
Amphibian Road Crossing



Volunteer Manual



March 2018



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Welcome!

Thank you for volunteering with North Branch Nature Center’s Amphibian Road Crossing (ARC) program! You are a fundamental part in fulfilling our mission of connecting people of all ages with the natural world. In accomplishing this mission, we must steward our natural resources for future generations. Your work will help ensure the protection of our incredible amphibian neighbors for many years to come.

In this manual you will find the information you need for a safe and meaningful experience with the ARC program. Whether you have participated in the past or this is your first time in the field, we hope that you will enjoy participating in the future. If you have further questions about ARC, or any other North Branch Nature Center (NBNC) program, be sure to contact us at the address below. Thank you again!

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Generous assistance with this program provided by Bonnyvale Environmental Education Center, Harris Center for Conservation Education, Vermont Agency of Transportation, Vermont Center for Ecostudies, and the Vermont Reptile & Amphibian Atlas. Cover photo: Spring Peeper © Larry Clarfeld



Blue-spotted Salamander © Sean Beckett

Amphibian Road Crossing Ecology

Why did the salamander cross the road? To get to the vernal pool! For thousands of years, amphibians have migrated from their upland wintering and denning habitats to lowland swamps, ponds, and vernal pools to breed every spring. After wintering deep underground, or in a frozen state of torpor, amphibians emerge on warm, wet nights in early spring to begin their march to breeding grounds.

In a race to breed, salamanders and frogs move en-masse as soon as conditions are right. On warm ($> 40^{\circ}\text{F}$), wet nights in March and April, thousands of amphibians journey across our forested landscapes up to $\frac{1}{4}$ mile to reach their breeding site.

Improved forestry practices and land use regulations have helped to maintain the large blocks of forest these species need to forage for prey and to overwinter. Wetland conservation and vernal pool mapping have helped protect their sensitive breeding areas. Unfortunately, the migratory paths in between these two habitat types have long been unprotected and understudied.

More frequently amphibians are encountering roads and traffic cutting through their ancient migration routes. While the death of a few individuals on a back road crossing may have little overall effect, crossings on busy roads with many deaths can lead to the loss of an entire population over time.

Recently, biologists, naturalists, and citizen scientists alike have begun working to study and protect amphibian road crossings. Volunteer crossing guards have helped save countless individual salamanders and frogs, as well as provided data to support changes to roads. In 2015, these data were used to secure grant funding to build two salamander crossing culverts under a busy road in Monkton. This project has saved the lives of thousands of amphibians, including some endangered species. State and local officials support these projects, but need detailed crossing information.



Wood Frogs © Tyler Pockette

Program History and Goals

Beginning in the early 1990's, environmentally conscious folks across the Northeast recognized the need to help amphibians in the annual migration. In our area, the Vermont Reptile & Amphibian Atlas, the Bonnyvale Environmental Education Center (Brattleboro), the Harris Center for Conservation Education (New Hampshire), and the Vermont Center for Ecostudies are leading the charge.

The amphibian conservation program at NBNC began in 2005, and has focused on building public engagement around amphibian conservation while rescuing amphibians at documented crossing sites in central Vermont. Over the years, NBNC has presented over 50 amphibian monitoring trainings across the state, teaching hundreds of Vermonters to find and protect amphibians in their local communities.

With ARC, we are expanding our tradition of community engagement while refining our protocols to enhance the scientific value of our monitoring process. The data submitted by ARC volunteers will be integrated into the work of our partners at the Vermont Reptile & Amphibian Atlas and the Vermont Agency of Transportation. Our findings will also be made available to city and town planners and conservation commissions to aid in transportation planning at the local level. As ARC grows, we are cultivating conversations with other amphibian conservation organizations to unify our methodologies and expand the regional relevance of local projects.

Going forward ARC has three primary goals:

- 1. To increase public engagement in amphibian conservation**
- 2. To decrease direct amphibian mortality at road crossing sites**
- 3. To inform transportation planning with robust data on movement and mortality at road crossings**



Survey Protocol

The ARC protocol is a transect survey where participants survey a distance of road that is a known or suspected amphibian road crossing site. Over 100 unique transects are being monitored throughout central Vermont, and more may be added as new crossing sites are found. An interactive map of the transect sites is available through the ARC section of the NBNC webpage. Transects are around half of a mile long, and will be selected for study based on the number and location of volunteers as well as site priority.

Please contact us to be paired with the survey transect that you will “adopt” for the season. We will make every effort to match you with sites that are nearest to your home and fit your interests as a volunteer. Volunteers are expected to **visit the site three times over the course of the migration season.**

Materials needed

- Road crossing sign
- Rain gear and boots
- Reflective clothes
- Bright flashlights
- Extra batteries
- Camera
- Mobile device for online data entry (optional)
- Spatula
- Clean bucket
- Waterproof data sheet and clipboard
- Crossing signs (with flashing lights)

Important Websites For Entering Your Data

ARC Online Data Entry Form

<http://bit.ly/2ow4126>

Central Vermont ARC Site Map

<https://bit.ly/2EpHkBP>

ARC Photo Upload Portal

<http://bit.ly/2GTCZJ3>

1. Before you go out

Before visiting your site for the first time, make sure to consult our online site map to identify your Site Code, verify **exactly where your transect begins and ends**, how to get there, and where to park.

Our Safety

Our transect surveys occur primarily on rainy nights on public roadways, so it is critical to use utmost caution to ensure safety for ourselves and for motorists. We recommend that there are at least two people in each search party. All participants (adults and children) must wear reflective clothing (i.e. safety vests) and carry a bright flashlight. When a car is approaching, step off the roadway, and use your flashlight to respectfully alert the motorist of your presence. While it may be tempting to “flag down” fast-moving motorists who may be unaware of imperiled amphibians, please do not put yourself or the driver at risk by doing so!

Upon arriving at your survey transect, always stop where your car is easily visible from behind and pull over to the side as much as possible. Place a sign along the road to alert motorists to your presence. We recommend a sign that indicates “Salamander X-ing” and “Caution: researchers on roadway.” Please contact NBNC if you would like a sign like this, or feel free to create your own.

Because of the inherent risks involved, all volunteers must sign our risk release waiver (included in this manual) to participate in ARC.

Amphibian Safety

Amphibians blend in easily with the gravel substrate of most roadways and are easy to accidentally step on or run over. For this reason, please avoid driving across the transect. Instead, park at the closest end of the transect and begin your survey from there. Drive slowly as you approach your transect (< 15 mph), as amphibians may be moving across the roadways outside the official transect area.

Please make sure your flashlight is bright and fully-charged, and carry a backup flashlight in case your primary light dims. Cell phone flashlights and standard headlamps are often not bright enough for prolonged surveys, and often fail to reveal cryptic species that blend into the color of the road gravel.

Before you leave home, make sure that your hands are washed and clean. Amphibians breathe through their skin. Lotions, perfumes and soaps leave a residue that is

harmful to the animals. Also make sure that any tools or buckets that will come in contact with the amphibians are also clean of any residue.

Holding these amphibians is one of the highlights of the project, but please avoid prolonged handling of any one animal. In addition to the stress this causes, any handling exposes the animal to any chemicals that are on your hands and increases the risk of its skin fatally drying out.

Survey Timing

Since movement nights are weather-dependent, it is up to the volunteers to anticipate potential “big nights” and plan to survey their site when the conditions are optimal. To assist volunteers in surveying on nights when amphibians are likely to move, NBNC will provide migration alerts based on temperature and weather forecasts.

Amphibians are likely to be migrating on the first rainy nights in spring when temperatures are above 40°F. There are often several nights in early spring when weather conditions are just right for movement. Early movements may occur as early as the beginning of March, and movements may continue through early May or later. Amphibian movement generally begins after dark, and continues through the night.

2. At the Site

Step 1. Fill out the first part of the data form. This is available either in hard copy (waterproof copies available at NBNC, or download at our website), or through our mobile-friendly online form. Below is more information to help you fill out the required fields correctly:

Site Code: This will generally be “ARC____.”.If you are unsure about your site code, please consult our ARC online map.

Lead Surveyor Name and Email: This should be the name of the person who was assigned the transect site.

Number in party: Please include adults and children together.

Survey Start Time and End Time: Please record this to the closest minute. Exact start and end times are very important, as this information allows us to accurately calculate amphibian abundance, mortality, and volunteer effort.

Road Conditions: Use your best judgement to indicate whether the road is wet or dry.

Rain: Use your best judgement to indicate the weather conditions at the time your survey begins.

Temperature: This is optional. Please only record temperature if you have a handheld thermometer or a reliable car thermometer. Since temperatures can vary widely based on microtopography, we ask that volunteers do not use mobile devices to record temperature. Weather apps provide only regional forecasts that may be quite different from actual site temperature.

Step 2. Begin your transect. Please **stick together** as a group. We standardize our calculations around party effort. It is therefore important that teammates don't get too far ahead or behind the rest of the group, as this creates situations where amphibians are detected and counted that may not have otherwise been found by a group walking side-by-side.

Walk slowly from one end of the transect to the other, canvassing the entire road surface with bright flashlights. When an amphibian is discovered in the roadway, pick it up carefully with a clean, bare hand and move it completely off the roadway in the direction that the animal was moving when you discovered it. Tally the individual on your datasheet in the appropriate "live" row, and continue the transect.

When you encounter a dead amphibian, remove it from the roadway with a spatula and tally it in your datasheet in the appropriate "dead" rows.

You are welcome to enjoy amphibians discovered in roadside ditches or nearby wetlands, but please **only record amphibians observed crossing the actual roadway**.

If you encounter a species you are unsure of, a rare species, or a species that is not readily field-identifiable, please take a photograph and submit it to us via our Dropbox file request folder. This link is available in the online data entry form, or you can contact us directly for the upload link. Please note in "additional sightings and information" a description of any rare or unknown species, and a note to alert us of your photo upload.

Be sure to look for amphibians in water-filled potholes and tire tracks in the roadway.

Step 3. When you reach the opposite end of the transect, please finish the remaining fields on the data entry form:

Passing Cars During Survey: Keep a count of the number of cars that pass through your transect while you are surveying. This information helps us understand traffic levels at each of our crossings during peak amphibian movement hours.

Amphibian Counts: These are counts of the live and dead amphibians of each species discovered in the roadway during your survey. Please do not record any animals found in the roadside puddles and ponds. If you encounter a Four-toed Salamander or Blue-spotted Salamander, please make additional notes describing the sighting and take a photo for upload via our Dropbox File Request portal.

Additional Sightings and Information: This space is for you to record anything else relating to your survey such as interesting behaviors, comments for researchers, etc.

If you are using our online data entry form in the field, please submit your entry before starting the next transect. If you are using a hard-copy datasheet, please switch to a clean sheet before beginning the next transect.

Step 4. Begin another survey. Each survey stint is a one-way inspection of the transect. Please **begin a new form for the return trip back to your car**. Since some time has elapsed since you arrived at your crossing site, a new survey allows us to account for changing weather, traffic conditions, temperature, amphibian behavior, etc. Follow the same protocols on the return survey.

Step 4. Once back at your vehicle, please ensure that all data sheets are fully completed, and submit all data via our online form, either in the field or as soon as you get home. All data must ultimately be submitted electronically via our (very easy to use) online data entry form. We will not accept hard copies of your data.

Make sure to check for amphibians hiding under your car before you leave.

Thank you!

This project is only possible thanks to our dedicated, passionate volunteers. Not only have you saved amphibians from car tires, you have contributed important data to help us understand amphibian movement across central Vermont roadways!

Tips for Amphibian Field Photography

- Photograph the amphibian as close as possible. Some cameras cannot focus on objects within 1-2 feet of the lens, but smartphones can generally focus within a few inches of the subject.
- Include a scale reference such as a small ruler or a quarter.
- Make sure the amphibian (not the substrate behind it) is in focus. On smartphones, tap the salamander on the screen to select it as your focal point.
- Dark creatures such as salamanders are better photographed against a dark background (backpack, rock, book cover, dark clothes). The dark background will help the camera better expose the image to reveal subtle details in the shadows and dark tones of the animal.
- The glare of on-camera flash will often cause the shiny skin of the salamanders to overexpose and wash out. Try illuminating the amphibian with your flashlight held at an oblique angle from the salamander. Take multiple images from different angles, and try holding the flashlight at different angles. Your goal is to minimize the amount of shadow cast on the amphibian while avoiding glare from your light.
- When you upload your image, if you have the ability, rename the filename to include your last name, the date the photo was taken, and your site code.

Species Profiles

The following are snapshots of the life histories and common field identification strategies for the species prioritized in the ARC program. Other species may be discovered at road crossing sites that are not listed here, such as Pickerel Frog, Leopard Frog, or Green Frog.

Spotted Salamander

Ambystoma maculatum



Photo © Tyler Pockette

Length: 4.5 - 8"

Identification: Large and unmistakable with prominent yellow spots on a gray-black body.

Status: Common (S5)

A common character at road crossing sites on rainy nights, the Spotted Salamander lives its entire life within half a mile of a vernal pool (often less than a few hundred yards from one). It is rarely seen outside of migration and breeding events, as it lives primarily underground in rodent tunnels or in the crevices of downed, rotting logs. Spotted Salamanders emerge from their underground quarters at night to feed on a wide range of invertebrates like crickets, worms, spiders, beetles, etc.

Fun Fact: Male Spotted Salamanders gather in large groups in breeding pools, herding females towards spermatophores the males deposit on debris at the bottom of the pools.

Jefferson Salamander

Ambystoma jeffersonianum



Photo © Larry Clarfeld

Length: 5 - 7.5"

Identification: Large; brown, often with light blue flecking on sides.

Status: Species of Special Concern (S2)

Like the other “mole” salamanders, the elusive Jefferson Salamander spends most of its life underground, emerging to feed, migrate, and breed. Jefferson Salamanders are among the earliest to migrate in the spring, often traveling over patches of snow to reach partially-thawed breeding pools. The male Jefferson Salamander courts a female with a range of swimming displays, clasping, and chemical pheromones released and absorbed through its glandular skin. Receptive females will collect the male’s spermatophore from the bottom of the breeding pool.

Fun Fact: Larvae take 2-4 months to develop and leave the breeding pool, but take another 3 years to reach sexual maturity.

Blue-spotted Salamander

Ambystoma laterale

Photo © Larry Clarfeld



Length: 3 - 5.5"

Identification: Medium to large; brown to black with bright blue spots across body.

Status: Special Concern (S3)

The Blue-spotted Salamander is the smallest of Vermont’s mole salamanders, emerging from its fossorial (i.e. underground) habitat beneath logs and damp cover to feed and migrate to and from vernal breeding pools. Blue-spotted Salamanders are most commonly found in the Champlain Valley, and are residents of forested wetlands and floodplains. Adults feed nocturnally on earthworms, slugs and arthropods.

IMPORTANT NOTE TO VOLUNTEERS:

Blue-spotted and Jefferson Salamanders hybridize regularly, resulting in offspring that are intermediate in appearance. This makes identification of pure Blue-spotted Salamanders very difficult. More than 99% of all hybrids are female, thus the only definitive field ID of a Blue-spotted Salamander is of a male indicated by a swollen vent at base of tail. Please provide descriptions and photographs of all Blue-spotted Salamanders.

Four-toed Salamander

Hemidactylium scutatum



Photo © Tyler Pockette

Length: 2 - 3.5"

Identification: Small with 4 toes on all four feet (as opposed to 5 on hind feet of other salamanders). Rusty brown-black with patterned mottling. Bright white belly with black spots. Narrowing at the base of the tail.

Status: Species of Special Concern (S2)

Four-toed Salamanders feed nocturnally on small insects and arthropods and spend days hidden under rocks and logs on the forest floor. This species uses a variety of breeding habitats like vernal pools, ponds, and marshes. Four-toed Salamanders lay their eggs in a nest hidden at water's edge in wet sphagnum. The female defends this nest until the larvae hatch and fall into the water 5 weeks later. This species is almost never encountered outside the Champlain Valley and southeast Connecticut River Valley.

Fun Fact: The tail of Four-toed Salamanders will break off if attacked by a predator, leaving a wriggling distraction while the salamander escapes danger.

Eastern Newt

Notophthalmus viridescens



Photo © Larry Clarfeld

Length: 3 - 5"

Identification: Green-orange to orange with unmistakable black-outlined red spots on back and a yellow belly. Adults have a vertically-flattened tail.

Status: Common (S5)

Adult Eastern Newts are entirely aquatic, commonly found in ponds and lakes. Prior to their aquatic adulthood, Eastern Newts spend 4 - 8 years in the neon orange "Red Eft" phase, which is entirely terrestrial and highly mobile. Efts disperse widely from natal pools and are frequently found traveling over leaf litter on moist summer and fall days. Once sexually mature, the eft selects a pond (preferencing newly-formed features like beaver ponds) and lives the remainder of its life as an adult in that water body.

Fun Fact: The bright orange coloration of the Red Eft is considered a warning to predators of the toxic compounds in its skin. As a result, Red Efts have few predators.

Eastern Red-backed Salamander

Plethodon cinereus



Photo © Larry Clarfeld

Length: 2 - 4"

Identification: Small and slender, with grey-black flanks and rusty to red back. Underside is speckled black, gray, and white.

Status: Common (S5)

Eastern Red-backed Salamanders are commonly found at road crossings, but they are not traveling to breeding pools. Their presence at migration crossings is largely related to their sheer abundance in our landscape. Red-backed Salamanders are entirely terrestrial. They live under logs and leaf litter and lay egg clusters under damp cover. Unlike aquatic obligate salamanders, larvae develop entirely within the egg and emerge as tiny adults in early summer. Red-backed salamanders overwinter in deep leaf litter nearly a foot beneath the forest floor.

Fun Fact: The Eastern Red-backed Salamander is often considered to be the most abundant form of live biomass in the forest, with densities greater than one per square meter throughout much of its range.

Wood Frog

Lithobates sylvaticus



Photo © Larry Clarfeld

Length: 1.5 - 2.75"

Identification: Brown to beige. Easily recognized by dark mask running from its eye through its tympanum (eardrum), and a dorsolateral ridge running down either side of the back.

Status: Common (S5)

Wood Frogs are almost entirely terrestrial outside the breeding season when they migrate by the thousands to vernal pools. Their distinct "quacking" vocalizations fool many into thinking that a flock of mallards has landed in the forest. Male wood frogs clasp the female by the waist to fertilize the eggs as she lays them. This behavior is called "amplexus." A single female can lay well over a thousand eggs.

Fun Fact: Wood Frogs "winterize" in response to cold temperatures. The frog increases glucose concentrations in its cells a thousand-fold, thereby lowering the freezing point of its liquids well below normal. The frog then burrows into dry areas under leaf litter where it will not encounter any ice crystals.

Spring Peeper

Pseudacris crucifer



Photo © Larry Clarfeld

Length: .5 - 1.5"

Identification: Very small and brown-to-beige, with a distinctive "X" pattern across the back.

Status: Common (S5)

Spring Peepers are more readily discovered by sound than by sight. These diminutive frogs emit a remarkably loud, repeated "peep" with the help of an inflated throat pouch nearly the size of its entire body. When approached, Spring Peepers typically go quiet and blend easily within the surrounding sedges and leaf litter. These insectivores feed on nearly any small insect and arthropod discovered in the forest floor. Related to tree frogs, Spring Peepers spend most of their life in the upland forests amid leaf litter or on low vegetation.

Fun Fact: Water temperature plays a large part in determining the developmental schedule of the eggs. Hatching may take place between four days and four weeks from laying depending on the warmth of the breeding pool.

American Toad

Anaxyrus americanus



Photo © Larry Clarfeld

Length: 2 - 4.5"

Identification: Medium sized, brown to grey or olive. Distinctive "warty" skin.

Status: Common (S5)

One of the later spring breeders, the American Toad's distinctive, long trill is typically heard on warmer spring nights at breeding pools in May and June. The larvae are largely vegetarian, feeding on plant matter and algae at the surface of the pond. After about one month of development as tadpoles, the toadlets exit the pond for a terrestrial lifestyle where they feed on ants, moths, caterpillars, worms, and other invertebrates.

Fun Fact: The largest "warts" behind the toad's eyes are paratoid glands which produce toxins that deter most predators. Snakes are generally undeterred by these toxins.



Site Code	Number in Party
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Lead Surveyor Name	Lead Surveyor Email
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Survey Date (MM/DD/YY)	Survey Start Time (HH:MM)	Survey End Time (HH:MM)
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Road Conditions (Check One)	Rain (Check One)	Passing Cars During Survey (#)
<input type="checkbox"/> Wet	0 (no rain) <input type="checkbox"/>	Temperature (°F)
<input type="checkbox"/> Dry	1 (sprinkle) <input type="checkbox"/>	
	2 (rain) <input type="checkbox"/>	
	3 (heavy rain) <input type="checkbox"/>	
	4 (downpour) <input type="checkbox"/>	

Spotted Salamander	# Live	Eastern Red-backed Salamander	# Live
	# Dead		# Dead
Jefferson Salamander	# Live	Spring Peeper	# Live
	# Dead		# Dead
Jefferson/Blue-spotted Hybrid	# Live	Wood Frog	# Live
	# Dead		# Dead
Eastern Newt	# Live	American Toad	# Live
	# Dead		# Dead
Four-toed Salamander*	# Live	Blue-spotted Salamander*	# Live
	# Dead		# Dead
Species: Other Species 1	# Live	Species: Other Species 2	# Live
	#Dead		# Dead

*species require a written description or photograph to confirm identity. Upload photos to <http://bit.ly/2GTCZ13>

Additional Sightings and Information
Please use this space to describe any rare species or notable activity observed during your survey.

All data must be entered into our online form: <http://bit.ly/2ow4126>

Release of Liability and Assumption of Risk Amphibian Road Crossing Project

2018

This Release and Assumption of Risk is a condition of participation in the **North Branch Nature Amphibian Road Crossing Project**. *Unless otherwise noted, references to "NBNC" include the North Branch Nature Center, its employees, agents and trustees.*

NBNC is not responsible for any negligent or willful act, or failure to act, of any person or entity, or of any other third party not under NBNC's immediate and direct control. Without limitation, NBNC is not liable for any direct, indirect, consequential or incidental damage; injury, loss, or damage to person or property, illness, death, delay, inconvenience or irregularity of any kind in connection with the program that may be occasioned by or resulting from any act or omission, including, but not limited to, any willful or negligent act, failure to act or breach of contract of any third party, acts of God, climate conditions, natural hazards, the operation of and/or mechanical or other failure of any means of transportation or for any failure of any transportation mechanism to arrive or depart in a timely or safe manner, dangers associated with or bites from animals, pests or insects, aquatic life or vegetation of any sort, dangers incident to any recreational activities, dangers associated with nighttime or rainy conditions, dangers associated with roadways and vehicles on roadways, risks associated with impure water, or for any other action or omissions of third parties, or conditions that are not caused by the willful acts or omissions of NBNC.

NBNC reserves the right to accept or reject any person as a program participant, for any reason.

In consideration of, and as part payment for, my right to participate in this program and associated activities, arranged by NBNC, I have and do hereby assume all of the above risks and conditions, and will hold NBNC harmless from any and all liability, actions, causes of action, debts, claims and demands of every kind and nature whatsoever which I now have or which may arise from or in connection with this program or participation in its activities arranged by NBNC. The terms hereof shall serve as a release and assumption of risk for my heirs, executors and administrators.

Participant's Signature _____ Date _____

Print Name:



Please return to: North Branch Nature Center, 713 Elm St, Montpelier, VT 05602

Or: email to info@northbranchnaturecenter.org