Remote Camera Metadata

Standards for Alberta

2023

Version 2.0

Prepared by

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on behalf of the

Alberta Remote Camera Steering Committee (RCSC)

Remote Camera Metadata: Standards for Alberta

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For more information about the Alberta Remote Camera Steering Committee and these standards, 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.

Preface

These standards were developed by members of the Alberta Remote Camera Steering Committee (RCSC) in collaboration with the Alberta Biodiversity Monitoring Institute (ABMI).

The Alberta RCSC is chaired by Alberta Environment and Protected Areas and comprises a group of remote camera experts from academia, government and not-for-profit organizations who aim to advance the science of remote camera monitoring and research while facilitating collaboration and knowledge sharing among remote camera users in Alberta.

The objective of these Remote Camera Metadata Standards is to provide guidance on the types of data that should be collected and reported when using remote cameras (or "wildlife cameras" or "camera traps") to detect wildlife in Alberta. Consistent collection of remote 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 within and 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 Protocol: Standards for Components of British Columbia's Biodiversity No. 44 (RISC, 2019; "B.C. Metadata Standards" hereafter). The Alberta Standards also follow a hierarchical structure similar to that of the B.C. Metadata Standards (RISC, 2019) and Wildlife Insights (Ahumada et al., 2019).

A companion document to this standard, the Remote Camera Survey Guidelines: Guidelines for Western Canada (RCSC et al., 2023), should be viewed alongside these standards. The guidelines offer advice on appropriate study / Survey Designs, camera deployment methods and data management. They were developed by the Alberta Remote Camera Steering Committee (RCSC) in collaboration with the Alberta Biodiversity Monitoring Institute (ABMI) and Wildlife Cameras for Adaptive Management (WildCAM; https://wildcams.ca/about-us/).

Acknowledgments

We would like to honour and acknowledge that work contributed by the RCSC took place on the traditional and ancestral land of the nêhiyaw (nay-hee-yow)/Cree, Denesuline (dene-su-lee-neh)/Dene (deh-neyh), Niitsitapi (nit-si-tahp-ee)/Blackfoot, Anishinaabe (ah-nish-in-ah-bay)/Saulteaux (so-toe), Nakota Sioux (na-koh-tah sue), and Métis' (may-tee) Peoples since time immemorial, and we recognize this history.

We sincerely thank the Government of British Columbia for the use of their B.C. Metadata Standards (RISC, 2019), which formed the basis for the Alberta Remote Camera Metadata Standards. The B.C. Metadata Standards (RISC, 2019) pulled concepts from *the Camera Trap Metadata Standards* (*CTMS*; Forrester et al. 2016).

Thank you to the Alberta Biodiversity Monitoring Institute (Kat Villeneuve, Corrina Copp, and Monica Kohler) who prepared the original (version 1.0) Alberta Remote Camera Metadata Standards (2022) with guidance from the Alberta Remote Camera Steering Committee (RCSC).

These Alberta Remote Camera Metadata Standards have been updated to align, where possible, with the most recent versions of other Metadata Standards (e.g., Wildlife Insights, WildTrax). By standardizing data collection and reporting of remote camera data within and across jurisdictions, we enhance collaborative opportunities to address large-scale management / research questions at regional, national and even global scales.

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 Protected Areas for his insights.

All decisions regarding these standards are the responsibility of the Alberta RCSC.

Table of Contents

Deleted: 11
Deleted: 12
Deleted: 12
Deleted: 13
Deleted: 14
Deleted: 16
Deleted: 16
Deleted: 17

1.0 Purpose

The purpose of these Remote Camera Metadata Standards is to provide guidance on the types of data that should be collected and documented when using remote cameras to detect wildlife.

There are several benefits to having standardized methods for collection and reporting of metadata, including:

- Enabling province-wide consistency and reliability in data collection;
- Enabling data consolidation amongst projects and enhancing the ability to answer large-scale management / research questions;
- Facilitating comparison between surveys or studies;
- Promoting higher quality of data which facilitates data sharing and tracking;
- Enhancing common design standards for reproducible research;
- Allowing for efficient project and data review; and
- Ensuring project planning meets required government and research institute standards.

A companion document exists, the Remote Camera Survey Guidelines: Guidelines for Western Canada (RCSC et al., 2023; "Remote Camera Survey Guidelines" hereafter), that should be viewed alongside these standards. The purpose of the Guidelines is to provide information on study /Survey Design and implementation (including equipment and deployment recommendations) for novice to advanced users of remote cameras. The intended audience includes consultants, researchers, and wildlife biologists working for government, non-government agencies and industry.

1.1 Supporting documents

There are several other supporting documents that are consistent with these standards and the Remote Camera Survey Guidelines (RCSC et al., 2023), including the following:

- Remote Camera Survey Guidelines supporting documents:
  - Camera Deployment Field Datasheet (RCSC et al., 2023)
  - Camera Service/Retrieval Field Datasheet (RCSC et al., 2023),
  - Test Image Sheet (RCSC et al., 2023),
  - Survey123 Template (RCSC et al., 2023; available in August 2023), and
  - EpiCollect Template (RCSC et al., 2023) (https://five.epicollect.net/project/rcsc-and-wildcam-remote-camera-survey-guidelines)
- Alberta Remote Camera Metadata Standards: Metadata Template (RCSC, 2023)

Copies of the Camera Deployment Field Datasheet, Test Image Sheet and Camera Service/Retrieval Field Datasheet are available in Appendix A of the Remote Camera Survey Guidelines (RCSC et al., 2023).

2.0 Background

Remote cameras (or “wildlife cameras” or “camera traps”) 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). Remote cameras consist of a digital camera with an external flash and/or passive infrared detector (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 remote 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).

Remote cameras have been used to measure presence / absence (e.g., Kucera & Barrett, 2011), relative abundance (e.g., Carbone et al., 2001), density of marked (e.g., Karanth et al., 2006) and unmarked (e.g., Becker et al., 2022) animals, population composition (age/sex ratios; e.g., Duquette et al., 2014), species richness / diversity (e.g., Ahumada et al., 2011), habitat use / distribution (e.g., Bowkett et al., 2008; O’Connell et al., 2006; Whittington et al., 2019), diel / seasonal activity patterns (e.g., Frey et al., 2017), individual breeding status (e.g., Fisher et al., 2014; Muhly et al., 2011), and behaviour (e.g., Holinda et al., 2020; Murray et al., 2016).

There has been a global push to standardize the collection of remote camera data (Fegraus et al., 2011; McShea et al., 2020; Meek et al., 2014; Steenweg et al., 2017). Here, we developed a Remote Camera Metadata Standards for Alberta based on the B.C. Metadata Standards (RISC, 2019), the Open Camera Trap Metadata Standard (CTMS; Forrester et al. 2016) and Wildlife Insights Minimum Metadata Standards (Ahumada et al., 2019). The Alberta Remote Camera Metadata Standards also builds on the experience of remote camera users in Alberta, British Columbia and other jurisdictions and creates the opportunity for data from Alberta to be integrated with regional, national and global remote camera datasets.

3.0 Metadata Standards

These Alberta Metadata Standards propose that remote camera data should be organized according to a hierarchical structure consisting of six levels: Project, Study Area, Survey, Sample station/Camera location, Deployment, and Image/Sequence (Figure 1).

This hierarchy was adapted from the Camera Trap Metadata Standards (CTMS; Forrester et al. 2016), the B.C. Metadata Standards (RISC, 2019), and Wildlife Insights Minimum Metadata Standards (Ahumada et al., 2019).

These standards describe the minimum metadata that should be documented for each of the six levels, as well as how to include optional data fields. Equivalent data fields may appear under different names in different protocols / repositories. To provide user-friendly terminology, a crosswalk table is included (Appendix A - Table A1) that can be used to match data fields to commonly used protocol/repositories, to further the potential amalgamation of data from Alberta with global remote camera datasets.

The process for recording and submitting data involves entering deployment and image/sequence 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 Inventory Protocols, Research and Collection permits). Refer to the Government of Alberta web pages for further information.

All fields described in these Remote Camera Metadata Standards are recommended unless stated as optional.

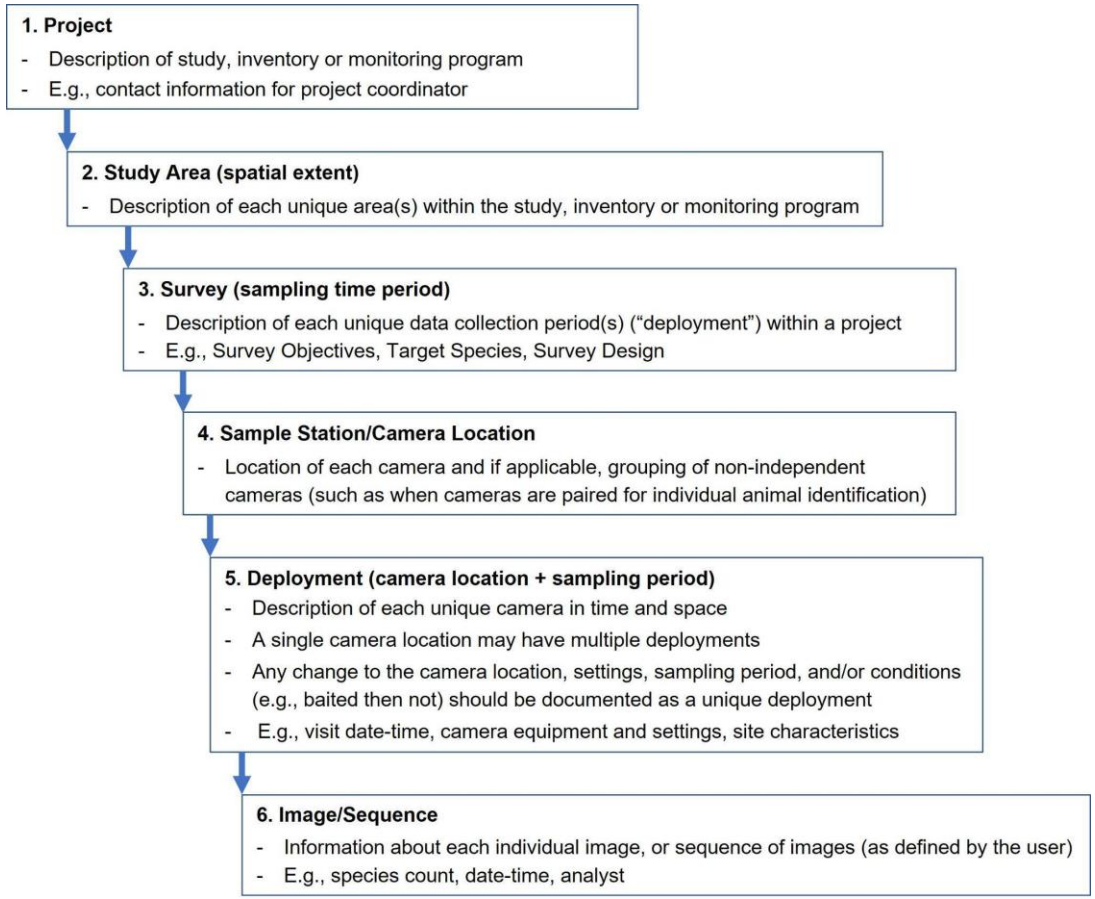

Figure 1. Hierarchical structure of remote camera data in the Remote Camera Metadata Standards for Alberta. Based on Forrester et al. (2016), Wildlife Insights Minimum Metadata Standards (Ahumada et al., 2019) and the B.C. Metadata Standards (RISC, 2019).

4.0 Project

A **project** is a scientific study, inventory or monitoring program that has a certain objective, defined methods, and a defined boundary in space and time. Careful consideration of the objectives and Survey Design for any remote camera project is encouraged. Recommendations on the appropriate Survey Designs to achieve various objectives are available in the Remote Camera Survey Guidelines (RCSC et al., 2023).

4.1 Project ID

The **Project ID** is a unique alphanumeric identifier for each project. Ideally, the Project ID should include an abbreviation for the organization, a brief project name, and the year the project began (e.g., “UofA_WildEdmonton-Urban-Wildlife-Monitoring_2018”).

4.2 Project Coordinator

The first and last name of the primary contact for the project.

4.3 Project Coordinator Email

The email address of the Project Coordinator.

4.4 Project Description

Describe the project objectives(s) and general methods.

For example: “The objective of this project is to compare wolf occupancy in the oil sands region of north-eastern Alberta using two study areas with high energy development and two reference areas with little to no industrial footprint.”

5.0 Study Area

A **study area** is a unique research, inventory or monitoring area (spatial boundary) within a project. There may be multiple study areas within a single project. Several factors may influence the spatial extent of the study area, including the Survey Objectives, landscape features (e.g., habitat type, land uses, etc.), the biology of the Target Species' (e.g., dispersal ability, habitat preferences, etc.) and proposed method(s) of data analysis.

5.1 Study Area ID

A unique alphanumeric identifier for each study area (e.g.,"OILSANDS-REF001," "OILSANDS-REF002"). If only one area was surveyed, the Project ID and Study Area ID should be the same.

5.2 Study Area Description

Describe for each unique research or monitoring area including its location, habitat type(s), land use(s) and habitat disturbances (where applicable).

For example: “The study area OILSANDS-REF001 was located in the south-east corner of the Birch Mountains Wildland Provincial Park in the Boreal Highlands subregion. The area consisted primarily of bogs, patches of pine, aspen and birch forest as well as riparian meadow habitats. There was no land use disturbance in the study area.”

6.0 Surveys

A **survey** is a unique deployment period (temporal extent) within a project. There may be multiple surveys in a single project. However, if multiple surveys are completed in the same study area and following the same Survey Design and methods of data collection, the project and survey information may be the same. If a project includes more than one type of survey, each should be included separately, with a unique Survey ID and survey-specific information.

6.1 Survey ID

A unique alphanumeric identifier for each survey period (e.g., "FORTMC_001").

6.2 Survey Objectives

Describe the specific objectives of each survey within a project, including the variable of interest (e.g., occupancy, density), and methods. Survey Objectives should be specific, measurable, achievable, relevant, and time-bound (i.e., SMART).

For example: “Our Survey Objective was to monitor trends in wolf occupancy at 5-year intervals from January – December 2020 to 2023 in the oils sands region in the northern boreal forest of Alberta.”

6.3 Target Species

The capitalized common name(s) of the species that the survey was designed to detect (e.g., “COYOTE” or “COMMON GOLDENEYE”).

If there is more than one Target Species, list the species in alphabetical order (e.g., “COYOTE, MOOSE, MULE DEER”). Alternatively, use the genus common name where appropriate (e.g., “GENUS ODOCOILEUS” for mule and white-tailed deer).

6.4 Survey Design

Survey design refers to the spatial arrangement of remote cameras within the study area. Select one of the Survey Designs from the list provided:

- **“Simple Random”** (randomized locations)

- **“Systematic”** (regular pattern - e.g., grid; across disturbance gradient or reference sites)
- **“Stratified”** (locations in pre-defined “strata”; e.g., habitat types)
- **“Clustered”** (multiple cameras at a sample station; can be used with systematic or stratified design)
- **“Paired”** (two cameras in close proximity to one another (“paired cameras”), or when one or more cameras are at two separate locations that are in close proximity or with some characteristics in common (“paired sites”)
- **“Targeted”** (locations with known or suspected high activity levels; e.g., game trails, mineral licks, etc.)
- **“Convenience”** (locations based on logistic considerations; e.g., remoteness, access constraints, costs)
- **“Hierarchical (Multiple)¶”** (e.g., Systematic and Stratified; describe in Survey Design Description field)
- **“Other¶”** (describe in Survey Design Description field)
- **“Unknown”**

For additional information on Survey Designs, refer to the Remote Camera Survey Guidelines (RCSC et al., 2023).

6.5 Survey Design Description (optional)

Describe any additional details about your Survey Design.

If you selected the “Hierarchical (multiple)” option from the Survey Design list, report all the designs as a comma delimited list from larger to smaller spatial scales. To help parse out this information later most easily, we recommend using a format that includes a header followed by the various Survey Designs, e.g., “Survey_Design[Systematic,Convenience]”.

For example: “our convenience sampling design consisted of one camera location within each township in our study area; each location was within 100m of a secondary road or cutline; lure dispensers with Gorman’s Gumbo (long line) were set-up at each camera location during initial camera deployment and not revisited during the survey period”.

If you selected the “Other” option from the Survey Design list, provide information about the design used.

If you set the Event Type field to “Sequence,” and are using a user-defined time threshold (e.g., 30 minutes) to define independent detection “events” within a sequence, report this threshold (or “sequence definition”). Refer to the Image/Sequence section for further details.

6.6 Event Type

Report whether detections were reported as an individual image captured by the camera (“Image”), a “Sequence,” or “Tag”.

A “**Tag**” refers to when individuals or groups of individuals are categorized within images, regardless of whether the information applies to all of the individuals in the image. A single “Tag” is generally applied to one or more individuals with the same combination of characteristics (e.g., adult males displaying the same behaviour). Conversely, individuals that have different characteristics would be given different tags. For example, if the Event Type is “Tag,” two individuals with an image that are of different Sex Classes would be categorized separately. This could also occur for Age Class, Behaviour, Human Transport Mode/Activity, etc. Since multiple tags can occur for a single image, there may be multiple data rows for the same image (if the Event Type is at the “Tag” level).

7.0 Sample Station/Camera Location

A **sample station** refers to a grouping of two or more non-independent camera locations, such as when cameras are clustered or paired. For example, multiple cameras in close proximity to one another for individual animal identification or on/off-trail comparison could be considered a sample station.

Each sample station should have its own unique Sample Station ID (grouping ID). Within a sample station, each camera will have a unique Camera Location ID and location (unless multiple cameras are on the same attachment point; e.g., tree).

7.1 Sample Station ID

A sequential alphanumeric identifier for each camera location within a grouping of two more non-independent camera locations when cameras are deployed in clusters, pairs or arrays (e.g., “SS1” in “SS1_BH1”, “SS1_BH2”, “SS1_BH3” etc.). Record as “NULL” if this field is not applicable.

7.2 Camera Location ID

A unique alphanumeric identifier for the location where a single camera was placed (e.g., "BH1", "BH2").

7.3 Latitude Camera Location

The latitude of the camera location in decimal degrees to five decimal places (e.g., 53.78136). Enter “NULL” if recording the Northing Camera Location instead.

7.4 Longitude Camera Location

The longitude of the camera location in decimal degrees to five decimal places (e.g., -113.46067). Enter “NULL” if recording the Easting Camera Location instead.

7.5 Northing Camera Location

The northing UTM coordinate of the camera location (e.g., 5962006). Record using the NAD83 datum. Enter “NULL” if recording the Latitude Camera Location instead.

7.6 Easting Camera Location

The easting UTM coordinate of the camera location (e.g., 337875). Record using the NAD83 datum. Enter “NULL” if recording the Longitude Camera Location instead.

7.7 UTM Zone Camera Location

This alphanumeric field applies if reporting camera locations in easting and northing UTM coordinates. The UTM zone refers to the coordinate system that divides geographic areas into north-south zones. In Alberta the UTM zones are either 11, 12, or TTM. Enter all other UTM zones in the Camera Location Comments field (e.g., zones 7-10 for British Columbia), or use latitude and longitude instead of UTM coordinates.

7.8 GPS Unit Accuracy (m)

The margin of error of the GPS unit used to record spatial information (e.g., “5” m), such as the coordinates of the camera location. On most GPS units (e.g., Garmin) this information is provided on the unit’s satellite information page. GPS Unit Accuracy may vary with the make and model of the GPS unit, surrounding vegetation, infrastructure, atmospheric interference, etc.

7.9 Camera Location Comments (optional)

Describe any additional details about a camera location (e.g., in UTM Zone 7 in British Columbia; aspen-dominated; type of “Off-Highway Vehicle Trail” used as a FOV Target Feature).

If you selected “Other” from the FOV Target Feature field, provide information about that feature (e.g., 2x4 m high woody debris piles within a cutblock).

8.0 Deployment

A **deployment** is a unique placement of a camera in space and time. There may be multiple deployments for one camera location. Deployments are often considered as the time between visits to a camera location (i.e., deployment to service, service to service, and service to retrieval). Any change to camera location, sampling period, camera equipment (e.g., Trigger Sensitivity setting, becomes non-functioning), and/or conditions (e.g., not baited then baited later; camera SD card replaced) should be documented as a unique deployment.

Metadata information associated with the deployment level of the hierarchy (Figure 1) can be grouped into the following subsections:

- **Visit Metadata** (collected at deployment and service/retrieval)
- **Equipment Information** (collected at both deployment and service/retrieval; fields vary by visit type)
- **Camera Settings** (collected at deployment)
- **Camera Placement** (collected at deployment)
- **Site Characteristics** (collected at deployment)
- **Equipment Checks** (collected at both deployment and service/retrieval)
- **Image Set Information** (collected as a combination of information from deployment and service/retrieval visits metadata)

8.1 Deployment - Visit Metadata

Visit metadata that should be collected each time a camera location is visited to deploy, service or retrieve a camera. The relevant data that should be collected may differ depending on the type of visit.

8.1.1 Deployment ID

A unique alphanumeric identifier for a unique camera deployed during a specific survey period (ideally recorded as: “Camera Location ID”_“Deployment Start Date” (or …_”Deployment End Date”) (e.g., “BH1_17-JUL-2018" or “BH1_17-JUL-2018_21-JAN-2019”). Alternative naming conventions may be used, but the goal should be to minimize duplicate image names.

8.1.2 Deployment Crew and Service/Retrieval Crew

The first and last names of all the individuals who collected data during deployment (“Deployment Crew”), and/or service/retrieval visits (“Service/ Retrieval Crew”).

Some platforms (e.g., FWMIS) collect this information in one field (e.g., “Crew Names”) rather than two. In this case, enter the data in a single data row (each row represents a deployment) and in a format that will make it easy to distinguish between the Deployment Crew and the

Service/Retrieval Crew (e.g., “deployment_crew[John Smith, Jimmy Smith], retrieval_crew[Susie Smith]”).

8.1.3 Deployment Start Date Time (DD-MMM-YYYY HH:MM:SS)

The date and time that a camera was placed for a specific deployment (e.g., 17-JUL-2018 10:34:22). The Deployment Start Date Time may not coincide with when the first image or video was collected (i.e., the Image Set Start Date Time). Recording this field allows users to account for deployments where no images were captured and to confirm the first date and time a camera was active.

8.1.4 Deployment End Date Time (DD-MMM-YYYY HH:MM:SS)

The date and time that the data was retrieved for a specific deployment (e.g., 27-JUL-2019 23:00:00). The Deployment End Date Time may not coincide with when the last image or video was collected (i.e., the Image Set End Date Time). Recording this field allows users to account for deployments where no images were captured and to confirm the last date and time that the camera was active.

If a camera fails (stops functioning), the Deployment End Date Time 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, the Deployment End Date Time should be reported as the date and time that the last image or video was captured (e.g., 28-APR-2023 12:36:27).

On rare occasions, a camera may be non-functioning in the middle of a deployment period but functioning at the start and end of the deployment period (e.g., snow covered 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 times.

To accurately measure survey effort in the event of camera failure, we recommend that users set the camera’s Trigger Mode(s) field to “time-lapse image” to capture at least one image at a consistent time each day. 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).

8.1.5 Visit Comments (optional)

Describe any additional details about a visit to a camera location (e.g., camera snow-covered; remaining battery (%); brand of lure reapplied during service visit).

8.2 Deployment - Equipment Information

8.2.1 Camera ID

A unique alphanumeric ID (e.g., “RECONPC900-1”) for the camera that distinguishes it from other cameras of the same make or model.

Referred to as “New Camera ID” on the Service/Retrieval Field Datasheet when a camera is replaced. Record “NULL” if the camera was not replaced.

8.2.2 Camera Make

The make (i.e., the manufacturer; e.g., "Reconyx" or "Bushnell') of a particular camera. The camera make is particularly important information for analyses where different types of cameras may result in variable detection probabilities.

Referred to as “New Camera Make“ on the Service/Retrieval Field Datasheet when a camera is replaced at a sample station/camera location. Record “NULL” for these fields if the camera is not replaced.

8.2.3 Camera Model

The model number or name (e.g., "PC900" or "Trophy Cam HD") of a particular camera. The camera model is particularly important information for analyses where different types of cameras may result in variable detection probabilities.

Referred to as “New Camera Model“ on the Service/Retrieval Field Datasheet when a camera is replaced at a sample station/camera location. Record “NULL” for these fields if the camera is not replaced.

8.2.4 Camera Serial Number

The serial number of a particular camera, which is usually found inside the camera cover (e.g., “P900FF04152022”). The serial number helps in differentiating cameras placed on the same attachment point (e.g., tree) and in identifying when cameras are replaced at an existing camera location.

Referred to as “New Camera Serial Number“ on the Service/Retrieval Field Datasheet when a camera is replaced at a sample station/camera location. Record “NULL” for this field if the camera is not replaced.

8.3 Deployment - Camera Settings

8.3.1 Trigger Mode(s)

The camera setting(s) that determine how the camera will trigger: by motion ("Motion Image"), at set intervals ("Time-lapse image"), and/or by video ("Video"; possible with newer camera models, such as Reconyx HP2X).

Select one of the options from the list provided:

- **“Motion Image”**

- **“Time-lapse Image”**
- **“Video”**
- **“Motion Image + Time-lapse Image”**
- **“Motion Image + Time-lapse Image + Video”**
- **“Time-lapse Image + Video”**
- **“Motion Image + Video”**

8.3.2 Video Length (seconds)

The minimum video duration (in seconds) that the camera will record when triggered (if applicable). Report the Video Length as “NULL” when the video setting is not used.

8.3.3 Trigger Sensitivity

The camera setting responsible for how sensitive a camera is to activation (to "triggering") via the infrared and/or heat detectors (if applicable). Select one of the following Trigger Sensitivity settings common to most cameras (e.g., Reconyx HyperFire): "Low," "Low/Med," "Med," "Med/High," "High," "Very high". Enter "NULL" if the trigger is set to a timer (see the Motion Image Interval (seconds) section) or if the camera does not have a sensitivity setting option.

8.3.4 Photos Per Trigger

The number of photos taken each time the camera is triggered (numeric, e.g., “1”, “2”, “3” etc.).

8.3.5 Motion Image Interval (seconds)

The time (in seconds) between images within a multi-image sequence that occur due to motion, heat, or activation of external detector devices. The Motion Image Interval is pre-set in the camera’s settings by the user, but the time at which the camera collects images because of this setting is influenced by the presence of movement or heat. For example, if the camera was set to take 3 images per event at a Motion Image Interval of 3 seconds when the camera detects motion or heat, the first image will be collected (e.g., at 09:00:00), the second image will be collected 3 seconds later (09:00:03), and the third will be collected 3 seconds after that (09:00:06). This setting differs from the Quiet Period in that the delay occurs between images contained within a multi-image sequence, rather than between multi-image sequences (as in Quiet Period). If a Motion Image Interval was not set, enter “0” seconds (i.e., instantaneous).

8.3.6 Quiet Period (seconds)

The user-defined camera setting which provides the time (in seconds) between shutter “triggers” if the camera was programmed to pause between firing initially and firing a second time. Also known as “time lag” (depending on the Camera Make/Model; Palmer et al., 2018). Report as "0"

if a Quiet Period was not set. The Quiet Period differs from the Motion Image Interval in that the delay occurs between multi-image sequences rather than between the images contained within multi-image sequences (as in the Motion Image Interval).

8.4 Deployment - Camera Placement

8.4.1 Camera Height (m)

This is the height from the ground (below snow) to the bottom of the lens (recorded in metres to the nearest 0.05 m).

8.4.2 Camera Direction (degrees) (optional)

The cardinal direction that a camera faces. Ideally, cameras should face north (N; i.e. “0” degrees), or south (S; i.e., “180” degrees) if north is not possible. The Camera Direction should be chosen to ensure the Field of View (FOV) is of the original FOV Target Feature.

8.4.3 Stake Distance (m) (optional)

The distance from the camera to a stake (if applicable; in metres to the nearest 0.05 m). If not applicable, enter "NULL".

8.4.4 FOV Target Feature

A specific man-made or natural feature at which the camera is aimed to maximize the detection of wildlife species or to measure the use of that feature. FOV Target Features are important to document in case they result in detection biases. Select one of the options from the list provided:

- **“Game Trail”**
- **“Hiking Trail”**
- **“Off-Highway Vehicle Trail”** (e.g., all-terrain vehicle, snowmobile, motorbike, 4 x 4 truck)
- **“Paved Road”**
- **“Dirt/Gravel Road”**
- **“Road Crossing”** (e.g., overpass, underpass, or bridge)
- **“Railway”**
- **“Cutline/Seismic Line”**
- **“Transmission Line”**
- **“Pipeline”**
- **“Wellsite”**

- **“Culvert”**
- **“Beaver Dam”**
- **“Burrow/Den”**
- **“Nest”**
- **“Carcass”** (not placed by the crew as bait/lure)
- **“Natural Mineral Lick”**
- **“Rub Post”**
- **“Other†”** (describe in Camera Location Comments field)
- **“None”** (when a FOV Target Feature was not used)
- **“NULL”** (not recorded)

8.4.5 FOV Target Feature Distance (m) (optional)

The distance (in metres) from the camera to the target feature (recorded to the nearest 0.05 m). If not applicable, enter "NULL."

8.4.6 Bait/Lure Type

The type of bait or lure used at a camera location. Select one of the options from the list provided:

- **“Scent”**
- **“Meal”** (including carcass placed by the crew)
- **“Bait Tree”**
- **“Visual”**
- **“Acoustic”**
- **“Other‡”** (describe in Visit Comments field)
- **“None”** (if no bait or lure was used)
- **“NULL”** (not recorded)

8.5 Deployment - Site Characteristics

8.5.1 Camera Location Characteristic(s) (optional)

Record any significant features around the camera at the time of the visit. This may include for example, manmade or natural linear features (e.g., trails), habitat types (e.g., wetlands), wildlife structure (e.g., beaver dam). Camera Location Characteristic(s) differ from FOV Target

Features in that landscape features could include those not in the camera's field of view. Researchers typically record information about the environment at camera locations to better understand how this might affect animal occurrence or behaviour.

List all the characteristics that apply to the camera location from the list provided below. List the values alphabetically and separate each entry by a comma and space; e.g., “Building, Forest - Mixedwood, Road, Trail”):

- **“Trail”** (e.g., game, hiking, off-highway vehicle trail)
- **“Road”** (e.g., paved, dirt/gravel, road crossing)
- **“Railway/Pipeline/Transmission Line”**
- **“Cutline/Seismic Line”**
- **“Wellsite”**
- **“Clearcut”**
- **“Building”**
- **“Forest - Deciduous”**
- **“Forest - Coniferous”**
- **“Forest - Mixedwood”**
- **“Forest - Undefined”**
- **“Meadow”**
- **“Burn”**
- **“Agriculture”** (e.g., crop, pasture)
- **“Shrubland”**
- **“Beaver Dam”**
- **“Wetland”** (e.g., bog, fen, marsh/shallow open water, swamp)
- **“Lentic”** (i.e., standing water, e.g., lake, pond)
- **“Lotic”** (i.e., flowing water, e.g., stream, river)
- **“Other†”** (describe in Camera Location Comments)
- **“NULL”**

8.6 Deployment - Equipment Checks

A **walktest** is conducted to ensure the Camera Height, tilt, etc., adequately captures the desired detection zone (i.e., the area (conical in shape) in which a remote camera can detect the heat signature and motion of an object (Rovero & Zimmermann, 2016). To learn more about walktests and detection zones, refer to the Remote Camera Survey Guidelines (RCSC et al., 2023).

8.6.1 Walktest Distance (m) (optional)

The **Walktest Distance (m)** is the horizontal distance (recorded in metres to the nearest 0.05 m) from the camera at which the crew performs the walktest. Record as “NULL" if no walktest was performed.

8.6.2 Walktest Height (m) (optional)

The **Walktest Height (m)** is the vertical distance (recorded in metres to the nearest 0.05 m) from the camera at which the crew performs the walktest. Record as “NULL" if no walktest was performed.

8.7 Deployment - Image Set Information

8.7.1 Image Set Start Date Time (DD-MMM-YYYY HH:MM:SS)

The date and time of the first image or video collected during a specific deployment (e.g., “17-JUL-2018 12:00:02”). The Image Set Start Date Time may not coincide with the Deployment Start Date Time. Recording this field allows users to confirm the first date and time a camera was active (reliable if Time-lapse images were collected; especially valuable if the user scheduled a start delay).

8.7.2 Image Set End Date Time (DD-MMM-YYYY HH:MM:SS)

The date and time of the last image or video collected during a specific deployment (e.g., “27-JUL-2019 22:10:05”). The Image Set Start End Time may not coincide with the Deployment End Date Time. Recording this field allows users to account for deployments that were conducted but for which no data was found and to confirm the last date and time a camera was active (if functioning) if no images or videos were captured prior to Service/Retrieval (especially valuable if users did not collect Time-lapse images or if the camera malfunctioned).

8.7.3 Deployment Image Count (optional)

The total number of images collected during the deployment, including false fires (i.e., empty images with no Species) and those triggered by a time-lapse setting. This field is important to record to confirm that no data has been lost during file transfers etc.

9.0 Image/Sequence

The **image/sequence level** provides information on the data for an image (individual photo) or sequence of related images (e.g., images that are grouped as part of the same trigger “event”).

An **image** may be part of a multi-image sequence.

A **sequence** refers to a user-defined group of images or video clips that denote a single “detection event”. Often camera users choose a certain time threshold (“sequence definition”) to define independent detection events; (e.g., 30 minutes (O'Brien et al., 2003; Gerber et al., 2010; Kitamura et al., 2010; Samejima et al., 2012) or 1 hour (e.g., Tobler et al., 2008; Rovero and Marshall, 2009)). This threshold should be recorded in the Survey Design Description field, if applicable.

When a sequence Event Type is used, only enter data once for the sequence of images (not for each unique image) and use the first image of the sequence as the Sequence ID, as this is the time of the first detection.

Refer to the Data Management section for information on image processing software, and recommendations on data file structure and naming conventions.

9.1 Image ID

A unique alphanumeric file name for the image. It is highly recommended that users develop a photo naming convention prior to entering data. It is important to include (at a minimum) the camera location, date, time, and image number when generating an Image ID to avoid duplicate file names. For example, the Deployment ID and image number would not be unique for the same deployment within Reconynx overflow file subfolders (i.e., when the number of images exceeds 9,999, another folder is created [e.g., 101MEDIA] and the numbers in the image file names begin again at IMG_001).

We recommend using either of the following naming conventions for Image IDs:

a) ”Deployment ID”_“Camera_Serial Number”_”Image_Sequence_Date_Time”_”Image Number” (e.g., “BH1_17-JUL-2018_P900FF04152022_22-JUL-2018 10:34:22_IMG_100”), or

b) ”Deployment ID”_”Image_Sequence_Date_Time”_”Image Number” (e.g., “BH1_17-JUL-2018_22-JUL-2018 10:34:22_IMG_100”)

The file name used to create the Image ID should ideally match the file name of the original image.

9.2 Sequence ID

A unique alphanumeric for a multi-image sequence.

The Sequence ID should ideally consist of the Deployment ID and the names of the first and last images and videos in the sequence (separated by “_”) (i.e., "Deployment ID"_"IMG_#[name of

first image in sequence]"_"IMG_#[name of last image in sequence]". For example, if a particular sequence contains five images, the Sequence ID might be "BH1_22-JUL-2018 IMG_001-IMG_005". If “IMG_” prefixes are used to create the Sequence ID, they ideally should match the names of the original photos.

Enter "NULL” if this field is not applicable.

Even though the first image of a sequence is the only image used to derive the Sequence ID, the remaining images typically also include useful information (e.g., images of all individuals in a group). Therefore, it is ideal to archive all of the images from a sequence. If it is not possible to submit all of the images, users should ideally submit the image(s) from a sequence that best represents the sequence (e.g., those that can be used to verify the Species and Individial Count).

9.3 Image/Sequence Date Time (DD-MMM-YYYY HH:MM:SS)

The date and time of an image, or the image chosen to represent the sequence. Depending on the Event Type, Image/Sequence Date Time may be reported for an individual image, or the first or representative image (i.e., the image with the most information). For example, if three images were included in a sequence, but the Sex Class could only be discerned in the second image [all else remaining equal], the second image would be the best representative image of the sequence.

Record the Image/Sequence Date Time as “DD-MMM-YYYY HH:MM:SS” (e.g., 22-JUL-2018 11:02:02).

The Image/Sequence Date Time differs from the Image Set Start Date Time which refers to the first image or video collected during a deployment.

9.4 Analyst

The first and last names of the individual who provided the observation data point (Species identification and associated information). If there are multiple Analysts for an observation, enter the primary Analyst.

9.5 Species

The capitalized common name of the Species being categorized (“tagged”) in the Tag, Image or Sequence (e.g., “COYOTE” or “COMMON GOLDENEYE”). If there is more than one wildlife Species present in an image/sequence, data for each Species should be entered on a unique row but with the same Image ID or Sequence ID (reporting as Event_Type = “Tag”).

For detections where you are unsure of the specific Species, report the level of lowest taxonomic ranking known (e.g., “CLASS,” “ORDER,” “FAMILY,” “GENUS”), followed by the scientific name of the taxa.

For example, for a detection of an individual that is in the Canidae family, but for which the Genus or Species or unclear, report “FAMILY CANIDAE.” Refer to the Species_Crosswalk table for ease of reference.

If no Species is present (i.e. blank or empty image), enter “NONE”.

9.6 Individual Count

The number of unique individuals being categorized. This may be recorded as the total number of individuals, or according to Age Class and/or Sex Class.

9.7 Age Class and Sex Class

The age and sex classification of an individual or multiple individuals (if the classification is the same) being categorized.

Select one **Age Class** from the following:

- **“Adult”** (animals that are old enough to breed; reproductively mature)
- **“Juvenile”** (animals in their first summer, with clearly juvenile features (e.g., spots); mammals older than neonates but that still require parental care)
- **“Subadult”** (animals older than a “Juvenile” but not yet an “Adult”; a “Subadult” may be further classified into “Young of the Year” or “Yearling”)
- **“Subadult - Young of Year”** (animals less than one year old; born in the previous year’s spring, but has not yet lived through a winter season; between “Juvenile” and “Yearling”)
- **“Subadult - Yearling”** (animals approximately one year old; has lived through one winter season; between “Young of Year” and “Adult”)
- **“Unknown”**

Select one **Sex Class** from the following:

- **“Male”**
- **“Female”**
- **“Unknown”**

If there is more than one Age Class or Sex Class in an image/sequence, users can enter either:

a) each unique Age/Sex Class combination as a unique row (Event Type = “Image” or “Sequence” or
b) each unique combination within the same row under an appropriate field (Event Type = “Tag”)

For example, if an image/sequence 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 Image/Sequence Date Time and unique identifier (Image ID or Sequence ID), where:

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

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

- Count = 6, Age Class = Blank, Sex Class = 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.

9.8 Behaviour (optional)

The behaviour of an individual or multiple individuals (if the classification is the same) being categorized.

Select one of the options from the list provided:

- **"Travelling"**
- **"Standing"**
- **"Running"**
- **"Bedding"**
- **"Drinking"**
- **"Feeding/Foraging"**
- **"Territorial Display"**
- **"Rutting/Mating"**
- **"Vigilant"**
- **"Inspecting Camera"**
- **"Inspecting (Non-specified)"**
- **"Unknown"**
- **"Other§"** (describe in Image/Sequence Comments field)
- **"Multiple§"** (describe in Image/Sequence Comments field; e.g., "Behaviour[Standing,Vigilant]")
- **"NULL"** (not applicable or did not collect)

If observing a group of individuals, record the Behaviour of all the individuals in the group or enter the Behaviour of each animal as a unique row (see example in the Age Class and Sex Class section above).

If an animal is performing multiple Behaviours, select “Multiple§,” and include all the Behaviours in the Image/Sequence Comments as a comma delimited list. To help parse out this information later most easily, we recommend using a format that includes a header followed by the behaviour(s), e.g., “Behaviour[Inspecting Camera,Travelling]”.

9.9 Animal ID (optional)

A unique ID for an animal that 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. If Animal IDs were not collected, enter "NULL.”

9.10 Human Transport Mode/Activity (optional)

The activity performed, or mode of transportation used, by a human observed (e.g., hiker, skier, all terrain vehicle etc.). This text field should be populated when data on humans (in addition to wildlife) are collected.

Select **one** of the options from the list provided:

- **“Activity - Walking”**
- **“Activity - Hiking”** (e.g., backpacker)
- **“Activity - Running”**
- **“Activity - Cycling”** (e.g., non-motorized or e-bike)
- **“Activity - Skiing”**
- **“Activity - Snowshoeing”**
- **“Activity- Fishing”**
- **“Activity - Hunting”**
- **“Activity - Unspecified”**
- **“Transport - Horse/Mule”**
- **“Transport - Off-Highway Vehicle”** (e.g., all-terrain vehicle, snowmobile, motorbike, snowmobile, 4 x 4 truck)
- **“Transport - Passenger Vehicle”** (e.g., car, truck without 4x4)
- **“Transport - Large Commercial Vehicle/Heavy Equipment”** (e.g., logging truck, semi-truck, bus)
- **“Transport - Unspecified”**
- **“Activity/Transport - Other§”** (describe in Image/Sequence Comments field)

- **“NULL”** (not applicable)

Where there are multiple individuals and transport modes within a tag, image, or sequence, enter the data for each individual mode as a unique row.

9.11 Image/Sequence Comments (optional)

Describe any additional data about the image or sequence.

If you selected the “Multiple§” option from the Behaviour field, enter all the Behaviours here (e.g., “Behaviour[Inspecting Camera,Travelling]”).

9.12 Image Trigger Mode (optional)

The type of trigger mode used to capture the image as reported in the image Exif data. This field is categorical; record “Unknown” if not known.

Data should be entered as one of the following:

- **“Motion Detection”**
- **“Time Lapse”**
- **“CodeLoc Not Entered”**
- **“External Sensor”**
- **“Unknown”**

9.13 Image Sequence (optional)

The order of the image in a rapid-fire sequence as reported in the image Exif data (text; e.g., “1 of 1” or “1 of 3”). This field is in text format; record “Unknown” if not known.

9.14 Image Infrared Illuminator (optional)

The infrared illuminator setting can be enabled, if applicable to the Camera Make/Model, to obtain greater visibility at night by producing infrared light. Record the **Image Infrared Illuminator** as reported in the image Exif data. This field is categorical; record “Unknown” if not known.

Data should be entered as **one** of the following:

- **“On”**
- **“Off”**
- **“Unknown”**

9.15 Image Flash Output (optional)

The **Flash Output** setting determines the level of intensity of the flash (if enabled). Record the **Image Flash Output** as reported in the image Exif data (e.g., "Flash Did Not Fire", "Auto"). This field is in text format; record "Unknown" if not known.

10.0 Data Management

Data management is a critical component of any project. Below are recommendations on file naming conventions and file structure to help manage remote camera data. Refer to the Remote Camera Survey Guidelines (RCSC et al., 2023) for additional information topics related to data management, including software platforms and tools to help camera users enter metadata as well as store, process and analyze image data.

10.1 Naming conventions

It is highly recommended that users develop a set of naming conventions prior to entering data. Using naming conventions will minimize the risk of having images from different deployments, study areas, or surveys with the same name.

Naming conventions are especially important for the following fields:

- Project ID
- Study Area ID
- Survey ID
- Sample Station ID
- Camera Location ID
- Deployment ID
- Image ID
- Sequence ID

Refer to Appendix A - Table A2 for examples of recommended naming conventions. If you wish to rename your images, it is highly recommended that renamed images reflect the associated Image ID. IDs or file names should not have spaces or leading zeros. Alternative naming conventions may be used, but the goal should be to minimize duplication of IDs (and/or file names).

Data entry software can be used for batch processing of image names, which can significantly reduce data processing time compared to renaming images manually (e.g., Timelapse2 [Greenberg, 2018], Reconyx MapView [Reconyx, Holmen, WI, USA]) or other tools (e.g., WildCo Lab's Image Renamer [WildCo Lab, 2021b]).

Note that it is not always necessary to rename images. For example, renaming would not be required if data are stored in a folder structure that identifies the camera location and the survey from which it was collected).

10.2 File structure

Image data ideally should be stored in a hierarchical structure as shown in Figure 1. Each level would typically comprise a series of file subfolders containing data from the level below it (e.g., a project folder with study area subfolders, with each study area with survey subfolders etc.). For example, Figure 2 shows the file structure for a project that consisted of two study areas, each with one survey and each survey with two camera locations with one deployment period and 2 sequences per camera location.

However, this is often not the way we store this information in the form of CSVs (e.g., if there are only one or two study areas, it might not make sense to store this information in a separate CSV file). These metadata standards suggest a CSV structure similar to that of other metadata/data repositories (e.g., B.C. Metadata Standards [RISC, 2019], Wildlife Insights Minimum Metadata Standards (Ahumada et al., 2019), WildTrax) that consists of four CSVs associated with these metadata standards:

- Project CSV
- Sample Staton/Camera Location
- Deployment CSV
- Image/Sequence CSV (includes Event Type = “Tag”)

The information from each CSV can be linked using identifiers for each of the levels in the folder structure/ hierarchy (refer to Figure 3) so that redundant information does not need to be repeated, and the chance of error is reduced. The connections between the levels and CSVs are also outlined in Appendix A - Table A2.

Refer to the Remote Camera Metadata Standards: Metadata Template (RCSC et al., 2023) for the template CSVs and additional information.

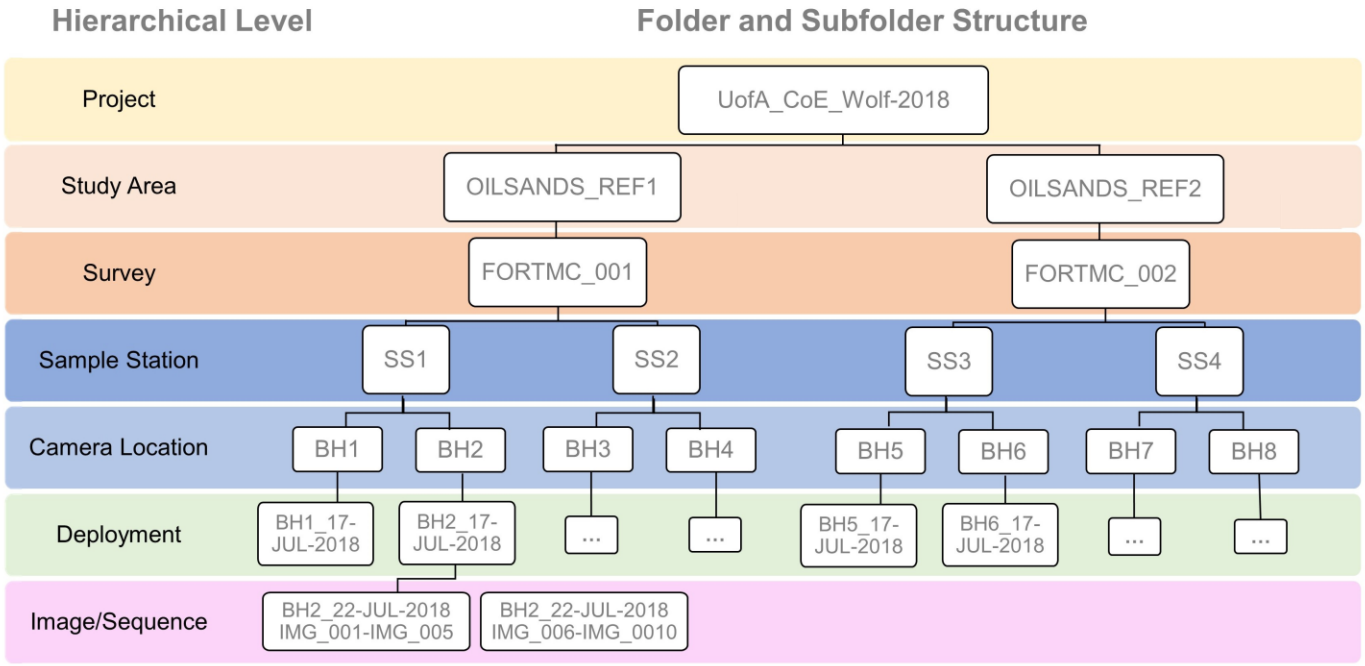

Figure 2. Example of the recommended file structure and naming conventions for a project that consisted of two study areas, each with one survey and each survey with two camera locations with one deployment period and 2 sequences per camera location.

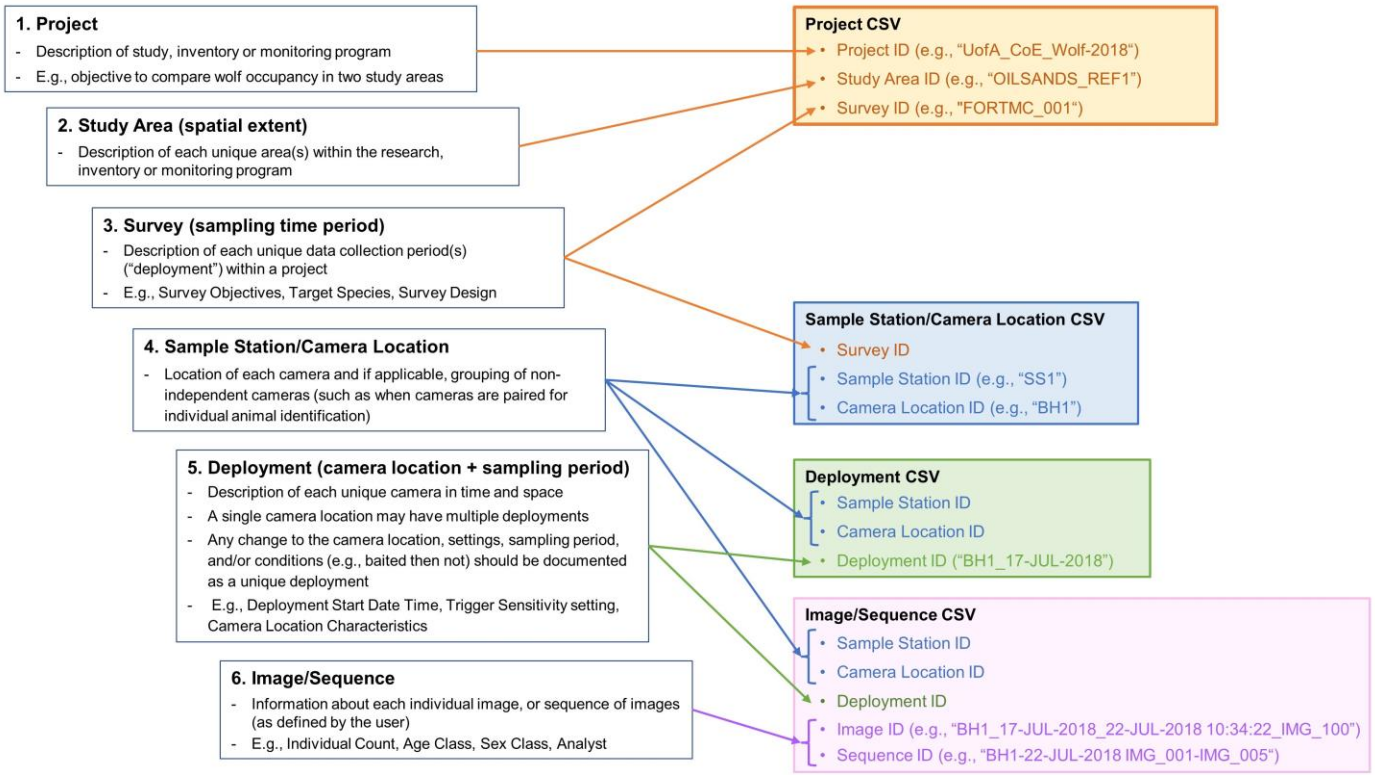

Figure 3. The hierarchical structure of remote camera data in the Remote Camera Metadata Standards for Alberta (based on Forrester et al. [2016], Wildlife Insights Minimum Metadata Standards [Ahumada et al., 2019] and the B.C. Metadata Standards [RISC, 2019]) and the linkages with and within the four CSVs included in these metadata standards ("Project CSV," "Sample Station/Camera Location CSV," "Deployment CSV," and the "Image/Sequence CSV").

10.3 Data storage (archival)

It is strongly encouraged/may be required that remote camera datasets are submitted to an open data repository. There are regulatory requirements to submit data loadforms to the FWMIS database (not images, although this is strongly encouraged) according to specific policies (e.g., Sensitive Species Inventory Protocols, Research and Collection permits, etc.). A new FWMIS loadform consistent with these Metadata Standards will be available in August 2023. Refer to the Government of Alberta web pages for further information.

There are other cloud or server-based repositories available to house all camera datasets, including WildTrax, eMammal (McShea et al., 2015), Wildlife Insights (Ahumada et al., 2019) and others (see Young et al., [2018] for a comparison of 12 available programs for the management of camera data).

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.

Appendix 1 - Table A1 contains a crosswalk table linking the data fields from these Alberta Metadata Standards with those from the B.C. Metadata Standards (RISC, 2019), FWMIS, WildTrax and Wildlife Insights (Ahumada et al., 2019) data repositories.

Refer to the Remote Camera Survey Guidelines (RCSC et al., 2023) for more information on data storage.

11.0 Conclusion

These standards provide information on how remote camera data should be collected and documented in Alberta. These standards are closely related to other proposed standards (e.g., Forrester et al., 2016) and strongly align, wherever possible, with the B.C. Metadata Standards (RISC, 2019) and Wildlife Insights Minimum Metadata Standards (Ahumada et al., 2019). The consistent collection of remote camera data helps support the development of robust Survey Designs and datasets, and enhance opportunities for collaboration across projects to address research and monitoring questions across administrative jurisdictions, including those on a global scale.

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14.0 Appendix A

Table A1. Metadata crosswalk table showing the corresponding fields used in this Alberta Metadata Standard (2023), and other standards used in Western Canada. An asterisk (*) denotes an optional field. Hierarchical levels are shown in bold font above each section.

Alberta Metadata Standards (2023)	**B.C. Metadata Standards** (RISC, 2019)	**WildTrax**	**FWMIS**	**Wildlife Insights Minimum Metadata Standards** (Ahumada et al., 2019)
Project				
Project ID	Project IDentification Number	Project Name	Project ID (auto populated)	Project ID
Project Coordinator	Project Coordinator	Project Coordinator	Project Administrator	Project Admin
Project Coordinator Email	-	Project Coordinator Email	Project Administrator, User Email	Project Admin Email
Project Description	Location Description, Project Objectives	Project Description	*Purpose and Methods	Project Stratification/Project Stratification Type
Study Area				
Study Area ID	Study Area Name	Study Area ID	-	Subproject Name
Study Area Description	Study Area Description	Study Area Description	*Purpose and Methods	Subproject Design
Survey				
Survey ID	Survey Name	Survey ID	-	-
Survey Objectives	Survey Objectives	Survey Objectives	*Purpose and Methods	Project Objectives
Target Species	Target Species*	Target Species		Project Species/Project Species Individual
Survey Design	Project Objectives	Survey Design		Project Sensor Layout / Project Sensor Cluster
*Survey Design Description	Project Objectives	Survey Design Description		-
Event Type	-	Event Type	-	Project Type
Sample Station				
Sample Station ID	Sample Station Label*, Nested in Sample Staion*	Sample Station ID	-	Subproject Name

Alberta Metadata Standards (2023)	**B.C. Metadata Standards** (RISC, 2019)	**WildTrax**	**FWMIS**	**Wildlife Insights Minimum Metadata Standards** (Ahumada et al., 2019)
Camera Location				
Camera Location ID	-	Camera Location ID	Location ID (auto populated)	Location ID
Latitude Camera Location	Easting or Longitude Sample Station	Latitude	Latitude	Latitude
Longitude Camera Location	Northing or Latitude Sample Station	Longitude	Longitude	Longitude
Northing Camera Location	Northing or Latitude Sample Station	UTM/TTM Northing	-	-
Easting Camera Location	Easting or Longitude Sample Station	UTM/TTM Easting	-	-
UTM Zone Camera Location	UTM Zone Sample Station	UTM Ref Meridian	-	-
GPS Unit Accuracy (m)	-	Precision (m)	-	-
*Camera Location Comments	Sample Station Comments and Camera Comments*	Location Comments	*Location Comments	-
Deployment				
Deployment ID	Deployment Name	Deployment ID	Location, Image Set Start Date	Deployment ID
Deployment Crew	Crew Members	Crew Names, Crew Type	*Crew Name(s)	Recorded By
Service/Retrieval Crew				-
Deployment Start Date Time (DD-MMM-YYYY HH:MM:SS)	Deployment Start Date	Deployment Start Date Time (DD-MMM-YYYY HH:MM:SS)	*Visit Date (YYYY-MM-DD)	Camera Deployment Begin Date
Deployment End Date Time (DD-MMM-YYYY HH:MM:SS)	Deployment End Date	Deployment End Date (DD-MMM-YYYY HH:MM:SS)	*Visit Date (YYYY-MM-DD)	Camera Deployment End Date
*Visit Comments	Deployment Comments*	Visit Comments	*Visit Comments	Event Description/Event Type/Bait Description
Camera ID	Camera Label	Camera ID	*Equipment Code	Camera ID
Camera Make	Camera Make and Model	Camera Make	Equipment Make	Make
Camera Model		Camera Model	Equipment Model	Model
Camera Serial Number	-	Camera Serial Number	Equipment Serial Number	Serial Number

Alberta Metadata Standards (2023)	**B.C. Metadata Standards** (RISC, 2019)	**WildTrax**	**FWMIS**	**Wildlife Insights Minimum Metadata Standards** (Ahumada et al., 2019)
Trigger Mode(s)	-	Trigger Mode(s)	*Visit Trigger Mode(s)	Project Sensor Method
*Video Length (seconds)	Video Length Setting	Video Length (seconds)	-	-
Trigger Sensitivity	Trigger Sensitivity Setting	Trigger Sensitivity	-	-
Photos Per Trigger	Photos per Trigger Setting	Photos Per Trigger	[from image metadata; Image Exif Sequence]	-
Motion Image Interval (seconds)	-	Motion Image Interval (seconds)	*Visit Motion Image Interval (seconds)	-
Quiet Period (seconds)	Quiet Period Setting	Quiet Period (seconds)	*Visit Quiet Period (seconds)	Quiet Period Setting
Camera Height (m)	-	Camera Height (m)	*Equipment Height (m)	Height
*Camera Direction (degrees)	-	Camera Direction (Bearing degrees)	*Equipment Direction (degrees)	-
*Stake Distance (m)	-	Stake Distance (m)	*Stake Distance (m)	-
FOV Target Feature	Deployment Feature	FOV Target Feature	*Target Feature	Project Sensor Layout Targeted Type
*FOV Target Feature Distance (m)	-	FOV Target Feature Distance (m)	-	-
Bait/Lure Type	Bait Lure Type	Bait/Lure Type	*Bait/Lure Type	Project Bait Use / Bait Type
*Camera Location Characteristic(s)	Deployment Feature	Camera Location Characteristics	*Landscape Feature(s)	Feature Type
*Walktest Distance (m)	-	Walktest Distance (m)	*Walktest Distance (m)	-
*Walktest Height (m)	-	Walktest Height (m)	*Walktest Height (m)	-
Image Set Start Date Time (DD-MMM-YYYY HH:MM:SS)	-	Image Set Start Date Time (DD-MMM-YYYY HH:MM:SS)	Image Set Start Date Time (YYYY-MM-DD HH:MM:SS)	-
Image Set End Date Time (DD-MMM-YYYY HH:MM:SS)	-	Image Set End Date Time (DD-MMM-YYYY HH:MM:SS)	Image Set End Date Time (YYYY-MM-DD HH:MM:SS)	-
*Deployment Image Count	-	Deployment Image Count	Image Set Total Image Count	-
Image/Sequence				
Image ID	Sequence/Image ID	Image ID	Image ID (auto populated)	Image ID

Alberta Metadata Standards (2023)	**B.C. Metadata Standards** (RISC, 2019)	**WildTrax**	**FWMIS**	**Wildlife Insights Minimum Metadata Standards** (Ahumada et al., 2019)
Sequence ID		Sequence ID	-	External Sequence ID
Analyst	Surveyor	Analyst	Observer, Observer ID (auto populated)	Photo Type Identified by
Species	Species	Species	Species Scientific Name	Species/Project Blank Images
Individual Count	Count	Individual Count	Individual Count (tag level)	Number of Objects
Age Class	Life Stage and Sex Classes*	Age Class	*Age Class (tag level)	Age
Sex Class		Gender Class	*Sex Class (tag level)	Sex
*Behaviour	Behaviour*	Behaviour	*Behaviour(s) (tag level)	-
*Animal ID	Animal ID*	Image/Sequence Comments	*Health/Disease(s), *Coat Colour(s), *Coat Attribute(s), *Collar (Y/N), *Ear Tag (Y/N), *Antler Tine Attributes (Antler Location, Tine Count, Tine Count Precision) (all Tag level)	Individual ID/Project Individual Animals
*Human Transport Mode/Activity	Human Transport Mode*, Human Use Type*	Human Transport Mode/Activity	-	-
*Image/Sequence Comments	Comments*	Image/Sequence Comments	*Tag Comments, *Image Comments	Individual Image and Animal Notes
*Image Trigger Mode	-	Image Trigger Mode	*Image Exif Trigger Mode	-
*Image Sequence	-	Image Sequence	*Image Exif Sequence	-
*Image Infrared Illuminator	-	Image Infrared Illuminator	-	-
*Image Flash Output	-	Image Flash Output	-	-
Image/Sequence Date Time (DD-MMM-YYYY HH:MM:SS)	Sequence/Image Start Date, Sequence/Image Start Time	Image/Sequence Date Time (DD-MMM-YYYY HH:MM:SS)	Image Date/Time (YYYY-MM-DD HH:MM:SS)	Date Time Captured

Note: The B.C. Metadata Standards (RISC, 2019) also contain the following fields not found in the Alberta Metadata Standards (2023): Publish Date, Funding Agency*, Project Start Date, Project End Date*, Region, Wildlife Permit Number*, Survey Start Date, Deployment Photos*, Number of Camera*, Camera Days, Sequence/Image Temperature and Sequence Definition

Table A2. Overview of the structure of the **RCSC et al's Remote Camera Metadata Template (2023)** including both the data fields recommended by the **Remote Camera Survey Guidelines: Guidelines for Western Canada** (RCSC et al., 2023) and these metadata standards.

Survey Guidelines	Metadata Standards	Data Group	Visit Type	Field Code	Data Type	Data Format[1]	Example
Project ID	**Project ID**	Visit Metadata	Both	proj_id	[alphanumeric]	[Ideally recorded as: "abbreviated organization name"_" brief project name"_"project start year"]	UofA_WildEdmonton-Urban-Wildlife-Monitoring_2018
Project Coordinator	Project Coordinator	-	-	proj_coord	[text]	-	John Smith
Project Coordinator Email	Project Coordinator Email	-	-	proj_coord_email	[text]	-	John.Smith@telus.net
Project Description	Project Description	-	-	proj_desc	[text]	-	The objective of this project is to compare wolf occupancy in the oil sands region of north-eastern Alberta using two study areas with high energy development and two reference areas with little to no industrial footprint
Study Area ID	**Study Area ID**	-	-	study_area_id	[alphanumeric]	-	OILSANDS-REF001
Study Area Description	Study Area Description	-	-	study_area_desc	[text]	-	The study area OILSANDS-REF001 was located in the south-east corner of the Birch Mountains Wildland Provincial Park in the Boreal Highlands subregion. The area consisted primarily of bogs, patches of pine, aspen and birch forest as well as riparian meadow habitats. There was no land use disturbance in the study area.

Survey Guidelines	Metadata Standards	Data Group	Visit Type	Field Code	Data Type	Data Format[1]	Example
Survey ID	**Survey ID**	-	-	surv_id	[alphanumeric]	-	FORTMC_001
Survey Objectives	Survey Objectives	-	-	surv_obj	[text]	-	Our survey objective was to monitor trends in wolf occupancy at 5-year intervals from January – December 2020 to 2023 in the Oilsands region in the northern boreal forest of Alberta.
Target Species	Target Species	-	-	target_species	categorical; one-to-many	[Refer to "species" in "species_crosswalk"]	COYOTE, WHITE-TAILED DEER
Survey Design	Survey Design	-	-	surv_design	categorical; one-to-one	Simple Random, Systematic, Stratified, Clustered, Paired, Targeted, Convenience, Hierarchical (Multiple)¶, Other¶, Unknown	Hierarchical (multiple)¶
*Survey Design Description	*Survey Design Description	-	-	surv_design_desc	[text]	-	survey_design[Systematic, Convenience]; Our Systematic, Convenience design consisted of one camera location within each township in our study area; each location was within 100m of a secondary road or cutline; lure dispensers with Gorman's Gumbo (long line) were set-up at each camera location during initial camera deployment and not revisited during the survey period.
Event Type	Event Type	-	-	event_type	categorical; one-to-one	Tag, Image, Sequence	Tag
Sample Station ID	**Sample Station ID**	Visit Metadata	Both	samp_st_id	[alphanumeric]	["NULL" if NA]	SS1
Camera Location ID	**Camera Location ID**			cam_loc_id	[alphanumeric]	-	BH1

Survey Guidelines	Metadata Standards	Data Group	Visit Type	Field Code	Data Type	Data Format[1]	Example
Latitude Camera Location	Latitude Camera Location		Deployment	cam_loc_lat	[numeric]	[5 decimal places]	53.78136
Longitude Camera Location	Longitude Camera Location			cam_loc_long	[numeric]	[5 decimal places]	-113.46067
Northing Camera Location	Northing Camera Location			cam_loc_north	[numeric]	[no decimal places]	5962006
Easting Camera Location	Easting Camera Location			cam_loc_east	[numeric]	[no decimal places]	337875
UTM Zone Camera Location	UTM Zone Camera Location			cam_loc_utm_zone	[alphanumeric]	[zone # / hemisphere; e.g., "12 N"]	12 N
GPS Unit Accuracy (m)	GPS Unit Accuracy (m)			gps_accuracy_m	[numeric]	[metres]	5
*Access Method	-			-	categorical; one-to-one	Foot, ATV, Argo, Truck, Snowmobile, Horse, Boat, Helicopter, NULL	Foot
*Camera Location Comments	*Camera Location Comments		Both	cam_loc_comments	[text]	-	Snowmobile trail, aspen-dominated
Deployment ID	**Deployment ID**	Visit Metadata	Deployment	deploy_id	[alphanumeric]	[ideally recorded as: “Camera Location ID”_“Deployment Start Date” (or …_”Deployment End Date”)] (e.g., “BH1_17-JUL-2018" or “BH1_17-JUL-2018_21-JAN-2019”	BH1_17-JUL-2018
Purpose of Visit	-		Service/ Retrieval	-	categorical; one-to-one	Deployment, Service, Retrieval	Deployment
Deployment Crew	Deployment Crew		Both	deploy_crew	[text]	-	Susie Smith
Service/Retrieval Crew	Service/Retrieval Crew		Service/ Retrieval	service_retrieval_crew	[text]	-	John Smith
Deployment Start Date Time (DD-MMM-YYYY HH:MM:SS)	Deployment Start Date Time (DD-MMM-YYYY HH:MM:SS)		Both	deploy_start_date_time	date/time	[DD-MMM-YYYY HH:MM:SS]	43298.44053
Deployment End Date Time (DD-	Deployment End Date Time (DD-			deploy_end_date_time	date/time	[DD-MMM-YYYY HH:MM:SS]	43673.95833

Survey Guidelines	Metadata Standards	Data Group	Visit Type	Field Code	Data Type	Data Format[1]	Example
MMM-YYYY HH:MM:SS)	MMM-YYYY HH:MM:SS)						
*Visit Comments	*Visit Comments			visit_comments	[text]	-	
*Deployment Comments	-		Deployment	-	[text]	-	applied Gorman's Gumbo lure
*Service/Retrieval Comments	-		Service/ Retrieval	-	[text]	-	reapplied Gorman's Gumbo lure
Camera ID	Camera ID	Equipment Information	Deployment	cam_id	[alphanumeric]	-	RECONPC900-1
Camera Make	Camera Make			cam_make	[text]	-	Reconyx
Camera Model	Camera Model			cam_model	[text]	-	PC900
Camera Serial Number	Camera Serial Number			cam_serial	[text]	-	P900FF04152022
*SD Card ID	-		Both	-	[alphanumeric]	-	CMU-100
*Key ID	-		Deployment	-	[alphanumeric]	-	Python#1
*Security	-			-	categorical; one-to-one	Security Box, Bracket, None	Security Box
*Camera Active On Arrival	-		Service/ Retrieval	-	categorical; one-to-one	Y, N	Y
*Camera Damaged	-			-	categorical; one-to-one	Physical‡, Mechanical‡, None	Physical
*Card Status (% Full)	-			-	[numeric]	[seconds]	56
*# Of Images	-			-	[numeric]	[count]	1567
*SD Card Replaced	-			-	categorical; one-to-one	Y, N	Y
*Remaining Battery (%)	-			-	[numeric]	[%]	99
*Batteries Replaced	-			-	categorical; one-to-one	Y, N	Y
New Camera ID	-			-	[alphanumeric]	["NULL" if NA]	-
New Camera Make	-			-	[text]	["NULL" if NA]	-

Survey Guidelines	Metadata Standards	Data Group	Visit Type	Field Code	Data Type	Data Format[1]	Example
New Camera Model	-			-	[text]	["NULL" if NA]	-
New Camera Serial Number	-			-	[text]	["NULL" if NA]	-
*New SD Card ID	-			-	[alphanumeric]	["NULL" if NA]	-
Trigger Mode(s)	Trigger Mode(s)	Camera Settings	Deployment	set_trig_modes	categorical; one-to-one	Motion Image, Time-lapse Image, Video, Motion Image + Time-lapse Image, Motion Image + Time-lapse Image + Video, Time-lapse Image + Video, Motion Image + Video	Motion Image + Time-lapse image
*Video Length (seconds)	*Video Length (seconds)			set_video_length_s	[numeric]	[seconds; "NULL" if NA]	NULL
Trigger Sensitivity	Trigger Sensitivity			set_trig_sensitivity	categorical; one-to-one	Low, Low/Med, Med, Med/High, High, Very High, NULL	High
Photos Per Trigger	Photos Per Trigger			set_photos_per_trig	[numeric]	[count]	3
Motion Image Interval (seconds)	Motion Image Interval (seconds)			set_motion_img_int_s	[numeric]	[seconds; "0" if not set]	0
Quiet Period (seconds)	Quiet Period (seconds)			set_quiet_period_s	[numeric]	[seconds; "0" if not set]	30
Camera Height (m)	Camera Height (m)	Placement		cam_ht_m	[numeric]	[metres, recorded to the nearest 0.05 m]	1
*Camera Direction (degrees)	*Camera Direction (degrees)			cam_dir_deg	[numeric]	[degrees]	0 (i.e. North)
*Camera Attachment	-			-	categorical; one-to-one	Tree, Post, Tree + Bungee/Strap, Tree + Screws, Post + Bungee/Strap, Post + Screws, Other†	Tree + Screws
*Stake Distance (m)	*Stake Distance (m)			stake_dist_m	[numeric]	[metres, recorded to the nearest 0.05 m; "NULL" if NA]	4.95
FOV Target Feature	FOV Target Feature			fov_target	categorical; one-to-one	Game Trail, Hiking Trail, Off-Highway Vehicle Trail, Paved Road, Dirt/Gravel Road, Road Crossing,	Off-Highway Vehicle Trail

Survey Guidelines	Metadata Standards	Data Group	Visit Type	Field Code	Data Type	Data Format[1]	Example
						Railway, Cutline/Seismic Line, Transmission Line, Pipeline, Wellsite, Culvert, Beaver Dam, Burrow/Den, Nest, Carcass, Natural Mineral Lick, Rub Post, Other, None, NULL	
*FOV Target Feature Distance (m)	*FOV Target Feature Distance (m)			fov_target_dist_m	[numeric]	[metres, recorded to the nearest 0.05 m; "NULL" if NA]	10
Bait/Lure Type	Bait/Lure Type			bait_lure_type	categorical; one-to-one	Scent, Meal, Bait Tree, Visual, Acoustic, Other‡, None, NULL	Scent
*Camera Location Characteristic(s)	*Camera Location Characteristic(s)	Site Characteristics		cam_loc_chars	categorical; one-to-many	Trail, Road, Railway/Pipeline/Transmission Line, Cutline/Seismic Line, Wellsite, Clearcut, Building, Forest - Deciduous, Forest - Coniferous, Forest - Mixedwood, Forest - Undefined, Meadow, Burn, Agriculture, Shrubland, Beaver Dam, Wetland, Lentic, Lotic, Other†, NULL	Building, Forest - Mixedwood, Road, Trail
*Deployment Area Photos Taken	-			-	categorical; one-to-one	Y, N	Y
*Deployment Area Photo Numbers	-			-	[text]	["NULL" if NA]	4
*Test Image Taken	-	Equipment Checks	Both	-	categorical; one-to-one	Y, N	Y
*Walktest Complete	-			-	categorical; one-to-one	Y, N	Y
*Walktest Distance (m)	*Walktest Distance (m)			walktest_dist_m	[numeric]	[metres, recorded to the nearest 0.05 m; "NULL" if NA]	4.95
*Walktest Height (m)	*Walktest Height (m)			walktest_ht_m	[numeric]	[metres, recorded to the nearest 0.05 m; "NULL" if NA]	0.75
Image Set Start Date Time (DD-	Image Set Start Date Time (DD-	Image Set	-	img_set_start_date_time	date/time	[DD-MMM-YYYY HH:MM:SS]	43298.50002

Survey Guidelines	Metadata Standards	Data Group	Visit Type	Field Code	Data Type	Data Format[1]	Example
MMM-YYYY HH:MM:SS)	MMM-YYYY HH:MM:SS)						
*Camera Active On Departure	-	Equipment Checks	Deployment	-	categorical; one-to-one	Y, N	Y
Image Set End Date Time (DD-MMM-YYYY HH:MM:SS)	Image Set End Date Time (DD-MMM-YYYY HH:MM:SS)	Image Set	-	img_set_end_date_time	date/time	[DD-MMM-YYYY HH:MM:SS]	43663.92367
*Deployment Image Count	*Deployment Image Count	Image Set	-	deploy_img_count	[numeric]	[count]	1567
Image ID	**Image ID**	-	-	img_id	[alphanumeric]	[Ideally recorded as: ”Deployment ID”_“Camera_Serial Number”_”Image_Sequence_Date_Time”_”Image Number” - OR - ”Deployment ID”_”Image_Sequence_Date_Time”_” Image Number”]	BH1_17-JUL-2018_22-JUL-2018 10:34:22_IMG_100
Sequence ID	**Sequence ID**	-	-	seq_id	[alphanumeric]	[Ideally recorded as: "Deployment ID"_"IMG_#[name of first image in sequence]"_"IMG_#[name of last image in sequence]"; "NULL" if NA]	BH1_22-JUL-2018 IMG_001-IMG_005
Analyst	Analyst	-	-	Analyst	[text]	-	Susie Smith
Species	Species	-	-	species	categorical; one-to-one	[Refer to "species" in "species_crosswalk"; "NONE" if no species]	COYOTE
Individual Count	Individual Count	-	-	individual_count	[numeric]	[count]	2
Age Class	Age Class	-	-	age_class	categorical; one-to-one	Adult, Juvenile, Subadult - Young of Year, Subadult - Yearling, Subadult, Unknown	Adult
Sex Class	Sex Class	-	-	sex_class	categorical; one-to-one	Male, Female, Unknown	Male
*Behaviour	*Behaviour	-	-	behaviour	categorical; one-to-one	Travelling, Standing, Running, Bedding, Drinking, Feeding/Foraging,	Travelling

Survey Guidelines	Metadata Standards	Data Group	Visit Type	Field Code	Data Type	Data Format[1]	Example
						Territorial Display, Rutting/Mating, Vigilant, Inspecting Camera, Inspecting (Non-Specified), Unknown, Other§, Multiple§, NULL	
*Animal ID	*Animal ID	-	-	animal_id	[alphanumeric]	["NULL" if NA]	NULL
*Human Transport Mode/Activity	*Human Transport Mode/Activity	-	-	human_tpt_mode_activity	categorical; one-to-one	Activity - Walking, Activity - Hiking, Activity - Running, Activity - Cycling, Activity - Skiing, Activity - Snowshoeing, Activity - Fishing, Activity - Hunting, Activity - Unspecified, Transport - Horse/Mule, Transport - Off-Road/All-Terrain Vehicle, Transport - Passenger Vehicle, Transport - Large Commercial Vehicle/Heavy Equipment, Transport - Unspecified, Activity/Transport - Other§, NULL	Activity - Walking
*Image/Sequence Comments	*Image/Sequence Comments	-	-	img_seq_comments	[text]	-	Behaviour[Inspecting Camera,Travelling]
*Image Trigger Mode	*Image Trigger Mode	-	-	img_trig_mode	categorical; one-to-one	Motion Detection, Time Lapse, CodeLoc Not Entered, External Sensor, Unknown	Motion Detection
*Image Sequence	*Image Sequence	-	-	img_sequence	[text]	[e.g., "0 of 0", "1 of 1", "0 of 0"; "Unknown" if not known]	1 of 3
*Image Infrared Illuminator	*Image Infrared Illuminator	-	-	img_infrared_illum	categorical; one-to-one	On, Off, Unknown	On
*Image Flash Output	*Image Flash Output	-	-	img_flash	[text]	[e.g., "Flash did not fire, Auto"; "Unknown" if not known]	Flash did not fire, Auto
Image/Sequence Date Time (DD-MMM-YYYY HH:MM:SS)	Image/Sequence Date Time (DD-MMM-YYYY HH:MM:SS)	-	-	img_seq_date_time	date/time	[DD-MMM-YYYY HH:MM:SS]	43303.45975

[1] The symbols refer to the field in which to provide additional information. I.e., † = in Camera Location Comments; ‡ = deployment OR service/retrieval comments; § = Image/Sequence Comments; ¶ = Survey Design Description