

# EASTERN BOX TURTLE POPULATION MONITORING PROTOCOL

NORTHEAST EASTERN BOX TURTLE WORKING GROUP

Supported by the Northeast Regional Conservation Needs (RCN) Program

[www.northeastturtles.org](http://www.northeastturtles.org)

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This Eastern Box Turtle (*Terrapene carolina carolina*) population monitoring protocol is designed to allow implementation by experienced researchers and citizen scientists. There are two approaches: 1) visual encounter surveys and 2) dog-assisted surveys. This standardized population monitoring protocol is meant to be flexible, to allow use in a variety of habitat types throughout the northeastern United States and elsewhere throughout the species range.

## **Goal:**

Provide a flexible and efficient framework for detecting and monitoring Eastern Box Turtle populations that will facilitate the assessment of distributional trends, patterns of occupancy and abundance, long-term population trends, and effects of habitat management throughout the northeastern United States.

## **Objectives:**

1. Assess Eastern Box Turtle occupancy and relative abundance throughout the northeastern United States.
2. Provide a framework for tracking trends in occupancy over time.

3. Quantify population densities for a subset of populations across the Northeast.
4. Provide a framework for tracking trends in population density over time.
5. Assist in the evaluation of the effects of habitat management actions on Eastern Box Turtle populations.
6. Provide a monitoring framework that is amenable to citizen science efforts.

To accomplish these objectives, we recommend that researchers select a study site, choose one of three sampling options outlined below, and conduct either rapid assessment or demographic surveys at the site, described below. Rapid assessment surveys are designed to evaluate occupancy and relative abundance at the broad scale and will be used to track those parameters at the regional level over time using n-mixture models (Royle 2004). Rapid assessments require 3 sampling days/site. Demographic assessments will utilize mark-recapture techniques to fit log-linear, spatially explicit capture-recapture (Efford and Fewster 2013), or open population models (e.g., Pledger et al. 2003) to estimate population size at specific sites and require at least 7 visits to a site.

## GUIDELINES

### Site Selection

Identify a site to survey: a “site” may be any area known or likely to be occupied by Eastern Box Turtles. For sites where occupancy is unknown, performing a reconnaissance site visit is advisable.

#### Option 1: Feature survey

Within a selected site, delineate a polygon encompassing a **feature** that will be surveyed (Figure 1). Multiple features may be designated at a single large site. A “feature” is defined as any component/aspect of the landscape consisting of suitable or potentially suitable Eastern Box Turtle habitat. For example, a feature may be a field-forest ecotone, section of a power line corridor, old gravel pit, patch of forest, or any area known, or suspected to be, suitable Eastern Box Turtle habitat. The Northeast Eastern Box Turtle Working Group recommends that surveyors target **early-successional habitat adjacent to forest**, but surveyors should also consider areas frequently used by Eastern Box Turtles during the spring months in your region (forested habitats may work well, too). Delineated feature polygons should be 1–4 ha in size. Willey (2010) estimated the probability of detection to be about 0.33 during the active season for radio-tagged box turtles that were 5m from a surveyor, so we chose a plot size of 4 ha for a high likelihood of detecting at least 1 turtle at an occupied site while minimizing survey area (and therefore effort) at each plot.

#### Option 2: Feature-based circular plot survey

Follow Option 1 directions for delineating a feature. Within your delineated feature, either (A) randomly select 4 points OR (B) select 4 non-random points centered within suitable habitat (Figure 2 and 3). Each point will serve as the center of a 28-m radius sampling plot,

corresponding to approximately ¼ ha. Sampling plots should not overlap and should be completed contained within the feature.

### Option 3: Random plot survey

For each site, delineate a polygon encompassing all potential Box Turtle habitat area(s). Generate random points throughout the site polygon at a density of 1 point per 5 hectares. These will be the center of your sampling plot. At each random point a ¼ ha circular plot, 28m in radius from the point center, will be surveyed for 15 minutes.

## **Visual Encounter Surveys**

### ***Rapid Assessment:***

#### Conditions for Surveys

- *Sampling period:* May– June. Optimal survey dates may vary by geographic location.
- *Time of day:* 7:00 AM and 3:00 PM
- *Weather conditions:* Surveys can take place under most weather conditions, but avoid extended (>3 days) cold (< 60 degrees) and hot (> 85 degrees) periods.

#### Option 1: Feature Survey

- *Sampling area:* The entire feature should be surveyed as evenly and thoroughly as possible. Surveyors may find it useful to upload feature boundary points into a GPS unit or use Google Earth on their cell phone to help guide them during the survey.
- *Survey effort:* During each survey, surveyors should spend 0.75 person hours per hectare searching for turtles (see Table 1). This excludes time spent processing turtles.
- *Number of surveys:* Each feature should be surveyed 3 times within a single season and least 48 hours should separate any two sampling events at a given feature.
- *Data:* Survey start time, end time, weather conditions, turtles observed, and habitat features will be noted. Survey field forms will be provided.

#### Options 2: Circular Plot Surveys (feature based or random)

- *Sampling area:* Sampling plots should be searched as evenly and thoroughly as possible.
- *Survey effort:* For both feature-based and random circular plot surveys (Options 2 and 3 under site selection), each ¼ ha sampling plot should be searched for a total of 0.25 person hrs (total of 1 hour of active search time over 1 ha of a selected feature during each visit). This excludes time spent processing turtles. All sampling plots within the

same feature should be surveyed during the same day and at least 48 hours should separate any two sampling events at a given feature.

- *Number of surveys:* Each set of plots should be surveyed 3 times within a single season.
- *Data:* The start time, end time, weather conditions, and habitat features will be noted. Survey field forms will be provided.

### ***Demographic Assessment:***

For demographic assessments, features will be delineated as described above, and the Rapid Assessment methodology will be followed. Four additional surveys will also be required for a total of 7 survey days at demographic sites.

### **Dog-Assisted Surveys**

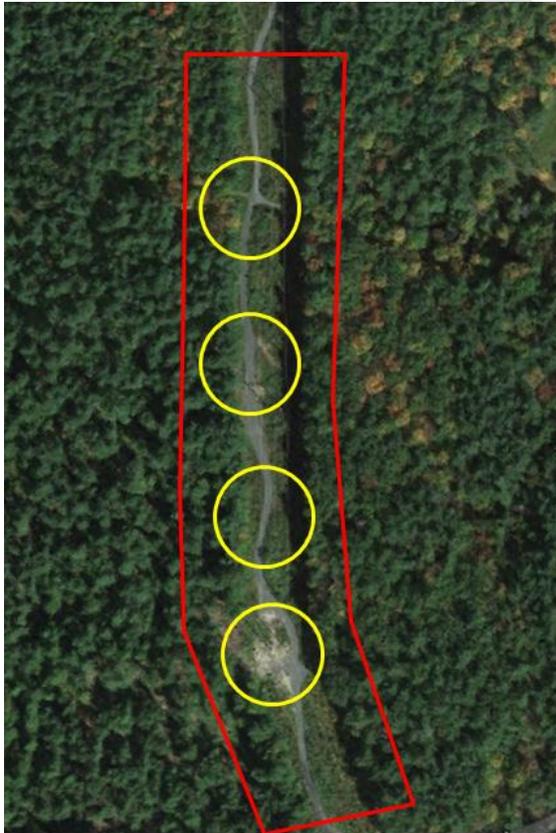
- Dog-assisted surveys should be evaluated as an additional optional survey method for population assessments. The protocol would follow the same survey conditions and sampling methods as the visual encounter surveys. However, an evaluation of the effects of weather conditions on detection is needed. We recommend a comparison study between the visual encounter surveys and dog-assisted surveys. This would be done by alternating human versus dog-assisted survey at each site. Surveyors should note the weather conditions for the week prior to the surveys, as well as during the survey, to determine if detection varies under different weather conditions for dog-assisted surveys. In particular, rain events and humidity should be tracked. Survey field forms will be provided.



Figure 1. Example feature delineation within a site.



Figures 2. Example feature delineation (red) with  $\frac{1}{4}$  ha plots (yellow). Yellow circles are 28m (~92 ft) radius.



Figures 3. Example feature delineation (red) with  $\frac{1}{4}$  ha plots (yellow). Yellow circles are 28m (~92 ft) radius.

Table 1. Survey time chart to calculate the number of minutes needed to reach a 0.75 person hours/ha of effort given the number of surveyors and area to be surveyed.

Size of Site (ha)	Number of Surveyors				
	1	2	3	4	5
1	45	23	15	11*	9*
1.25	56	29	19	14*	11*
1.5	68	35	23	17	14*
1.75	79	40	26	19	16
2	90	46	30	22	18
2.25	101	52	34	25	20
2.5	113	58	38	28	23
2.75	124	63	41	30	25
3	135	69	45	33	27
3.25	146	75	49	36	29
3.5	158	81	53	39	32
3.75	169	86	56	41	34
4	180	92	60	44	36

\*Surveys should not be less than 15 min in length.

### Literature Cited

- Efford M.G. and R.M. Fewster. 2013. Estimating population size by spatially explicit capture-recapture. *Oikos* 122(6):918-928.
- Pledger, S., K.H. Pollock and J.L. Norris. Open capture-recapture models with heterogeneity: I. Cormack-Jolly-Seber Model. *Biometrics* 59(4):786-794.
- Royle, J.A. 2004. *N*-mixture models for estimating population size from spatially replicated counts. *Biometrics* 60:108-115.
- Wiley L.L. 2010. Spatial ecology of eastern box turtles (*Terrapene c. carolina*) in central Massachusetts. Dissertation, University of Massachusetts, Amherst, USA.