Amphibian Monitoring on Mt. Mansfield, Vermont 1993-2000

James S. Andrews and Katherine M. Wright
Biology Department
Middlebury College, Middlebury Vermont 05753

Update

Background

Populations of amphibian species are monitored annually on Mount Mansfield using drift-fences. 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. Eight years of data have now been gathered at this site. This is the longest-running set of amphibian monitoring data in the state. 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. For more detailed information on methods, locations of fences, and survey results, see the 1995 VForEM annual report.

Changes in species composition

Overall, a lower percentage of anurans (frogs and toads) was caught at the fences this year than last year. Anurans continue to dominate at the fences, but only by a slim margin (57%, Table 1), as opposed to last year where they constituted 76% of the total catch. Green Frogs continue to show an increase in number caught per trapping and in percentage of the anuran population. This was the first year that Green Frogs (34% of the frog population) surpassed Wood Frogs (32%). The lower overall percentage of Wood Frogs (from 53% of anurans to 32%) is due both to the increase in the number of Green Frogs caught, and a decrease in the number of Wood Frogs caught per trapping. American Toads held relatively steady at 18% of the frog population, despite a decrease in number caught per trapping. Spring Peepers made up 14% of the anuran catch, up from last year's 4%, but still down from their high of 30% of the frog population in 1994. Pickerel Frogs, which made up 4% of the anuran catch last year, only made up 1% this year (1 individual).

As a whole, the composition of salamander species at the fences has not changed much from last year. The percentage of Eastern Red-backed Salamanders showed a slight increase from 41% to 48% of the salamander population, reversing its dramatic drop of last year. This increase drove the decline of percentages of Spotted Salamanders (22%) and Eastern Newts (18%), both of which showed an increase in numbers caught per trapping. Dusky Salamanders showed a slight increase in percentage of the salamander population from 3% to 6%, while Northern Two-lined Salamanders decreased very slightly from 6% to 5%. The fences are not in appropriate habitat to accurately monitor the populations of these latter two species, so it is probable that these slight changes do not reflect changes in the population size.

Young of the year and abnormalities

The number of young of the year for 2000 was higher than in the previous four years, and the number of abnormalities reported was lower (Table 1). There were a large number of anuran young of the year (47%), close to the peak of 51% in 1995. Much of this percentage was due to the large numbers of young Green Frogs (79% of all Green Frogs caught). The percentage of young of the year in the salamander population was similarly high (16%), approaching its peak in 1995 and 1996 of 18%. The number of abnormalities is lower than last year's, with only two abnormal amphibians caught out of 287 (<1%). Last year, three were caught, and in 1998, 5 were caught. Similar to last year's abnormalities, the two abnormalities this year occurred in adults, not in the young of the year. So, this year's young had an abnormality rate of 0%. This year, the two species represented were Dusky Salamander and Spring Peeper. The Spring Peeper was among the abnormalities of last year, but Dusky Salamander was not. Both amphibians were missing all of the toes on the left hind leg. This type of abnormality might well have been the result of a traumatic injury as opposed to a developmental abnormality. This number of abnormalities is within the expected range.

Trends

Linear regressions most closely fit most of the data plots, so they were used to show potential trends in the abundance indices for all species caught from 1993-2000 (Figures 1-5). The data gathered suggest that three of the seven species abundant enough to monitor show an average increase over this eight year period: Green Frog, American Toad, and Eastern Red-backed Salamander. In 2000 the number of Green Frogs continued to increase, quadrupling the number caught in 1998. This species is showing the most dramatic and consistent trend of any of the species monitored. All of the records are coming from fences at 1200 feet elevation: the majority of these records from the fence near the Research Center (60%), and the rest from the fence near Pleasant Valley Road. Despite this dramatic increase in Green Frog numbers over the past years, the phenomenon is a local one. At the three fences in the Lye Brook Wilderness Region in southern Vermont, Green Frogs appear to be holding relatively steady, with no obvious increase over the 6 years of monitoring there. The number of American Toads caught in 2000 decreased for the second year in a row, after increasing steadily until 1998 when they peaked at 3.6 caught per trapping. Despite this decline, it was not enough to flip the upward trend. Similar to the trend observed in Green Frogs, this appears to be a local phenomenon. American Toads in the Lye Brook Wilderness Region have been on a steady decline since 1996, not demonstrating the peak in 1998 that was shown at Mt. Mansfield. The number of Eastern Red-backed Salamanders increased from last year, continuing a slight upward trend. There is a very large amount of fluctuation in the Red-backed Salamander catch from year-to-year, which was unexpected considering that Red-backed Salamanders have a relatively small clutch size.

The other species caught at the fences show either no trend or a slight downward trend. The number of Wood Frogs showed a sharp decline in 2000 (3.1 per trapping), to their lowest showing since 1994 (1.7 per trapping). They show no visible trend. Spring Peepers were the only species showing a downward trend last year, and although numbers have increased to the highest showing since 1995, this species still shows a slight downward trend. We catch so few Pickerel Frogs that it is difficult to observe any long-term trend in this species. Eastern Newts and Spotted Salamanders appear to be relatively stable (both at approximately 1.4 per trapping), with little variation from year-to-year. Newts, which were caught in relatively low numbers last year, appear to have rebounded this year. Despite the fact that the fences are not placed in appropriate locations to catch large enough numbers to accurately monitor Northern Two-lined Salamander populations, the numbers have been increasing over the past two years, with the second highest number (0.4) caught in 2000.

Summary

This year at the fences, five of the seven amphibian species that can be reliably monitored had a better year than last year (excluding American Toad and Wood Frog), and three of the seven appear to be increasing in population over the long term. The Green Frog population has continued its dramatic growth, while the increase of the American Toad's population is apparently at an end after two successive years of declining numbers. The downward trend for Spring Peepers is continuing, despite this year's increase in number caught per trapping. The number of abnormalities continues to decrease from its high in 1998. It will be interesting to see if the number of American Toads continues to decline next year, if the Green Frog population continues its dramatic increase, if Spring Peepers continue their slight downward trend, and if any of these phenomena are widespread enough to include other monitoring areas such as the Lye Brook Wilderness.

Acknowledgments

Long-term monitoring at this site has been supported by the Lintilhac Foundation and the Vermont Department of Forests, Parks, and Recreation through the Vermont Monitoring Cooperative (VMC). Field personnel for 2000 were Warren Ellison and Janet Ely, under the direction of Julie Longstreth. Graphs accompanying this report were prepared by Katherine Wright.

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 2000. Traps were opened whenever conditions were appropriate for amphibian movement from April through October excluding August. Three successful trappings per month (± 10 days) were the goal. If there were not three successful trappings per month, two trappings per month were used. Data from 16 of 23 trap-efforts were used: April 5, May 2 and 6; May 10 and 23; June 9 and 22; July 10, 17, and 27; September 12, 13, and 24; and October 6, 19, and November 10. Trapping on April 5 and May 2 was possible at the lower two drift-fences only.

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]
Salamanders										
E. Red-backed Salama	*Plethodon cinereus*	56	2	4%	Oct. 19	94	3.5	48%	21%	0 / 58
Spotted Salamander	*Ambystoma maculatum*	26	12	46%	Sept. 13	177	1.6	22%	10%	0 / 30
Eastern Newt	*Notophthalmus viridescer*	21	5	24%	Sept. 12	83	1.3	18%	8%	0 / 22
Dusky Salamander	*Desmognathus fuscus*	7	0	0%	NA	89	0.4	6%	3%	1 / 8
N. Two-lined Salaman	*Eurycea bislineata*	6	0	0%	NA	90	0.4	5%	2%	0 / 6
Spring Salamander [5]	*Gyrinophilus porphyriticus*	NA	NA	NA	NA	115	NA	NA	NA	0 / 1
Group totals		116	19	16%	NA	NA	7.3	100%	43%	1 / 125
Frogs and Toads										
Green Frog	*Rana clamitans*	53	42	79%	July 10	84	3.3	34%	19%	0 / 54
Wood Frog	*Rana sylvatica*	50	14	28%	July 17	58	3.1	32%	18%	0 / 51
American Toad	*Bufo americanus*	28	4	14%	June 9	78	1.8	18%	10%	0 / 29
Spring Peeper	*Pseudacris crucifer*	22	12	55%	Sept. 12	33	1.4	14%	8%	1 / 25
Gray Treefrog	*Hyla versicolor*	2	1	50%	Sept. 24	54	0.1	1%	1%	0 / 2
Pickerel Frog	*Rana palustris*	1	1	100%	Sept. 13	NA	0.1	1%	<1%	0 / 1
Group totals		156	74	47%	NA	NA	9.8	100%	57%	1 / 162
Amphibian totals		272	93	34%	NA	NA	17.0	NA	100%	2 / 287

[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), B. americanus (23 mm), H. versicolor (26 mm), P. crucifer (20 mm), R. clamitans (44 mm), R. palustris (34 mm), and R. sylvatica (27 mm). 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]Numbers per trapping are rounded to the nearest 0.1. All other figures are rounded to the nearest whole number.

[4]These may contain old deformities (traumatic) as well as malformities (developmental). Salamanders missing all or portions of their tails are not included. The total number checked may contain specimens that were caught more than once.

Table 2. A comparison of drift-fence data from the 1993 through 2000 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.

Species name	# per trapping[1]								% of total catch							
	93	94	95	96	97	98	99	00	93	94	95	96	97	98	99	00
Caudates (Salamanders)																
Spotted Salamander	1.7	1.0	1.4	2.0	1.4	1.2	1.2	1.6	12%	10%	9%	12%	8%	6%	7%	10%
Dusky Salamander	0.3	0.3	0.3	0.0	0.0	0.6	0.1	0.4	2%	3%	2%	0%	0%	3%	1%	3%
N. Two-lined Salamander	0.5	0.1	0.2	0.1	0.2	0.2	0.2	0.4	4%	1%	1%	1%	1%	1%	1%	2%
Spring Salamander	< 0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	< 1%	0%	0%	< 1%	0%	0%	0%	0%
Eastern Newt	1.3	1.2	1.7	1.4	1.8	1.3	0.8	1.3	10%	12%	11%	8%	10%	7%	5%	8%
E. Red-backed Salamander	1.2	4.2	1.3	2.5	3.3	5.4	1.6	3.5	9%	40%	9%	14%	18%	29%	10%	21%
Group totals	5.1	6.8	4.9	6.1	6.8	8.6	3.9	7.3	38%	66%	32%	36%	37%	46%	24%	43%
Anurans (Frogs and Toads)																
American Toad	0.7	0.6	1.5	2.2	2.5	3.6	2.1	1.8	5%	5%	10%	13%	14%	19%	13%	10%
Gray Treefrog	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0%	0%	0%	0%	0%	< 1%	0	1%
Spring Peeper	1.7	1.1	2.2	0.9	0.3	1.1	0.5	1.4	13%	10%	14%	5%	2%	6%	3%	8%
Green Frog	< 0.1	0.2	0.9	0.6	1.3	0.8	2.6	3.3	< 1%	2%	6%	3%	7%	4%	16%	19%
Pickerel Frog	0.1	0.0	1.1	0.3	0.3	0.0	0.5	0.1	1%	0%	7%	2%	1%	0%	30%	<1%
Wood Frog	5.6	1.7	4.4	6.8	7.0	4.7	6.5	3.1	42%	16%	29%	40%	39%	25%	41%	18%
Group totals	8.2	3.6	10.1	10.8	11.3	10.1	12.2	9.8	62%	33%	66%	64%	63%	54%	76%	57%
Amphibian totals	13.4	10.4	15.0	16.8	18.1	18.7	16.1	17.0	100%	100%	100%	100%	100%	100%	100%	100%

Numbers per trapping are rounded to the nearest 0.1. All other figures are rounded to the nearest whole number. 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, and 16 in 2000. Trappings counted were on those nights when at least 2 of the three traps were opened under appropriate weather conditions for amphibian movement.

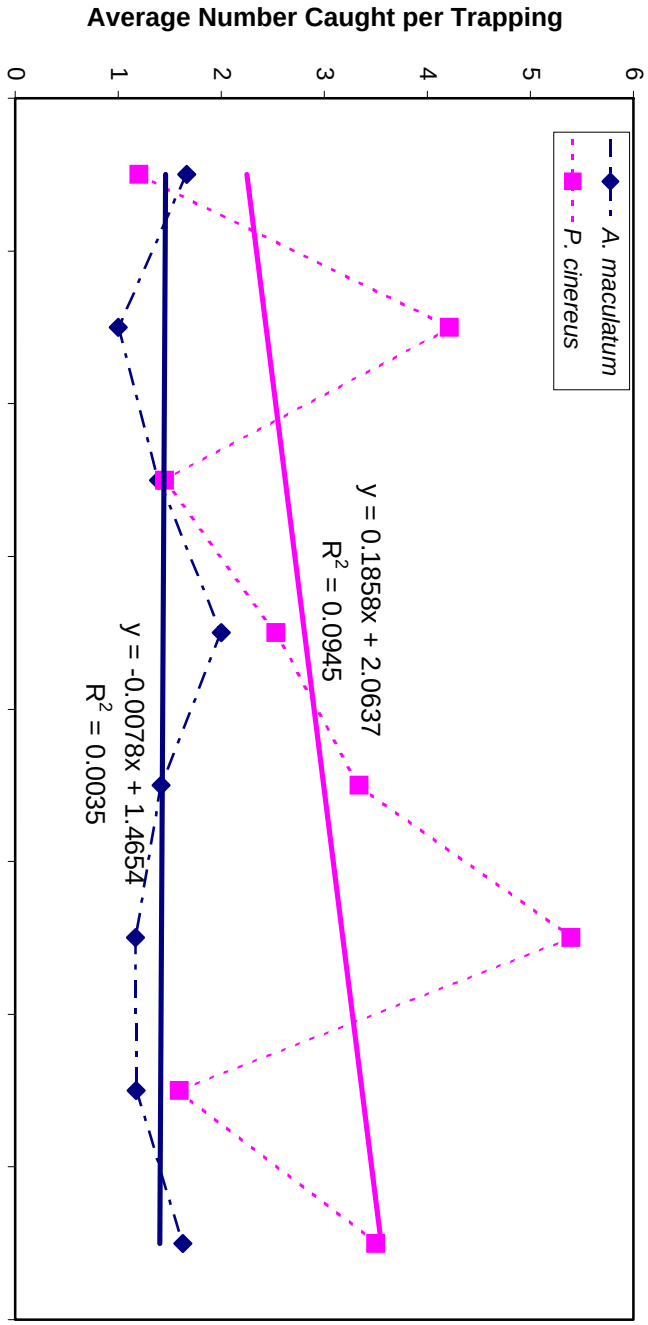

Figure 1. Spotted *(Ambystoma maculatum)* and Eastern Red-backed *(Plethodon cinereus)* Salamander population indices from Mt. Mansfield, Underhill, Vermont, 1993-2000.

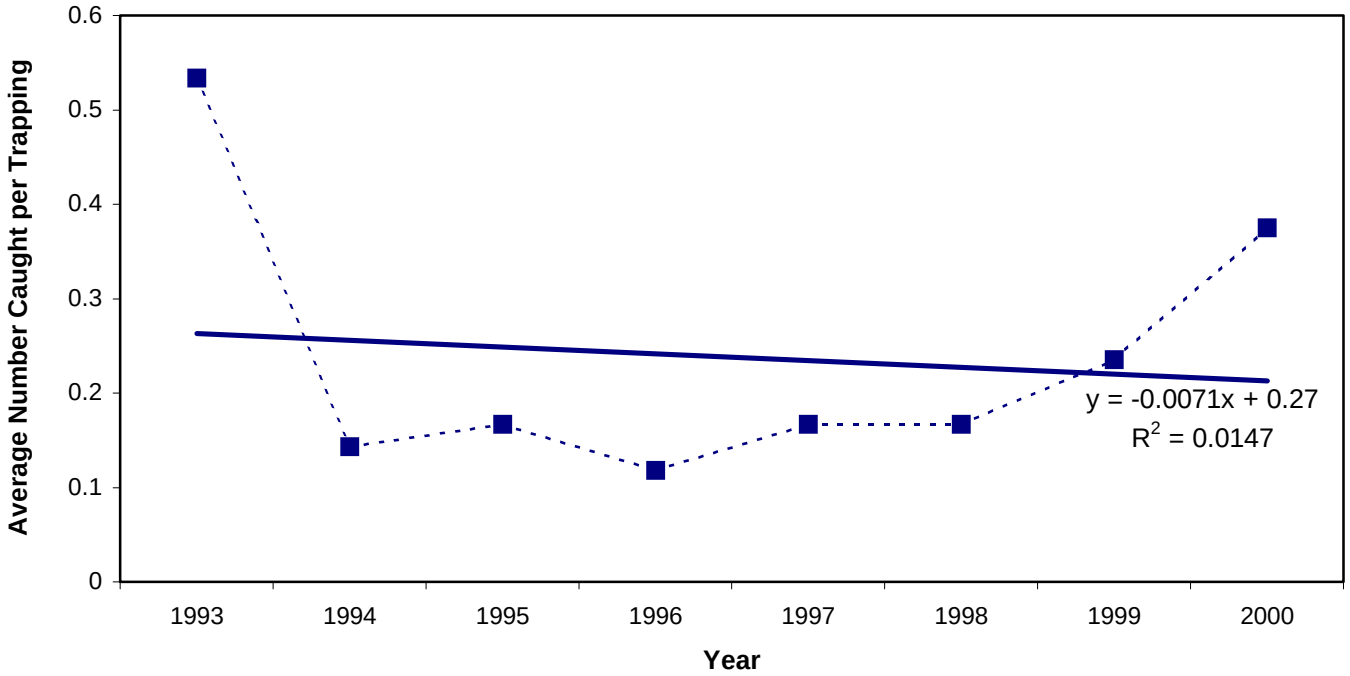

Figure 2. Northern Two-lined Salamander *(Eurycea bislineata)* population index from Mt. Mansfield, Underhill, Vermont, 1993-2000.

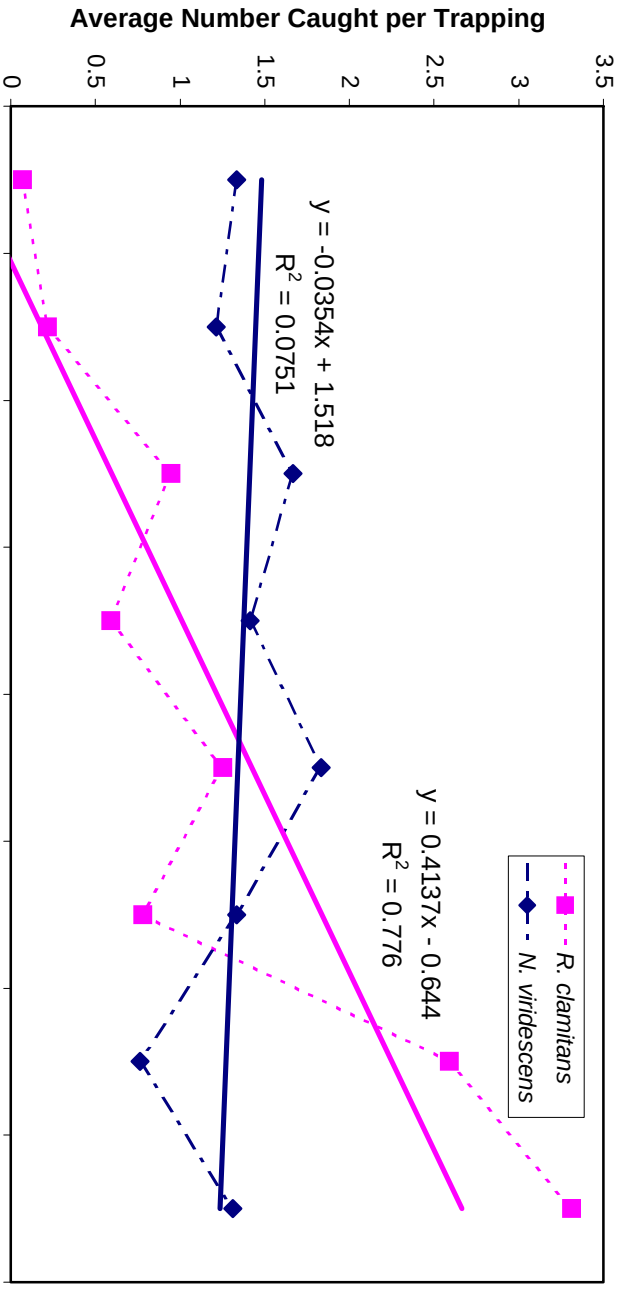

Figure 3. Eastern Newt *(Notophthalmus viridescens)* and Green Frog *(Rana clamitans)* population indices from Mt. Mansfield, Underhill, Vermont, 1993-2000.

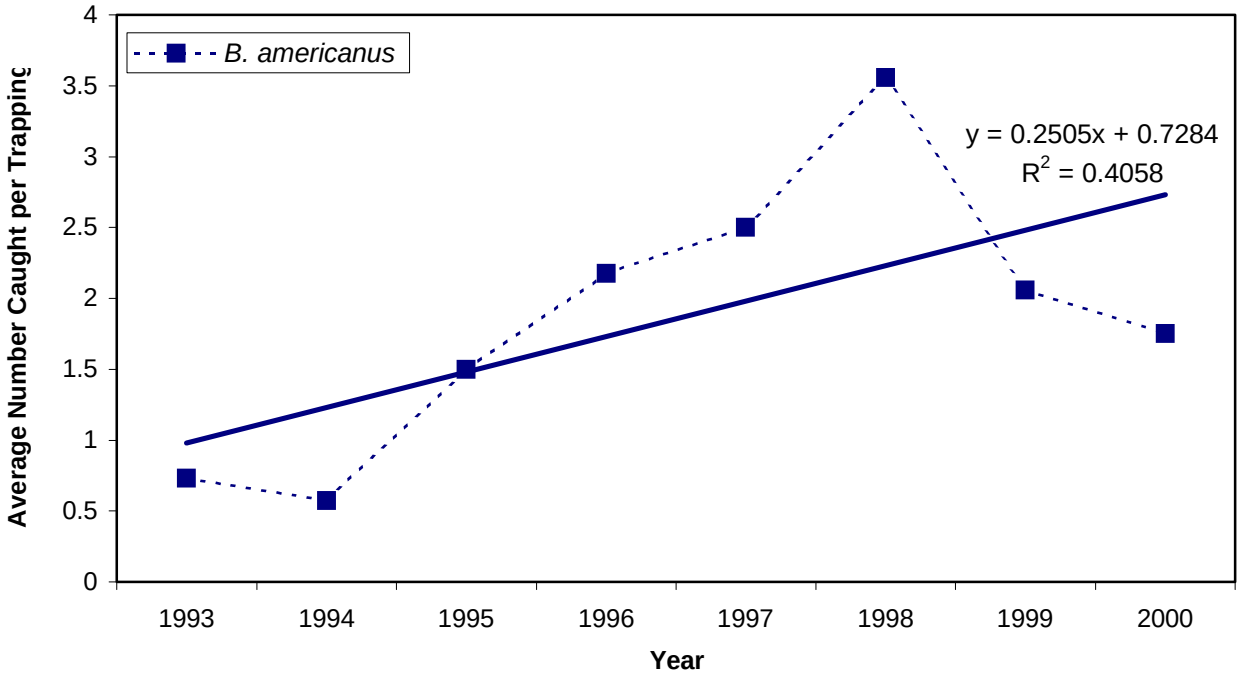

Figure 4. American Toad *(Bufo americanus)* population index from Mt. Mansfield, Underhill, Vermont, 1993-2000.

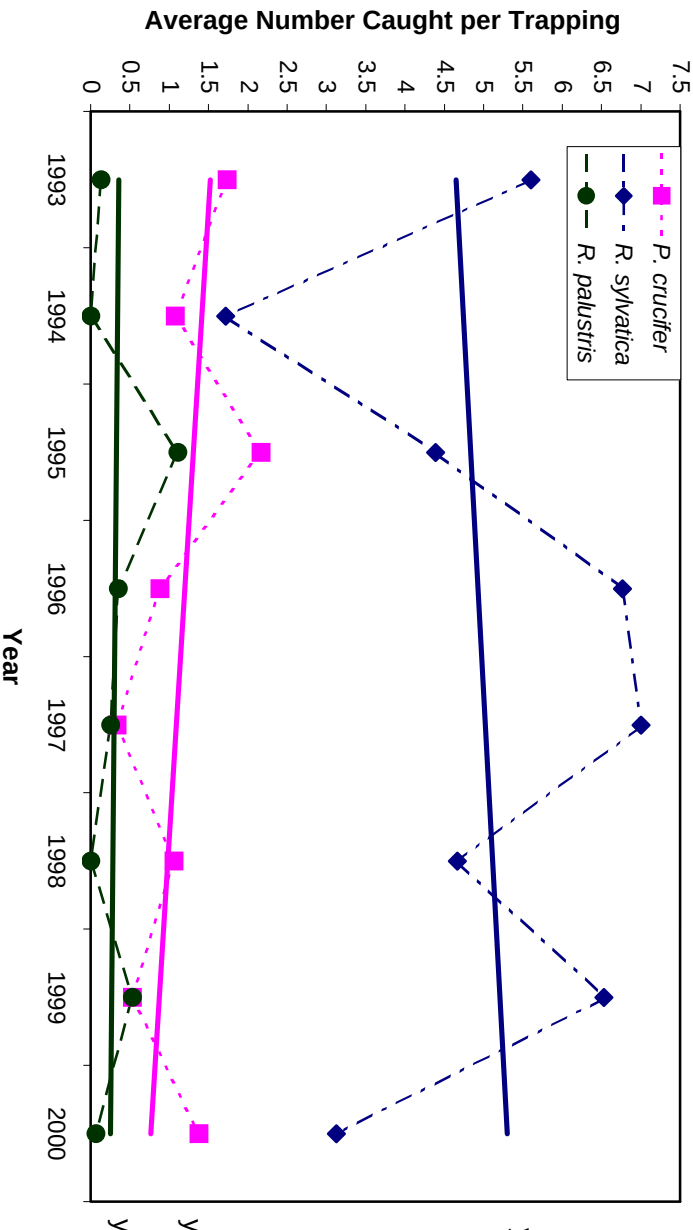

Figure 5. Wood Frog *(Rana sylvatica),* Spring Peeper *(Pseudacris crucifer),* & Pickerel Frog *(Rana palustris)* indices from Mt. Mansfield, Underhill, Vermont, 1993-2000.