

**Amphibian Monitoring in the Lye Brook Wilderness Region of the Green Mountain National Forest  
April - October 1998**

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## Background

An inventory of amphibians in the Lye Brook Region of the Green Mountain National Forest in Bennington County was begun in 1993 and completed in 1995. Monitoring of selected amphibian species began in 1994. 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) compare population changes between this site and other monitoring locations in the Green Mountains, (4) look for correlations between amphibian populations and other data gathered at this site, (5) monitor changes in the number or type of obvious external abnormalities, (6) gather inventory data for the Vermont Herp Atlas, and (7) gather basic natural history information on the species present. Five species of salamander (Eastern newt, Northern two-lined salamander, Redback salamander, Spotted salamander, Spring salamander) and five species of frog (American toad, Green frog, Pickerel frog, Spring peeper, Wood frog) are monitored using drift-fences, egg-mass counts, and stream surveys. Five years of monitoring data have been gathered using egg-mass counts and stream surveys. Any trends suggested at this point will need to be confirmed as the number of years spent monitoring increases. For details on methods and locations see the 1995 VMC annual report.

## Stream surveys and egg-mass counts

The stream surveys showed a decreasing pH until this year when the pH was much higher (5.0 compared with 3.8 in 1997, Table 1). However, the pH meter used to take this reading was malfunctioning at the time of the stream survey, so the field technicians returned three weeks after the survey to re-take the pH. In addition, only one measurement was taken, limiting the reliability of the reading. The numbers of Spring salamanders were up slightly from last year, and Two-lined salamanders held relatively constant. The egg-mass counts showed no clear trends in populations of Wood frogs or Spotted salamanders but numbers for two of the three sites were up compared to 1997 (Table 2). The previously noted decline in pH seems to have stopped in 1998 with all three sites showing a higher pH than in 1997. Again, however, these readings may not be reliable, as this was the same pH meter that was malfunctioning later in the year.

## Upper drift-fences

Four years of monitoring data have been gathered at the upper drift-fences. Indices for each species continue to show considerable annual variability but the relative abundance of each species is still maintained (Tables 3 and 4). The Eastern newt continues to be the most frequently caught salamander, followed in order by the Spotted salamander, Redback salamander and Northern two-lined salamander. Spotted and Redback Salamander populations do not show any clear trends at this time (Figure 1). The fences are not in appropriate habitat to accurately monitor the populations of Northern two-lined salamanders, so it is possible that the apparent decline at the upper fences (Figure 2) is not reflective of population trends. Eastern newts appear to be declining at the upper fences (Figure 3), showing the lowest numbers ever in 1998.

Wood frogs continue to be the most frequently caught frog, followed by Green frog, Spring peeper, and American toad. American toads seem to be declining at the upper two fences, with the number of individuals caught per trapping dropping each year (Figure 4). 1998 showed the lowest number yet (1.1 per trapping), at approximately one-quarter of 1995's average number caught per trapping (4.3). This trend, however, is a local phenomenon; at the lower fence, American toads are holding relatively steady (Figure 5), and at drift-fences on Mt. Mansfield in northern Vermont, American toads show an increase in numbers. The Pickerel frog appeared at the upper fences for the first time in 1998. Wood Frogs have increased over the past three years at the upper fences (Figure 6), but this also appears to be a local phenomenon, as the lower fence shows no such increase (Figure 7).

#### Lower drift-fence

At the lower drift-fence there were very few young of the year caught (8% of the amphibian catch). This number was lower than the young of the year caught last year or the year before (26% and 36% of the amphibian catch, respectively). Redback salamander numbers more than quadrupled (Figure 8) and were again the most abundant species followed by the Eastern newt (Tables 5 and 6). The number of newts has dropped sharply at the lower fence, like at the upper fences (Figure 9). There appears to be a decline in this species at all of the Lye Brook fences. However, this is probably a local phenomenon; at drift-fences on Mt. Mansfield, newts are holding steady.

In 1998 there was a decline (by half to three-quarters) in the numbers of all frog species (Spring Peeper, Pickerel Frog, and Wood Frog) except Green frogs. Green frog numbers increased (Figure 9) but they still remain the least abundant frog at this fence. American toads were the most abundant anuran at the lower fence in 1998, but their numbers were about the same as last year (Figure 5). Spring peepers, the most abundant frog in 1997 (20 individuals), dropped to third place in 1998 (5 individuals). Pickerel frogs at the lower fence appear to be declining, with this year's catch lower than that of all previous years (Figure 5). However, the low numbers of this species caught make this data suggestive at best.

#### Abnormalities

There were no abnormalities observed out of a total of 987 (counting all nights) amphibians caught at the fences in 1998. One of the 157 Redback salamanders caught was an unusual all-red color (erythristic) phase but these are well described in the literature and I do not consider them an abnormality. Abnormalities are more commonly seen in the young of the year, because those individuals with abnormalities are weeded out through natural selection by adulthood. The fact that we caught so few young of the year at the lower fence could partially explain the lack of abnormalities this year. However, it should be kept in mind that low numbers of young are a more significant concern than abnormalities in the long run.

#### Summary

Over the past four years of data collection, we have established a strong baseline for looking at population trends. We have determined the amphibian species present at the fences, and now have a general idea of their relative abundances. Although trends can be suggested after four years, it is too early yet to verify them. Future years of monitoring should clarify these trends. The suggested decline of newts at all three fences needs to be watched, as does the declining pH at both the stream survey and egg-mass count sites, the decreasing numbers of young of the year caught at the lower fence, and the apparent decline of American toads at the upper two fences.

## Acknowledgments

Funding for this monitoring was provided through a cost-share agreement between the Green Mountain National Forest and Middlebury College. Colleen Jones and Maureen Rice were the local field technicians.

Table 1. Results of three 50-meter stream-transects in Branch Pond Brook in the Lye Brook Wilderness Region from 1994-1998. Only adult *Gyrinophilus porphyriticus* (Spring salamander) and *Eurycea bislineata* (Two-lined salamander) are included in the table.

Year	Spring salamander	Two-lined salamander	pH <sup>1</sup>	Water temp. in °C <sup>1</sup>	Max. water depth <sup>2</sup> in cm
<b>1994</b>					
(7/18/94)	10	11	4.9 (N = 3)	17.4 (N = 1)	20
<b>1995</b>					
(7/24/95)	6	1	4.4 (N = 5)	17.4 (N = 3)	26
<b>1996</b>					
(8/6/96)	3	0	4.0 (N = 3)	16.1 (N = 3)	21
<b>1997</b>					
(7/11/97)	7	3	3.8 (N = 2)	15.6 (N = 3)	27
<b>1998</b>					
(7/14/98) <sup>3</sup>	11	5	5.0 (N = 1)	16.3 (N = 3)	26

<sup>1</sup>Temperature and pH were taken two meters downstream from the downstream end of the first transect.

<sup>2</sup>Reference point is the deepest point between the two large rocks which constrict the channel approximately two meters downstream from the beginning of the first transect.

<sup>3</sup>pH measurements were taken on August 5, 1998.

Table 2. Maximum counts of egg masses from monitoring locations in the Lye Brook Wilderness region from 1994 through 1998. At the site near Benson Pond the entire pond is surveyed. At North Alder Dam a four-meter strip around all of the pond except the swampy north end is surveyed. At the Pond Near Drift-fence #2, a four-meter strip around the entire pond is surveyed.

Site	Spotted salamander	Wood frog	Mean pH <sup>2</sup>
<b>Near Benson Pond</b>			
1994 count dates: 4/26, 5/10, 5/25	10	67 <sup>1</sup>	7.3 (N = 1)
1995 count dates: 4/24 <sup>2</sup> , 5/12	3	19	6.8 (N = 1)
1996 count dates: 4/24, 4/27, 5/7, 5/8, 5/15	73	2	6.9 (N = 3)
1997 count dates <sup>3</sup> : 4/27, 5/5, 5/12	16	97	6.1 (N = 3)
1998 count dates <sup>5,6</sup> : 4/21, 4/28, 5/5	33	96	7.5 (N = 1)
<b>North Alder Dam</b>			
1994 count dates: 5/11, 5/25, 6/8	97	225	5.0 (N = 2)
1995 count dates: 4/24 <sup>2</sup> , 5/12, 6/9	292	3	5.1 (N = 2)
1996 count dates: 5/8, 5/15, 5/25	176	3	5.0 (N = 3)
1997 count dates <sup>4</sup> : 5/20, 5/27, 6/3	0	44	4.2 (N = 3)
1998 count dates <sup>6</sup> : 5/4, 5/12, 5/19	9	256	4.8 (N = 1)
<b>Pond Near Drift-fence #2</b>			
1994 count dates: 5/11, 5/25, 6/9	6	3	5.7 (N = 2)
1995 count dates: 4/24 <sup>2</sup> , 5/12, 6/9	70	152	5.6 (N = 2)
1996 count dates: 5/8, 5/15, 5/25	78	62	5.2 (N = 3)
1997 count dates: 5/20, 5/27, 6/3	55	77	5.0 (N = 3)
1998 count dates <sup>6</sup> : 5/4, 5/12, 5/19	13	30	5.5 (N = 1)

<sup>1</sup>Hatched by May 10

<sup>2</sup>All readings taken on April 24, 1995 were believed to be erroneous and are not included in the mean. All pH measurements taken during 1996 at the site near Benson Pond were taken in May. Each reading used in the average is itself composed of three measurements taken from different areas of the ponds. All pH means have been rounded to the nearest 0.1.

<sup>3</sup>Site has been flooded over. Three newly created adjacent puddles were included in the count along with the original site.

<sup>4</sup>Water level much higher due to new beaver activity. Visibility poor.

<sup>5</sup>Two flooded stream areas were included in the count along with the original site and the 3 puddles included last year.

<sup>6</sup>pH readings were taken on August 5, 1998.

Table 3. Monitoring results from the upper two drift-fences in the Lye Brook Wilderness Region during 1998. Traps were opened whenever conditions were appropriate for amphibian movement from April through October excluding August. The three most successful trappings per month (+/- 7 days) are included (15 out of 24 trappings). Data used are from May 2, 5, and 11; June 13, 17, and July 2; July 8, 21, and 24; Sept. 3, 8, and 16; Sept. 28, Oct. 9 and 29. Abnormality, maximum size, and first metamorph data are taken from all 24 trappings.

Common name	Scientific name	# of all ages	# of young of the year <sup>1</sup>	% young of the year	date of first metamorph <sup>2</sup>	largest adult (total length in mm)	# per trapping <sup>3</sup>	% of group	% of total catch	# abnormal/total <sup>4</sup>
<b>Salamanders</b>										
Eastern newt	<i>Notophthalmus viridescens</i>	157	99	63%	Sep-3	86	10.5	48%	23%	0/201
Spotted salamander	<i>Ambystoma maculatum</i>	119	72	61%	Jul-24	198	7.9	36%	17%	0/129
Redback salamander	<i>Plethodon cinereus</i>	50	3	6%	Oct-9	100	3.3	15%	7%	1/58
Northern two-lined	<i>Eurycea bislineata</i>	3	0	0%	NA	98	0.2	1%	<1%	0/3
Group totals		329	174	53%	NA	NA	21.9	100%	48%	1/391
<b>Frogs and Toads</b>										
Wood frog	<i>Rana sylvatica</i>	201	163	81%	Jul-2	62	13.4	56%	29%	0/251
Green frog	<i>Rana clamitans</i>	109	105	96%	Jul-8	76	7.3	30%	16%	0/110
Spring peeper	<i>Pseudacris crucifer</i>	34	21	62%	Jul-21	35	2.3	9%	5%	0/34
American toad	<i>Bufo americanus</i>	16	0	0%	NA	72	1.1	4%	2%	0/17
Pickerel frog	<i>Rana palustris</i>	2	0	0%	NA	55	0.1	1%	<1%	0/2
Group totals		362	289	80%	NA	NA	24.1	100%	52%	0/414
Amphibian totals		691	463	67%	NA	NA	46.1	NA	100%	1/805

<sup>1</sup>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.

<sup>2</sup>No trapping took place in August.

<sup>3</sup>Numbers per trapping are rounded to the nearest 0.1. All other figures are rounded to the nearest whole number.

<sup>4</sup>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 4. A comparison of data from the upper two drift-fences in Lye Brook Wilderness, Sunderland, Bennington County, Vermont. Data are taken from the 1995, 1996, 1997, and 1998 field seasons. Fences were opened at least three times per month.

Species Name	# Per Trapping <sup>1</sup>				% of Total Catch			
	95	96	97	98	95	96	97	98
<b>Caudates (Salamanders)</b>								
Blue-spotted Salamander Group	0.0	0.0	0.1	0.0	0%	0%	<1%	0%
Spotted Salamander	8.7	4.7	5.7	7.9	20%	9%	14%	17%
Northern Two-lined Salamander	0.8	0.3	0.3	0.2	2%	6%	1%	<1%
Eastern Newt	12.7	29.5	19.4	10.5	29%	57%	49%	23%
Redback Salamander	2.0	3.3	1.5	3.3	5%	7%	4%	7%
Group Totals	24.2	37.1	27.1	21.9	56%	74%	68%	48%
<b>Anurans (Frogs and Toads)</b>								
American Toad	4.3	2.7	2.0	1.1	10%	5%	5%	2%
Spring Peeper	0.8	1.2	1.8	2.3	2%	2%	5%	5%
Green Frog	6.8	2.9	3.1	7.3	15%	6%	8%	16%
Pickerel Frog	0.0	0.0	0.0	0.1	0%	0%	0%	<1%
Wood Frog	8.2	6.3	6.0	13.4	18%	13%	15%	29%
Group Totals	20.0	13.1	12.8	24.1	45%	26%	32%	52%
Amphibian Totals	44.2	50.2	39.9	46.1	100%	100%	100%	100%

<sup>1</sup>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 18 trappings counted in 1995, 15 in 1996, 15 in 1997, and 15 in 1998. Fence-nights counted are those nights where the upper traps were opened under appropriate weather conditions for amphibian movement.

Table 5. Monitoring results from the lower drift-fence in the Lye Brook Wilderness Region during 1998. Traps were opened whenever conditions were appropriate for amphibian movement from April through October excluding August. The three most successful trappings per month (+/- 7 days) are included (18 out of 28 trappings). Data used are from April 2, 17, and May 2; May 5, 22 and June 1; June 13, 17, and 27; July 2, 10, and 24; Sept. 3, 8, and 16; Sept. 28, Oct. 9, and 29. Abnormality, maximum size, and first metamorph data are taken from all 28 trappings.

Common name	Scientific name	# of all ages	# of young of the year <sup>1</sup>	% young of the year	date of first metamorph <sup>2</sup>	largest adult (total length in mm)	# per trapping <sup>3</sup>	% of group	% of total catch	# abnormal/total <sup>4</sup>
<b>Salamanders</b>										
Redback salamander	<i>Plethodon cinereus</i>	88	0	0%	NA	93	4.9	66%	54%	0/99
Eastern newt	<i>Notophthalmus viridescens</i>	38	5	13%	Sep-16	84	2.1	29%	23%	0/44
Spotted salamander	<i>Ambystoma maculatum</i>	6	4	67%	Sep-3	154	0.3	5%	4%	0/6
Northern two-lined	<i>Eurycea bislineata</i>	1	0	0%	NA	69	0.1	1%	1%	0/1
Group totals		133	9	7%	NA	NA	7.4	100%	82%	0/150
<b>Frogs and Toads</b>										
American toad	<i>Bufo americanus</i>	12	0	0%	NA	94	0.7	41%	7%	0/14
Wood frog	<i>Rana sylvatica</i>	5	0	0%	NA	62	0.3	17%	3%	0/5
Spring peeper	<i>Pseudacris crucifer</i>	5	0	0%	NA	32	0.3	17%	3%	0/6
Pickerel frog	<i>Rana palustris</i>	4	2	50%	Sep-3	35	0.2	14%	2%	0/4
Green frog	<i>Rana clamitans</i>	3	2	67%	Jul-24	45	0.2	10%	2%	0/3
Group totals		29	4	14%	NA	NA	1.6	100%	18%	0/32
Amphibian totals		162	13	8%	NA	NA	9.0	NA	100%	0/182

<sup>1</sup>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.

<sup>2</sup>No trapping took place in August.

<sup>3</sup>Numbers per trapping are rounded to the nearest 0.1. All other figures are rounded to the nearest whole number.

<sup>4</sup>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 6. A comparison of data from the lower drift-fence in Lye Brook Wilderness, Manchester, Bennington County, Vermont. Data are taken from the 1995, 1996, 1997, and 1998 field seasons. Fences were opened at least three times per month.

Species Name	# Per Trapping <sup>2</sup>				% of Total Catch			
	95 <sup>1</sup>	96	97	98	95	96	97	98
<b>Caudates (Salamanders)</b>								
Spotted Salamander	0.4	0.2	0.3	0.3	3%	2%	3%	4%
Northern Two-lined Salamander	0.0	0.0	0.0	0.1	0%	0%	0%	1%
Eastern Newt	8.3	1.9	4.7	2.1	56%	28%	51%	23%
Redback Salamander	4.1	2.2	1.1	4.9	28%	32%	11%	54%
Group Totals	12.8	4.3	6.1	7.4	87%	62%	65%	82%
<b>Anurans (Frogs and Toads)</b>								
American Toad	0.4	0.7	0.7	0.7	3%	10%	7%	7%
Spring Peeper	0.1	0.2	1.1	0.3	<1%	3%	12%	3%
Green Frog	0.1	0.1	0.1	0.2	<1%	2%	1%	2%
Pickerel Frog	1.1	0.8	0.7	0.2	7%	12%	7%	2%
Wood Frog	0.4	0.8	0.7	0.3	3%	11%	8%	3%
Group Totals	2.1	2.6	3.3	1.7	13%	38%	35%	18%
Amphibian Totals	14.9	6.9	9.4	9.1	100%	100%	100%	100%

<sup>1</sup>In 1995, there were only 10 successful trappings. Dates used were April 20; June 16; July 1 and 18; September 10, 14, and 15; and October 6, 15, and 28.

<sup>2</sup>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 10 trappings counted in 1995, 18 in 1996, 18 in 1997, and 18 in 1998. Fence-nights counted are those nights where the lower traps were opened under appropriate weather conditions for amphibian movement.

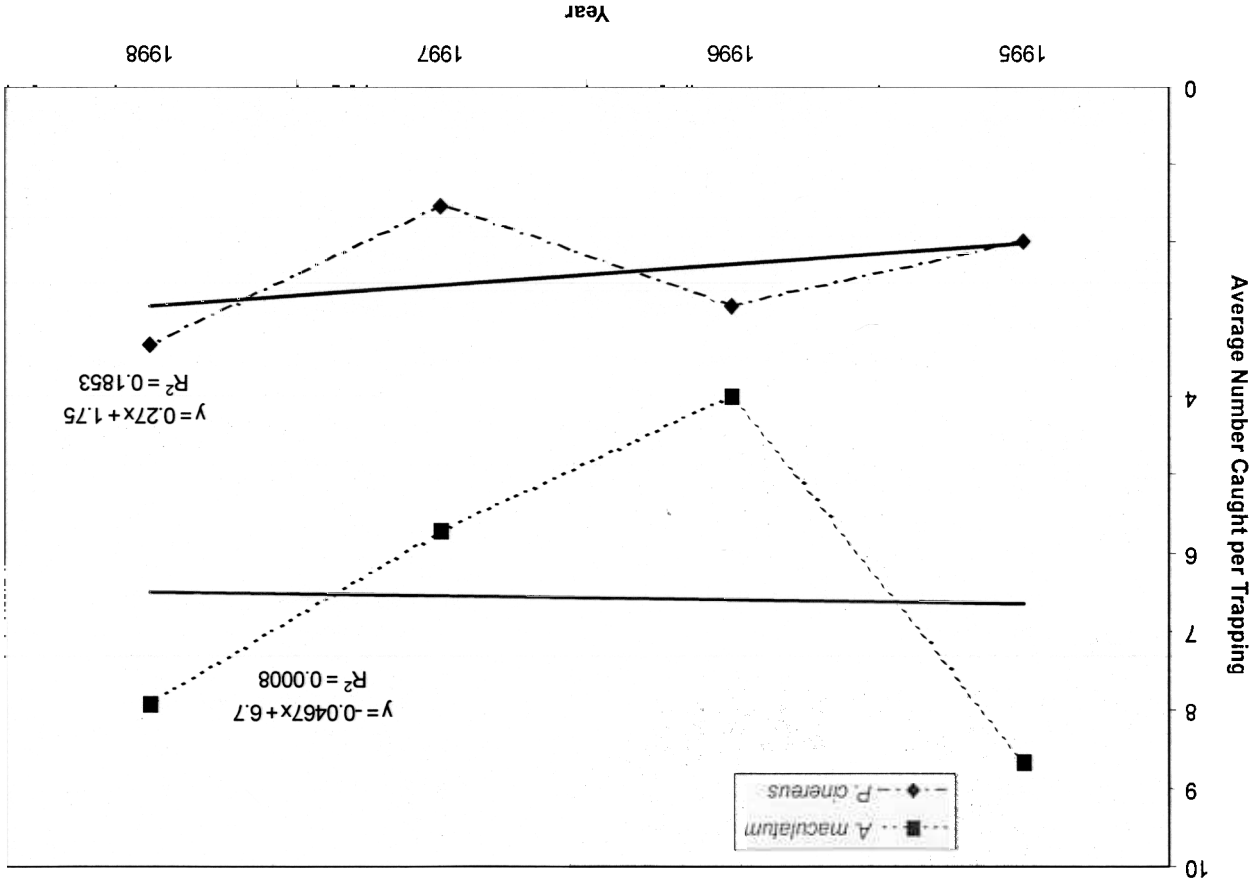


Figure 1. Spotted (*Ambystoma maculatum*) and Redback Salamander (*Plethodon cinereus*) population indices from the upper two drift-fences in the Lye Brook Wilderness, Sunderland, Vermont, 1995-1998.

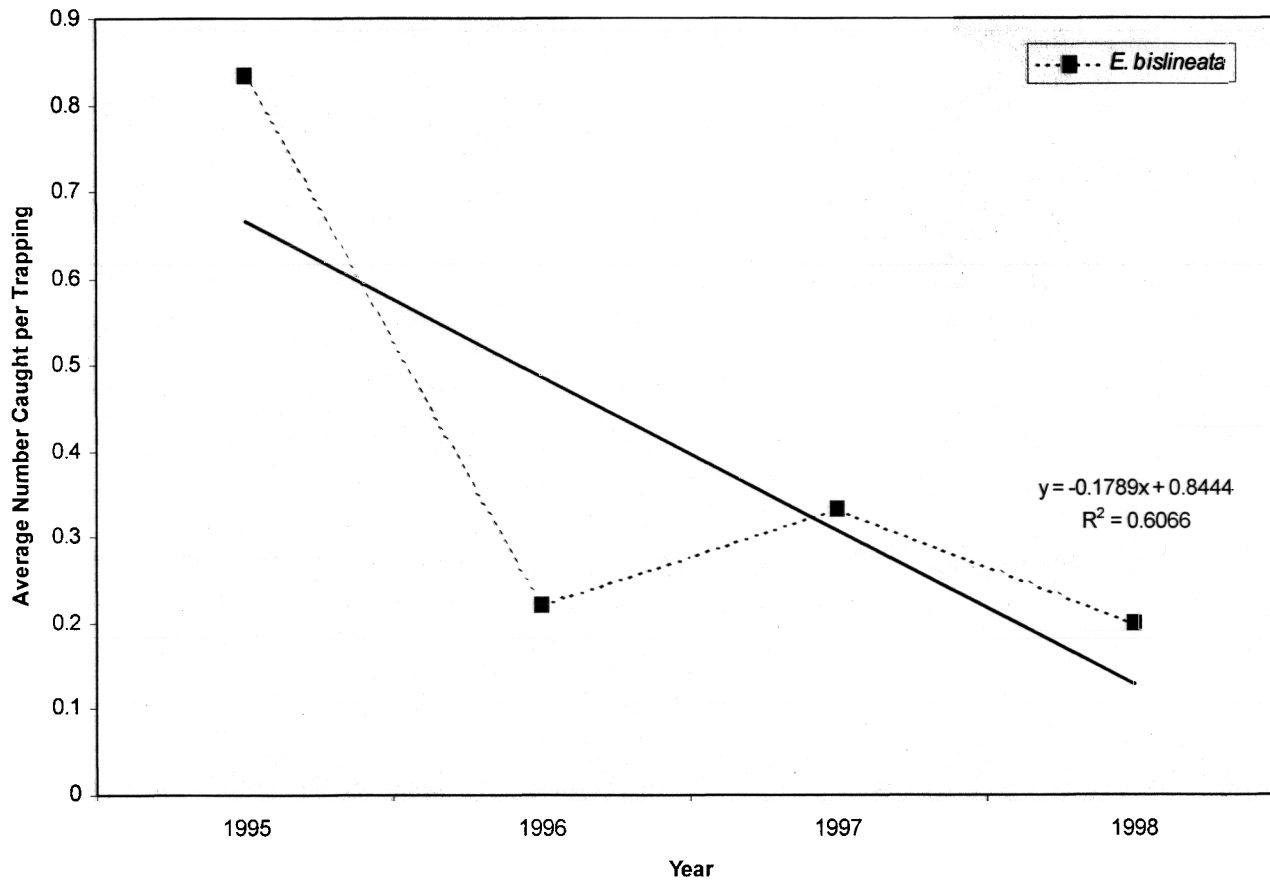


Figure 2. Northern Two-lined Salamander (*Eurycea bislineata*) population indices from the upper two drift-fences in the Lye Brook Wilderness, Sunderland, Vermont, 1995-1998.

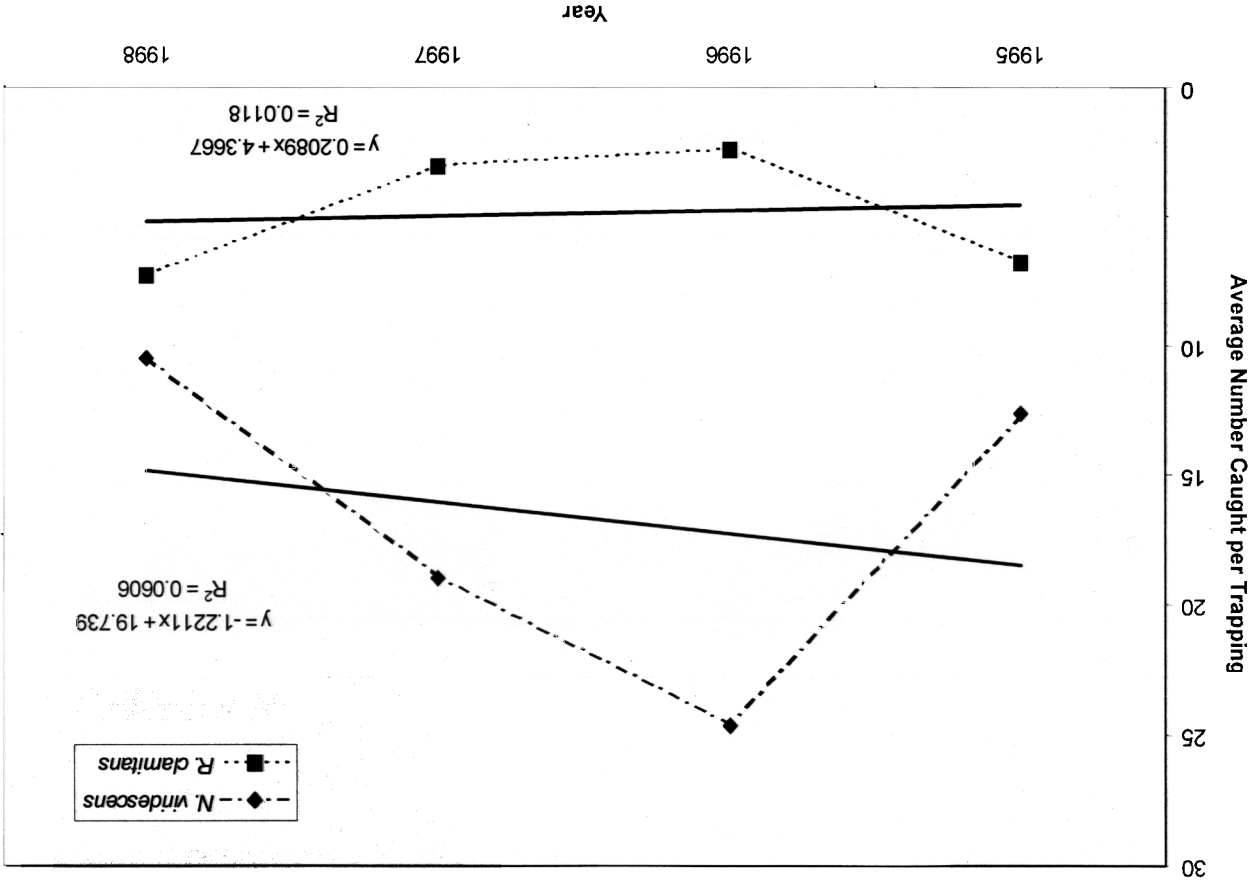


Figure 3. Eastern Newt (*Notophthalmus viridescens*) and Green Frog (*Rana clamitans*) population indices from the upper two drift-fences in the Lye Brook Wilderness, Sunderland, Vermont, 1995-1998.

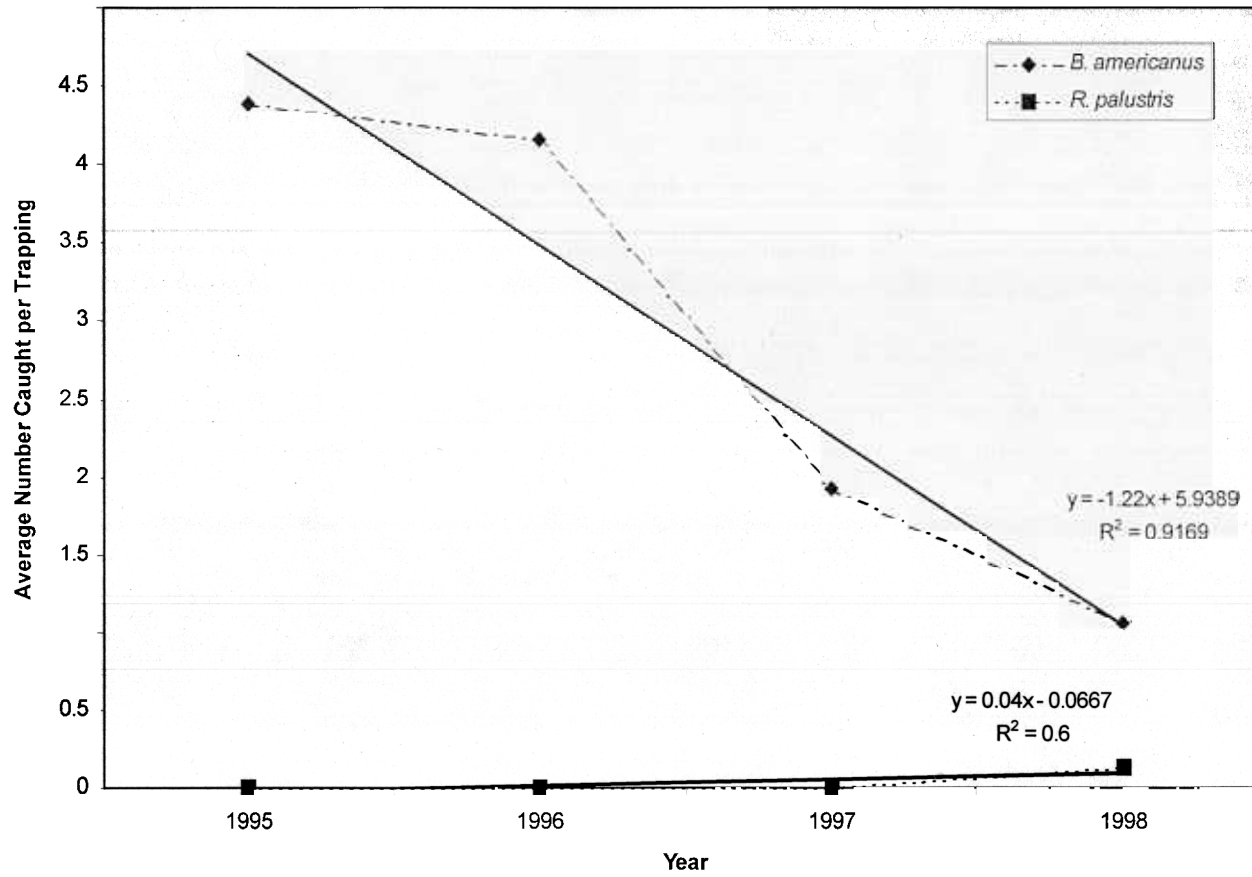


Figure 4. American Toad (*Bufo americanus*) and Pickerel Frog (*Rana palustris*) population indices from the upper two drift-fences in the Lye Brook Wilderness, Sunderland, Vermont, 1995-1998.

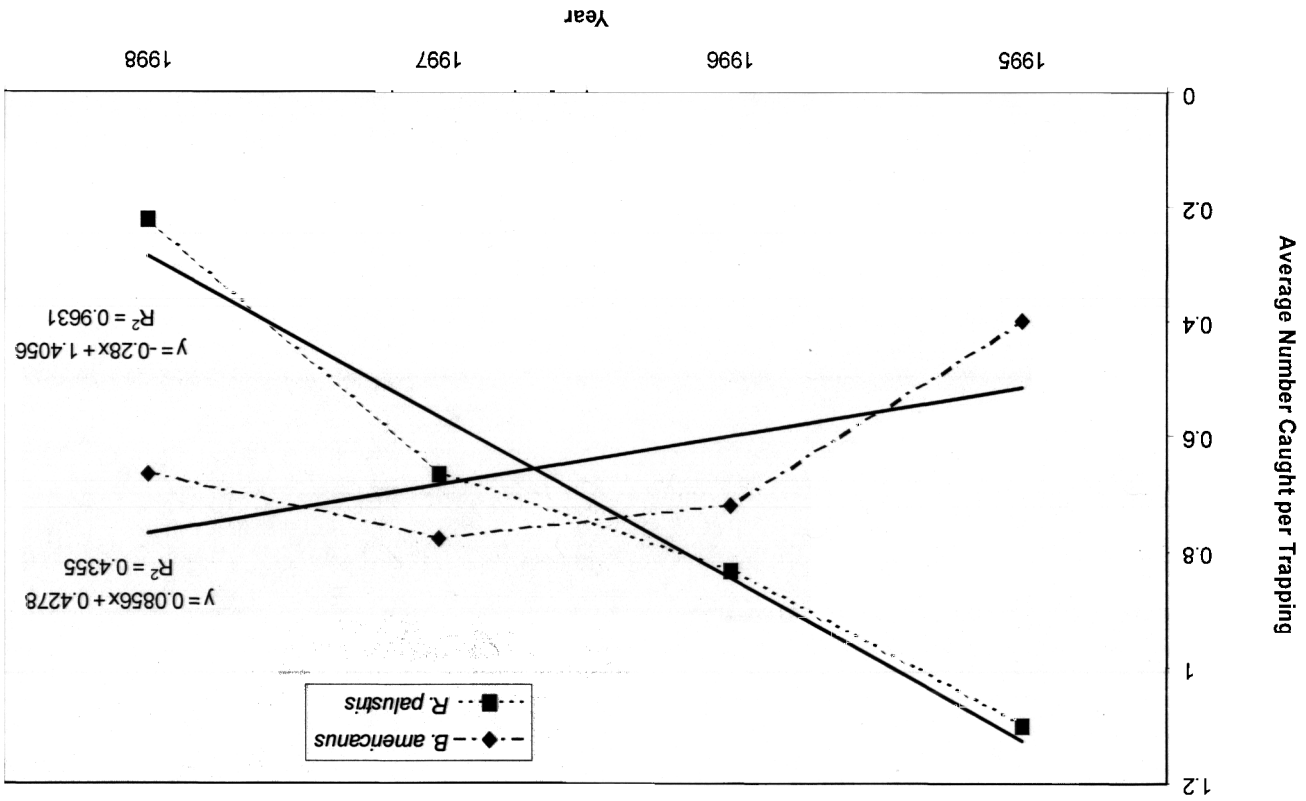


Figure 5. American Toad (*Bufo americanus*) and Pickerel Frog (*Rana palustris*) population indices from the lower drift-fence in the Lye Brook Wilderness, Manchester, Vermont, 1995-1998.

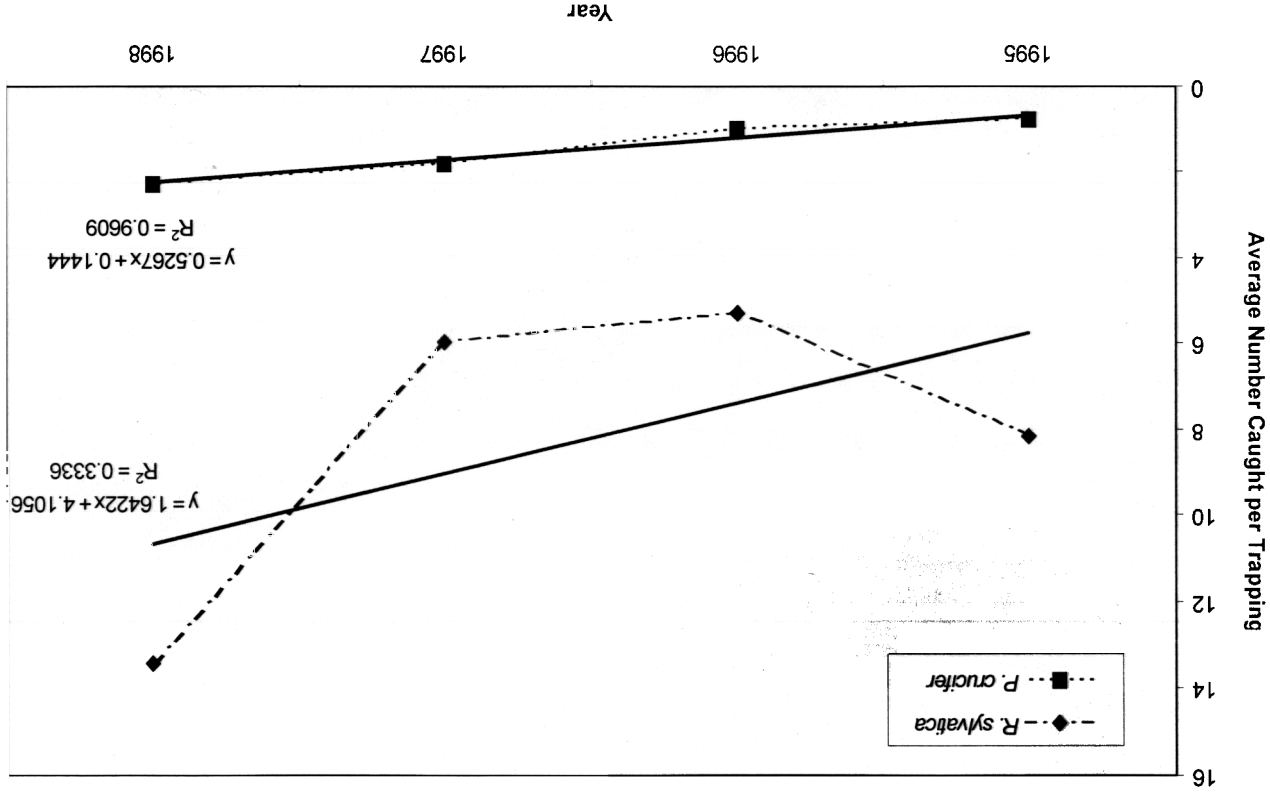


Figure 6. Wood Frog (*Rana sylvatica*) and Spring Peeper (*Pseudacris crucifer*) population indices from the upper two drift-fences in the Lye Brook Wilderness, Sunderland, Vermont, 1995-1998.

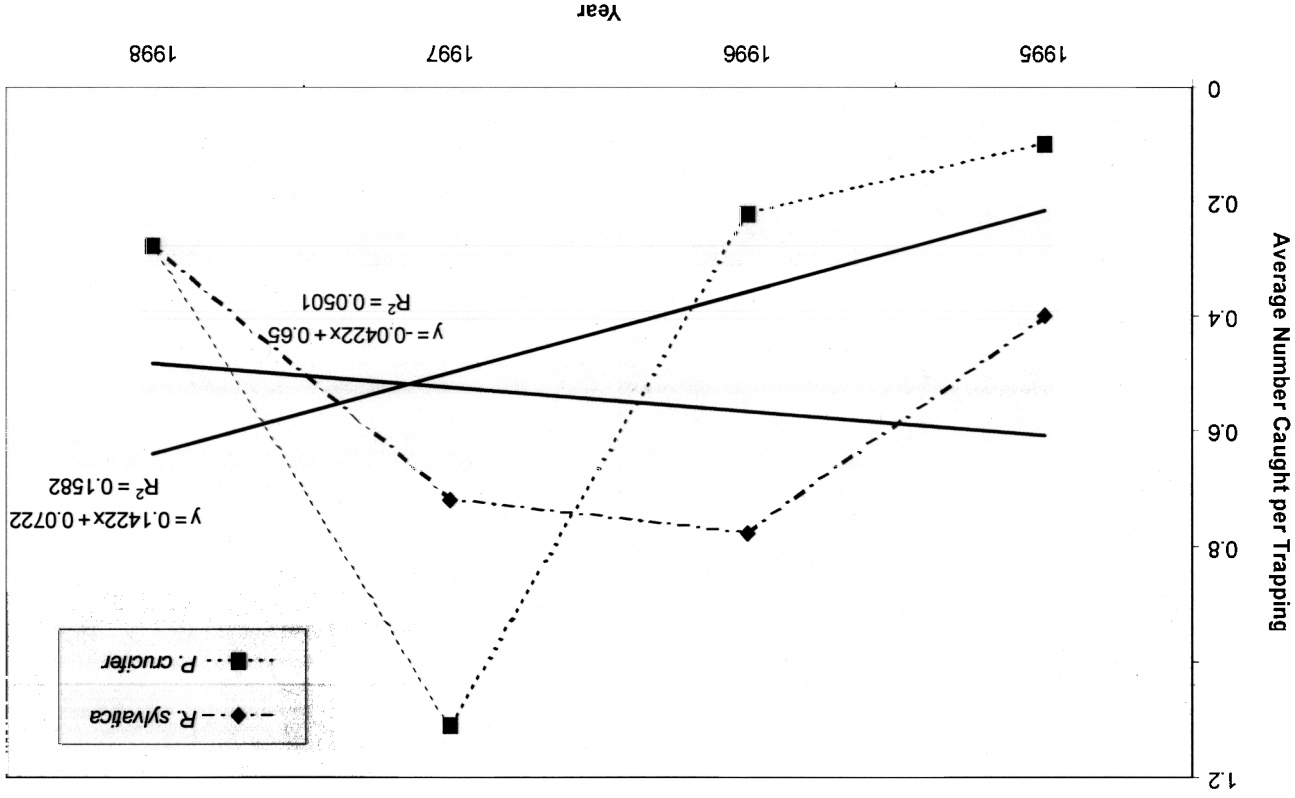


Figure 7. Wood Frog (*Rana sylvatica*) and Spring Peeper (*Pseudacris crucifer*) population indices from the lower drift-fence in the Lye Brook Wilderness, Manchester, Vermont, 1995-1998.



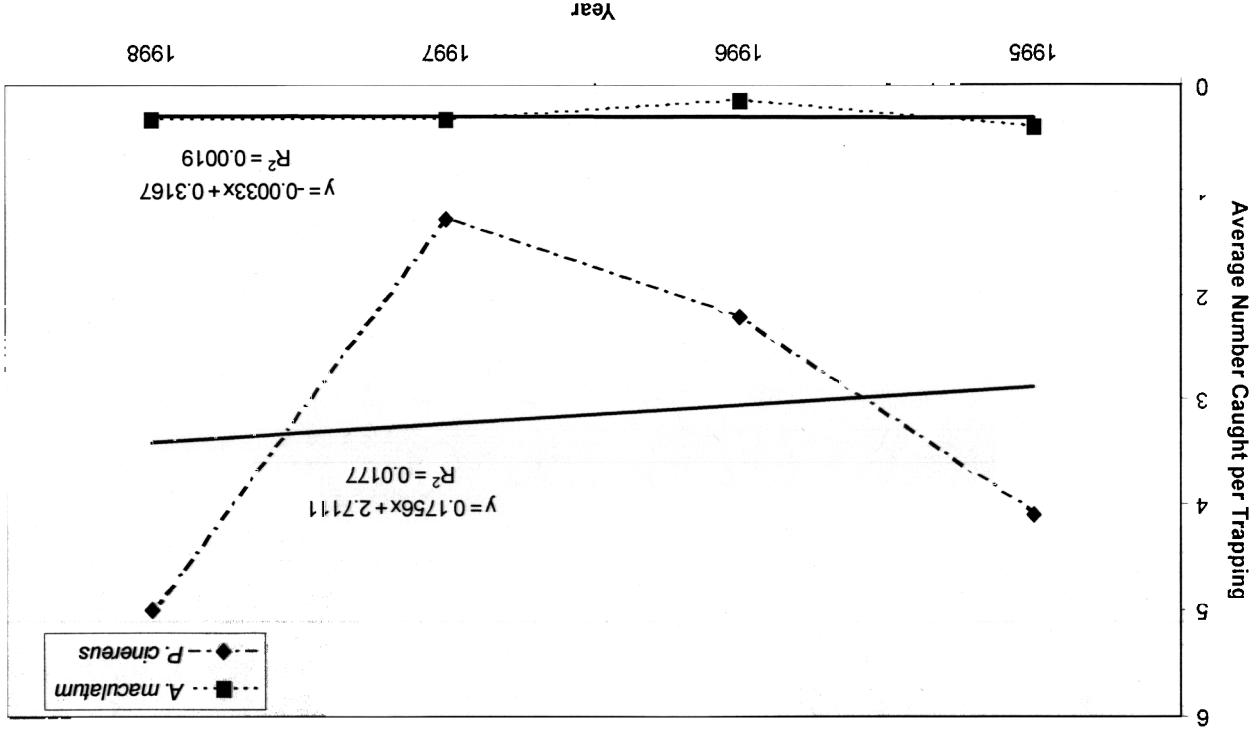


Figure 8. Spotted (Ambystoma maculatum) and Redback Salamander (Plethodon cinereus) population indices from the lower drift-fence in the Lye Brook Wilderness, Manchester, Vermont, 1995-1998.

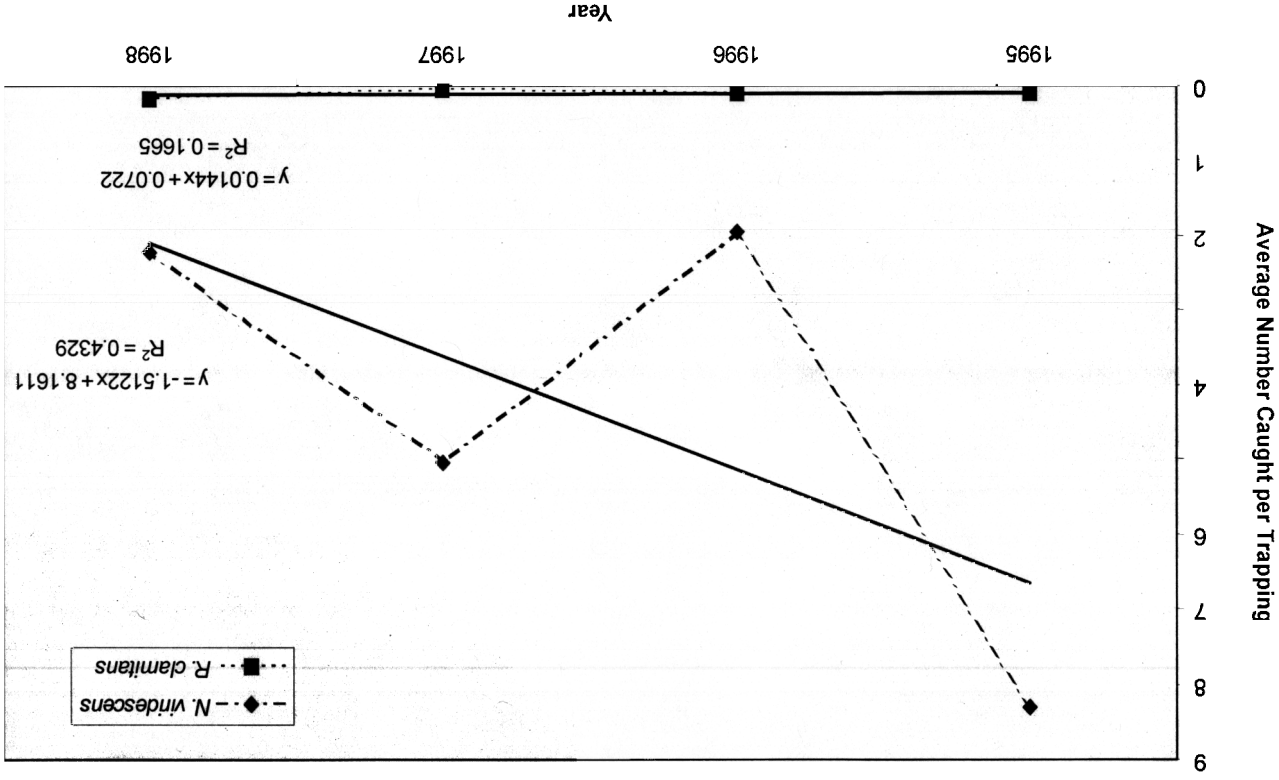


Figure 9. Eastern Newt (*Notophthalmus viridescens*) and Green Frog (*Rana clamitans*) population indices from the lower drift fence in the Lye Brook Wilderness, Manchester, Vermont, 1995-1998.

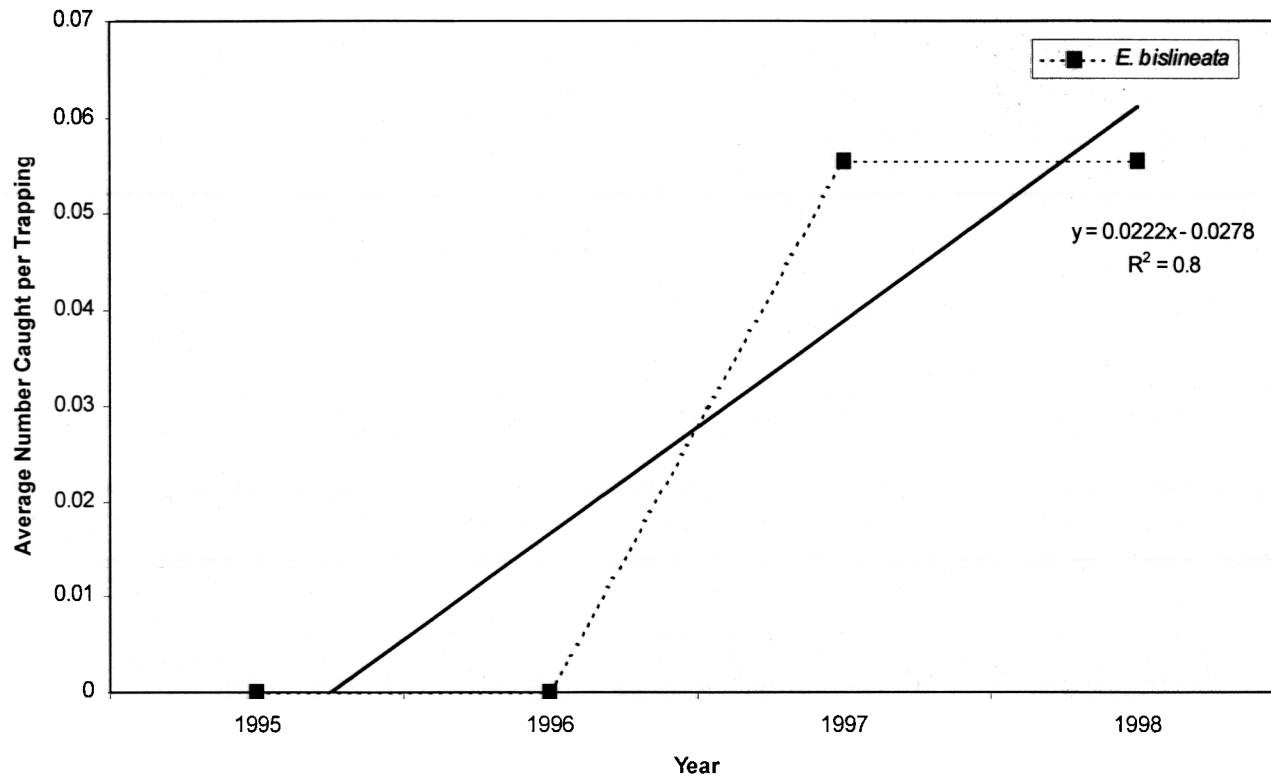


Figure 10. Northern Two-lined Salamander (*Eurycea bislineata*) population indices from the lower drift-fence in the Lye Brook Wilderness, Manchester, Vermont, 1995-1998.