

Mt. Mansfield Amphibian Monitoring

Update

2023

(Covering 1993-2023)

February 9, 2024

For the Forest Ecosystem Monitoring Cooperative

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Amphibian Monitoring on Mt. Mansfield, Vermont 1993-2023

Background

After an initial amphibian survey and establishment of monitoring protocols, populations of amphibian species have been monitored almost annually on Mount Mansfield since 1993. The goals of the monitoring are to (1) establish a baseline data set of abundance indices for the amphibian species caught in the fences, (2) monitor year-to-year changes in their abundance indices, (3) monitor changes in the number and type of obvious external abnormalities, (4) gather inventory data for the Vermont Herp Atlas, and (5) gather basic natural history information on the species present. Amphibians are targeted for this kind of study because their multiple habitat usage and permeable skin make them especially sensitive to changes in environmental conditions. This is the longest-running set of amphibian monitoring data in the state.

Four drift fences were built at three elevations on the west slope of Mt. Mansfield (Figure 1): 1200 feet (2 fences), 2200 feet (1), and 3200 feet (1). With the exception of the fence at 3200 ft., each fence was made of two 50-foot sections of 20-inch-wide metal flashing buried 4 inches below the surface of the ground. The two sections were placed at right angles to each other, resulting in 100 feet of flashing set upright as a 16-inch-high fence. Buckets were buried every 12.5 feet on both sides of the fence so that the top edges of the buckets were flush with the ground. The fence at 3200 feet was made of only one 50-foot section of flashing with buckets at 12.5-foot intervals. Amphibians that encounter a fence while moving through the forest must turn to one side and many eventually fall into a bucket. The lids are taken off the buckets in the late afternoon on rainy days, and the captured amphibians identified and counted the following morning. The locations of these four sites are indicated in Figure 1. The fence at 3200 feet was removed in 1996. The remaining three fences are opened and checked up to five times per month during rain events throughout the field season (April through October excluding August). The abundance indices are generated using the three most successful trap-nights per month. In drought years, only one or two successful trap nights might need to be used instead.

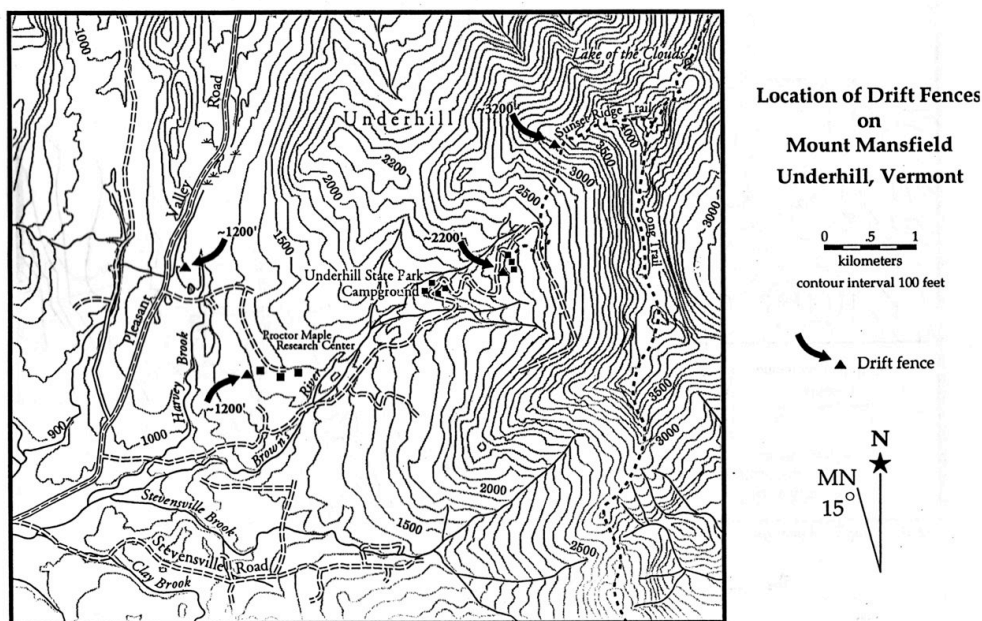


Figure 1. Drift fence locations on Mt. Mansfield.

We have drift-fence data from Mt. Mansfield from 1993 to the present, with the exceptions of 2004, 2009, 2015, and April and May of 2016. Due to an anticipated break in the funding the drift fences were removed from Mt. Mansfield during the summer of 2015. Luckily, funding was restored, the fences were reinstalled in May of 2016 and data collection began again in June of 2016.

Periodic monitoring at Lye Brook allowed us to compare data at the two locations to see if there were corresponding patterns that may signal statewide changes. We collected data from fences near the Lye Brook Wilderness in southern Vermont annually from 1994 through 2002 when funding from the Green Mountain National Forest ended. During 2008 monitoring began again at Lye Brook Wilderness and continued at Mt. Mansfield as well. In 2009, only the Lye Brook Wilderness fences were monitored, and in 2010, only Mt. Mansfield fences were monitored. In the fall of 2011, Hurricane Irene washed out the road leading to the Lye Brook drift fences from the west, preventing data collection in the fall of 2011 and in 2012. A new road allowing access from Manchester was completed. However, we no longer have funding or staff to monitor Lye Brook.

To save money and time, we agreed in 2009 to begin an every-other-year schedule of generating indices, analyzing, and reporting on the data gathered. However, recent contracts have again required annual reports. The 2016 report included all data from 1993 through June of 2017 from Mt. Mansfield. Due to the re-installation of the fences in the summer of 2016, no data were collected in April and May 2016. To be able to continue comparing year-to-year results we needed to have a full year of results, including a spring migration in April and May. We chose to include the data collected during April and May 2017, as it was the closest chronologically to the 2016 field season and encompasses one full year. The 2017 report contained all data collected only in the 2017 season, as have all subsequent annual reports.

Cleaned and updated sets of all the drift-fence data from Mt. Mansfield, including data not used in our indices have been sent to the FEMC.

Diversity of Adults and Young

In 2023, the usual five caudate (salamander) species were caught as adults. They are Spotted Salamander (*Ambystoma maculatum*), Northern Dusky Salamander (*Desmognathus fuscus*), Northern Two-lined Salamander (*Eurycea bislineata*), Eastern Newt (*Notophthalmus viridescens*), and Eastern Red-backed Salamander (*Plethodon cinereus*). Spring Salamanders (*Gyrinophilus porphyriticus*) were detected in 2023. This is a species we have only caught 13 of our 28 trapping seasons. It is a stream species that only occasionally travels far enough from its home stream to get caught in one of our fences. Young of the year of Spotted Salamander and Eastern Newt were captured: (Table 1).

In 2023, adults of five of our normally trapped anurans (frogs) were caught. They are American Toad (*Anaxyrus americanus*), Spring Peeper (*Pseudacris crucifer*), Green Frog (*Lithobates clamitans*), Pickerel Frog (*Lithobates palustris*), and Wood Frog (*Lithobates sylvaticus*). No Gray Treefrogs (*Hyla versicolor*) were captured. Gray Treefrogs can climb over our fences and out of our buckets. Our fences are not placed in or near the preferred habitat for Pickerel Frogs and typically very few are captured. Young of the year were captured for Green Frogs, Pickerel Frogs, and Wood Frogs (Table 1).

Combined Numbers

The total number of total amphibians (salamanders & frogs) detected per trapping was the lowest (18.9) it has been since 2008, following a relatively high number (30.5) in 2022. Overall, the number of salamanders detected in the last 14 years of the study is considerably higher than the numbers detected in the first 14 years (13.73 per trapping versus 6.24) with each individual species showing an increase. It may be worth examining habitat, management, or weather changes that took place around 2006. While the number of salamanders increased when comparing those two timeframes, the numbers of frogs remained fairly stable (10.96 per trapping versus 10.79). During those same two timeframes, Wood Frogs increased by 23% while all other species decreased, resulting in what looks like stable frog numbers.

Long-term Trends

Linear regressions most closely fit the data plots, so they are used to show potential trends in the abundance indices for all species caught from 1993-2023 (Figures 2-7). In 2017, in addition to using linear regressions to show potential trends in the abundance indices, we used the Monitor.exe freeware program to determine the reliability of the apparent trends. We plan to reexamine the reliability of the trend lines in 2024.

Young of the Year

Beginning with the 1995 report, we began documenting the number of young of the year, calculating the percentage of young of the year (YOY), and recording the date of the first metamorph caught by a drift fence. The cutoff lengths listed on Table 1 were calculated in 1995, based on data we had collected, and information gathered from the literature. As mentioned below and in the table footnotes, in addition to using the total length as one cutoff for determining young of the year, we also use dates, as some larvae or tadpoles may overwinter in their aquatic phase and metamorphose in the early spring. In 2023, young of the year made up 16% of the total amphibians captured (Table 1). Over the course of the portion of the study where we have juvenile information (1995 – 2023) the average percentage of young of the year of total catch has been 24.93%. Since 1995 the young of the year have varied from 11% (2014) to 74% (2002). The 2023 result of 16% is below average. Table 3 and Table 4 summarize the young of the year information for salamanders and frogs respectively.

All frogs monitored except for Green Frogs generally grow from egg to metamorph in one season. At this latitude and elevation, Green Frogs usually spend at least one winter as a tadpole and metamorphose a year or more after the eggs are laid. Other frogs metamorphose during the same year as egg laying but at a very small size. American Toads can be as small as 8-13 mm after metamorphosis. Gray Treefrogs can be as small as 15 mm. Wood Frogs can transform as small as 10-20 mm and Spring Peepers as small as 13 mm. It is possible that a froglet may have transformed in a previous year but still be under the cut-off size to be considered young of the year when found the following spring. Therefore, when determining young of the year we do not include small frogs or toads found in spring if it was unlikely enough time had passed to allow for development through metamorphosis.

Different species of salamanders show even more variability and for many, the term young of the year is misleading since they spend multiple years in their aquatic larval stage. It would be more accurate to say first year of their terrestrial phase. The Eastern Newt and the Eastern Red-backed Salamander generally develop into a terrestrial form in the first year of their life; although like the frogs, they may still be very small and below our cutoff sizes the spring after they were deposited as eggs. Spotted Salamanders have a minimum larval phase of about 60 days but can remain in the water as larvae over their first winter. Small Spotted Salamanders found in the spring and very early summer are not counted as young of the year in this report. Northern Dusky Salamanders can spend 7 to 11 months as larvae and transform the spring after emerging from eggs. Northern Two-lined Salamanders may remain in their aquatic stage for 2 – 3 years, and Spring Salamanders can remain in their larval form for up to 3-4 years. What we refer to as young of the year for these species are individuals that had hatched in previous years but were spending their first year in the terrestrial form.

Over the years of gathering and analyzing these data, as well as studying the literature, our ability to determine a particular species phenology at this latitude and elevation has increased. In 2022 and 2023 we created specific cut off dates for determining if an individual should be considered young of the year. Species found prior to these dates were not considered young of the year: Spotted Salamander (July 1) Northern Dusky Salamander (June 1), Northern Two-lined Salamander (June 1), Eastern Newt (August 15), and Eastern Red-backed Salamander (July 15), American Toad (May 1), Spring Peeper (July 1), Green Frog (June 1), Pickerel Frog (July 1), and Wood Frog (July 1), and Gray Treefrogs (July 1).

Although we used the best information we had in previous reports to determine young of the year, it is possible that not all were classified using the cut off at the dates listed above, and may account for some minor differences seen between years. It may be necessary in a future year to go back and re-evaluate all individuals determined young of the year between 1993 and 2021 using the above criteria.

Individual Species' Trends

Northern Two-lined Salamander

We catch relatively few Northern Two-lined Salamanders. This is expected since the fences were not placed within their preferred habitat. This species prefers saturated soils and travels only a limited distance away from those areas in very wet conditions. The first decade of monitoring showed a slight increasing trend in numbers caught. Since 2003, the indices have shown some large annual fluctuations, and the linear regression trend line continues to show an increase even though low numbers were captured 2018-2021, and in 2023. When comparing the first fourteen years of the study to the second fourteen

years the numbers have increased by 53%. However, the timing and amount of rainfall, groundwater levels, and drainage changes all would have a large impact on the extent that this species travels and intercepts our fences. In our 2021 report we mentioned an apparent decline in the last ten years; 2022's relatively high numbers have reversed that trend, and overall, they appear to be increasing despite the fluctuation. (Figure 2 and Table 2).

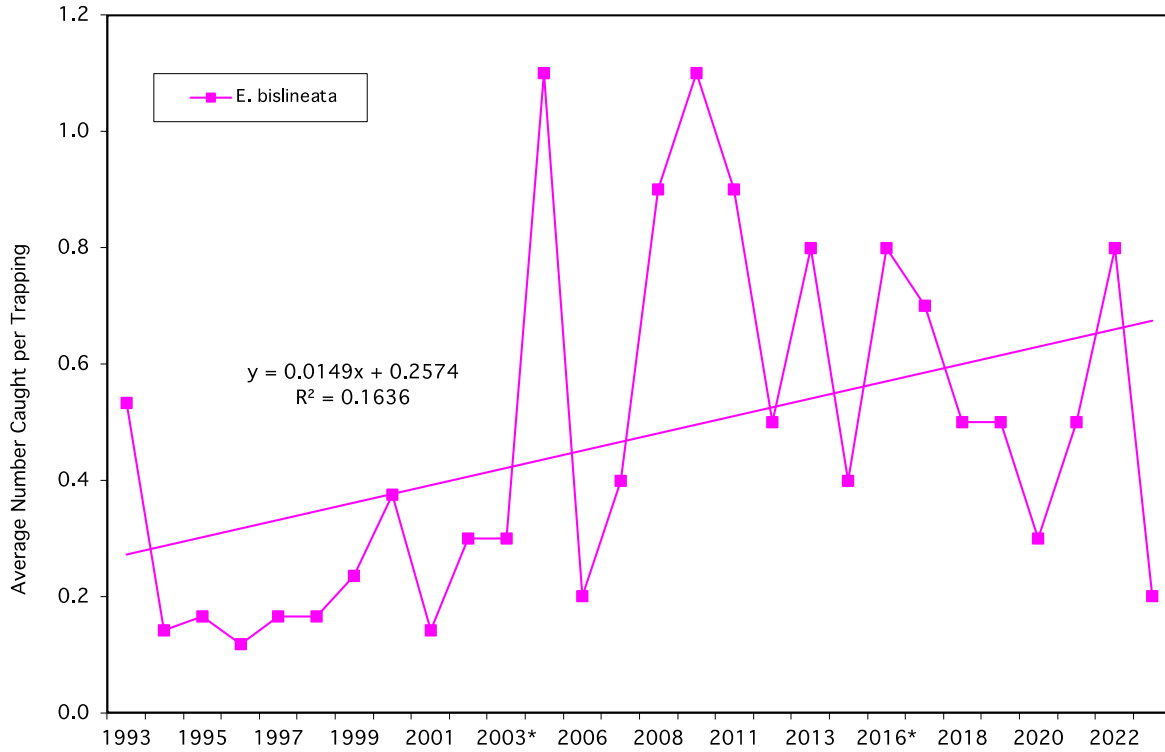


Figure 2. Northern Two-lined Salamander (*Eurycea bislineata*) population indices from Mt. Mansfield, Underhill, Vermont, 1993-2023.

Spotted Salamander

The Spotted Salamander has a regression trend line showing a very slight increase with some annual variation (Figure 3). The trapping of 2.9 individuals in 2017 was a record high for this species and the capture rate has remained above or equal to the average (1.6) the past seven years. When comparing the first fourteen years of the study to the second fourteen years the numbers have increased by 28%. This is a long-lived species with a life span of over 20 years. As a result, adult numbers are not expected to vary as much annually as a shorter-lived species such as a Spring Peeper or Wood Frog. The number of young of the year detected in 2023 was 18% (Table 4). Capture rates for this species may be affected by our efforts to reduce small mammal mortality (see page 11).

Eastern Red-backed Salamander

This species shows a clear long-term increase. Like the other amphibian species found at this site, the Eastern Red-backed Salamander population occasionally shows large annual fluctuations. In 2017, a record number (14.5 per trapping) were detected, and 11.3 per trapping were detected in 2022. There was a dramatic drop in 2023 and we only caught 1.1 per trapping. As mentioned earlier, the number of overall salamanders detected in the second 14 years as compared to the first 14 years of the study was considerably higher and a 67% increase was calculated for this species. Despite the low numbers detected in 2023, the Eastern Red-backed Salamanders appear to be the major driver of the overall shift. (Figure 3 and Table 2).

This species is reported to do well in mature hardwood forests with abundant coarse woody debris and deep deciduous leaf litter. Unlike the Wood Frog and Spring Peeper, it overwinters deep in the soil below the frost line, so it is likely less subject to overwintering mortality. Also, unlike Wood Frogs and Spring Peepers, it does not require wetlands in any stage of its development, so hydroperiod or other conditions in breeding ponds would not have any direct impact on their numbers, although soil moisture could. The overall increase in this species could be a result of the leaf litter becoming deeper, the leaf litter holding moisture better, an increasing amount of course woody debris, or some combination of these factors. These could also be a result of a maturing hardwood forest. The annual variation could be related to changes in moisture in the top layers of leaf litter, and in drier years (such as 2020) the salamander may be further underground. Invasive earthworms can influence the depth of the leaf litter and soil moisture and are now being monitored at our fences.

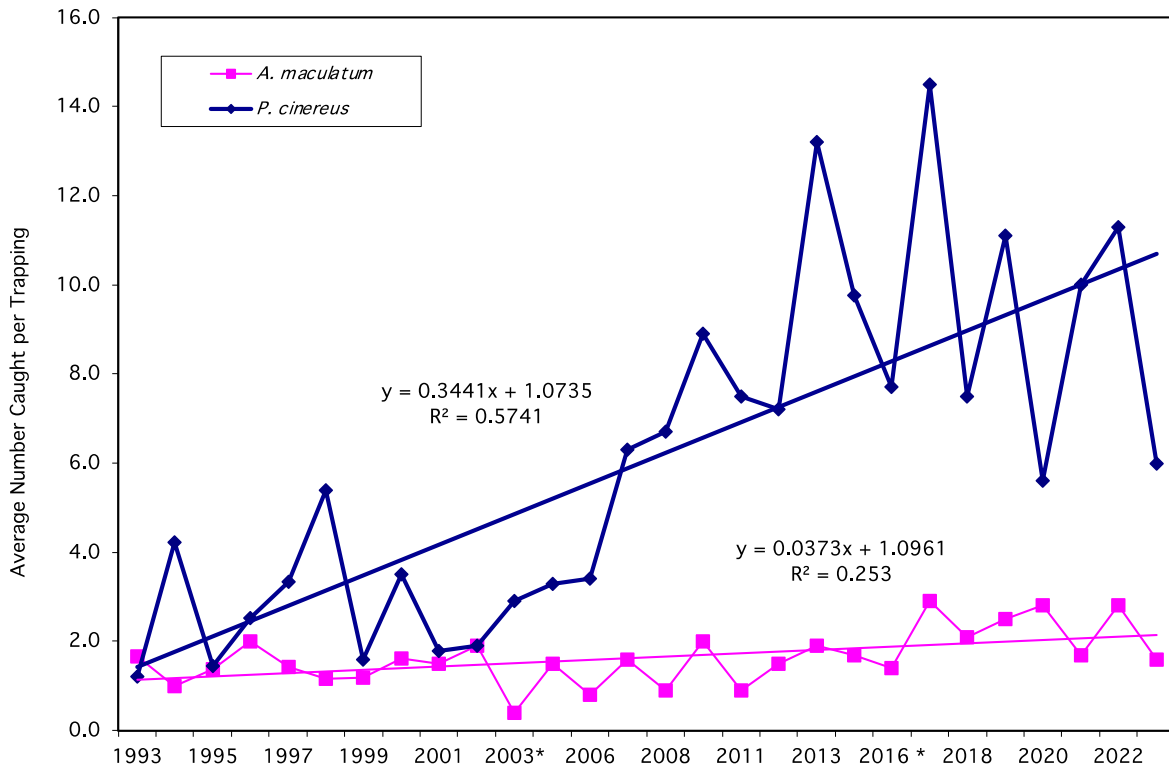


Figure 3. Spotted Salamander (*Ambystoma maculatum*) and Eastern Red-backed (*Plethodon cinereus*) Salamander population indices from Mt. Mansfield, Underhill, Vermont, 1993-2023.

Eastern Newt

The trapping rate for the Eastern Newt in 2023 was 1.1 animals per trapping. This is well below the previous year of 2022 when the highest (3.1) capture rate of any year of the study was detected. The long-term trend is virtually flat with a great deal of annual variation (Figure 4). When comparing the first fourteen years of the study to the second fourteen years the numbers have increased by 6%. Of the animals captured, (32%) were considered young of the year (Table 1 and Table 3).

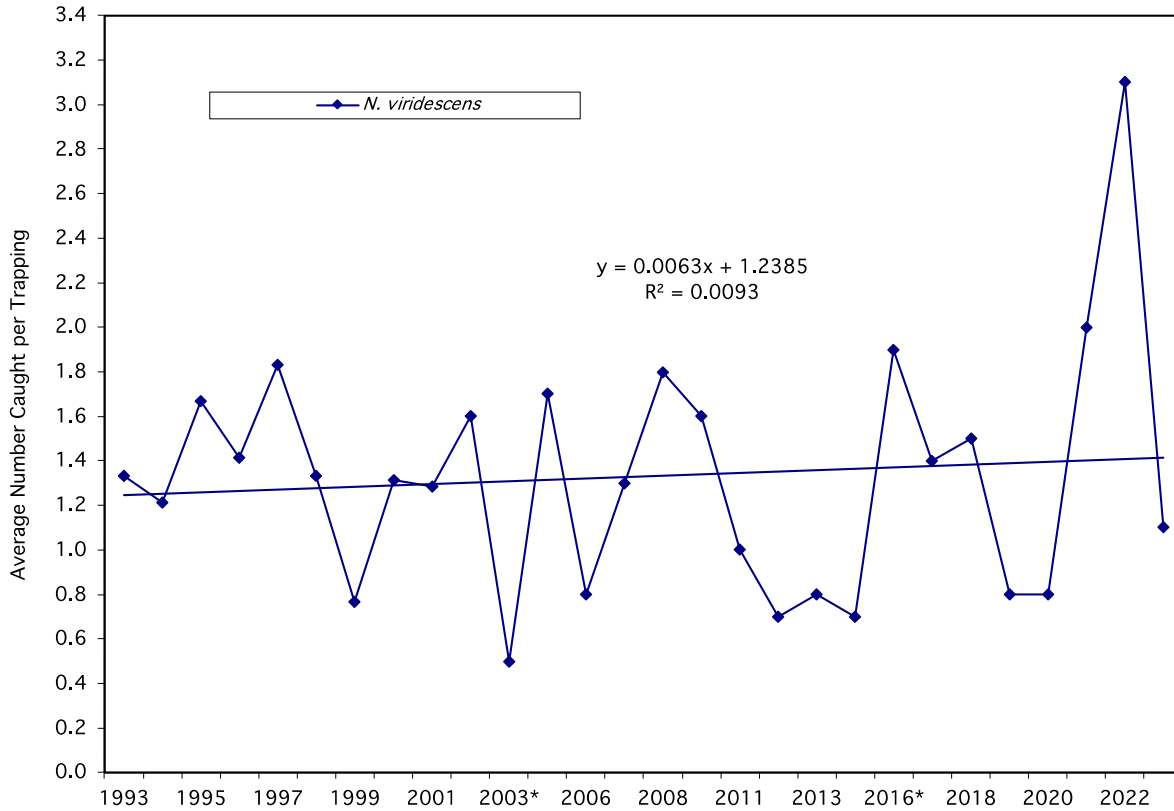


Figure 4. Eastern Newt (*Notophthalmus viridescens*) population indices from Mt. Mansfield, Underhill, Vermont, 1993-2023.

American Toad

American Toad capture rates have fluctuated with large annual variations (Figure 5). An all-time high of 5.5 American Toads per trapping was detected in 2013. The regression line shows that the population appears to be steady with no discernable increase or decrease. When comparing the first fourteen years of the study to the second fourteen years, the capture rates have decreased by 2%. Of the animals captured, (0%) were considered young of the year (Table 1 and Table 4).

Pickereel Frog

We catch so few Pickereel Frogs (less than 1.0 per trapping) that although it appears the population continues to decrease slightly; it is not possible to draw any meaningful conclusions (Figure 5 and Table 2). This is not surprising. Our fences were not located in the preferred foraging habitat (open annual vegetation near water) for this species.

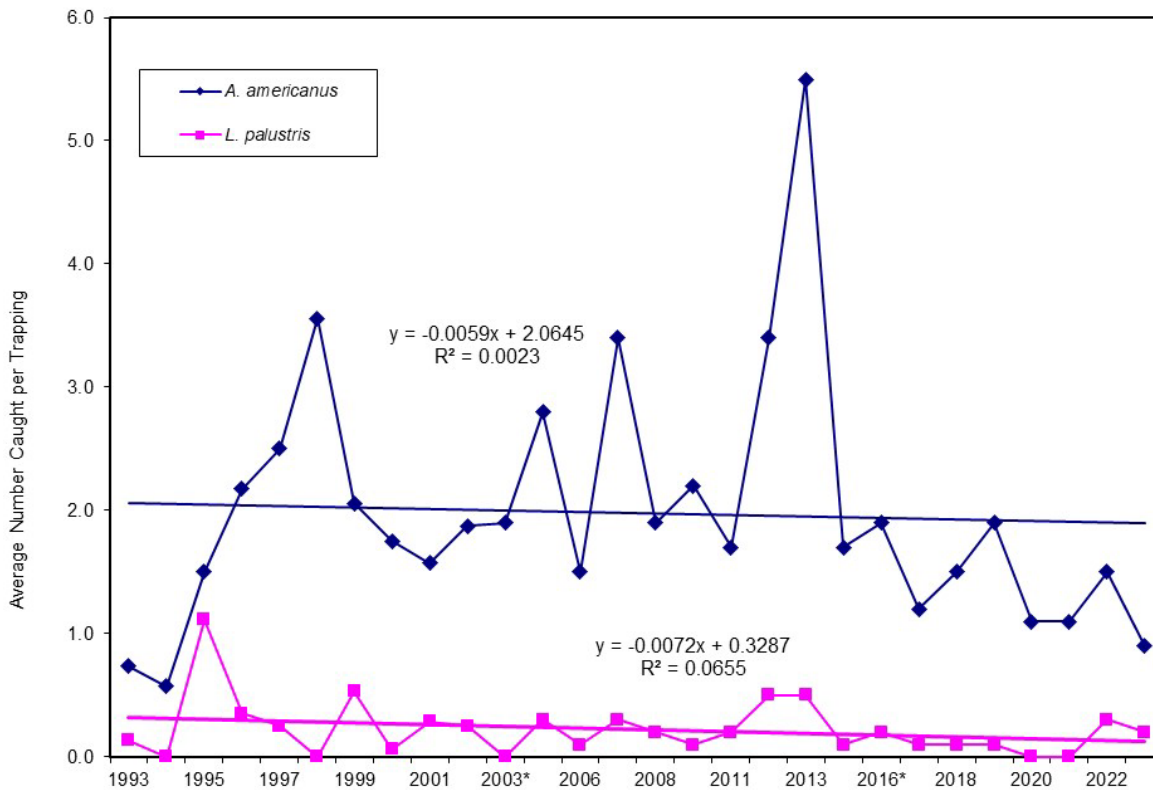


Figure 5. American Toad (*Anaxyrus americanus*) and Pickerel Frog (*Lithobates palustris*) population indices from Mt. Mansfield, Underhill, Vermont, 1993-2023. The numbers for the Pickerel Frog are too low to draw any meaningful conclusions.

Wood Frog

Wood Frogs continue to have large year-to-year fluctuations (Figure 6 and Table 2). The regression line appears to show a long-term increase, although that is largely the result of record numbers of Wood Frogs per trapping (11.3) detected in both 2017 and 2019, and 11.4 in 2020. In 2021 and 2022, capture rates for Wood Frogs were below the average of 5.3 per trapping at 2.8 and 4.9 respectively and in 2023 rates were slightly above average at 5.6. It is possible many were missed in 2021, as the first trapping date was April 29, 2021. Wood Frogs migrate to breeding ponds early in the spring and return shortly afterwards. If peak migration was missed, it would impact the abundance index for that year. When comparing the first fourteen years of the study to the second fourteen years, the numbers have increased by 23%. In 2017 and 2022, a relatively high percentage of Wood Frogs detected were young of the year (42%), in 2023 only 14% of those captured were young of the year.

Since this species grows from egg to metamorph in a matter of months, seasonal droughts (such as seen in 2020) of only a couple weeks duration could have a large impact on a population. In addition, since this species overwinters in the leaf litter, depth of freeze, snow depth, and invasive earthworms could also have immediate and pronounced impacts on populations. At a privately-funded research site in Lincoln (Colby Hill Ecological Preserve) where we are monitoring egg-mass numbers, we have not seen any significant trends for this species. Data from the Mt. Mansfield fences in the coming years may help us understand if timing was the problem, or if there indeed was a dramatic decline in Wood Frog populations near these fences.

Spring Peeper

In 2017, using Power analysis, we showed that the Spring Peeper was showing an annual decline of 1.6%. It was the only decline shown among the species we monitor on Mt. Mansfield that we confidently (100%) had the power to claim. However, at that time it appeared that their population was beginning to recover after completely disappearing from our fences back in 2008. By 2017 their numbers had bounced back to those seen at the very beginning of our monitoring back in 1993. Since 2017, their numbers have declined once again with only two animals detected in 2021, four detected in 2022, and one detected in 2023 (Table 1 and 2 and Figure 6). When comparing the first fourteen years of the study to the second fourteen years, the numbers have decreased by 59%.

Local changes in breeding habitat are one possible explanation for this population variation, but we have no data to support a significant change in habitat. Spring Peepers breed primarily in open, shallow, and well-vegetated wetlands. If local breeding habitat were flooded by beaver and/or exposed to trout, populations would be expected to decline. The importance of nearby breeding habitat is supported by the fact that we have never caught a Spring Peeper at the drift-fence at Underhill State Park. As far as we can tell, there is no breeding habitat in that area. In our minds, changes in appropriate breeding habitat, perhaps because of forest succession, or changes in local beaver activity could potentially be driving population changes.

Spring Peeper is another species that overwinters in the leaf litter. Changes in the depth of frost during winter, snowpack, or changes in the depth of the leaf litter, could also bring about declines. Invasive worms and disease are other potentially significant variables.

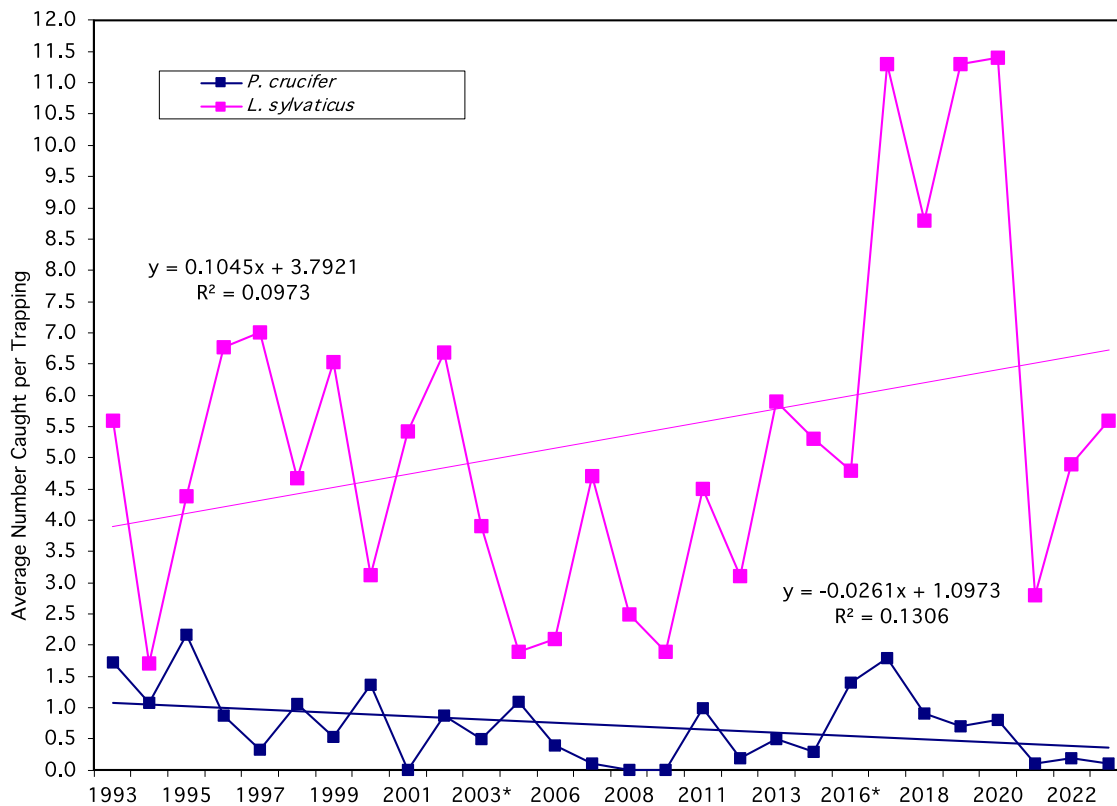


Figure 6. Wood Frog (*Lithobates sylvaticus*) and Spring Peeper (*Pseudacris crucifer*) indices from Mt. Mansfield, Underhill, Vermont, 1993-2023.

Green Frog

The number of Green Frogs increased slightly through 2002 when there was a dramatic increase from 1.9 per trapping to 22.1 per trapping, for a total of 350 Green Frogs captured (Figure 7). After that one dramatic year, there was a large drop back down to the historic trend line in 2003 and only relatively small annual variations since then. The long-term trend line shows no discernable increase or decrease. 2022 was an above average year with 5.1 Green Frogs detected per trapping, 2023, with 2.4 detected, was much closer to the average of 2.6. When comparing the first fourteen years of the study to the second fourteen years the numbers have decreased by 55%; although this was influenced by the 2002 results. Since this species overwinters as a tadpole, a winter that allowed high survival in a nearby breeding pond could generate a spike like that seen in 2002, particularly if it was preceded and/or succeeded by wet conditions. Green Frogs are also largely aquatic and require standing pools of water to rehydrate and wet conditions in which to move.

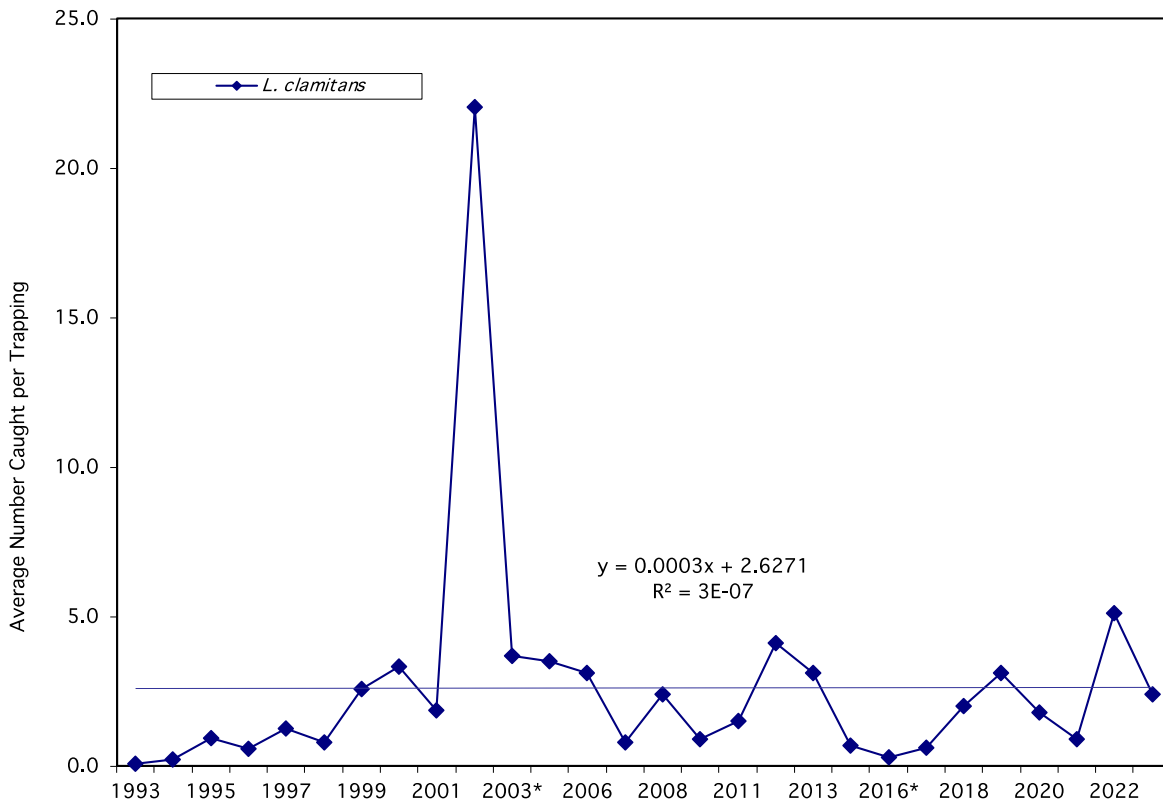


Figure 7. Green Frog (*Lithobates clamitans*) population indices from Mt. Mansfield, Underhill, Vermont, 1993-2023.

Abnormalities

The number of abnormalities continues to be low, with only two abnormalities found out of a total of 326 animals. No abnormalities were detected in 2022 out of 526 animals captured. One abnormality this year was a Wood Frog with the last two sections of its right rear leg missing. The stump was healed with two projections that might have been toes. We suspect this might have been the result of predation during the frog’s late tadpole stage. A second Wood Frog had the toes on its left rear foot fused. It is unclear whether this was a developmental problem or the result of predation and regrowth.

Very few abnormalities have been seen at this site. In 2011, one abnormality was detected in the 314 animals captured. It was a Wood Frog that had a left leg that bent back over the top of the frog. This could well have been the result of an injury. In 2012, two of the 384 animals were found with abnormalities. One Spring Salamander was missing toes and its lower leg, and a Green Frog was found with an atrophied right rear leg. In 2018 a Spotted Salamander was found with an adventitious tail.

The numbers of abnormalities at this site have always been well below the level of concern. From 1998 through 2023, the total number of amphibians showing abnormalities from all captures has been 18 individuals.

Data

Data from these efforts are exported in Excel format and sent via E-mail to FEMC annually.

Amphibian mortality

In 2023, of the 326 amphibians, 23 were found dead: one Northern Dusky Salamander, two Spring Salamanders, two Green Frogs, four Wood Frogs, and fourteen Eastern Red-backed Salamanders. Of the fourteen Eastern Red-backed Salamanders,

nine were found dead on the first day the traps were opened in the spring. These Eastern Red-backed Salamanders were not included in the capture data as they somehow got into the traps prior to the season beginning.

Small mammal mortality

Small mammals fall into the pitfall traps along with amphibians. Sadly, mammals smaller than a chipmunk are unable to escape the traps and most die. During field seasons 2002, 2003, and 2005 we experimented with installing dowels and sponges in ½ of the pitfalls to allow small mammals to climb out, unfortunately many Spring Peepers and all Eastern Red-backed Salamanders also escaped, making it impossible to continue to monitor Eastern Red-backed Salamanders using traps with dowels. As a result, we removed the dowels from all the traps. To compare these years' data to years when we did not use dowels, we excluded data from all traps with dowels, doubled captures from traps without dowels, and added the snake trap data.

There was a dramatic jump in jumping mice populations during 2019. Consequently, there was a large increase in their mortality at the fences. This stimulated efforts to once again alter the pitfall traps in a way that would lower small-mammal mortality while at the same time not allowing amphibians to escape. Starting in the 2020 season, we hung nylon parachute cord (string) in the center of one of each pair of pitfall traps, keeping the end of the string off the bottom of the pitfall traps. Making these changes to only ½ of the traps allows us to measure the success of the method and generate correction factors to compare data to other years. When comparing non-strings to string, small mammal mortality dropped 75%, 67%, 60%, and 39 % from 2023-2020 respectively. During the 2020 field season, 155 small mammals died in traps without strings and 95 in traps with strings. During the 2021 field season 176 small mammals died in traps without strings and 70 in traps with strings. During the 2022 field season 270 small mammals died in traps without strings and 88 in traps with strings. During the 2023 field season 285 small mammals died in traps without strings and 71 in traps with strings.

Again, this year, the percentages differed between species. In 2023 jumping mouse mortality dropped by 84% (94% in 2022 and 81% in 2021). Shrew (not including short-tailed Shrew) mortality declined by 80% in 2023, (63% in 2022, 43% in 2021). Mortality of Short-tailed Shrews dropped by 61% (21% in 2022 and 35% in 2021). *Peromyscus* sp. mortality dropped by 69%, (88% in 2022 and 75% in 2021), and voles dropped by 17% (33% in 2022 and 40% in 2021).

Overall small mammal mortality at the fences in 2023 totaled 312 individuals: 51 *Peromyscus* species, 125 Other shrews, 43 Short-tailed Shrews, 11 voles, 1 mole, no jumping mice, 84 woodland jumping mice. All of these were transferred to Dr. Sarah Helms Cahan of UVM. This year's combined total mortality of 312 compares to 366 in 2022, and an average of 376 per year in the eight years prior to this experiment with strings. Although we see annual variation in species numbers, we have not seen any long-term declines in the numbers of any of the mammal species caught in our fences.

Impacts on amphibian capture rates

This is the fourth year of using this method. We are monitoring amphibian capture rates closely in the two treatment types to determine if this method is facilitating the escape of any amphibians. We are most concerned with numbers of Spotted Salamanders. Over the last four trapping seasons, 78 Spotted Salamanders were captured in buckets with no strings while only 50 were captured in buckets with strings (Table 5). There is a noticeable percentage change between string and non-string traps for the Northern Two-lined Salamander (10 captured in traps without string and 17 in traps with strings). In addition, only about 44% of total individuals/species were found in the string buckets for both Eastern Newts and Wood Frogs.

Since these four species all showed differences between string and non-string capture rates we further divided the results into young of the year and non-young of the year for each species, to explore any differences between the age groups, as it is known that the climbing ability of some of the young differs from the adults (Table 5). Except for the Northern Two-lined Salamander, the young of the year captures are relatively fewer in buckets with strings. To determine if this is based on the young's ability to climb out of buckets with string, or the placement of buckets with string, in 2023 we placed the strings in opposite buckets prior to the 2023 field season. All other species have relatively similar capture rates when comparing strings versus non-strings (Table 5).

These differences are currently too small to generate a reliable correction factor that would allow us to compare indices generated from traps with and without strings. We plan to continue to use strings in one half of the pitfall traps for one or

two more years. If we are seeing a consistent decrease in small mammal mortality and we are able to generate reliable correction factors for decreased captures of amphibians in buckets with strings, we will put cords in all the pitfall traps. If not, we will continue the comparison for additional years.

Summary

The drift-fence array at Mt. Mansfield has generated the longest-running set of amphibian-monitoring data in the state. It is the only amphibian drift-fence location in Vermont that has been monitored almost continuously from 1993 through 2023.

The overall number of suitable nights to open the drift fences was similar to previous years. The capture indices for all amphibians captured was below average following thirteen years of above average captures.

- Populations of **Spring Peeper** have declined over the long-term duration of this study. They entirely disappeared and then rebounded in 2016 and 2017. Their numbers have been low the last two years.
- Although this year's results were lower than the last two years, populations of the **Eastern Red-backed Salamander** have increased over the length of the study, with considerable annual variation.
- Populations of **Spotted Salamander** remain fairly stable; although there may be a larger population than indicated in the last four years' data since some young Spotted Salamanders appear to be escaping the traps using the strings.
- Populations of **Eastern Newt** have remained fairly stable but show large annual variations. A record number was detected in 2022.
- Populations of the **Northern Two-lined Salamander** have increased over the entire study. However, we continue to catch relatively few.
- Populations of **Green Frog** remain fairly stable, except for 2002 when there was a large increase in young of the year. They do show annual fluctuation and although relatively more were seen in 2022, the numbers were close to average in 2023.
- Populations of **Wood Frog** are showing an increase over the long term.
- Populations of **American Toad** have decreased slightly over the duration of the study; however, we continue to catch relatively few.
- We have gathered enough data to better determine when **young of the year** show up as opposed to small non young of the year. We may want to return to some of our earlier data and reexamine for better year to year comparisons.

Life history differences and similarities between species help us rule out some potential causes of these changes and suggest others, but at this point, little is known about what is driving these changes.

Although always rare at this site, the **number of abnormalities remains very low (2 out of 326 in 2023)**.

Once again, we are experimenting with methods to reduce small mammal mortality in the pitfall traps. This time we are using braided-nylon parachute cords suspended near the center of half of the traps. The addition of strings to traps is facilitating the escape of small mammals and lowering their mortality. However, before we can put strings in all traps, we need to generate reliable conversion factors for the number of escaping amphibians. We plan to continue this experiment for one or two more years and then, depending on the results, either suspend cords in all the pitfall traps, continue the comparison, or revise the design.

Acknowledgments

Long-term monitoring at Mt. Mansfield during 2023 was supported by a cost-sharing grant from the Vermont Department of Forests, Parks, and Recreation through the Forest Ecosystem Monitoring Cooperative (FEMC) to Vermont Family Forests. Cindy Brown entered all the data. Erin Talmage reviewed the data, generated the tables and figures, and drafted the report. Field personnel at Mt. Mansfield were Warren Ellison, Jeff Salisbury, Kate Arms, Sandy Hamlet, and Robert Robbins.

Table 1. Monitoring results from the two drift-fences at 1,200 ft. and one at 2,200 ft. on Mt. Mansfield, Underhill, Vermont during 2023. Traps were opened whenever conditions were appropriate for amphibian movement from April through November excluding August. Three successful trappings per month (± 10 days) were the goal, however due to periods of low rainfall, two trappings per month were sometimes used. **Data from 17 of 18 trap-efforts were used: April 14 and April 24; May 1, 21, and June 38; June 7, 15, and June 25; July 2, 10, and July 17; September 8, 14, and Sept 19; October 8, 16, and October 22.** Abnormality, maximum size, and first metamorph data were taken from all 18 trappings.

Common name	Scientific name	# of all ages	# of young of the year ¹	% young of the year	date of first metamorph ²	largest adult (total length in mm)	# per trapping ³	% of group	% of total catch	# abnormal/total ⁴
Caudates (Salamanders)										
Spotted Salamander	<i>Ambystoma maculatum</i>	28	5	18%	Sept. 8	196	1.6	17%	9%	0/28
N. Dusky Salamander	<i>Desmognathus fuscus</i>	9	0	0%	N/A	50	0.5	5%	3%	0/9
N. Two-lined Salamander	<i>Eurycea bislineata</i>	3	0	0%	N/A	40	0.2	2%	1%	0/3
Spring Salamander	<i>Gyrinophilus porphyriticus</i>	3	0	0%	N/A	180	0.2	2%	1%	0/3
Eastern Newt	<i>Notophthalmus viridescens</i>	19	6	32%	Sept. 14	91	1.1	12%	6%	0/19
E. Red-backed Salamander	<i>Plethodon cinereus</i>	102	0	0%	N/A	94	6.0	62%	32%	0/102
Group totals	Group totals	164	11	7%	N/A	N/A	9.6	100%	51%	0/164
Anurans (Frogs)										
American Toad	<i>Anaxyrus americanus</i>	16	0	0%	N/A	72	0.9	10%	5%	0/16
Green Frog	<i>Lithobates clamitans</i>	41	25	61%	June 25	91	2.4	26%	13%	0/46
Pickerel Frog	<i>Lithobates palustris</i>	3	1	33%	Sept. 19	44	0.2	2%	1%	0/3
Wood Frog	<i>Lithobates sylvaticus</i>	96	13	14%	July 17	82	5.6	61%	30%	2/96
Spring Peeper	<i>Pseudacris crucifer</i>	1	0	0%	N/A	46	0.1	1%	0%	0/1
Group totals	Group totals	157	39	25%	N/A	N/A	9.2	100%	49%	2/162
Amphibian totals	Amphibian totals	321	50	16%	N/A	N/A	18.9	100%	100%	2/326

1 For each species, individuals under a given total length were considered potential young of the year. The chosen length was based on the timing of their appearance, gaps in their size continuum, and records in the literature. The cutoff sizes used were *A. maculatum* (70 mm), *D. fuscus* (30 mm), *E. bislineata* (60 mm), *N. viridescens* (45 mm), *P. cinereus* (32 mm), *A. americanus* (23 mm), *H. versicolor* (26 mm), *P. crucifer* (20 mm), *L. clamitans* (44 mm), *L. palustris* (34 mm), and *L. sylvaticus* (27 mm). Young of the year for *G. porphyriticus* have external gills and are aquatic for up to 4 years. In addition, it was necessary to examine the minimum possible development time for each species. Individuals shorter than the cutoff lengths clearly overwinter (possibly as larvae for *N. viridescens* and *A. maculatum*) and show up in very early spring. These are not counted as young of the year.

2 No trapping took place in August.

3 These figures are rounded to the nearest 0.1. All other figures are rounded to the nearest whole number. As a result of this, group totals may not be equivalent to the sum of the individual species' values.

Table 2. A comparison of drift-fence data (numbers per trapping) from 1993 through 2023 (no data were collected in 2004, 2009, nor 2015) field seasons at Mt. Mansfield, Underhill, Vermont. Data used are from two fences at 1,200 ft. and one fence at 2,200 ft. in elevation.

Common name	# per trapping ¹																												
	93	94	95	96	97	98	99	00	01	02 ²	03 ²	05 ²	06	07	08	10	11	12	13	14	16 ⁴	17	18	19	20	21	22	23	
Caudates (Salamanders)																													
Spotted Salamander	1.7	1.0	1.4	2.0	1.4	1.2	1.2	1.6	1.5	1.9	0.4	1.5	0.8	1.6	0.9	2.0	0.9	1.5	1.9	1.7	1.4	2.9	2.1	2.5	2.8	1.7	2.8	1.6	
N. Dusky Salamander	0.3	0.3	0.3	0.0	0.0	0.6	0.1	0.4	0.3	0.4	0.1	0.0	0.0	0.1	0.3	0.6	0.2	0.5	0.8	0.9	0.6	0.7	0.6	0.9	0.5	0.5	0.6	0.5	
N. Two-lined Salamander	0.5	0.1	0.2	0.1	0.2	0.2	0.2	0.4	0.1	0.3	0.3	1.1	0.2	0.4	0.9	1.1	0.9	0.5	0.8	0.4	0.8	0.7	0.5	0.5	0.3	0.5	0.8	0.2	
Spring Salamander	<0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.2	0.1	0.2	0.6	0.0	0.3	0.0	0.0	
Eastern Newt	1.3	1.2	1.7	1.4	1.8	1.3	0.8	1.3	1.3	1.6	0.5	1.7	0.8	1.3	1.8	1.6	1.0	0.7	0.8	0.7	1.9	1.4	1.5	0.8	0.8	2.0	3.1	1.1	
E. Red-backed Salamander	1.2	4.2	1.3	2.5	3.3	5.4	1.6	3.5	1.8	1.9	2.9	3.3	3.4	6.3	6.7	8.9	7.5	7.2	13.2	9.8	7.7	14.5	7.5	11.1	5.6	10.0	11.3	6.0	
Group totals	5.0	6.8	4.9	6.1	6.7	8.7	3.9	7.2	5.0	6.1	4.2	7.8	5.2	9.7	10.8	14.3	10.6	10.5	17.7	13.6	12.6	20.8	12.2	16.1	10.1	14.7	18.6	9.6	
Anurans (Frogs)																													
American Toad	0.7	0.6	1.5	2.2	2.5	3.6	2.1	1.8	1.6	1.9	1.9	2.8	1.5	3.4	1.9	2.2	1.7	3.4	5.5	1.7	1.9	1.2	1.5	1.9	1.1	1.1	1.5	0.9	
Gray Treefrog	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	
Green Frog	<0.1	0.2	0.9	0.6	1.3	0.8	2.6	3.3	1.9	22.1	3.7	3.5	3.1	0.8	2.4	0.9	1.5	4.1	3.1	0.7	0.3	0.6	2.0	3.1	1.8	0.9	5.1	2.4	
Pickereel Frog	0.1	0.0	1.1	0.3	0.3	0.0	0.5	0.1	0.3	0.3	0.0	0.0	0.3	0.1	0.3	0.2	0.1	0.2	0.5	0.5	0.1	0.2	0.1	0.1	0.2	0.0	0.3	0.2	
Wood Frog	5.6	1.7	4.4	6.8	7.0	4.7	6.5	3.1	5.4	6.7	3.9	1.9	2.1	4.7	2.5	1.9	4.5	3.1	5.9	5.3	4.8	11.3	8.8	11.3	11.4	2.8	4.9	5.6	
Spring Peeper	1.7	1.1	2.2	0.9	0.3	1.1	0.5	1.4	0.0	0.9	0.5	1.1	0.4	0.1	0.0	0.0	1.0	0.2	0.5	0.0	1.4	1.8	0.9	0.7	0.8	0.1	0.2	0.1	
Group totals	8.1	3.6	10.1	10.8	11.4	10.3	12.2	9.8	9.2	31.9	10.0	9.5	7.2	9.3	7.0	5.1	8.9	11.3	15.5	7.9	8.7	15.0	13.3	17.1	15.2	4.9	11.9	9.2	
Amphibian totals	13.1	10.4	15.0	16.9	18.1	19.0	16.1	17.0	14.2	38.0	14.2	17.4	12.4	19.0	17.8	19.4	19.5	21.8	33.2	21.5	21.3	35.8	25.5	33.2	25.3	19.6	30.5	18.9	

¹ Numbers per trapping are rounded to the nearest 0.1. All other figures are rounded to the nearest whole number. As a result of this, group totals may not be equivalent to the sum of the individual species' values. There were a total of 15 trappings in 1993, 14 in 1994, 18 in 1995, 17 in 1996, 12 in 1997, 18 in 1998, 17 in 1999, 16 in 2000, 14 in 2001, 16 in 2002, 15 in 2003, 16 in 2005, 16 in 2006, 15 in 2007, 14 in 2008, 15 in 2010, 15 in 2011, 17 in 2012, 17 in 2013, 18 in 2014, 18 in 2016⁴, 18 in 2017, 18 in 2018, 15 in 2019, 13 in 2020, 15 in 2021, and 17 in 2022. Trappings counted were on those nights when at least 2 of the three traps were opened under appropriate weather conditions for amphibian movement.

² For three years we used dowels in half of the traps to reduce small mammal mortality. In order to compare those year's with other year's data, we converted all numbers to approximate non-dowel values. Using the preselected data sets, this was done by excluding all dowel captures, doubling captures in unimproved traps and adding snake trap data.

³ These figures are rounded to the nearest 0.1. All other figures are rounded to the nearest whole number. As a result of this, group totals may not be equivalent to the sum of the individual species' values.

⁴ April and May data were gathered in the spring of 2017.

Table 3. A comparison of young-of-the-year salamanders from drift-fence data from 1995 through 2023 (no data were collected in 2004, 2009, and 2015) field seasons at Mt. Mansfield, Underhill, Vermont. Data used are from two fences at 1,200 ft. and one fence at 2,200 ft. in elevation.

Common Name	# young of the year/ total amphibians captured (% young of the year) ^{1,2,3,4}																											
	95	96	97	98	99	00	01	02 ³	03 ³	05 ³	06	07	08	10	11	12	13	14	16 ⁴	17	18	19	20	21	22	23		
Caudates (Salamanders)																												
Spotted Salamander	3/25 (12%)	16/34 (47%)	0/17 (0%)	4/21 (19%)	0/20 (0%)	12/26 (46%)	6/21 (29%)	5/25 (20%)	5/10 (50%)	3/20 (15%)	6/12 (50%)	4/24 (17%)	4/12 (33%)	16/28 (57%)	5/13 (38%)	10/25 (40%)	8/32 (25%)	10/30 (33%)	11/16 (69%)	5/52 (10%)	7/35 (20%)	13/38 (34%)	16/36 (44%)	6/25 (24%)	19/48 (40%)	5/28 (18%)		
N. Dusky Salamander	0/6 (0%)	0/0 (0%)	0/0 (0%)	0/10 (0%)	0/2 (0%)	0/7 (0%)	0/4 (0%)	0/7 (0%)	0/1 (0%)	0/1 (0%)	0/0 (0%)	0/1 (0%)	0/4 (0%)	0/9 (0%)	0/3 (0%)	0/9 (0%)	0/13 (0%)	0/17 (0%)	0/5 (0%)	0/12 (0%)	0/11 (0%)	0/14 (0%)	0/7 (0%)	0/7 (0%)	0/10 (0%)	0/9 (0%)		
N. Two-lined Salamander	0/3 (0%)	0/2 (0%)	0/2 (0%)	0/3 (0%)	0/4 (0%)	0/6 (0%)	0/2 (0%)	1/2 (50%)	1/2 (50%)	1/8 (13%)	0/3 (0%)	0/7 (0%)	2/13 (15%)	3/15 (20%)	2/14 (14%)	1/9 (11%)	3/13 (23%)	1/8 (13%)	3/12 (25%)	0/13 (0%)	3/8 (38%)	2/8 (25%)	1/4 (25%)	3/8 (38%)	2/13 (15%)	0/33 (0%)		
Spring Salamander	0/0 (0%)	0/1 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/3 (0%)	0/0 (0%)	0/0 (0%)	0/3 (0%)	0/2 (0%)	0/2 (0%)	0/1 (0%)	0/4 (0%)	0/1 (0%)	0/2 (0%)	0/10 (0%)	0/0 (0%)	0/5 (0%)	0/5 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/3 (0%)		
Eastern Newt	13/30 (43%)	3/24 (13%)	1/22 (5%)	0/24 (0%)	0/13 (0%)	5/21 (24%)	6/18 (33%)	14/19 (74%)	0/5 (0%)	4/16 (25%)	4/13 (31%)	10/19 (53%)	4/25 (16%)	17/23 (74%)	9/15 (60%)	5/12 (42%)	5/14 (36%)	4/12 (33%)	11/26 (42%)	5/26 (19%)	6/26 (23%)	8/12 (67%)	5/11 (45%)	8/30 (27%)	31/53 (58%)	6/19 (32%)		
E. Red-backed Salamander	0/24 (0%)	0/42 (0%)	2/40 (5%)	1/97 (1%)	0/27 (0%)	2/56 (4%)	0/25 (0%)	0/19 (0%)	0/24 (0%)	1/27 (4%)	1/55 (2%)	6/94 (6%)	1/94 (1%)	6/125 (5%)	0/113 (0%)	3/22 (4%)	9/224 (4%)	2/176 (1%)	2/97 (2%)	3/261 (1%)	1/127 (1%)	1/167 (1%)	0/73 (0%)	0/150 (0%)	3/192 (2%)	0/102 (0%)		
Salamander group totals	16/88 (18%)	19/103 (18%)	3/81 (4%)	5/155 (3%)	0/66 (0%)	19/116 (16%)	12/70 (17%)	19/72 (26%)	6/42 (14%)	9/75 (12%)	11/83 (13%)	20/144 (14%)	11/51 (7%)	42/202 (21%)	16/160 (10%)	19/178 (11%)	25/300 (8%)	17/244 (7%)	27/158 (17%)	13/374 (3%)	17/206 (8%)	24/244 (10%)	22/131 (17%)	17/220 (8%)	55/316 (17%)	14/164 (9%)		
Amphibian totals	108/270 (40%)	86/286 (30%)	55/217 (25%)	53/337 (16%)	67/274 (24%)	93/272 (34%)	57/198 (29%)	389/526 (74%)	68/155 (44%)	58/177 (33%)	80/197 (41%)	48/290 (17%)	41/249 (16%)	63/274 (23%)	50/295 (17%)	86/368 (23%)	103/562 (18%)	41/390 (11%)	40/226 (18%)	110/642 (17%)	98/432 (23%)	76/501 (15%)	39/329 (12%)	37/294 (13%)	163/519 (31%)	53/21 (17%)		

¹ There were a total of 18 trappings in 1995, 17 in 1996, 12 in 1997, 18 in 1998, 17 in 1999, 16 in 2000, 14 in 2001, 16 in 2002, 15 in 2003, 16 in 2005, 16 in 2006, 15 in 2007, 14 in 2008, 15 in 2010, 15 in 2011, 17 in 2012, 17 in 2013, and 18 in 2014, 18 in 2016⁴, 18 in 2017, 18 in 2018, 15 in 2019, 13 in 2020, 15 in 2021, 17 in 2022, and 17 in 2023. Trappings counted were on those nights when at least 2 of the three traps were opened under appropriate weather conditions for amphibian movement. Data from 1993 and 1994 are not included in this chart as not all individuals were measured.

² For each species, individuals under a given total length were considered potential young of the year. The chosen length was based on the timing of their appearance, gaps in their size continuum, and records in the literature. The cutoff sizes used were *A. maculatum* (70 mm), *D. fuscus* (30 mm), *E. bislineata* (60 mm), *N. viridescens* (45 mm), *P. cinereus* (32 mm), *A. americanus* (23 mm), *H. versicolor* (26 mm), *P. crucifer* (20 mm), *L. clamitans* (44 mm), *L. palustris* (34 mm), and *L. sylvaticus* (27 mm). Young of the year for *G. porphyriticus* have external gills and are aquatic for up to 4 years. In addition, it was necessary to examine the minimum possible development time for each species. Individuals shorter than the cutoff lengths clearly overwinter (possibly as larvae for *N. viridescens* and *A. maculatum*) and show up in very early spring. These are not counted as young of the year.

³ For three years we used dowels in half of the traps to reduce small mammal mortality. In order to compare those year's with other year's data, we converted all numbers to approximate non-dowel values. Using the preselected data sets, this was done by excluding all dowel captures, doubling captures in unimproved traps and adding snake trap data.

Table 4. A comparison of young-of-the-year frogs from drift-fence data from 1995 through 2023 (no data were collected in 2004, 2009, and 2015) field seasons at Mt. Mansfield, Underhill, Vermont. Data used are from two fences at 1,200 ft. and one fence at 2,200 ft. in elevation.

Common Name	# young of the year/ total amphibians captured (% young of the year) ^{1,2,3,4}																										
	95	96	97	98	99	00	01	02 ³	03 ³	05 ³	06	07	08	10	11	12	13	14	16 ⁴	17	18	19	20	21	22	23	
Anurans (Frogs and Toads)																											
American Toad	25/27 (93%)	10/37 (27%)	6/30 (20%)	12/64 (19%)	2/35 (6%)	4/28 (14%)	6/22 (27%)	4/20 (20%)	3/19 (16%)	11/32 (34%)	12/24 (50%)	0/51 (0%)	0/26 (0%)	4/31 (13%)	1/26 (4%)	15/57 (26%)	1/93 (1%)	5/31 (16%)	0/27 (0%)	1/22 (5%)	0/26 (0%)	2/29 (7%)	0/14 (0%)	2/17 (12%)	4/25 (16%)	0/16 (0%)	
Gray Treefrog	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/1 (0%)	0/0 (0%)	1/2 (50%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/7 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	1/1 (100%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	0/0 (0%)	
Spring Peeper	3/39 (8%)	2/15 (13%)	2/4 (50%)	0/19 (0%)	0/9 (0%)	12/22 (55%)	0/0 (0%)	4/11 (36%)	2/6 (33%)	0/9 (0%)	0/7 (0%)	0/2 (0%)	0/0 (0%)	0/0 (0%)	0/15 (0%)	1/3 (33%)	0/8 (0%)	0/6 (0%)	1/1 (100%)	4/32 (13%)	0/15 (7%)	8/11 (73%)	0/10 (0%)	0/2 (0%)	3/4 (75%)	0/1 (0%)	
Green Frog	14/17 (82%)	4/10 (40%)	10/15 (67%)	9/14 (64%)	27/44 (61%)	42/53 (79%)	21/26 (81%)	340/350 (97%)	31/44 (70%)	28/36 (78%)	43/49 (88%)	6/12 (50%)	25/34 (74%)	11/12 (92%)	12/23 (52%)	46/70 (66%)	39/52 (75%)	3/13 (23%)	2/6 (33%)	7/10 (70%)	22/34 (65%)	13/47 (28%)	3/24 (13%)	10/13 (77%)	65/86 (76%)	25/41 (61%)	
Pickerel Frog	19/20 (95%)	1/6 (17%)	0/3 (0%)	0/0 (0%)	0/9 (0%)	1/1 (100%)	4/4 (100%)	2/2 (100%)	0/0 (0%)	2/2 (100%)	1/1 (100%)	2/4 (50%)	1/3 (33%)	0/2 (0%)	0/3 (0%)	6/11 (55%)	0/8 (0%)	0/1 (0%)	0/3 (0%)	0/1 (0%)	0/1 (0%)	1/1 (100%)	1/2 (50%)	0/0 (0%)	1/5 (20%)	1/3 (33%)	
Wood Frog	31/79 (39%)	50/115 (43%)	34/84 (40%)	27/84 (32%)	38/111 (34%)	14/50 (28%)	14/76 (18%)	19/76 (27%)	26/44 (59%)	8/23 (35%)	13/23 (39%)	20/70 (29%)	4/35 (11%)	6/27 (22%)	21/68 (31%)	02/52 (4%)	38/101 (38%)	16/95 (17%)	10/31 (32%)	85/203 (42%)	58/150 (39%)	28/169 (17%)	13/148 (9%)	8/42 (19%)	35/83 (42%)	13/9 6 (14%)	
Frog group totals	92/182 (51%)	67/183 (37%)	52/136 (38%)	48/182 (26%)	67/208 (32%)	74/156 (47%)	45/128 (35%)	369/454 (81%)	62/113 (55%)	49/102 (48%)	69/114 (61%)	28/146 (20%)	30/98 (31%)	21/72 (29%)	34/135 (25%)	67/190 (35%)	78/262 (30%)	24/146 (16%)	13/68 (19%)	97/268 (36%)	81/226 (36%)	52/257 (20%)	17/198 (9%)	20/74 (27%)	108/203 (53%)	39/157 (25%)	
Amphibian totals	108/270 (40%)	86/286 (30%)	55/217 (25%)	53/337 (16%)	67/274 (24%)	93/272 (34%)	57/198 (29%)	389/526 (74%)	68/155 (44%)	58/177 (33%)	80/197 (41%)	48/290 (17%)	41/249 (16%)	63/274 (23%)	50/295 (17%)	86/368 (23%)	103/562 (18%)	41/390 (11%)	40/226 (18%)	110/642 (17%)	98/432 (23%)	76/501 (15%)	39/329 (12%)	37/294 (13%)	163/519 (31%)	53/321 (17%)	

¹ There were a total of 18 trappings in 1995, 17 in 1996, 12 in 1997, 18 in 1998, 17 in 1999, 16 in 2000, 14 in 2001, 16 in 2002, 15 in 2003, 16 in 2005, 16 in 2006, 15 in 2007, 14 in 2008, 15 in 2010, 15 in 2011, 17 in 2012, 17 in 2013, 18 in 2014, 18 in 2016⁴, 18 in 2017, 18 in 2018, 15 in 2019, 13 in 2020, 15 in 2021, 17 in 2022, and 17 in 2023. Trappings counted were on those nights when at least 2 of the three traps were opened under appropriate weather conditions for amphibian movement. Data from 1993 and 1994 are not included in this chart as not all individuals were measured.

² For each species, individuals under a given total length were considered potential young of the year. The chosen length was based on the timing of their appearance, gaps in their size continuum, and records in the literature. The cutoff sizes used were *A. maculatum* (70 mm), *D. fuscus* (30 mm), *E. bislineata* (60 mm), *N. viridescens* (45 mm), *P. cinereus* (32 mm), *A. americanus* (23 mm), *H. versicolor* (26 mm), *P. crucifer* (20 mm), *L. clamitans* (44 mm), *L. palustris* (34 mm), and *L. sylvaticus* (27 mm). Young of the year for *G. porphyriticus* have external gills and are aquatic for up to 4 years. In addition, it was necessary to examine the minimum possible development time for each species. Individuals shorter than the cutoff lengths clearly overwinter (possibly as larvae for *N. viridescens* and *A. maculatum*) and show up in very early spring. These are not counted as young of the year.

³ For three years we used dowels in half of the traps to reduce small mammal mortality. In order to compare those years with other year's data, we converted all numbers to approximate non-dowel values. Using the preselected data sets, this was done by excluding all dowel captures, doubling captures in unimproved traps and adding snake trap data.

⁴ April and May data were gathered in the spring of 2017.

Table 5. Comparison of amphibians captured in traps with string versus traps without strings (2020 - 2023) from the two drift-fences at 1,200 ft. and one at 2,200 ft. on Mt. Mansfield, Underhill, Vermont. Starting in the 2020 season, nylon parachute cord (string) were hung in the center of one of each pair of pitfall traps, to reduce small mammal mortality.

Common name	Scientific name	# in traps with string	# in traps without strings	Total	Percentage found in traps with string/total
Caudates (Salamanders)					
Spotted Salamander	<i>Ambystoma maculatum</i>	50	78	128	39.1%
N. Dusky Salamander	<i>Desmognathus fuscus</i>	18	16	34	52.9%
N. Two-lined Salamander	<i>Eurycea bislineata</i>	17	10	27	63.0%
Spring Salamander	<i>Gyrinophilus porphyriticus</i>	0	0	0	
Eastern Newt	<i>Notophthalmus viridescens</i>	52	65	117	44.4%
E. Red-backed Salamander	<i>Plethodon cinereus</i>	226	250	476	47.5%
Group totals	Group totals	363	419	782	46.4%
Anurans (Frogs)					
American Toad	<i>Anaxyrus americanus</i>	37	35	72	51.4%
Green Frog	<i>Lithobates clamitans</i>	87	77	164	53.0%
Pickerel Frog	<i>Lithobates palustris</i>	5	5	10	50.0%
Wood Frog	<i>Lithobates sylvaticus</i>	163	203	366	44.5%
Spring Peeper	<i>Pseudacris crucifer</i>	7	8	15	46.7%
Group totals	Group totals	299	328	627	47.7%
Amphibian totals	Amphibian totals	662	747	1409	47.0%
YOY					
Spotted Salamander YOY	<i>Ambystoma maculatum</i>	11	35	46	23.9%
Spotted Salamander Non-YOY	<i>Ambystoma maculatum</i>	38	43	81	46.9%
Eastern Newt YOY	<i>Notophthalmus viridescens</i>	25	35	60	41.7%
Eastern Newt Non-YOY	<i>Notophthalmus viridescens</i>	27	30	57	47.4%
Northern Two-lined YOY	<i>Eurycea bislineata</i>	5	2	7	71.4%
Northern Two-lined Non-YOY	<i>Eurycea bislineata</i>	12	8	20	60.0%
Wood Frog YOY	<i>Lithobates sylvaticus</i>	30	41	71	42.3%
Wood Frog Non-YOY	<i>Lithobates sylvaticus</i>	133	162	295	45.1%