Bog Turtle Bucket Camera Trapping Fabrication, Field, and Processing Protocol

by the Amphibian and Reptile Conservancy in Cooperation with
the Virginia Department of Wildlife Resources

This bucket camera trap system was developed as a passive method to evaluate bog turtle presence and abundance. This technique excludes drift fences primarily for logistical reasons, but also to limit wetland disturbance. Drift fences or other techniques may increase detection, but based upon many surveys utilizing this method, it is sufficient to detect turtles at low density sites. Unlike traditional survey methods (e.g. probing and live trapping), bucket camera traps are less labor intensive and can be effectively implemented anytime during the active season May 1st to September 1st.

Fabrication Supply List (per trap)*

5 or 7 gallon bucket	Bushnell Trophy E3 Trail Camera (Non-Cellular)	GardePro T5CF Camera (Non-Cellular)
- 2x #8-32 x 1" stainless steel machine screws w/ nuts **not needed for 7 gallon	- 8 AA lithium batteries	- 8 AA lithium batteries
- 1x ¼"-20 x ⅜" stainless steel eye bolt w/ washer & nut	- 2x 16-32 GB SD cards	- 2x 16-32 GB SD cards
- 3x 12" zip ties	- gorilla tape	- 1x 4 ½" L x ¾" W x 1 ¼" H stainless steel slotted L-bracket
- 2x 2" x 2" x 4' galvanized steel electric fence post	- 1x +3.0 reading glass lens	- 1x ¼"-20 x ⅜" stainless steel hex head machine screw w/ washer
- oscillating power-tool w/ sand paper attachment	- gorilla glue or mounting putty	- 2x ¼"-20 x ½" stainless steel hex head machine screws
- drill & bits	- 1x ¼" - 20 x ½" stainless steel machine screw w/ washer & nut	- 2x ¼" x 20 stainless steel flange nuts
- large tarp		
- sharpie		
- PPE: work gloves, face mask, & safety glasses		

*After field testing many variations of bucket sizes and trail camera models, the setups with the best quality pictures are 1) 5-gallon bucket with GardePro T5CF trail camera or 2) 7-gallon bucket with Bushnell Trophy E3 trail camera with a modified lens attachment. Other trail camera models and attachment styles may also work, however they have not been field tested.

Fabrication Protocol:

1) Put on all necessary PPE (i.e. work gloves, face mask, safety glasses). Cutting and drilling the buckets will result in a significant amount of microplastic debris, therefore do not do this outdoors. Laying a tarp down inside will aid in clean up.
2) Cut ~5" H x 8" W openings at the lip of the bucket centered around the handles with an oscillating multi-tool.

3) Sand the cut areas to remove sharp edges with an attachment on the oscillating tool or with loose sandpaper.
4) Drill one hole on each side of the remaining protruding rim using a 3/8" bit, across from each other and approximately centered on the remaining reinforced lip. Do not drill all the way through the inside wall. These will be anchoring points for zip ties to secure the bucket to the stakes in the field.
5) Label each bucket with a unique ID on the top, along with permit and contact info inside.
6) Drill one hole on top of the bucket using a 3/16" bit on the same side as the remaining lip, ~ 1" from the edge. Screw in an eye bolt here. This will be used to anchor the bucket to the rebar to prevent it from tipping over.

Step 4:   Step 6:

7) For the 5-gallon buckets (bypass this step if using 7-gallon buckets): Drill 2 holes opposite each other using a 3/16" bit 5" from bottom of bucket and install #8-32 x 1" screw and nut. These screws allow the buckets to stack on top of each other during transport and prevents the lens on the cameras from being damaged.

8) Camera Installation
   a) Bushnell Trophy E3:
       i)   Cover the camera flash with gorilla tape. Be careful not to obscure the camera lens or motion sensors.
       ii)   Gently pry the lenses out of the reader's glasses and clean if needed. Use either mounting putty or gorilla glue to attach the lens over the camera. Attaching the lens allows animals in close proximity to be in focus.
       iii)   Load camera with 8 AA lithium batteries and a blank SD card with the following settings: motion detection, 3MP, 2x photo per capture, 4s photo interval, and a day only cycle. Note: after changing any setting, "OK" has to be pressed or the setting will not change. Turn off the cameras until they are ready to be deployed.
       iv)   Drill one hole directly in the center of the bucket top with a 3/16" bit. Insert one ¼"-20 x ⅜" stainless steel machine screw with a washer and nut. This will fit the socket on the back of the camera where it will screw into the bucket.
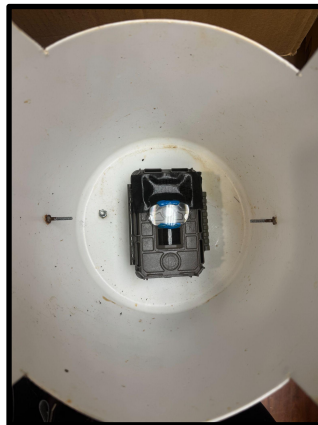
b) GardePro T5CF:
   i)   Drill 2 holes in the center of the bucket top with a 3/16 "bit, corresponding to the end lengths of the L-bracket.
   ii)   Attach the L-bracket to the inside of the bucket with 2 ¼"-20 x ½" stainless steel hex screws and flange nuts.
   iii) Load camera with 8 AA lithium batteries and a blank SD card with the following settings: motion detection, 8MP, 5s delay, 2x photo per capture, set to record from sunrise to sunset. Turn off the cameras until they are ready to be deployed.
   iv)   Position the camera on the L-bracket so that the L lines up with the socket on the base of the camera, and attach it with a ¼"-20 x ⅜" stainless steel hex screw.

Field Supplies

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● 5 gallon bucket(s) fitted with trail cameras	● sharpie
● 2x metal stakes per bucket	● GPS and/or phone
● flagging	● mallet
● ziptie(s)	● extra supplies: batteries, super glue, SD cards, etc.
● steel wire & wire cutters for sites with cattle	

Wetland Installation Guide:

1) Prior to setting traps, walk around and scope out the entirety of the wetland to determine the best areas for trap placement. Approximately 8-10 traps per acre of habitat is sufficient. To maximize probability of detection, traps should be placed in "core" bog turtle habitat, i.e. shallowly inundated, mucky soils, rivulets, between tussocks, and open canopy areas. Extreme care must be taken if setting and taking down traps during bog turtle breeding season as to not trample nests or place traps over potential nesting tussocks.
2) When an appropriate location is selected, **turn the trail camera ON**, check that it has an SD card, batteries are full, and ensure the settings are correct.
3) Press the two metal stakes into the ground ~12" apart. A mallet may be required if the ground is too hard.
4) Attach the bucket to the stakes via the holes drilled into the bucket lips with zip ties, and secure with a zip tie attached to the eye bolt on the top of the bucket.
   a) For sites with cattle, it may be necessary to further secure the buckets from tipping over by wrapping metal wire around the stakes.
5) Clear out any tall vegetation under the bucket that may trigger the camera.
6) Tie a piece of neon flagging to one of the stakes with the trap # (sequential) and bucket ID (unique label) (i.e. 1-60, 2-34, 3-22 and so on). This will help with locating the buckets in tall vegetation. Note: this step should be bypassed if the buckets and/or flagging are visible from the road to prevent bringing any unwanted attention to the site. Also, if there are cattle present they sometimes like to eat the flagging.
7) Take a GPS coordinate for the bucket location using an app like Avenza or ARC GIS Field Maps, or a handheld GPS unit.
8) Leave traps set for approximately 21 days, which should be sufficient to detect turtles at low-density sites.
9) When removing traps, first turn off the camera, then remove and label the SD cards.
10) Properly disinfect buckets and stakes before deploying at another site.

| ● 2x external hard drives	● SD card reader
● small labeling stickers	● SD card organizer

Photo Processing Protocol:

1) On one external hard drive, create a folder labeled with the Site Name.
2) Create subfolders within the Site folder with the SD card labels (i.e. 1-60, 2-34, 3-22…; 1= trap #, 60=bucket ID), and transfer all photos to the corresponding folder. This will be the backup hard drive with all of the "raw" photos.
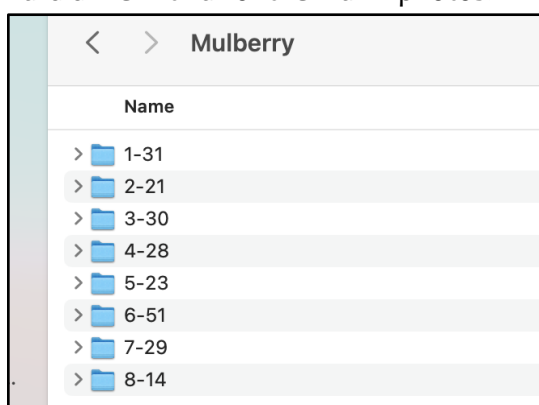
3) Copy all of the data uploaded in steps 1 & 2 onto another, separate hard drive. This will be the "working" drive where photos will be processed.
4) Within each SD card folder, create a "processed" folder. This is where any photos of bog turtles will go.
5) Bog turtle images will first be separated into "capture" events. A single capture event is measured when a bog turtle is captured on camera within a 10 minute interval. If the same turtle is "captured" again after 10 minutes, it is recorded as another capture event.
   - Exceptions: if multiple turtles are observed in the same photo, those are separate captures; turtle 1 goes out of frame and 1-9 minutes later a different turtle is captured on camera, that would be a separate capture event.
6) Create subfolders within the "processed" folder for each capture event, and transfer all pictures from that capture event (10 minute intervals).
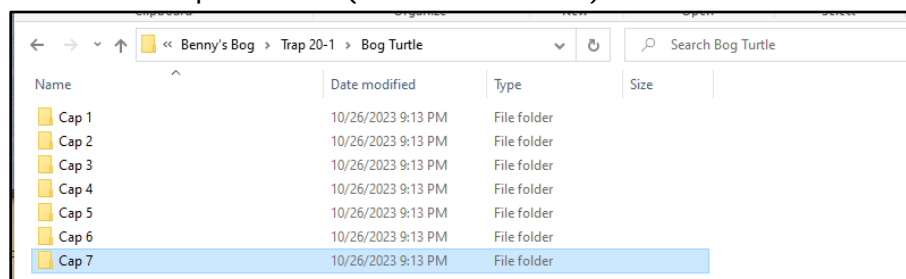
7) Create another subfolder within the "processed" folder labeled "other". This is where any other wildlife observations will be transferred to.
8) After the captures are identified and transferred into the folders, turtles will be placed into discrete or unknown individuals.
    - Discrete = Turtles that are able to be identified to individuals via notches, neck marking, or shell patterns. They will be labeled as X1, X2, X3, and so on.
    - Unknown = Turtles that are not able to be identified to individuals (i.e. partial photos, blurry photos, other factors that make them indistinguishable). They will be labeled as U1, U2, U3, and so on.
    - Tip: On particularly abundant populations (10+) create a portfolio of each individual using the single best image to compare to.
9) Relabel the "capture" folders to correspond to the turtle ID (X's or U's).