberta's Fish and Wildlife Management Information System (FWMIS).

Data are organized into a hierarchy with five levels: Project, Study Area, Survey, Deployment, and Sequence/Image (Figure 1). This protocol describes the minimum metadata that should be documented for each of the five levels, as well as how to include optional data fields. Equivalent data fields may appear under different names in Forrester et al. (2016) CTMS, the British Columbia Wildlife Camera Metadata Protocol (RISC, 2019), WildTrax, and FWMIS. To provide user-friendly terminology, a crosswalk table (Appendix 1, Table 1a,b) has been provided that can be used to match data fields between these protocol/repositories, to further the potential amalgamation of data from Alberta with global wildlife camera datasets.

The process for recording and submitting data involves entering Deployment and Sequence/Image information into a standardized data repository to facilitate long-term storage, prevent data loss and enhance the comparability of remote camera data in Alberta.

In Alberta, there are regulatory requirements to submit data to the [FWMIS database](#) according to existing provincial policies (e.g., Sensitive Species Guidelines, Research and Collection permits). Refer to the Government of Alberta web pages for further information.

All fields described in this Wildlife Camera Metadata Protocol are mandatory unless stated as optional.

2.1 Projects

Data on the Project should include information on the objectives, methods, location and time period of study. Careful consideration of the objectives and data collection design for any wildlife camera project is encouraged. Recommendations on the appropriate designs to achieve various objectives are available in reports and the scientific literature (see Burton et al., 2015; Fisher & Burton, 2012; Meek et al., 2014; O'Connell et al., 2010; Rovero et al., 2013; Steenweg et al., 2015).

2.1.1 Project Name

The Project Name should be unique and in text format.

2.1.2 Project Coordinator

The Project Coordinator field should provide the first and last name of the primary contact (text format).

2.1.3 Location Description

The Location Description should describe the Project, Location, and details about large-scale habitat types and environmental conditions.

2.1.4 Project Description

The Project Description should clearly describe the Project objective(s), study design and methods. The Project Description should, at a minimum, include the following:

- **The Project design**, including descriptions of unique Study Areas and/or Surveys (if applicable)
- **Criteria for selecting sampling locations** (e.g., random, systematic, or targeted habitat types/features)
- **Camera arrangement** - Arrangement of cameras specific to the of cameras per design level (i.e., if cameras were 'clustered' into hierarchical groups with common characteristics, paired sites, or otherwise arranged (e.g., 4 cameras in pairs of 2 at each location)
- **Camera spacing** - the average, minimum or maximum between cameras
- **Surveyed area/study area extent and method of delineation** (e.g., management unit or minimum convex polygon)
- **Number of sampled sites** (Forrester et al., 2016; Meek et al., 2014)
- The **research permit number(s)** (if applicable)

For example:

“The objective of this program was to measure moose occupancy of Wildlife Management Units (WMUs) relative to adjacent areas to test whether moose are more likely to occupy UWRs during the winter. The study area extent included <location name> and was divided into 1 km grid cells. Sixty cameras were deployed in a subset of randomly selected grid cells inside (30 sites with one camera per site) and outside (30 sites with one camera per site) of UWR U-8-007 in the winters (November 1 to March 30) of 2015/16 and 2016/17. Cameras were deployed on wildlife trails in each selected grid cell and were at least 500 m apart from the nearest camera. The research permit number for this project was <number>.”

Other information relevant to the sampling design may be included in this section, including descriptions or links to procedures, software, tools or spatial layers used in the process.

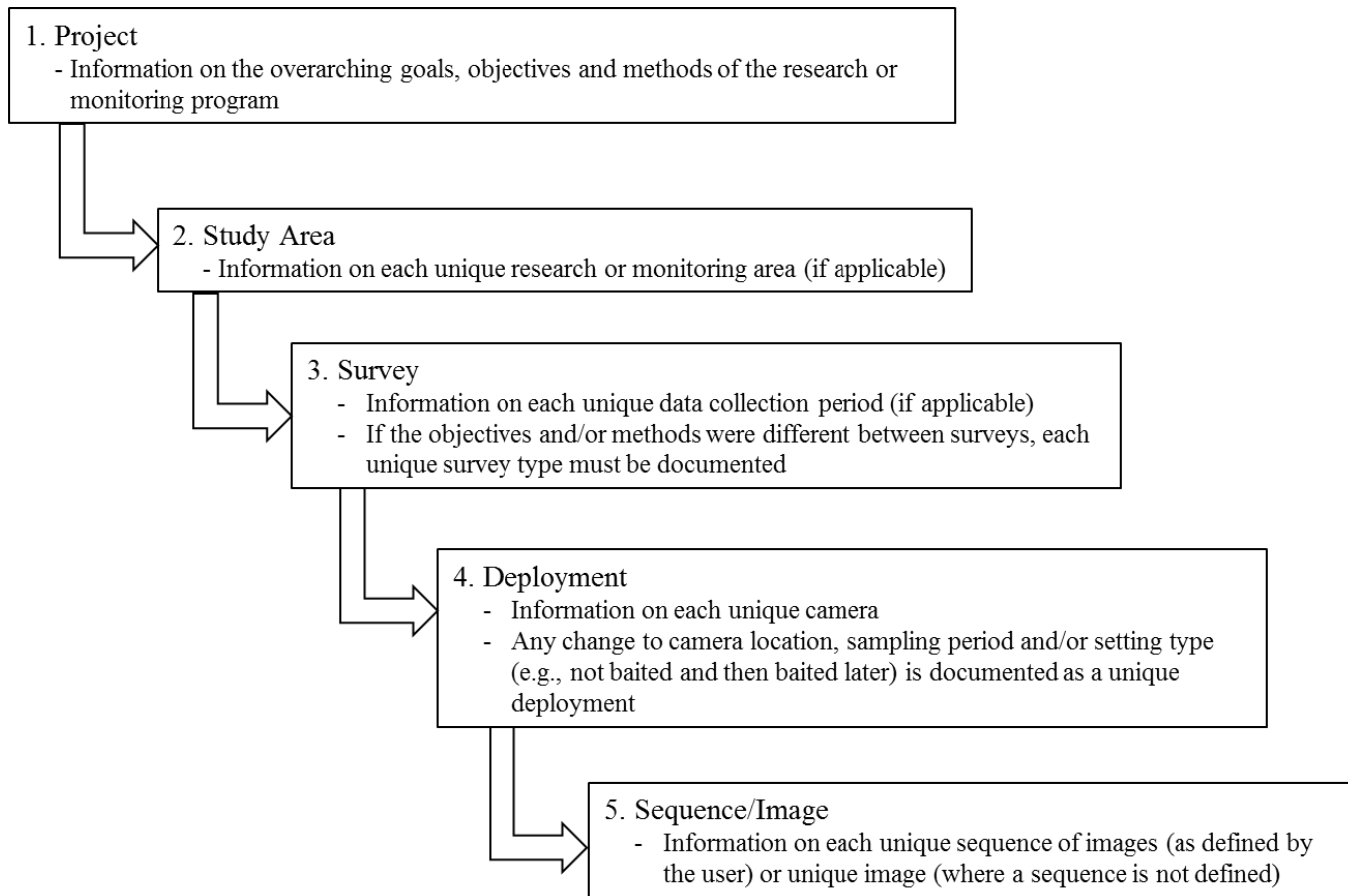


FIGURE 1. Hierarchical structure of wildlife camera data in the Wildlife Camera Metadata Protocol for Alberta. Based on Forrester et al. (2016) and the government of British Columbia’s Wildlife Camera Metadata Protocol (RISC, 2019).

2.2 Study Area

The Study Area level should include information on unique study area(s) within a Project. If only one area was surveyed, the Project and Study Area should be the same. If a Project consists of more than one Study Area, additional Study Area fields can be used to provide information about each unique area.

2.2.1 Study Area Name

The Study Area Name should provide a unique name(s) for each unique Study Area of a Project (if applicable).

2.2.2 Study Area Description

The Study Area Description should include the habitat type (if applicable), land uses and habitat disturbances within it and be described for each unique Study Area (if applicable).

2.3 Surveys

The Survey level should include information on the Survey(s) completed within a Project or Study Area. If a Project or Study Area consists of more than one type of Survey, each should have a unique name, and survey-specific information should be included by populating additional Survey fields. The same rule applies if an aspect of the study design changes during the Project (e.g., the target species or method of data collection). If a Project has multiple Study Areas and Surveys, careful attention should be used to ensure that each Survey is linked to the correct Study Area Name.

Note: The Project, Study Area and Survey may be the same if Surveys are completed in the same Study Area following the same design.

2.3.1 Survey Objectives

The Survey Objectives field describes the specific objectives and design of each Survey within a Project. If a Project has only one Survey or multiple Surveys with identical methods and locations, the Project and Survey objectives, and design may be the same. Otherwise, the differences between each unique Survey should be documented carefully.

If a Project and Survey Objectives are not the same, each Survey should, at a minimum, describe the following:

- **Criteria for selecting camera locations** (e.g., random, systematic, or targeted habitat types or features)
- **Camera arrangement** (i.e., if cameras were 'clustered' into hierarchical groups with common characteristics; e.g., paired sites)
- **Spacing between cameras** - average, minimum or maximum spacing between cameras
- **Surveyed area/study area extent and method for delineation** (e.g., management unit or minimum convex polygon)

- **Number of sampled sites** (Forrester et al., 2016; Meek et al., 2014)
- Research permit number

2.3.2 Target Species

A Target Species is the species that the Survey was designed to detect. Record this field if you are targeting a particular species or not. If more than one species was targeted, list them all.

The FWMIS species codes can be used for entering species data, which are built into the [FWMIS loadform](#).

2.3.3 Crew Members

The Crew Members field should contain a list of all the crew members who collected or entered data for a Survey, including complete first and last names.

2.4 Deployments

The Deployment level includes data on each unique camera within a Survey. Any change to camera location, sampling period, and/or setting type (e.g., not baited and then baited later) should be documented as a unique Deployment. The following subsections describe data fields that provide information related to each Deployment.

2.4.1 Deployment Name (Sample Station Label)

The Deployment Name should be a unique alphanumeric identifier for each sampling location. Because camera settings, setup, coordinates and survey effort may differ for each camera Deployment, it is recommended to give each camera a unique Sample Station Label and enter corresponding information for each camera in the Wildlife Camera Template in separate rows.

If cameras are set up in a non-independent array, users should label each camera sequentially and with a common linkage (e.g., SS01A, SS01B, SS01C, and SS01D). Providing a unique Sample Station Label for each camera Deployment will allow photos to be compared on a deployment-by-deployment basis. If multiple cameras are deployed at a single point (e.g., multiple cameras on a post), coordinates for each Sample Station Label will be identical. In some cases, multiple cameras deployed at a single point with uniform settings, setup, coordinates, effort and amalgamated observation data may be treated as a single sample station (see Section 2.4.5 for recording the number of cameras).

2.4.2 UTM Zone Sample Station

The UTM Zone of the Sample Station of each Deployment. This field is only required if users provide coordinates in UTM Easting and Northing.

2.4.3 Easting or Longitude Sample Station

The Easting or Longitude Sample Station is a numeric identifier describing either the UTM Easting or the Longitude of the Deployment (no need to provide both). UTM coordinates must be recorded using the NAD 83 datum. Longitude must be recorded in decimal degrees.

2.4.4 Northing or Latitude Sample Station

The Northing or Latitude Sample Station is a numeric identifier describing either the UTM Northing or Latitude of the Deployment (no need to provide both). UTM coordinates must be recorded using the NAD 83 datum. Latitude must be recorded using decimal degrees.

2.4.5 Number of Cameras

The Number of Cameras is a count of cameras deployed together at a Sample Station.

If several cameras were deployed together at a Sample Station (a group of cameras acts as the sampling unit), this field could be used to indicate the number of cameras in the sampling unit. If only one camera was used at a location, enter as "1." Note that in most cases, each camera should be entered as a unique Sample Station (Deployment Name, see section 2.4.1).

2.4.6 Deployment Feature

The Deployment Feature is the type of man-made or natural feature, if any, that the Deployment location was associated with. Cameras are often deployed on specific features to maximize the detection of wildlife species or to measure the use of the feature. Deployment Features are important to document in case they result in detection biases.

Deployment Feature types should be documented as one of the following:

- "Paved Road"
- "Dirt Road"
- "Gravel Road"
- "Hiking Trail"
- "Game Trail"
- "Road Crossing" (e.g., overpass, underpass, or bridge)
- "Culvert"
- "Burrow"
- "Nest"
- "Den"
- "Carcass" (not placed by the crew members as bait/lure)
- "Water" (e.g., creek, wetland, lake, spring),
- "Natural Mineral Lick"
- "Seismic Line"
- "Pipeline Right-of-Way"
- "Electrical Transmission Line"
- "Railway"
- "Clearcut"
- "Burn"
- "Fruiting Tree or Shrub"
- "N/A"
- "Other" (described in Sample Station Comments)

2.4.7 Sample Station Comments (Optional)

Sample Station Comments is an optional text field that allows users to describe additional details about the conditions at a Deployment location.

For example:

“Recent caribou activity in vicinity of station, lichen-rich habitat in old-growth stand, near river.”

2.4.8 Deployment Start Date

The Deployment Start Date is the date that a Deployment begins. The Deployment could commence on the same day the camera was installed or the day that it was checked to retrieve data (if that is how a user defines a sampling period). Any change to a camera location, sampling period, and/or setting type(s) (e.g., camera settings, the addition of bait/lure) should be considered a unique Deployment.

The Deployment Start Date format should be “**dd-mmm-yyyy**” (e.g., 17-Jun-2008).

2.4.9 Deployment End Date

The Deployment End Date is the date that a Deployment ends. For study designs where camera checks/data download events define a sampling period, the Deployment End Date for a specific Deployment will likely be the same date as the Deployment Start Date for the subsequent Deployment.

The Deployment End Date format should be “**dd-mmm-yyyy**” (e.g., 17-Jun-2008).

Note: if a camera fails (e.g., non-functioning) before the camera was checked or retrieved, the Deployment End Date should be the date the camera was last known to be operational. For example, if a camera was not operational when it was retrieved on May 5th, but the last photo was taken on April 28th, the latter should be considered the Deployment End Date.

On rare occasions, a camera may be non-functioning in the middle of a Deployment period but functioning at the beginning and end of the Deployment period (e.g., was covered in snow for a few days). In this case, two unique Deployments should be entered for periods before and after the period the camera was not functioning and with unique start and end dates.

To accurately measure survey effort in the event of camera failure, we recommend that users set cameras to take at least one picture per day, automatically at a daily interval (aka ‘Timelapse’ images). This will allow users to more accurately determine failure dates. For example, it may be difficult to determine a failure date for a camera that is only occasionally triggered by animals (e.g., on a weekly basis). Taking an image at a prescribed interval also provides a consistent record of site conditions over time (e.g., snow cover, vegetation growth).

2.4.10 Camera Days (Total Deployment Time per Unit)

The Camera Days is the number of days each camera was active and functioning correctly from the Total Survey Time (e.g., 24-hour periods or the difference in days between Deployment End and Start Dates).

Note: Camera Days can be calculated from Deployment Start and End Dates.

2.4.11 Camera Make and Model

The Camera Make (manufacturer) and Model number (e.g., Reconyx PC900 or Bushnell Trophy Cam HD) are particularly important for analyses where different types of cameras may result in variable detection probabilities.

2.4.12 Camera Serial Number

The Camera Serial Number should be documented when available. Doing so facilitates the separating deployments of cameras placed on the same tree when the deployment names are not unique, and identifies when new units were installed at existing deployment locations (due to damage, etc.).

2.4.13 Quiet Period Setting

The Quiet Period Setting provides the time, in seconds, between shutter “triggers.” If a quiet period was not specified, the Quiet Period Setting field should be set to “0”.

2.4.14 Trigger Sensitivity Setting

The Trigger Sensitivity Setting field describes the setting responsible for how sensitive a camera is to activation (“triggering”) via the infrared and/or heat sensors (if applicable; e.g., Reconyx HyperFire cameras have a choice between ‘low,’ ‘low/medium,’ ‘medium,’ ‘medium/high’ and ‘high’ sensitivity). If the trigger mode is set to a timer (see 2.4.15 “Trigger Timing”) or if the camera does not have a sensitivity setting option, the Trigger Sensitivity should be entered as “NULL.”

2.4.15 Trigger Timing

The Trigger Timing field provides the time between triggers (seconds) when the camera is set to take pictures at defined time intervals. If the trigger is set to sensor (see 2.4.14 “Trigger Sensitivity Setting”), Trigger Timing should be entered as “NULL.”

2.4.16 Photos per Trigger Setting

The Photos per Trigger Setting field describes the setting for the number of photos taken each time the camera was triggered (e.g., “1 of 1”, “1 of 3”, etc.).

2.4.17 Bait/Lure Type

The type of bait or lure used at a Deployment location (if applicable). Bait or lure should be documented as one of the following:

- “Scent”
- “Meal” (including carcass placed by a crew member(s),
- “Bait Tree”
- “Visual”

- “Acoustic”
- “Other” (described in “Deployment Comments”)
- “None” (if no bait or lure was used)

2.4.18 Deployment Comments (Optional)

The Deployment Comments field is an optional text field that allows users to describe any additional data collected during a Deployment, such as details about the condition of the camera (e.g., non-functioning 01-Jan-2022 and 06-Jan-2022, battery status) and/or bait or lure used (e.g., brand, ingredients if homemade).

2.4.19 Deployment Area Photos (Optional)

The Deployment Area Photos field is an optional ‘yes/no’ field where the user indicates whether photographs of the deployment area were taken or not.

Images of the area where cameras were deployed may be useful for documenting environmental conditions (e.g., vegetation, ecosite, weather) or other variables of interest.

All images for each Deployment should be saved to a unique folder that identifies the deployment name (sample station label), deployment date and content, and converted to a zip file (e.g., ‘Camera03_01Dec2017_Photos.zip’) for loading to a database.

Users are strongly encouraged to submit all the original images from each Deployment for archiving (see 3.1 Data Archival).

2.5 Sequence/Image (Sequence Image Data)

The Sequence/Image fields provide information on the data within an Image or on the data within a Sequence of related images (e.g., images that are grouped as part of the same trigger “event”). The Sequence Definition (where applicable, see Section 2.5.5) is defined by the user so as to apply to their study design. Therefore, information on how a Sequence is defined must be provided in the database. When a Sequence Definition is used, only enter data for the Sequence of images (not for each unique Image) and use the first image of the Sequence as the Sequence/Image ID (see Section 2.5.4), as this is the time of the first detection.

Note: Users do not need to manually enter each Sequence/Image into the Wildlife Camera Template; it would be more efficient to input image data into a separate database using wildlife camera-specific data entry software (e.g., [Timelapse2](#), [Reconyx MapView](#), Scotson et al., 2017). This standard does not endorse specific wildlife camera image processing software but does highly recommend the use of such software to facilitate data entry (e.g., [WildTrax](#)). When using data entry software, it is ideal to align the created data field names and data format with this Wildlife Camera Metadata Protocol as much as possible.

2.5.1 Sequence/Image Start Date

The Sequence/Image Start Date is the date of the Image or the first image of a unique Sequence.

The Sequence/Image Start Date format should be: "**dd-mmm-yyyy**" (e.g., 17-Jun-2018).

2.5.2 Sequence/Image Start Time

The Sequence/Image Start Time should include the time (24 hr) that an Image (or the first image of a unique Sequence) was taken.

The Sequence/Image Start Time format should be: "**hh:mm:ss**" (e.g., 13:01:26).

2.5.3 Sequence/Image Temperature

The Sequence/Image Temperature field should be a numerical field indicating the air temperature (degrees Celsius) at the time an Image (or the first of a unique Sequence) was taken. **Note:** most cameras record this information in the photo metadata.

2.5.4 Sequence/Image ID

The Sequence/Image ID is a unique alphanumeric file name for the *Image or the first of a Sequence*. The file names of the photos included as the Sequence/Image ID must match the names of the original photos.

The recommended format for naming each image (Sequence/Image) is:
"deploymentID_date_time_XofX."

It is highly recommended that users develop a photo naming convention prior to entering data. This will minimize the risk of having images from different deployments, study areas or surveys with the same name. File names must not have spaces. Giving each Deployment a unique identification should minimize the risk of duplicate image names. Alternative naming conventions may be used, but the goal should be to minimize duplicate image names. Data entry software (see section 2.5) can be used for batch processing of image names, which can significantly reduce data processing time compared to renaming images manually.

Note: The name of the image file may be automatically populated using data entry software (e.g., [Timelapse2](#), [Reconyx MapView](#), Scotson et al., 2017).

Even though only the first image of a Sequence can be used as the Sequence ID, typically, other images within the Sequence provide additional information (e.g., images of all individuals in a group). Therefore, it's ideal to archive all the images from a Sequence (see 2.4.20 Deployment Photos for instruction on archiving photos from unique camera deployments). If it is not possible to submit all of the images from a Deployment, ideally, users should submit the image(s) from a Sequence that best represents the Sequence (e.g., those that can be used to verify the species and number of individuals).

Note: The Sequence/Image ID must match that of the photos submitted to FWMIS and/or WildTrax (Appendix 1, Table 2b).

2.5.5 Sequence Definition

Sequence Definition describes the amount of time (in seconds) between consecutive images that defines an "image Sequence." All images that are separated by fewer seconds than the defined interval are considered part of the same Sequence. If no Sequence Definition was used, the Sequence Definition field should be "NULL."

2.5.6 Species

The Species field indicates the common name of the species being categorized in the Sequence/Image. If there are more than one wildlife species present in a Sequence/Image, data for each Species should be entered on a unique row but with the same Sequence/Image ID.

Species codes from the FWMIS can be used for entering species data; these codes are built into the [FWMIS loadforms](#). Additional species metadata (optional) can include information on species class, order and family names, in addition to scientific and common names.

2.5.7 Count

The count field indicates the number of unique individuals in a Sequence/Image.

2.5.8 Life Stage and Sex Classes

Life Stage (age) and Sex Class fields include multiple options for classifying the age and sex of animals of the same species that occur in the same Sequence/Image:

- "Adult - Male"
- "Adult - Female"
- "Adult - Unknown"
- "Juvenile - Male"
- "Juvenile - Female"
- "Juveniles - Unknown"
- "Young of the year - Male"
- "Young of the year - Female"
- "Young of the year - Unknown"
- "Yearling - Male"
- "Yearling - Female"
- "Yearlings - Unknown"
- "Unknown - Male"
- "Unknown - Female"
- "Unknown - Life Stage and Sex"

If there is more than one Life Stage or Sex Class in a Sequence/Image, users can enter either a) each unique Life Stage/Sex Class combination as a unique row or b) each unique combination within the same row under an appropriate field.

For example, if a Sequence/Image contains 6 elk, 2 of which are adult females, 3 of which are juveniles of unknown sex and one of which is an adult male, the data could be entered as 3 unique rows, each with the same Sequence/Image date, Time and Unique Identifier, where:

- the first row: Count = 2, Life Stage = Adult, and Sex = Female
- a second row: Count = 3, Life Stage = Juvenile, and Sex = Unknown
- a third row is Count = 1, Life Stage = Adult, and Sex = Male

Alternatively, the same data could be entered in one single row as:

- Count = 6, Life Stage = Blank, Sex = Blank, Adult Males = 1, Adult Females = 2, and Juveniles – Unclassified Sex = 3.

Deciding how to enter the data is at the user's discretion. However, the recommended approach to entering data where unique individuals are identified (or the behaviours of individuals are identified) is to enter data for each individual as a unique row.

2.5.9 Behaviour (Optional)

To record the behaviour of the animal or group of animals in the Sequence/Images, use the following:

- "Bedding"
- "Standing"
- "Drinking"
- "Feeding/Foraging"
- "Running"
- "Travelling"
- "Territorial Display"
- "Vigilant"
- "Inspecting camera"
- "Unknown"
- "Other" (described in Comments)

If observing a group of individuals, record the exact, sub-sampled or estimated mode behaviour of all the individuals in the group or enter the behaviour of each animal as a unique row (see section 2.5.8 Life Stage and Sex Classes).

2.5.10 Animal ID

The Animal ID field can be populated when animals can be uniquely identified (e.g., marked in some way). More than one unique individual can be identified in an image; each individual should be entered as a unique row (see 2.5.8 Life Stage and Sex Classes).

2.5.11 Human Transport Mode

The Human Transport Mode field should be populated when data on humans (in addition to wildlife) are collected. This is a text field, and data should be entered as:

- "Walking" (e.g., hiker, backpacker, runner, skier, snowshoer)
- "Cycling" (e.g., non-motorized or e-bike)
- "Equestrian/Horseback Rider"
- "Off-Road/All-Terrain Vehicle" (e.g., motorized quad, snowmobile, motorbike)
- "Passenger Vehicle" (e.g., pickup truck, car)
- "Large Commercial Vehicle/Heavy Equipment" (e.g., logging truck, semi-truck, bus)
- "Other" (described in Comments)

2.5.12 Analyst

This field allows the user to submit the full name of the analyst who provided the observation data point (species identification and associated information). If there are multiple analysts for an observation, pick the primary analyst.

2.5.13 Comments (Optional)

This text field allows the user to describe any additional data collected during an Image or Sequence observation.

3.0 Conclusion

This protocol provides information on how wildlife camera data should be collected and documented in Alberta. This protocol is closely related to other proposed protocols (e.g., Forrester et al., 2016) and strongly aligns with the British Columbia Wildlife Camera Metadata Protocol. The consistent collection of wildlife camera data will support the creation of large-scale datasets on wildlife distribution across Alberta. It also promotes further amalgamation of datasets to answer research and monitoring questions across administrative jurisdictions, including those on a global scale.

3.1 Data Archival

It is strongly encouraged/may be required that wildlife camera datasets are submitted to an open data repository. There are regulatory requirements to submit data forms to the [FWMIS database](#) (not images, although this is strongly encouraged) according to specific policies (e.g., Sensitive Species Guidelines, Research and Collection permits, etc.). Refer to the Government of Alberta web pages for further information.

All data, including the images, deployment area photos and complete metadata, can be uploaded and stored in the [WildTrax repository](#). Wildtrax has multiple privacy options and can accommodate all categories of images that users may prefer to manage separately, including “false fires” and images of humans.

All uploaded data must conform to the WildTrax website’s [Policies](#) and [Terms and Conditions of Use](#). For example, images that allow for the identification of people (e.g., faces or vehicle license plates) should not be uploaded to some databases for privacy reasons. Other databases allow users to upload blurred images (e.g., using [WildCoLab’s FaceBlur R-script](#)). Users should follow the [Freedom of Information and Protection of Privacy Act](#) when collecting and managing data on people.

A crosswalk of the metadata standards described here against these two data repositories is provided in Appendix 1 (Appendix 1, Table 1a,b).

References

- Ahumada, J. A., Silva, C. E. F., Gajapersad, K., Hallam, C., Hurtado, J., Martin, E., McWilliam, A., Mugerwa, B., O'Brien, T., Rovero, F., Sheil, D., Spironello, W. R., Winarni, N., & Andelman, S. J. (2011). Community structure and diversity of tropical forest mammals: Data from a global camera trap network. *Philosophical Transactions: Biological Sciences*, *366*(1578), 2703–2711. <https://doi.org/10.1098/rstb.2011.0115>
- Becker, M., Huggard, D. J., Dickie, M., Warbington, C., Schieck, J., Herdman, E., Serrouya, R., & Boutin, S. (2022). Applying and testing a novel method to estimate animal density from motion-triggered cameras. *Ecosphere*, *13*(4), e4005. <https://doi.org/10.1002/ecs2.4005>
- Bowkett, A. E., Rovero, F., & Marshall, A. R. (2008). The use of camera-trap data to model habitat use by antelope species in the Udzungwa Mountain forests, Tanzania. *African Journal of Ecology*, *46*(4), 479–487. <https://doi.org/10.1111/j.1365-2028.2007.00881.x>
- Burkholder, E. N., Jakes, A. F., Jones, P. F., Hebblewhite, M., & Bishop, C. J. (2018). To Jump or Not to Jump: Mule Deer and White-Tailed Deer Fence Crossing Decisions. *Wildlife Society Bulletin*, *42*(3), 420–429. <https://doi.org/10.1002/wsb.898>
- Burton, A. C., Neilson, E., Moreira, D., Ladle, A., Steenweg, R., Fisher, J. T., Bayne, E., & Boutin, S. (2015). REVIEW: Wildlife Camera Trapping: A Review and Recommendations for Linking Surveys to Ecological Processes. *Journal of Applied Ecology*, *52*(3), 675–685. <https://doi.org/10.1111/1365-2664.12432>
- Carbone, C., Christie, S., Conforti, K., Coulson, T., Franklin, N., Ginsberg, J. R., Griffiths, M., Holden, J., Kawanishi, K., Kinnaird, M., Laidlaw, R., Lynam, A., Macdonald, D. W., Martyr, D., McDougal, C., Nath, L., O'Brien, T., Seidensticker, J., Smith, D. J. L., Wan Shahrudin, W. N. (2001). The use of photographic rates to estimate densities of tigers and other cryptic mammals. *Animal Conservation*, *4*(1), 75–79. <https://doi.org/10.1017/S1367943001001081>
- Clevenger, A. P., & Waltho, N. (2005). Performance indices to identify attributes of highway crossing structures facilitating movement of large mammals. *Biological Conservation*, *121*(3), 453–464. <https://doi.org/10.1016/j.biocon.2004.04.025>
- Dunne, B. M., & Quinn, M. S. (2009). Effectiveness of above-ground pipeline mitigation for moose (*Alces alces*) and other large mammals. *Biological Conservation*, *142*(2), 332–343. <https://doi.org/10.1016/j.biocon.2008.10.029>
- Fegraus, E. H., Lin, K., Ahumada, J. A., Baru, C., Chandra, S., & Youn, C. (2011). Data acquisition and management software for camera trap data: A case study from the TEAM Network. *Ecological Informatics*, *6*(6), 345–353. <https://doi.org/10.1016/j.ecoinf.2011.06.003>
- Fisher, J. T., & Burton, C. (2012). *Monitoring Mammals in Alberta: Recommendations for Remote Camera Trapping*. Alberta Innovates - Technology Futures & Alberta Biodiversity Monitoring Institute. <https://doi.org/0.13140/RG.2.1.3944.3680>
- Fisher, J. T., Wheatley, M., & Mackenzie, D. (2014). Spatial patterns of breeding success of grizzly bears derived from hierarchical multistate models. *Conservation Biology*, *28*(5), 1249–1259. <https://doi.org/10.1111/cobi.12302>
- Forrester, T., O'Brien, T., Fegraus, E., Jansen, P. A., Palmer, J., Kays, R., Ahumada, J., Stern, B., & McShea, W. (2016). An Open Standard for Camera Trap Data. *Biodiversity Data Journal*, *4*, e10197. <https://doi.org/10.3897/BDJ.4.e10197>
- Holinda, D., Burgar, J. M., & Burton, A. C. (2020). Effects of scent lure on camera trap detections vary across mammalian predator and prey species. *PloS One*, *15*(5), e0229055. <https://doi.org/10.1371/journal.pone.0229055>

- Karanth, K. U., Nichols, J. D., Kumar, N. S., & Hines, J. E. (2006). Assessing Tiger Population Dynamics Using Photographic Capture–Recapture Sampling. *Ecology*, *87*(11), 2925–2937. [https://doi.org/10.1890/0012-9658\(2006\)87\[2925:ATPDUP\]2.0.CO;2](https://doi.org/10.1890/0012-9658(2006)87[2925:ATPDUP]2.0.CO;2)
- Kruger, H., Vaananen, V.-M., Holopainen, S., & Nummi, P. (2018). The new faces of nest predation in agricultural landscapes - a wildlife camera survey with artificial nests. *European Journal of Wildlife Research*, *64*(6), 76. <https://doi.org/10.1007/s10344-018-1233-7>
- Lahoz-Monfort, J. J., & Magrath, M. J. L. (2021). A Comprehensive Overview of Technologies for Species and Habitat Monitoring and Conservation. *Bioscience*, *71*(10), 1038–1062. <https://doi.org/10.1093/biosci/biab073>
- Lazenby, B. T., Mooney, N. J., & Dickman, C. R. (2015). Detecting species interactions using remote cameras: Effects on small mammals of predators, conspecifics, and climate. *Ecosphere*, *6*(12), 1–18. <https://doi.org/10.1890/ES14-00522.1>
- Lynch, T. P., Alderman, R., & Hobday, A. J. (2015). A high-resolution panorama camera system for monitoring colony-wide seabird nesting behaviour. *Methods in Ecology and Evolution*, *6*(5), 491–499. <https://doi.org/10.1111/2041-210X.12339>
- McShea, W. J., Shen, X., Liu, F., Wang, T., Xiao, Z., Li, S. (2020). China's wildlife camera-trap monitoring needs a unified standard. *Biodiversity Science*, *28*(9), 1125–1131. <https://doi.org/10.17520/biods.2020188>
- Meek, P. D., Ballard, G., Claridge, A., Kays, R., Moseby, K., O'Brien, T., O'Connell, A., Sanderson, J., Swann, D. E., Tobler, M., & Townsend, S. (2014). Recommended guiding principles for reporting on camera trapping research. *Biodiversity and Conservation*, *23*(9), 2321–2343. <https://doi.org/10.1007/s10531-014-0712-8>
- Mills, C. A., Godley, B. J., & Hodgson, D. J. (2016). Take Only Photographs, Leave Only Footprints: Novel Applications of Non-Invasive Survey Methods for Rapid Detection of Small, Arboreal Animals. *PloS One*, *11*(1), e0146142. <https://doi.org/10.1371/journal.pone.0146142>
- Muhly, T., Serrouya, R., Neilson, E., Li, H., & Boutin, S. (2015). Influence of In-Situ Oil Sands Development on Caribou (*Rangifer tarandus*) Movement. *PloS One*, *10*(9), e0136933. <https://doi.org/10.1371/journal.pone.0136933>
- Muhly, T. B., Semeniuk, C., Massolo, A., Hickman, L., & Musiani, M. (2011). Human activity helps prey win the predator-prey space race. *PloS One*, *6*(3), e17050. <https://doi.org/10.1371/journal.pone.0017050>
- Murray, M. H., Hill, J., Whyte, P., & St Clair, C. C. (2016). Urban Compost Attracts Coyotes, Contains Toxins, and may Promote Disease in Urban-Adapted Wildlife. *Ecohealth*, *13*(2), 285–292. <https://doi.org/10.1007/s10393-016-1105-0>
- Natural Regions Committee. (2006). *Natural regions and subregions of Alberta* (T/852; p. 264). Government of Alberta. <https://open.alberta.ca/publications/0778545725>
- O'Connell, A. F., Nichols, J. D., & Karanth, K. U. (Eds.). (2010). *Camera traps in Animal Ecology: Methods and Analyses*. Springer. <https://doi.org/10.1007/978-4-431-99495-4>
- O'Connell, A. F., Talancy, N. W., Bailey, L. L., Sauer, J. R., Cook, R., & Gilbert, A. T. (2006). Estimating Site Occupancy and Detection Probability Parameters for Meso- And Large Mammals in a Coastal Ecosystem. *Journal of Wildlife Management*, *70*(6), 1625–1633. [https://doi.org/10.2193/0022-541X\(2006\)70\[1625:ESOADP\]2.0.CO;2](https://doi.org/10.2193/0022-541X(2006)70[1625:ESOADP]2.0.CO;2)
- Resources Information Standards Committee (RISC). (2019). *Wildlife Camera Metadata Protocol: Standards for Components of British Columbia's Biodiversity No. 44*. Province of British Columbia Knowledge Management Branch, Ministry of Environment and Climate Change Strategy, and Ministry of Forests, Lands, Natural Resource Operations and Rural Development. Victoria, B.C. www2.gov.bc.ca/assets/download/DABCE3A5C7934410A8307285070C24EA
- Rovero, F., Zimmermann, F., Berzi, D., & Meek, P. (2013). "Which camera trap type and how many do I need?" A review of camera features and study designs for a range of wildlife research applications.

- Hystrix - The Italian Journal of Mammalogy*, 24(2):148–156. <https://doi.org/10.4404/hystrix-24.2-6316>
- Scotson, L., Johnston, L. R., Iannarilli, F., Wearn, O. R., Mohd-Azlan, J., Wong, W. M., Gray, T. N. E., Dinata, Y., Suzuki, A., Willard, C. E., Frechette, J., Loken, B., Steinmetz, R., Moßbrucker, A. M., Clements, G. R., & Fieberg, J. (2017). Best practices and software for the management and sharing of camera trap data for small and large scales studies. *Remote Sensing in Ecology and Conservation*, 3(3), 158–172. <http://dx.doi.org/10.1002/rse2.54>
- Steenweg, R., Hebblewhite, M., Kays, R., Ahumada, J., Fisher, J. T., Burton, C., Townsend, S. E., Carbone, C., Rowcliffe, J. M., Whittington, J., Brodie, J., Royle, J. A., Switalski, A., Clevenger, A. P., Heim, N., & Rich, L. N. (2017). Scaling-up Camera Traps: Monitoring the Planet's Biodiversity with Networks of Remote Sensors. *Frontiers in Ecology and the Environment*, 15(1), 26–34. <https://doi.org/10.1002/fee.1448>
- Steenweg, R., Whittington, J., & Hebblewhite, M. (2015). *Canadian Rockies remote camera multi-species occupancy project: Examining trends in carnivore populations and their prey*. University of Montana. <http://parks.canadahistory.com/wildlife/steenweg-2015.pdf>
- Suwanrat, S., Ngoprasert, D., Sutherland, C., Suwanwaree, P., & Savini, T. (2015). Estimating density of secretive terrestrial birds (Siamese Fireback) in pristine and degraded forest using camera traps and distance sampling. *Global Ecology and Conservation*, 3, 596–606. <https://doi.org/10.1016/j.gecco.2015.01.010>
- Tigner, J., Bayne, E. M., & Boutin, S. (2014). Black bear use of seismic lines in Northern Canada. *Journal of Wildlife Management*, 78(2), 282–292. <https://doi.org/10.1002/jwmg.664>
- Tschumi, M., Ekroos, J., Hjort, C., Smith, H. G., & Birkhofer, K. (2018). Rodents, not birds, dominate predation-related ecosystem services and disservices in vertebrate communities of agricultural landscapes. *Oecologia*, 188(3), 863–873. <https://doi.org/10.1007/s00442-018-4242-z>
- Whittington, J., Low, P., & Hunt, B. (2019). Temporal road closures improve habitat quality for wildlife. *Scientific Reports*, 9(1), 3772. <https://doi.org/10.1038/s41598-019-40581-y>

Appendix 1

The following metadata crosswalk table links the metadata used in the Alberta Wildlife Camera Metadata Protocol to the equivalent fields used in other metadata standards, such as the British Columbia Wildlife Metadata Protocol (RISC, 2019), WildTrax and FWMIS. The “Sections” columns list the relevant sections of each standard/standard component. The rest of the table contains the names of each “Metadata” component within each section. An asterisk (*) denotes an optional field.

TABLE 1a. Wildlife Camera Metadata Crosswalk Sections columns listing the relevant sections of each standard/standard component. An asterisk (*) denotes an optional field.

Alberta Wildlife Metadata Protocol	BC Wildlife Metadata Protocol	WildTrax	FWMIS
2.1 Project	2.1 Project	1. Organization	1. Project
2.2 Study Area	2.2 Study Area	2. Equipment	2. Survey Project
2.3 Surveys	2.3 Survey	3. Location	3. Project Location
2.4 Deployment	2.4 Deployment	3.1 Location Visit	4. Count Sample
2.5 Sequence/Image	2.5 Sequence/ Image	3.2 Location Equipment	5. Individual Sample
		4. Project	6. Habitat Sample
		4.1 Deployment	7. Feature Sample
		4.2 Project Users	
		5. Image	
		6. Species Tag	

TABLE 1b. Wildlife Camera Metadata Crosswalk Metadata components within each section are listed in Appendix 1, Table 1a. An asterisk (*) denotes an optional field.

Alberta Wildlife Metadata Protocol	BC Wildlife Metadata Protocol	WildTrax	FWMIS
Project			
Project Name	Project Name	Project Name	Project Name
Project Coordinator	Project Coordinator	Project Administrator	Project Description
Location Description	Location Description	Project Description	Location Comments
Project Description	Project Objectives	Project Description	Project Description
Study Area			
Study Area Name	Study Area Name	Project Description	Study Area Name
Study Area Description	Study Area Description	Project Description	Project Description
Survey			
Survey Objectives	Survey Objectives	Project Description	Projection Description
Target Species	Target Species	Project Description	Target Species Code
Crew Members	Crew Members	Crew	Crew Members
Deployment			
Deployment Name	Deployment Name	Location Name Database assigns unique deployment ID to track different visits to the same location	Location Name Database assigns unique SurveyID for each individual camera
UTM Zone Sample Station	UTM Zone Sample Station	N/A	UTM Reference Meridian Datum
Easting or Longitude Sample Station	Easting or Longitude Sample Stations	Longitude	Longitude or Easting
Northing or Latitude Sample Station	Northing or Latitude Sample Station	Latitude	Latitude or Northing
Number of Cameras	Number of Detectors	Populated from other fields or reports	Populated from other fields or reports
Deployment Feature	Deployment Feature	Landscape Feature	Deployment Feature Code
Sample Station Comments *	Sample Station Comments	Location Visit Comments	Sample Station Comments
Deployment Start Date	Deployment Start Date	Location Visit Date	Deployment Start Date (e.g., 2018-11-17 9:10:00 AM)
Deployment End Date	Deployment End Date	Location Visit Date	Deployment End Date
Camera Days	Camera Days	Populated from other fields or reports	Populated from other fields or reports
Camera Make and Model	Detector Make and Model	Camera Make Camera Model	Camera Make Camera Model
Camera Serial Number	Camera Serial Number	Camera Serial Number	Camera Serial Number
Quiet Period Setting	Quiet Period Setting	Image Metadata	Quiet Period Setting

Alberta Wildlife Metadata Protocol	BC Wildlife Metadata Protocol	WildTrax	FWMIS
Trigger Sensitivity Setting	Trigger Sensitivity Setting	Image Metadata	Trigger Sensitivity Code
Trigger Timing	Trigger Timing	N/A	Trigger Timing
Photos per Trigger Setting	Photos per Trigger Setting	Image Metadata	Deployment Comments
Bait/Lure Type	Bait/Lure Type	Bait Type	Bait/Lure Type Code
Deployment Comments*	Deployment Comments	Location Visit Comments	Deployment Comments
Deployment Area Photos*	Deployment Photos	Location Visit Images	Deployment Area Photos
<i>Sequence/Image</i>			
Sequence/Image Start Date	Sequence/Image Start Date	image_date	Sequence/Image Start Date
Sequence/Image Start Time	Sequence/Image Start Time	image_time	Sequence/Image Start Time
Sequence/Image Temperature*	Sequence/Image Temperature	image_meta	Sequence/Image Temperature
Sequence/Image ID	Sequence/Image ID	image_id	Sequence/Image ID
Sequence Definition	Sequence Definition	N/A	Sequence Definition
Species	Species	Species Scientific Name	Species Code
Count	Count	Species Tag Individual Count	Count
Life Stage and Sex Classes	Life Stage Sex Classes	Species Tag Age Type Species Tag Sex Type	Age Code Gender Code
Behaviour*	Behaviour	Behaviour	Behaviour Code
Animal ID	Animal ID	Coat Colour Disease Collar (Y/N) Tag (Y/N) Left/Right Antler Tines	Sample, Individual Species
Human Transport Mode	Human Transport Mode	Species Tag Species ID	Human Transport Mode Code
Analyst	Surveyor	Species Tag User ID	Analyst
Comments*	Comments	Species Tag Comments	Comments