Amphibian Monitoring on Mt. Mansfield, Underhill, Vermont

1993-2001

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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. Nine 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 for 2001

Every year, mice, shrews, and voles die in the pitfall traps. Although our data show no declines in small mammal numbers, we would like to minimize these non-target mortalities. Therefore, this year we placed dowels into the pitfall traps to hopefully allow the escape of small mammals, without allowing amphibians to escape. The data suggest that the dowels did not allow the escape of amphibians. Unfortunately, it also appears that the dowels did not allow small mammals to escape, as the data do not show a decline in small mammal mortality. Although not a change, the weather this year was particularly dry, which limited the number of trappings (14 successful of 19 total); the Mt. Mansfield summit (between April and October) received 20% (8.73 inches) less precipitation than the average over those months (43.59 inches, 1955-2000). This could potentially affect data collected.

Trends at the drift-fences

Power

This year, in addition to using linear regressions to show potential trends in the abundance indices, I used the Monitor.exe freeware program to estimate the reliability of the apparent trends. These statistics are shown in Table 1. The likelihood that an apparent trend reflects a true trend in population numbers is referred to as power. Statistically it is defined as the likelihood of correctly rejecting the null hypothesis (no trend). My goal is to achieve a power of 90% or greater. The powers of these data sets are dependent upon a number of variables: the length of the series of data-gathering units (at this point 9 years), the number of times each year data are gathered (3, see description below), the number of locations from which data are gathered (in this case one, because although three fences are used, the data are combined), the variability of the data collected (differs for each species, see below), the starting value of the abundance indices (differs for each species), how small a trend I hope to be able to detect (5% annually), and what statistical level of significance is acceptable: alpha = 0.10 (10% chance of incorrectly rejecting the null hypothesis). The variability (standard deviation) of the data collected for each species is an estimate of how much the index varies, not how much a species varies from year-to-year. Therefore, it was not reasonable to calculate standard deviation across years. It was also not

reasonable to calculate across months, due to seasonal differences in amphibian movement. Consequently, standard deviation was calculated using numbers from two successful trappings per month in 1998 (which had the maximum of 18 successful trappings per year). Different combinations of two trappings per month gave 3 different indices, from which standard deviation was calculated. Therefore, the number of counts per plot per survey (number of times each year data were gathered) was three, despite the fact that data is actually gathered between 12 and 18 times each year. It is assumed that the standard deviation value I used is a very conservative estimate (higher than the actual SD), since it is based on only two trappings per month instead of three, which is what the actual index is based on. In Table 1, trends that meet the 90% power criteria are bold faced in the column at the far right. The power figures shown were generated using the Monitor.exe freeware program written by James P. Gibbs and available on the National Biological Survey's Inventory and Monitoring website (www. mp1-pwrc.usgs.gov/powcase/). Also available through this site is a more extended discussion of power and the rationale for the power and alpha values used here.

Standard deviation and coefficient of variation

In Table 1, there are two sets of standard deviations, means, and coefficients of variation. The first (labeled 1998) were the values used in the calculation of power (as described above), and were calculated using the three different indices. The second were taken from all 9 years of monitoring data, and therefore were calculated using the individual years' values. Standard deviation (SD) values ranged from a low of 0.29 for Eastern Newts to a high of 1.77 for Wood Frogs. However, some of this difference is due to differences in the mean number caught. Therefore, it is useful to use a statistic that takes the mean number caught into consideration. The coefficient of variation (CV) does this. It is defined as the standard deviation divided by the mean. The lowest CVs (and therefore the species that fluctuate the least from year-to-year) are the Spotted Salamander (0.21), Eastern Newt (0.21), and Wood Frog (0.35). Other species that are not included in the table (Dusky, Northern Two-lined, and Spring Salamanders, Gray Treefrog, and Pickerel Frog) would more than likely show high CVs, because they are caught in such low numbers, thereby making them hard to monitor with any accuracy at the fences (see the 1998 VMC report).

Power to show a 5% decline

As shown in Tables 1 and 2, if a 5% decline exists, we have the ability to detect it for 5 of 7 species. Wood Frogs show the best power (1.00), followed by American Toads and Green Frogs (if you eliminate the first two years of Green Frog data). Spotted Salamanders show the worst power (58%), followed by Spring Peepers (85%). This is primarily due to a large standard deviation in relation to the starting value (a high SD/starting value ratio).

Upward trends

The data gathered suggest that three of the seven species abundant enough to monitor show an average increase over this nine year period, with statistical power to support the trend: Green Frog, American Toad, and Wood Frog. In 2001 the number of Green Frogs dropped to 1.9 per trapping (Tables 3 & 4), thereby halting their dramatic increase observed from 1993 to 2000. Despite the decline in number per trapping this year, the overall trend is still upward (Figure 2). In Table 1, it appears that Green Frogs have increased dramatically (498%) annually, but that the power is not high enough to back up this trend. This is disputable for two reasons: (1) there were exceptionally low numbers of Green Frogs in 1995 (0.07), (2) the Monitor program does not calculate power for annual changes greater than 10%, so the value of 0.86 is highly conservative. In order to correct for the first anomaly, I eliminated both the 1993 and 1994 values, as they were both very low. Ordinarily, this would decrease the power by decreasing the number of years, but because this increased the starting value, power was usually increased. As shown in Table 2, the annual increase is then at 37.8%, and the power is 100%, which strongly supports the reliability of this trend. American Toads also dropped slightly from last year, but continue an overall upward trend (Figure 3). The dramatic increase that we observed in Toads up through 1998 appears to have stopped, with three years of decreasing numbers since then. Table 1 shows that we have 100% power to see this 22% annual increase in American Toads. Similar to Green Frogs, the first two years of Toad

data yielded low numbers, so in Table 2, these years were eliminated. This was enough to flip the trend to a slightly negative one, with 97% power. However, Toads show an interesting pattern, in that they were on a steady increase from 1994 to 1998, at which point they peaked and then began to fall again. In 1998, this species showed a strong upward trend, and from then on shows a downward trend. Therefore, the annual change values are very dependent on the first and last years of data, and eliminating those years causes the trend to change dramatically. Both the Green Frog and American Toad trends appear to be local phenomena; at the Lye Brook Wilderness Region in southern Vermont, Green Frogs have been holding steady, and American Toads have been declining since 1996. The third species showing an increase, the Wood Frog, has greatly increased from last year (which had the second lowest numbers caught per trapping). This species shows an overall upward trend, although it is not very strong (Figure 4). We have 100% power to detect the 2% increase that we saw. Overall, frogs show a 5.21% increase over the years, and power is quite high (95%). Amphibians overall appear to be increasing as well, at 3.34% per year, with 100% power to detect this change.

The final species that shows an upward trend is the Eastern Red-backed Salamander (Figure 1). However, we do not have the power enough to detect this trend. The annual change is 4.67%, and power to detect it is at 46% (Table 1). Similar to Green Frogs and American Toads, the Red-backed numbers were very low in 1993, so in Table 2, these were eliminated. The annual change dropped to 1.04%, and power dropped to 18%. For this species, we have the power to detect a 5% decline, but because the annual change is so small, power is low and we cannot accurately detect it. Overall, salamanders show a very slight increase (0.39%), but because the increase is so slight, it is nearly impossible to detect it, and power is not greater than 90%.

Downward trends

The species with the strongest downward trend, and the only one with the power to show it, is the Spring Peeper (Figure 4). Peepers have been slowly declining since 1993, and this year we caught none. To see if this could be the result of the dowels we added to the buckets, we looked at the data from the Lye Brook Wilderness in southern Vermont. In Lye Brook, the number of Peepers has been holding steady, and dropped only slightly from last year, suggesting that the dowels do not affect the number of Peepers caught. In addition, these data from Lye Brook suggest that the decline we are seeing at Mt. Mansfield is a local phenomenon. We have 99% power to detect the –9% annual change we have seen over the past 9 years. Spotted Salamanders show very little annual change (-0.06%, Figure 1), which makes the trend nearly impossible to detect. This is one of the few species for which we do not have the power to detect a 5% decline. This is primarily due to the low number of individuals caught in 1998, the year from which we calculated standard deviation. However, we do have the power to detect a 10% decline for this species (90.1% power). We have the power to detect a 5% annual decline in Eastern Newts, but they show such a small annual percent change (–2.31%, Figure 2) that we can't statistically confirm it (power=39%).

Young of the year and abnormalities

The number of young of the year for 2001 was the lowest it has ever been for frogs, the fourth lowest for salamanders, and the third lowest for amphibians. The low numbers for frogs were due to a few factors: a continuing low number of Wood Frog young of the year (14, the same as last year's lowest number), a decline in Green Frog young of the year (21, down from 42 last year), and a decline in Spring Peeper young of the year (0, down from 12 last year). It was primarily this drop in anuran young of the year that affected the overall drop in amphibian young. There were no abnormalities reported this year, for the first time since 1997. The abnormality rate for this year's young, therefore, was 0%.

Summary

In 2001, power was re-evaluated for all species. It appears that three species (American Toad, Green Frog, and Wood Frog) are increasing overall, and that we have the power to accurately report these changes. One species (Spring Peeper) is declining. The other three species that we monitor show either slight increases (Eastern Red-backed Salamander) or decreases (Spotted Salamander and Eastern Newt). Power is not greater than 90% for these species at their rates of annual change. Overall, we have

the power to detect our goal, a 5% annual decline, for 5 of 7 species, and for both salamanders and amphibians. Salamanders show very little change, while both frogs and amphibians appear to be increasing (5% and 3% annually, 95% and 100% power respectively). Although no abnormalities were reported this year, the diminished number of young of the year (especially in frogs) needs to be watched. Similarly, the downward trend in Spring Peepers is troubling. The Green Frog population's dramatic increase stopped this year, and American Toads have continued to decrease slightly from their peak in 1998. It will be interesting to see whether Spring Peepers return next year, whether the Green Frogs' increase has truly ceased, and whether the number of young of the year continues to be below normal.

Acknowledgments

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Table 1. Statistical analyses of the Mt. Mansfield drift-fence data from 1993 through 2001. Percentages in bold type are generated with a power greater than 90%. Not included in the table are Dusky Salamander, Northern Two-lined Salamander, Spring Salamander, Gray Treefrog, and Pickerel Frog, as they are not caught in large enough numbers to accurately monitor their populations.

Common name	# per trapping [1]									Statistics and trends [2]									
	93	94	95	96	97	98	99	00	01	SD 1998 [3]	Mean 1998 [3]	CV 1998 [3]	SD [4]	Mean [4]	CV [4]	Power 5% decline [5]	Power (x%) [6]	Annual Change	Annual % Change
Caudates (Salamanders)																			
Spotted Salamander	1.7	1.0	1.4	2.0	1.4	1.2	1.2	1.6	1.5	0.51	1.17	0.44	0.30	1.44	0.21	0.58	0.10 (0%)	-0.001	-0.06%
Eastern Newt	1.3	1.2	1.7	1.4	1.8	1.3	0.8	1.3	1.3	0.22	1.33	0.17	0.29	1.34	0.21	0.93	0.39 (-2%)	-0.030	-2.31%
E. Red-backed Salamander	1.2	4.2	1.3	2.5	3.3	5.4	1.6	3.5	1.8	0.63	5.39	0.12	1.45	2.76	0.53	0.27	0.46 (5%)	0.056	4.67%
Group totals	5.1	6.8	4.9	6.1	6.8	8.6	3.9	7.3	5.0	0.71	8.61	0.08	1.46	6.06	0.24	0.99	0.08 (0%)	0.020	0.39%
Anurans (Frogs and Toads)																			
American Toad	0.7	0.6	1.5	2.2	2.5	3.6	2.1	1.8	1.6	0.10	3.56	0.03	0.92	1.84	0.50	0.99	1.00 (10%)	0.156	**22.29%**
Spring Peeper	1.7	1.1	2.2	0.9	0.3	1.1	0.5	1.4	0.0	0.35	1.05	0.33	0.69	1.02	0.68	0.85	0.99 (-9%)	-0.152	**-8.94%**
Green Frog	< 0.1	0.2	0.9	0.6	1.3	0.8	2.6	3.3	1.9	0.05	0.78	0.06	1.07	1.45	0.74	0.02	0.86 (10%)	0.332	498.00%
Wood Frog	5.6	1.7	4.4	6.8	7.0	4.7	6.5	3.1	5.4	0.30	4.67	0.06	1.77	5.02	0.35	1.00	1.00 (2%)	0.096	**1.71%**
Group totals	8.2	3.6	10.1	10.8	11.3	10.1	12.2	9.8	9.1	2.02	10.11	0.20	2.49	9.47	0.26	0.71	0.95 (5%)	0.427	**5.21%**
Amphibian totals	13.4	10.4	15.0	16.8	18.1	18.7	16.1	17.0	14.1	0.55	18.72	0.03	2.60	15.51	0.17	1.00	1.00 (3%)	0.447	**3.34%**

[1]Numbers per trapping are rounded to the nearest 0.1. 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, and 14 in 2001. Trappings counted were on those nights when at least 2 of the three traps were opened under appropriate weather conditions for amphibian movement.

[2]Trends are taken from a linear regression (see Figures 1-4). Annual change is shown in individuals per trapping and is the slope of the regression line. Percentage of change is based on the annual change's percent of the starting population.

[3]This standard deviation (SD), mean, and coefficient of variation (CV) are taken from the 1998 data. The measures of variation are between three indices, each of which used 2 dates from every month. The mean is an average of the three indices. This standard deviation value was used in the calculation of power using the Monitor.exe freeware program.

[4]This standard deviation (SD), mean, and coefficient of variation (CV) are taken from all 9 years of monitoring data. The measures of variation are between the different years, and the mean is the average of the indices from all 9 years. These values were not used in the calculation of power, but can be used to show how much each species varies from year-to-year.

[5]This is the power to detect a 5% annual population decline after 9 years of monitoring, as determined using the Monitor.exe freeware program using linear regressions (with an alpha of 0.10).

[6]This is the power to detect the percent change indicated in the parentheses after 9 years of monitoring. This percent change is equivalent to the value in the column "Annual % Change" (rounded to the nearest whole number).

Table 3. Monitoring results from the two drift-fences at 1,200 ft. and one at 2,200 ft. on Mt. Mansfield, Underhill, Vermont during 2001. 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 14 of 19 trap efforts were used: May 5, 13, and 24; May 28, June 2 and 12; July 2 and 6; September 1, 19, and 21; September 25, October 22, and November 3. Abnormality, maximum size, and first metamorph data were taken from all 19 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]
Salamanders										
E. Red-backed Salamander	*Plethodon cinereus*	25	0	0%	NA	90	1.8	36%	13%	0 / 27
Spotted Salamander	*Ambystoma maculatum*	21	6	29%	Sept. 1	155	1.5	30%	11%	0 / 21
Eastern Newt	*Notophthalmus viridescens*	18	6	33%	Sept. 1	86	1.3	26%	9%	0 / 19
Dusky Salamander	*Desmognathus fuscus*	4	0	0%	NA	100	0.3	5%	2%	0 / 4
N. Two-lined Salamander	*Eurycea bislineata*	2	0	0%	NA	72	0.1	3%	1%	0 / 2
Group totals		70	12	17%	NA	NA	5.0	100%	35%	0 / 73
Frogs and Toads										
Wood Frog	*Rana sylvatica*	76	14	18%	July 2	58	5.4	59%	38%	0 / 77
Green Frog	*Rana clamitans*	26	21	81%	Sept. 1	60	1.9	20%	13%	0 / 28
American Toad	*Bufo americanus*	22	6	27%	June 2	76	1.6	17%	11%	0 / 22
Pickerel Frog	*Rana palustris*	4	4	100%	Sept. 1	33	0.3	3%	2%	0 / 4
Group totals		128	45	35%	NA	NA	9.1	100%	65%	0 / 131
Amphibian totals		198	57	29%	NA	NA	14.1	NA	100%	0 / 204

[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. As a result of this, group totals may not be equivalent to the sum of the individual species' values.

[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. Statistical analyses of the Mt. Mansfield drift-fence data from 1993 through 2001, eliminating starting values (in 1993 or 1994) that were particularly low. Percentages in bold type are generated with a power greater than 90%. Not included in the table are Dusky Salamander, Northern Two-lined Salamander, Spring Salamander, Gray Treefrog, and Pickerel Frog, as they are not caught in large enough numbers to accurately monitor their populations.

Common name	# per trapping [1]									Statistics and trends [2]				
	93	94	95	96	97	98	99	00	01	# years included [3]	Power 5% decline [4]	Power (x%) [5]	Annual Change	Annual % Change
Caudates (Salamanders)														
Spotted Salamander	1.7	1.0	1.4	2.0	1.4	1.2	1.2	1.6	1.5	9	0.58	0.10 (0%)	-0.001	-0.06%
Eastern Newt	1.3	1.2	1.7	1.4	1.8	1.3	0.8	1.3	1.3	9	0.93	0.39 (-2%)	-0.030	-2.31%
E. Red-backed Salamander	1.2	4.2	1.3	2.5	3.3	5.4	1.6	3.5	1.8	8	0.92	0.18 (1%)	0.044	1.04%
Group totals	5.1	6.8	4.9	6.1	6.8	8.6	3.9	7.3	5.0	9	0.99	0.08 (0%)	0.020	0.39%
Anurans (Frogs and Toads)														
American Toad	0.7	0.6	1.5	2.2	2.5	3.6	2.1	1.8	1.6	7	1.00	0.97 (-3%)	-0.039	**-2.57%**
Spring Peeper	1.7	1.1	2.2	0.9	0.3	1.1	0.5	1.4	0.0	9	0.85	0.99 (-9%)	-0.152	**-8.94%**
Green Frog	< 0.1	0.2	0.9	0.6	1.3	0.8	2.6	3.3	1.9	7	1.00	1.00 (10%)	0.340	**37.80%**
Wood Frog	5.6	1.7	4.4	6.8	7.0	4.7	6.5	3.1	5.4	9	1.00	1.00 (2%)	0.096	**1.71%**
Group totals	8.2	3.6	10.1	10.8	11.3	10.1	12.2	9.8	9.1	9	0.71	0.95 (5%)	0.427	**5.21%**
Amphibian totals	13.4	10.4	15.0	16.8	18.1	18.7	16.1	17.0	14.1	9	1.00	1.00 (3%)	0.447	**3.34%**

[1]Numbers per trapping are rounded to the nearest 0.1. 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, and 14 in 2001. Trappings counted were on those nights when at least 2 of the three traps were opened under appropriate weather conditions for amphibian movement.

[2]Trends are taken from a linear regression. Annual change is shown in individuals per trapping and is the slope of the regression line. Percentage of change is based on the annual change's percent of the starting population.

[3]For Eastern Red-backed Salamanders, American Toads, and Green Frogs, the first year or two of trapping caught particularly low numbers per trapping. Therefore, in this chart, the first year(s) was not included in the calculation of power, annual change, or percent change, and the 1994 or 1995 data was used as the starting population. This column indicates how many years were included in the calculations.

[4]This is the power to detect a 5% annual population decline after 7-9 years of monitoring, as determined using the Monitor.exe freeware program using linear regressions (with an alpha of 0.10).

[5]This is the power to detect the percent change indicated in the parentheses after 7-9 years of monitoring. This percent change is equivalent to the value in the column "Annual % Change" (rounded to the nearest whole number).

Table 4. A comparison of drift-fence data from the 1993 through 2001 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]									% of total catch.								
	93	94	95	96	97	98	99	00	01	93	94	95	96	97	98	99	00	01
Caudates (Salamanders)																		
Spotted Salamander	1.7	1.0	1.4	2.0	1.4	1.2	1.2	1.6	1.5	12%	10%	9%	12%	8%	6%	7%	10%	11%
Dusky Salamander	0.3	0.3	0.3	0.0	0.0	0.6	0.1	0.4	0.3	2%	3%	2%	0%	0%	3%	1%	3%	2%
N. Two-lined Salamander	0.5	0.1	0.2	0.1	0.2	0.2	0.2	0.4	0.1	4%	1%	1%	1%	1%	1%	1%	2%	1%
Spring Salamander	< 0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	< 1%	0%	0%	< 1%	0%	0%	0%	0%	0%
Eastern Newt	1.3	1.2	1.7	1.4	1.8	1.3	0.8	1.3	1.3	10%	12%	11%	8%	10%	7%	5%	8%	9%
E. Red-backed Salamander	1.2	4.2	1.3	2.5	3.3	5.4	1.6	3.5	1.8	9%	40%	9%	14%	18%	29%	10%	21%	13%
Group totals	5.1	6.8	4.9	6.1	6.8	8.6	3.9	7.3	5.0	38%	66%	32%	36%	37%	46%	24%	43%	35%
Anurans (Frogs and Toads)																		
American Toad	0.7	0.6	1.5	2.2	2.5	3.6	2.1	1.8	1.6	5%	5%	10%	13%	14%	19%	13%	10%	11%
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%	< 1%	0%	1%	0%
Spring Peeper	1.7	1.1	2.2	0.9	0.3	1.1	0.5	1.4	0.0	13%	10%	14%	5%	2%	6%	3%	8%	0%
Green Frog	< 0.1	0.2	0.9	0.6	1.3	0.8	2.6	3.3	1.9	< 1%	2%	6%	3%	7%	4%	16%	19%	13%
Pickerel Frog	0.1	0.0	1.1	0.3	0.3	0.0	0.5	0.1	0.3	1%	0%	7%	2%	1%	0%	30%	<1%	2%
Wood Frog	5.6	1.7	4.4	6.8	7.0	4.7	6.5	3.1	5.4	42%	16%	29%	40%	39%	25%	41%	18%	38%
Group totals	8.2	3.6	10.1	10.8	11.3	10.1	12.2	9.8	9.1	62%	33%	66%	64%	63%	54%	76%	57%	65%
Amphibian totals	13.4	10.4	15.0	16.8	18.1	18.7	16.1	17.0	14.1	100%	100%	100%	100%	100%	100%	100%	100%	100%

[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, and 14 in 2001. Trappings counted were on those nights when at least 2 of the three traps were opened under appropriate weather conditions for amphibian movement.

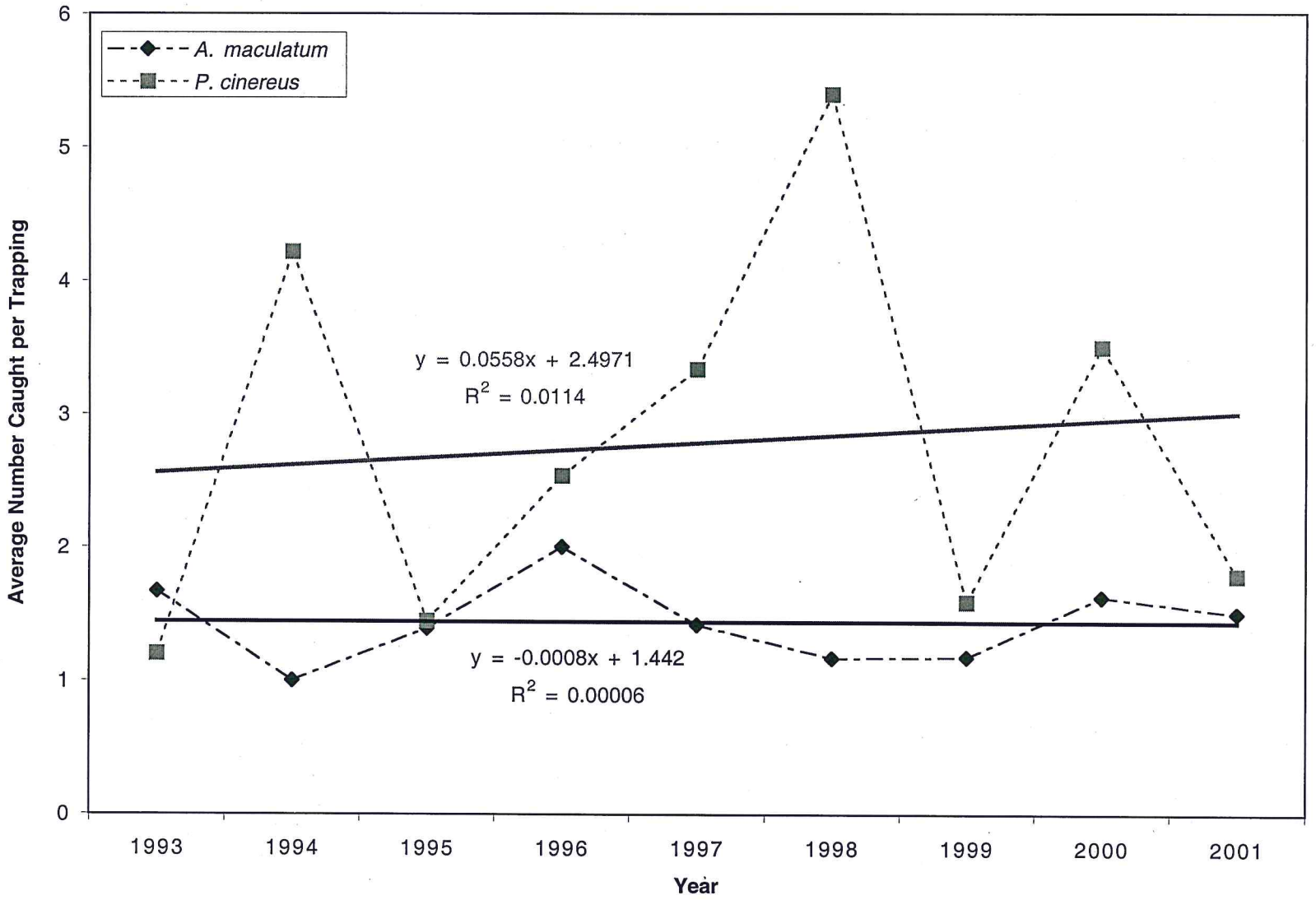

Figure 1. Spotted *(Ambystoma maculatum)* and Eastern Red-backed *(Plethodon cinereus)* Salamander population indices from Mt. Mansfield, Underhill, Vermont, 1993-2001.

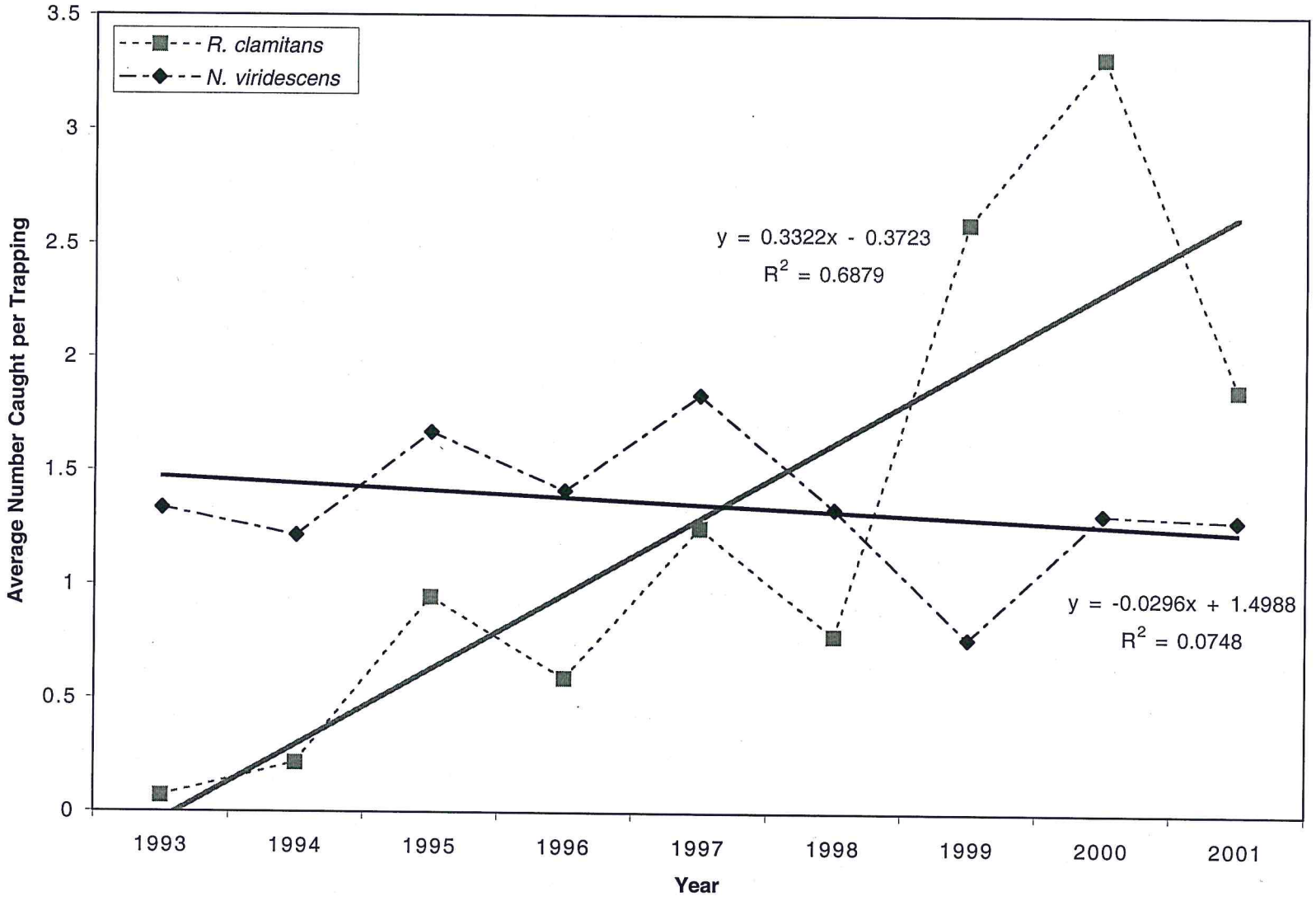

Figure 2. Eastern Newt *(Notophthalmus viridescens)* and Green Frog *(Rana clamitans)* population indices from Mt. Mansfield, Underhill, Vermont, 1993-2001.

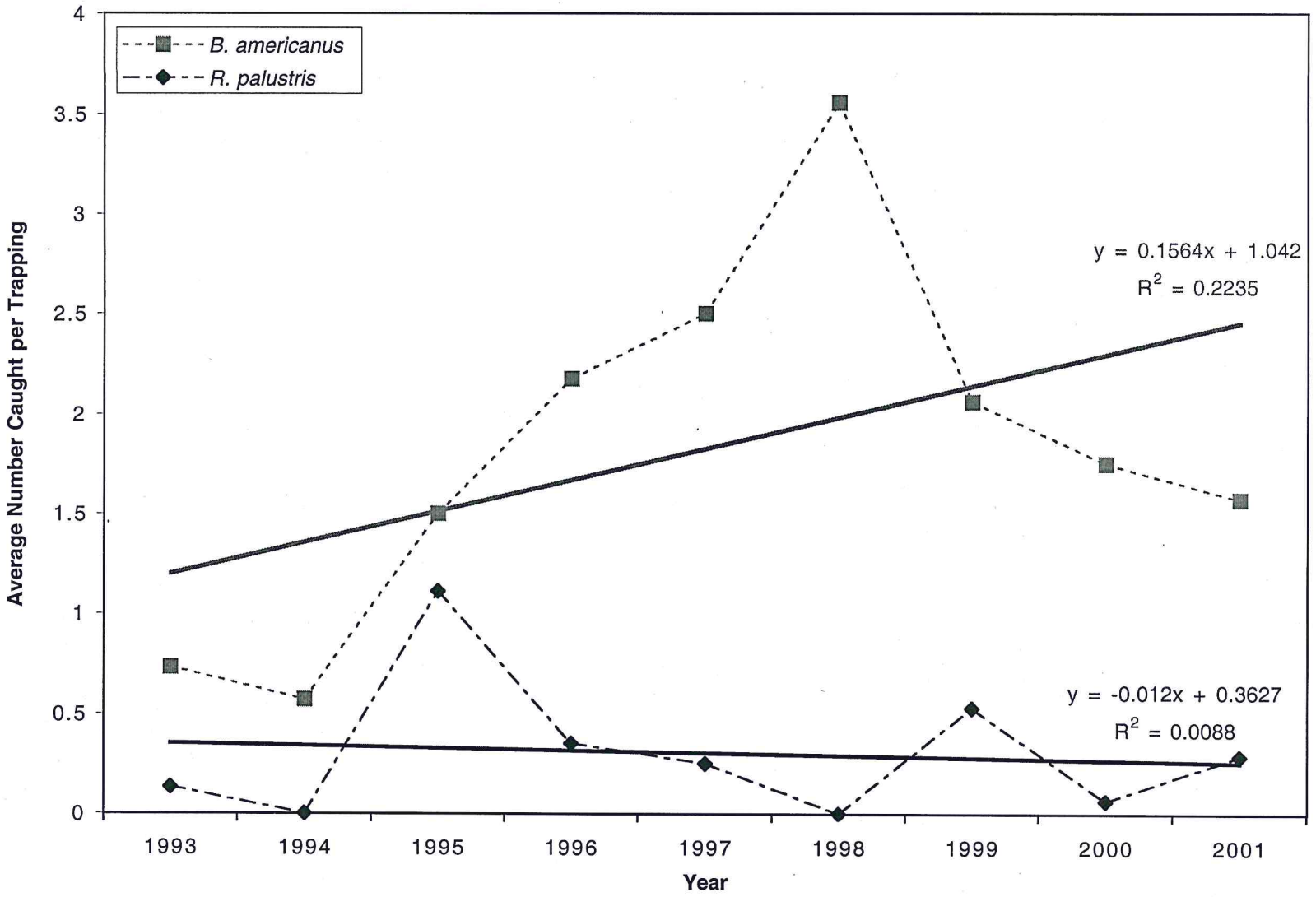

Figure 3. American Toad *(Bufo americanus)* and Pickerel Frog *(Rana palustris)* population indices from Mt. Mansfield, Underhill, Vermont, 1993-2001.

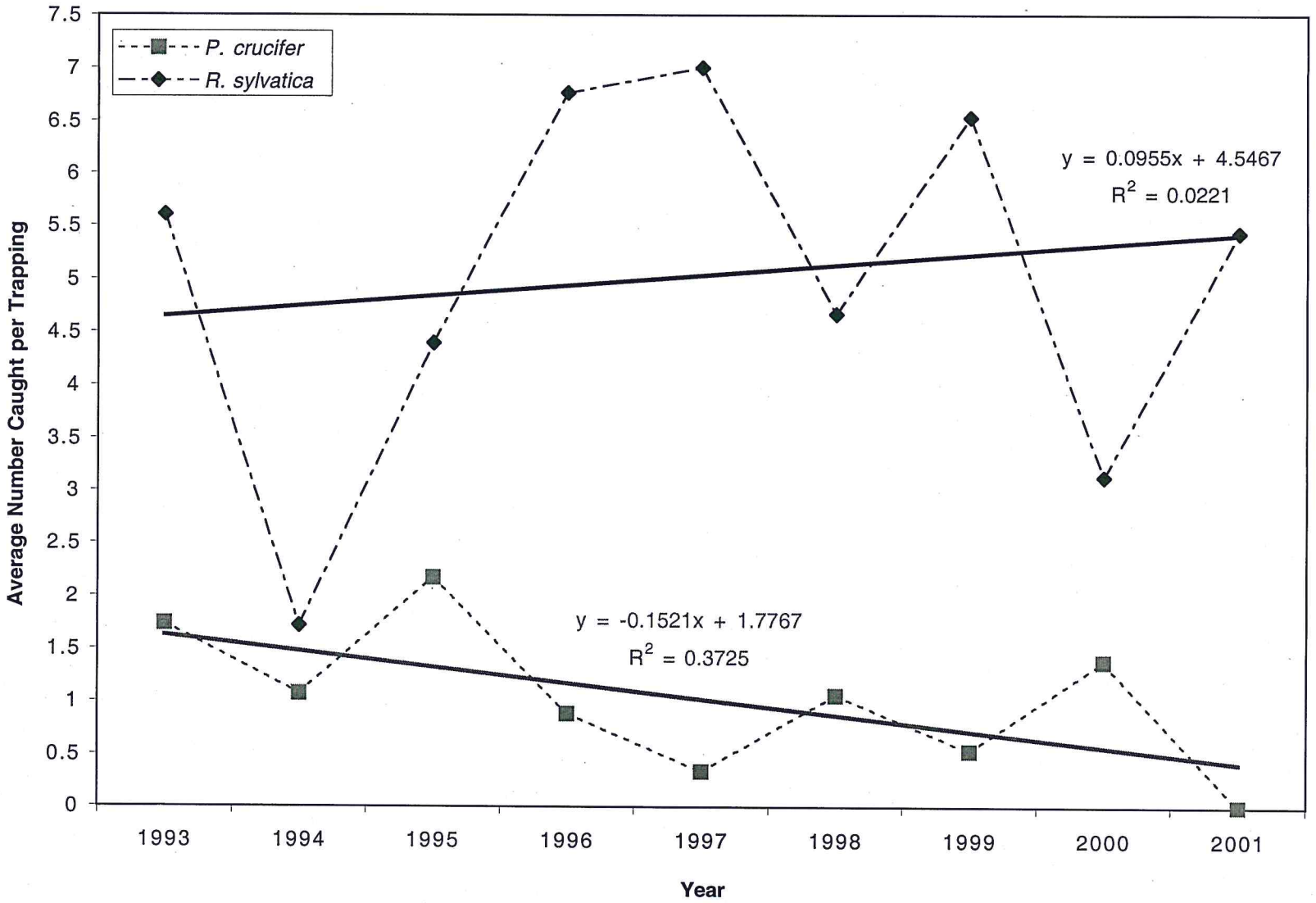

Figure 4. Wood Frog *(Rana sylvatica)* and Spring Peeper *(Pseudacris crucifer)* indices from Mt. Mansfield, Underhill, Vermont, 1993-2001.