

Monitoring Terrestrial Salamander Population Trends Using Coverboards (Protocol)

Coverboards are uniform pieces of wood arranged on the forest floor for salamanders to hide under (and be counted). Coverboard surveys are a common method for long-term population monitoring of terrestrial salamanders, and a popular alternative to conducting more intensive time- and area-constrained searches.

Pre-Monitoring Steps

Before any monitoring begins, a few preliminary steps are necessary:

Identify Target Species. {1} Learn how to identify the terrestrial salamanders located in your study region. The easiest way is to use a Reptile and Amphibian field guide, or by looking on the Internet for amphibian identification websites. {2} Generate a list of species that have been known to exist regularly and consistently under coverboards, based on the literature and personal experience. *Ambystoma* species and stream-side salamanders will occur periodically under terrestrial cover objects but only irregularly.

Scouting Sites. Potential monitoring sites should be scouted to determine if populations of any of the salamander species are present. Terrestrial salamanders in this region occur primarily in wooded areas. Scout for salamanders by turning over logs in spring or late fall (when they are most likely to be found). When scouting sites, keep track of the proportion of natural objects under which you found salamanders (this will be important for determining the number of coverboards to include in your study – see below).

Type of Coverboards. Generally, untreated wood is the preferred material for coverboards. Best is green, fresh-cut lumber that has NOT been treated with any chemicals to prevent rot, termites etc. Any chemicals in the wood can potentially leach into the soil and be absorbed by the salamanders.

Size of Coverboards. The preferred size is 12 x 12 inches or, four 6" x 6" pieces placed together work well, as do two 2" x 10" pieces. Very large boards should not be used as the soil will dry out underneath. Whichever size you choose, the boards should be consistent (uniform) throughout the plot, and the same dimensions must continue to be used from that point on, replacing the original boards that rot away.

Transect or Array? The coverboards are best placed in a line transect (row) to cover the greatest area, (which can be adjusted to fit topography). However, if site space is limited then an array (grid) will work equally well. Below is an example of each type of plot, where 'x' designates the location of a coverboard.

4 x 5 Array (Grid)

XXXXX
XXXXX
XXXXX
XXXXX

Line Transect

XXXXXXXXXXXXXXXXXXXXXXXXXXXX

Number of Coverboards: Use enough boards so that salamander counts average 10 or more per check (during the season of peak salamander abundance). A rough estimate of this number can be made by scouting a prospective area during peak season and counting the proportion of natural cover objects with salamanders under them. Double this proportion and use that number to estimate the number of coverboards to put in place. For example, if you found that 1 out of 10 natural cover objects had a salamander under it during your scouting runs, then you would want 50 coverboards in your array or transect. Another way to approach the problem is to put 100 boards out in a suspected low salamander density area, 50 boards at moderate densities, and 25 boards at high densities.

Modified by J.L. Purrenhage (2017), from R. Fernandes's 'Step-by-Step Procedure for Locating and Running a Coverboard Plot,' published in: The Clean Water Team Guidance Compendium for Watershed Monitoring and Assessment Patuxent Wildlife Research Center State Water Resources Control Board, Division of Water Quality (2002)

Installing a Coverboard. When installing a cover board, the leaf litter should be removed, the soil leveled, and the board placed so its entire surface is in contact with the earth. Boards that are not in contact with the earth are not attractive to salamanders.

Minimum Distance. The minimum distance between coverboards should be ~18 feet (~6 meters).

Numbering. Each location should be marked and numbered with a flag, label or similar object.

Monitoring Steps

When optimal environmental conditions allow, monitoring can begin.

Optimal Conditions for Finding Salamanders Under Coverboards. Recognize the optimal environmental salamander conditions in your area. The highest surface densities are usually found in early spring and late fall (until the first hard freeze), but may vary according to your region. Generally, high air moisture, calm wind conditions, high soil and litter moisture, and low (but above freezing) temperatures are the optimal conditions that prompt salamanders to move from their soil retreats to under coverboards. If those time periods are not known, then you can check your coverboards weekly or bi-weekly.

Equipment. Ziploc bags, water (mister), markers, datasheets, pen/pencil, ruler, field guide (*if necessary*).

Checking Coverboards. Lift each board, & capture any salamanders found underneath. Place salamanders in a moistened Ziploc bag or Tupperware container (not a lot of water, as they can drown), and mark the coverboard # (location) on the bag / tape on the container. No need to mark the bag/container if you process and release salamanders as you work through the transect/grid.

Capturing. It is sometimes easier to grab a handful of litter/dirt along with the salamander than to try and capture the salamander by its "waist." Do NOT grab the creature by the tail, as their tails can break off as a defense mechanism. If the tail does break, it can seriously lessen the salamander's chance for survival.

Identifying. Each salamander must be identified to species. Note that some species have color variations (*e.g.*, the red-backed salamander, *Plethodon cinereus*, has several color morphs, including a red-striped variation and a "leadback" variation—speckled black with no red stripe). Record color phase.

Measuring. Measure salamanders (in millimeters, mm) using a small ruler. Salamanders can be kept in the bags and *gently* straightened out to facilitate measuring. Measure snout-vent length (SVL) and tail length. Total length can be calculated later (snout-vent length + tail length = total length).

Recording Data. Record SVL (#1, *at right*) and tail length. The vent is located near the hind legs—on larger specimens it is easily noticeable, but on smaller specimens, close inspection may be necessary. SVL is more important than total length for age-class determination (adult v. subadult).

Data Sheet. Record all data on prepared data sheets. Promptly and carefully enter data into a database (*e.g.*, Excel). Always keep the original datasheets.

Releasing. After salamanders have been measured, return them to the coverboards where they were found. To prevent crushing the salamanders with the board, place each one beside its respective board and gently "persuade" it to go back underneath.

