Standard Operating Procedures (8.1): Motion Wildlife Camera Surveys

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Standard Operating Procedures: Motion Wildlife Camera Surveys

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Protocol Suitability Evaluation

A habitat suitability table containing appropriate estuarine wetland habitat types (of those evaluated) to implement the motion wildlife camera survey protocol is displayed in Table 1. While cameras should not be placed directly in habitats with a high tidal range (due to the potential for lens flooding), they can be positioned to capture those habitat types (e.g., view towards tidal channels). A comparative assessment of cost, effort, and data quality are shown in Table 2. A matrix of additional detailed categorical evaluations of the motion wildlife camera survey protocol can be found in Appendix 8.1A.

Table 1. Appropriate habitat types to implement the motion wildlife camera survey protocol.

	Habitat Types					
Survey Protocol	**Tidal Channel**	**Mud/sand flat**	**Emergent salt marsh**	**Non-tidal salt marsh**	**Salt pan**	**'Degraded' / fill**
Wildlife Camera	X	X	X	X	X	X

Table 2. Categorical assessment of cost/effort and data quality for the motion wildlife camera survey protocol.

	Evaluation Metric	Wildlife Camera	Notes
Time / Effort	Office Preparation Time	10-30 minutes	Print data sheets, maps, GPS locations
	Equipment Construction Time (one time)	> 30 minutes	Construct stakes and camera housing
	Field Time (per station)	30-60 minutes	Depending on field location and hiking time (site-dependent) as well as the difficulty of setting up the housing in the field
	Laboratory Time (per transect)	0 minutes	---
	Post-Survey Processing / QAQC Time	30-60 minutes	Download images and label
	Minimum Repetition (site-dependent)	Many Repetitions	Several stations can capture a broad area; however, may need many 'capture nights'
	Relative Cost (equipment and supplies)	> $50	Motion-activated camera, GPS, tools, housing
Survey / Data Quality	Accuracy (at a survey area level)	High	---
	Precision (at a survey area level)	Medium	---
	Qualitative-Quantitative Score	Qualitative	---
	Subjectivity-Objectivity Score	Objective	---

Resulting Data Types

The application of the motion wildlife camera survey protocol will yield qualitative data displayed as images visually confirming the presence of medium or large wildlife. These images can then be processed into quantitative data displayed as relative frequency of sightings per time of day, or direction of travel. Data are useful to identify broad-scale species distributions and ranges across an entire site.

Objective

Mammalian species and other medium and large fauna fill a wide range of ecological roles and are a central component to maintaining balance within an ecosystem (IUCN 2014). From seed dispersal to the regulation of invertebrate and smaller mammal populations, the presence and abundance of large mammals may act as indicators of general ecosystem health (Jones and Safi 2011). Documenting the presence and relative abundances of larger wildlife can be difficult due to their high mobility, acute senses, nocturnal behavior, or general aversion to human interaction; however, the use of motion activated cameras provides a non-invasive, cost-effective method to capture medium and large wildlife presence (Moruzzi et al. 2002).

Figure 1. Example of photographs confirming the presence of a raccoon and coyote.

The primary purpose of this sampling method is to visually confirm the presence of medium or large wildlife species residing within an area (Figure 1). While the goal of deploying motion activated cameras is typically aimed at gathering data on medium to large sized mammals, it is not uncommon to capture data on various wildlife species, e.g., birds or reptiles. In many cases it may be possible to document habitat-specific use relationships (e.g., feeding, Figure 2). Behavior and interaction as well as estimated relative abundances can be assessed if distinguishing marks can be utilized to identify recaptured individuals. Additionally, this method can be used to assess movement of different species within or between specific geographical locations. To address vandalism issues, these methods include deterrent measures for high volume human presence areas, but additional efforts may be necessary.

Figure 2. Photograph of a great blue heron feeding.

Equipment

Equipment and supplies needed for this survey include:

1. Motion activated camera(s) (Figure 3)
2. 16 GB (or larger) SD card for each camera
3. Batteries
4. Digital camera
5. Human deterrents and camera housing (as needed, Figure 4). As an alternative, surrounding vegetation may also be used to camouflage the cameras.
    a. Keys and locks
    b. Two 2 x 4 in stakes
    c. Screws & power drill
    d. Rubber mallet
    e. Chains
    f. Cinder Blocks
6. Maps and/or GPS (recommended)
7. Datasheets (recommended; Appendix 8.1B)
8. Plug-in remote control (depending on model)
9. Bait (optional)
10. Informational signage (optional – to avoid tampering in areas with high human use traffic, it may be necessary to state "For scientific survey purposes – Please do not touch")

Figure 3. Motion activated wildlife camera secured to cinder blocks and a 2 x 4" stake.

Figure 4. Supplies used to reduce the potential for camera theft or vandalism.

Field Preparation

Survey implementation methodologies will vary between targeted surveys and general presence/absence studies. Prior to deploying motion camera traps, it is essential to evaluate the purpose of your survey, study site, and monitoring goals to inform optimum camera deployment location and configuration. The methods outlined in this SOP should be used primarily for general surveys but may be modified for species-specific assessments. For targeted surveys, background research should be conducted on habitat preference, movement patterns, and eating habits. Additionally, numerous studies have been conducted utilizing and evaluating various camera array configurations which should also be referenced prior to deploying wildlife cameras (Kucera and Barrett 1993, Moruzi et al. 2002, Sarmento et al. 2009, Ikeda et al. 2012).

For previously deployed cameras, if needed, ensure either a map or GPS point showing the camera's exact location is prepared. For highest quality results, the user's manual for each motion activated camera model should be read to become familiarized with its specifications and capabilities.

Equipment described above should be collected prior to the field shift. Batteries for all electronic devices should be checked and replaced as needed.

Field Methods

Specific field methods for camera options and placement including sensor sensitivity, multiple photos, location, heights, angles, and multiple camera array configurations will affect the quality and type of data obtained. Methods listed below describe general survey protocols which attempt to maximize the probability of capturing the broadest quantity of species and individuals. Targeted species-specific surveys may have different placement criteria and methodologies.

Specific survey implementation steps:

1. Identify optimal camera trap placement locations by locating the confluence of several game trails. Optimum picture quality range may vary depending on specific camera model, but a 1 – 5 meter distance placement from the camera to the trail will produce quality results for most models. Placement distance and height may vary for species specific surveys, QA/QC test photos should be taken at each station to ensure proper placement properties (see Step 7).
2. Depending on the level of deterrence needed to mitigate tampering, cameras may be attached securely using chain or steel cables to cinder blocks and a 2 x 4" stake hammered into the ground. Cameras with appropriate housings may also be securely mounted to trees or fence posts. Figure 5 illustrates the steps required to attach camera models to a cinder block.

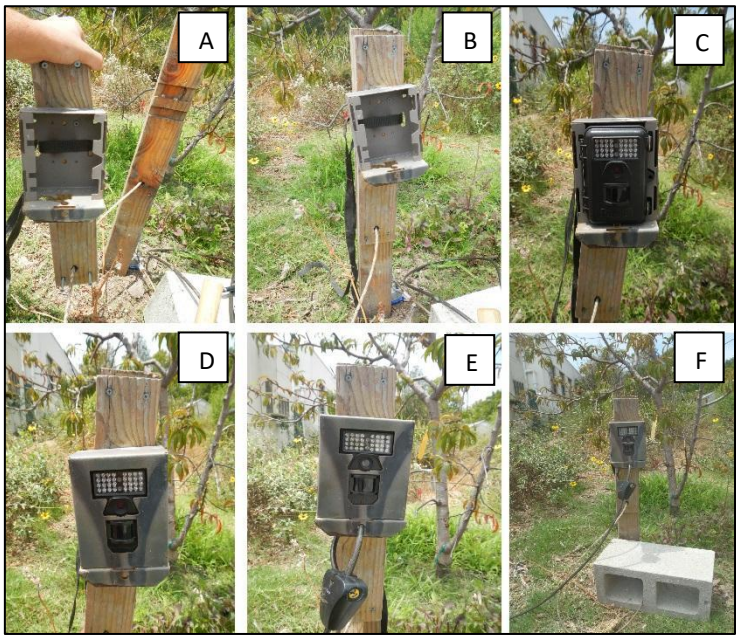

Figure 5. Steps (A-F) to create a full (deterrent) camera housing setup.

a. Two pieces of 2 x 4" wooden stake (one end hammered into the ground, a tapered edge should be cut for ease) attached via a locking cable strung through holes drilled in-line on each stake. The locking cable should be long enough to be strung through at least one cinder block. The outer camera housing should be secured to the non-grounded stake via a strap.
b. Secure both stakes together using screws. The strap holding the camera housing should be pinched between both stakes.
c. Set the camera settings and place camera into the attached housing case.
d. Cover the camera with the front of the housing case (also see Figure 3).
e. Secure both housing cases using a sliding cable bike lock.
f. Completed camera trap deterrent housing setup.

3. To maximize the probability of capturing various-sized species, place the camera at a height of 25 – 45 cm above ground and angle it slightly towards the ground. This technique will ensure the presence of both larger animals (e.g., coyotes and large birds) and smaller rodent sized mammals (e.g., squirrels and rats) are captured. Heights and angle of view may be adjusted for species-specific surveys. To ensure the successful placement, location, angle, and height, it may be necessary to conduct a pilot survey for several days.
4. Consider the vegetation when placing the cameras. If permitted, remove any vegetation (such as nearby grasses) which may wave in front of the camera and activate the motion sensor inadvertently. Note: motion sensor for some models may activate up to 45 feet away.
5. Place empty SD card in the camera unit. Place new batteries or ensure batteries have sufficient power to operate the camera trap for the duration of the deployment period (typically one week to ensure SD memory does not reach capacity, but larger SD cards and stronger batteries may extend the time if frequency of access is an issue). Note: A pilot survey will determine the frequency of capture rate of each camera and will allow for adjustments as needed.
6. Program camera settings to the highest resolution and to capture three-burst photos every time the camera is triggered (Figure 6). The three-photo burst setting will provide additional information required to identify species, individual, activity, and direction of travel which may not be possible with a single photograph.
7. Test photos should be captured for quality assurance purposes. Set the camera to capture images and trigger the camera yourself by walking in front of the motion detection range. Turn the camera off and transfer the SD card to a digital camera. View the images to ensure proper camera placement and settings.
8. As the final step, set the camera to begin taking pictures and close up and lock the housing.

Figure 6. Three shot burst photo sequence. Note: The first photograph would not provide enough information to confirm the coyote is feeding on the bait.

Laboratory Methods

Not applicable.

Data Entry and QAQC Procedures

Photos should be downloaded from the SD card immediately upon returning to the office and should be properly labelled with site location, date, and status of baiting (e.g., BW4_09.15.13_UNBAITED.jpeg). The level of detail extracted from each photo to be entered into a spreadsheet will be project

dependent. Extracted detail may range from a simple confirmation of species presence by area to the identification of individuals, inference of activities, and/or direction of travel. Electronic copies of all data should be housed on an in-house dedicated server and backed up to a cloud-based or off-site server nightly. Hard copies should be saved for five years. Electronic copies should be saved indefinitely.

Quality Assurance and Quality Control (QAQC) procedures should be conducted on all data. QAQC procedures should be conducted by the QA Officer and include a thorough review of all entries and confirmation that all data sheets, Chain-of-Custody forms, and field notes are filed appropriately with electronic back-up copies available. QAQC should verify that entered data match the hard copies of the field data sheets. Any discrepancies should be corrected, and the initial data entry technician notified.

Data Analyses

After data have been entered, corrections made, and QAQC procedures completed, data can be used in multiple analyses. Depending on project scope and purpose, possible analyses using camera trap data may include the confirmation of species presence by area or location (Table 1 and Figure 7), pie charts and associated Chi-squared tables displaying the movement patterns by direction of travel for each species (Figure 8 and Table 2), and/or histograms displaying the relative frequency of species sightings during specific time ranges.

Table 1. List of species recorded by each camera trap. Note: Asterisk (*) denotes non-native species.

		Area A					Area B				
Common Name	**Scientific Name**	**A-Middle**	**A-2**	**A-3**	**A-West**	**A-East**	**B-Dune**	**B-Hole**	**B-Channel**	**B-FBW**	**B-Riparian**
California ground squirrel	*Spermophilus beecheyi*						X	X		X	
Cottontail	*Sylvilagus audubonnii*		X	X	X	X	X	X	X	X	X
Coyote	*Canis latrans*		X	X	X		X		X		
Raccoon	*Procyon lotor*						X	X		X	
Rat *	*Rattus* sp.										
Striped skunk	*Mephitis mephitis*						X				
Virginia opossum *	*Didelphis virginiana*						X	X		X	X
Domestic cat *	*Felis cattus*						X	X		X	X
Domestic dog *	*Canis familiaris*		X			X		X		X	
Human	*Homo sapien*		X	X		X	X	X		X	

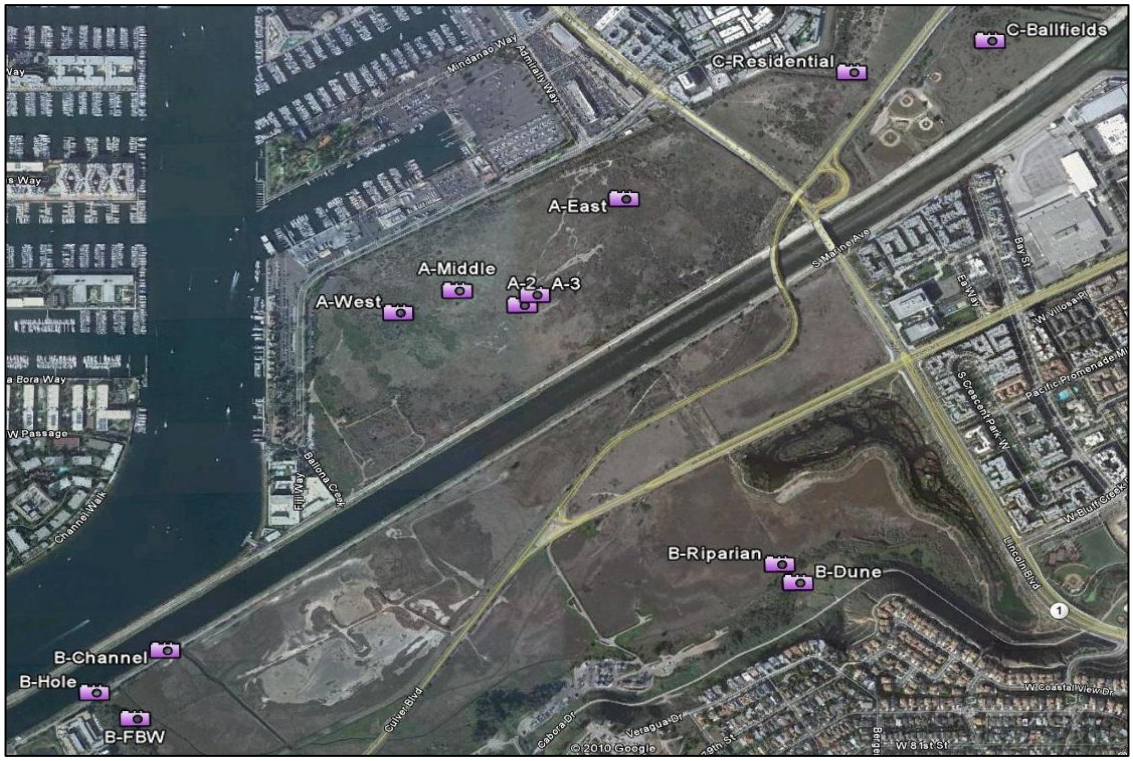

Figure 7. Map showing the location of camera traps.

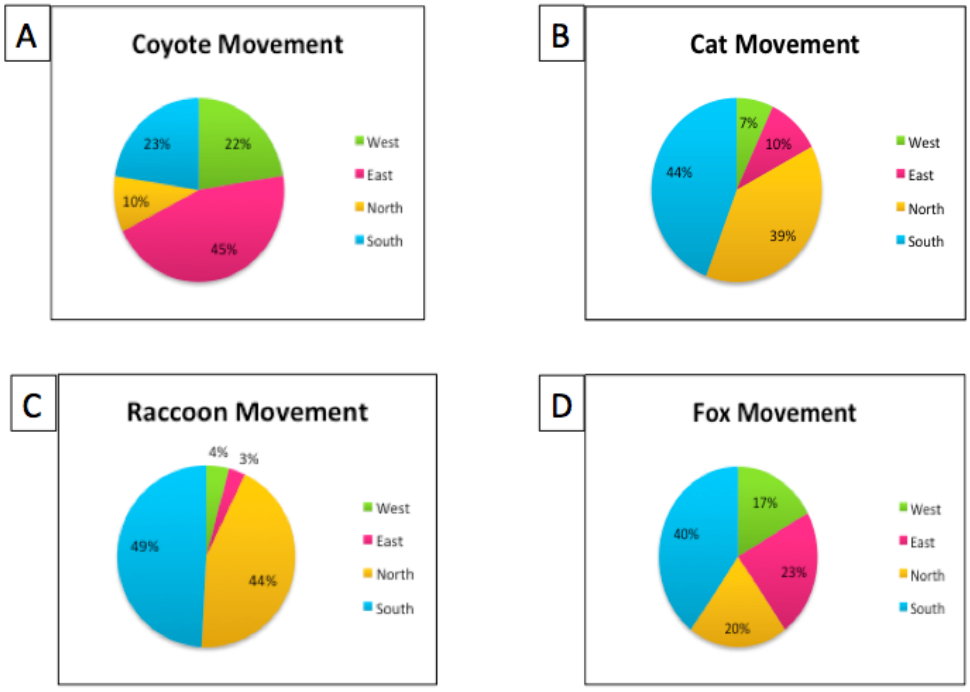

Figure 8. Pie charts displaying movement pattern by direction of travel for recorded coyotes (A), cats (B), raccoons (C), and foxes (D) (McCammon 2014).

Table 2. Chi-squared analysis of animal movement pattern by direction of travel (McCammon 2014).

	Animal				
Direction	**Coyote**	**Fox**	**Cat**	**Raccoon**	**Skunk**
West	16	32	42	7	4
East	32	43	61	5	2
North	7	38	231	73	3
South	16	75	264	82	8
p-value	< 0.001	< 0.001	< 0.001	< 0.001	0.1806

Health and Safety Precautions

In areas suspected of containing larger predatory wildlife, extreme caution should be exercised when carrying bait for camera traps. Be familiar with animals that may potentially be present within the study area and the proper responses if confronted with one.

References and Applicable Literature

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Contact Information

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APPENDIX 8.1A

	Evaluation Metric	Wildlife Camera	Notes
	Correlation to L2 CRAM	Not Applicable	Functions loosely tied to Attribute 4 and the patch type metric
Personnel Requirements	Specialty Equipment or Clothing Required	Many Specialty Items	Motion-activated camera, GPS, housing, supplies, tools
	Ease of Transport (amount or weight of supplies)	Many or Heavy Items / Difficult	Site-dependent; open spaces may require cinder blocks, 2 x 4"
	Ease of Implementation	Moderate	Depending on field location and hiking time (site-dependent)
	Expertise / Skill Level	Some Technical Knowledge	Knowledge of camera operating instructions is required
	Number of Personnel	2+	---
	Training Requirements	None	Knowledge of camera set-up
	Seasonality of Survey Time	Year round	---
	Suggested Frequency	Annual	Or periodically to capture seasonal differences; goal-dependent
Survey / Data Quality	Type of Output	Non-numerical	---
	Active or Passive Monitoring Style	Passive / Active	May require the manipulation of vegetation to provide clear field of vision; otherwise, passive
	Specialty Computer Software Required	No	More advanced image analyses may require specialty software
	Availability of Online / External Resources	Yes	Minimal suggested use documents exist for survey purposes; however, ample instructional manuals are available for camera use
Potential Limitations	Wetland Type Applicability	All	---
	Images or Multi-Media Required	Images Required	Video is also possible
	Degree of Impact / Disturbance	Low disturbance	Moderate disturbance may be necessary at some sample locations
	Vegetation Height Limitation	No Limitations	Camera trap methods may however be limited within areas with of high vegetation density
	Appropriate for Tidal / Wet Habitats	Yes	---
	Tide Height	Low Tide Only	Most camera models are not water resistant and are not applicable in fully tidal habitats; however, they may be placed to photographically capture those habitat types
	Regional or Broad Implementation *	Frequently Used	---
	Potential for Hazards / Risk	Moderate risk	Caution must be exercised while carrying or placing bait
	Restrictions	Special Status Species	---

** based on monitoring literature review*

Appendix 8.1B

Motion Wildlife Camera Surveys	
Survey Area / Habitat (e.g., "A / seasonal wetland"):	
Staff:	Comments:
Weather:	Entered (name): QAQC (name):
Station ID:	
GPS Coords:	Location Description:
Date Deployed:	Time Deployed:
Date Pulled:	Time Pulled:
Baited: Yes | No	Photo Settings:
Housing Included: Yes | No	Timing:
Notes (incl. deterrents implemented):	
Station ID:	
GPS Coords:	Location Description:
Date Deployed:	Time Deployed:
Date Pulled:	Time Pulled:
Baited: Yes | No	Photo Settings:
Housing Included: Yes | No	Timing:
Notes (incl. deterrents implemented):	
Station ID:	
GPS Coords:	Location Description:
Date Deployed:	Time Deployed:
Date Pulled:	Time Pulled:
Baited: Yes | No	Photo Settings:
Housing Included: Yes | No	Timing:
Notes (incl. deterrents implemented):	
Station ID:	
GPS Coords:	Location Description:
Date Deployed:	Time Deployed:
Date Pulled:	Time Pulled:
Baited: Yes | No	Photo Settings:
Housing Included: Yes | No	Timing:
Notes (incl. deterrents implemented):	
Station ID:	
GPS Coords:	Location Description:
Date Deployed:	Time Deployed:
Date Pulled:	Time Pulled:
Baited: Yes | No	Photo Settings:
Housing Included: Yes | No	Timing:
Notes (incl. deterrents implemented):	