Amphibian & Reptile Monitoring

During the 2007 Field Season

on the Lester and Monique Anderson Lands

in Lincoln, Vermont

Prepared for the

Colby Hill
Ecological Project

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Introduction

In the spring of 1999 Lester Anderson expressed an interest in establishing herpetological monitoring at selected sites on his property. Three types of monitoring were discussed: egg-mass counts of spring breeding amphibians, cover-board monitoring of woodland salamanders, and snake monitoring using artificial cover (slate). All these methods provide indices of different segments of the local herpetofaunal population. During the 1999 field season four ponds were selected for egg-mass monitoring and counts began. During the 2000 field season both the cover-board transects for salamanders and the snake covers were put in place. Counts began along the cover-board transects in 2000. However, many of the snake covers broke over the late fall and winter and needed to be replaced with thicker slates during the early fall of 2001 before counts began. The thicker slates have held up well with only two or three needing replacement each year since.

Methods

Egg-mass counts

Egg-mass counts took place at four ponds that I refer to using the name of the parcels on which they are found: Upper Fred Pierce (UFP), Lower Fred Pierce (LFP), Wells (WP), and Guthrie (GP). Upper Fred Pierce Pond is immediately across Colby Hill Road (east) from the Anderson residence. Lower Fred Pierce is roughly 100 m south of the residence across Colby Hill Road. Both of these ponds are found on the Fred Pierce tract. Guthrie Pond is immediately inside the gate off Guthrie Road on the Guthrie-Bancroft tract. Wells Pond is in a field roughly 50 m northwest of the Wells homestead on the Wells tract. Exact locations for these ponds are shown in the 2001 & 2002 reports.

Egg-mass counts at this site are designed to monitor egg-masses of two spring breeding species with very large and easily-identified egg-masses: *Rana sylvatica* (Wood Frog) and *Ambystoma maculatum* (Spotted Salamander). The annual high count of egg-masses for each species is the index that over time can be used to show the relative size of the female breeding population at these sites (Corn and Livo, 1989). It is not intended to provide an estimate of the total population of either of these species only a convenient index of the breeding females. This is a variation of the breeding site survey recommended by Heyer et al. (1994). Adults and young of these and other species may be found during these counts and their presence and numbers are noted but these numbers are not intended to provide a meaningful index to those populations.

Over time the index that will be most useful is the highest count of egg-masses on any one day for each of the two species monitored. Since the egg-masses are visible for a few weeks after laying, the high count will be very close to the total count in most years. These counts are not cumulative nor do they have to be from the same day for different species. All surveys are performed under conditions that allow the viewer to see easily into the pond (limited wind, no rain, and adequate light from a high angle). Polarized glasses are sometimes helpful. The counts are designed to take place in habitats where Wood Frog and Spotted Salamander have been previously located and during or shortly after their breeding period. Egg-mass counts begin soon after the snow and ice melt and continue until egg-laying activity ends or the total number of egg-masses is declining.

Cover-boards for salamanders

Three sets of cover-boards were constructed and put in place along the old wood road connecting the Guthrie-Bancroft fields with Rte. 17. This road starts in Lincoln and crosses into Bristol. Consequently some of the cover-boards lie in each town. The first two sets each contain 15 pairs of cover-boards. Although it was our intention to have three sets of 15 pairs, it was discovered in 2001 that the third set of cover-boards actually contained 16 pairs rather than the 15 that was intended. The extra set was left in place and the data are included. Exact locations of the three sets with UTM coordinates are shown in the 2001 report. These cover-boards were spaced based on North American Amphibian Monitoring Program

(NAAMP) protocols with Canadian design covers (Craig et al., 1999) that have been shown to be the most successful in attracting salamanders. The structures (salamander condos) each consist of four rough-cut white-oak boards that measure 305 mm x 152 mm (12" x 6") and two spacers. White oak was selected on the basis of its resistance to rot while in ground contact, however both boards and spacers have needed to be replaced at the rate of five or six per year as they gradually become saturated and rotten. Each condo consists of two boards side by side on the ground with a slight gap (~10 mm) left between them, so that they almost form a square 305 mm by 315 mm. The remaining two boards are placed on top of them and at right angles. In between the two layers of boards are 10-mm square spacers 280 mm long, which are used to hold up the outside edge of the upper two boards and create a small gap of varying height for the salamanders. The pairs of structures were placed a minimum distance of 0.5 m apart based on NAAMP recommendations and each pair of condos was located a minimum distance of 6 m from the nearest pair. The three 15-pair transects are separated by distances of between 100 and 200 m. All organic matter was removed from under the condos so that they rested on the mineral layer. Herbaceous growth was removed from between the pairs and for a distance of ~50 cm in all directions and is kept free from the area. Forest litter is removed from the top of the condos but left between and around them. All condos are numbered with latex exterior paint (white). These numbers fade over the course of a year and are remarked as needed. The first set of 15 pairs consists of condos marked 1A and 1B through 15A and 15B. The second set consists of condos 16 A & B through 30 A & B, and the last set consists of condos 31 A & B through 46 A & B.

Records are kept on the specific condo in which amphibians are found. In addition, all amphibians found under the cover-boards are measured to provide some information on age-class structure of the population using the boards. We measure both the snout to vent length (SVL) and the total body length (TBL) of the salamanders. However, the small salamander species, which are being monitored using this method, sometimes lose all or a portion of their tails to predatory birds and small mammals. Consequently, the most reliable measure of size is their snout to vent length (SVL). Starting in 2006, in addition to taking length measurements we massed the majority of the Red-backed Salamanders found.

We also keep records on where within the salamander condos the amphibians are found. It is of interest to me in order to more effectively design future condos. Four locations have been noted: board (between boards), substrate (between board and ground), crack (in the space between the boards) and adjacent (along side the cover-boards).

During the fall of 2001, Middlebury College student Caitlin Corey gathered additional data on soil moisture, the sex of the salamanders found, salamanders found adjacent to the cover-boards, and interactions between different sex- and age-classes within cover-boards. Her most interesting and best supported finding (Corey, 2002) was that adult Red-backeds would only rarely be found with adults of the same sex and much more often would be found with larger young or adults of the opposite sex. This strongly suggests that there is an upper limit to the number of adults that we can find under the boards since they exclude same sex adults. This is in addition to the apparent exclusion of the smallest size-classes by adults. Her analyses support our design concept that the multiple compartments formed by the visual barriers of the salamander condos allow adults to be physically quite close (a few centimeters) without excluding each other. She also points out that the age-class data generated by the cover-boards may not be representative of those in the larger populations as a result of the active exclusion of same sex adults and possible predation upon younger juveniles. She examined preferred positions within the cover-boards and found that over the course of the entire season salamanders were more often in one of the two ground contact positions (crack or ground), however, on certain days between the boards was the preferred position.

Snake-covers

The snake-covers were an experiment but they are working well. I am not aware of any other efforts to monitor snake populations using covers, though they are used as an inventory tool. I chose to use slate as a result of its ability to absorb the sun's rays and retain its heat as well as slate's longevity in ground contact. Through experience and informal communications with other herpetologists I have come to believe that the larger the piece of cover the better, but practical and aesthetic considerations led me to initially try old roofing slate. The largest used roofing slate that I could locate was 610 mm x 360 mm and 5 mm thick. With two of these slates I formed a sandwich with a small wooden spacer in between but off center to create a small space of varying height for the snakes. I placed forty of these snake sandwiches along the upper margins of the Guthrie-Bancroft fields at a distance of roughly 2 m from the trees (see earlier reports for photos). I chose the upper margins of the fields to maximize the exposure to southern and western sun. The snake covers were placed on the cut grass that already was in place. No additional cutting or clearing was done. During the late fall and winter of 2000-2001 most of the original snake-covers were broken. During the early fall of 2001, they were all replaced with thicker slate slabs that measured 560 x 360 mm and were 20-25 mm thick. Three of these were broken over the summer of 2002 and replaced in the early fall. Those that had been marked previously with a Magnum 44 permanent marker needed to be remarked. A few slates are remarked each year with white exterior latex paint as needed. A few broken slates are replaced each year to keep the array in good condition. Some new slates were slightly longer (610mm x 360 x 20-25 mm thick) but otherwise identical.

Snake populations are often widely dispersed during their foraging season; consequently it was unknown whether forty pairs of artificial cover would attract enough snakes to provide useful data, however they seem to be working well. Conditions under the covers have changed from the first couple years as remaining vegetation dies, invertebrates colonize them, and small mammals begin to tunnel under them. In some places the woods are creeping into the field and/or branches are reaching out and over them. Initially the covers were approximately two meters from the woods.

In 2007 we cleaned up the cover array, including clearing brush that had moved into the field (and shaded the covers), and replaced broken slates. We checked each snake cover and recorded the species on the day in August when we did the maintenance, but we did not begin with measuring and massing until September 5. Starting in late summer is ideal, as it is after the young-of-the-year have been produced and snake numbers are at their annual maximum. In addition, the cooler air temperatures of late summer/early fall should make the relative warmth of the slate more attractive at this time of the year. The snake-covers were checked once a week through November 7.

When a snake is found, we measure the snout to vent distance as well as the total body length. We record any unusual physical findings or injuries, and when we find Milksnakes (*Lampropeltis triangulum*) we record their patterns to allow us to distinguish individual snakes. In 2006 and 2007, in addition to length measurements we massed all the snakes we found. We also keep records on where within the snake cover the reptiles are found. Two locations have been noted: between (between slate) and surface (between slate and ground).

Basic species information

Two of the spring-breeding amphibians that deposit large easily identified **egg-masses** are using the breeding ponds: *Ambystoma maculatum* (Spotted Salamander) and *Rana sylvatica* (Wood Frog).

The Spotted Salamander is a large (190 mm) heavy-bodied salamander that is widespread in Vermont in areas where mature hardwoods or mixed hardwoods and suitable breeding ponds occur and migration is not obstructed. It is black with yellow spots and is largely fossorial. It emerges from its woodland over wintering sites during the first warm rains of spring to migrate to its breeding pond. Within a few short

weeks it returns to its summer foraging territory. The egg-masses that it deposits are the most obvious evidence of its occurrence in an area.

The Wood Frog is a medium sized (60 mm) frog that is almost entirely terrestrial. It is easily recognized by its white upper lip and black mask on a solid brown background. It forages and over winters in the woodlands and only enters ponds in the spring to breed. It too is widespread in Vermont as long as healthy woodlands and breeding ponds can be found and travel between the two is largely unobstructed. It also deposits large and easily identified egg-masses in early spring. Within two weeks it has usually returned to nearby woodlands.

Only one species of salamander is found often enough under the **cover-boards** to be monitored: *Plethodon cinereus* (Eastern Red-backed Salamander). Over time, as small mammals start to tunnel under the boards, other species may start to use them.

The Eastern Red-backed Salamander is a slender and small (40 mm) salamander that is our (Vermont's) only fully terrestrial species of amphibian. Its most common color morph has a dark reddish-brown back with black sides and a salt and pepper (gray and white speckled) belly. Occasionally it is missing the red stripe on its back and the entire salamander is a dark gray/brown color, this is considered a *lead phase*. Very occasionally the entire salamander is orange-red, this is considered *erythristic*. This species undergoes its larval stage and metamorphosis inside the egg. Eggs are laid in moist conditions inside a rotten log or in cavities in the soil as long as there is some solid object to suspend the egg-mass from. Consequently, it does not require open water at any life-stage and is dispersed widely in medium to mature hardwoods or mixed hardwoods regardless of the distance to the nearest water body. It is sensitive to soil pH, soil moisture, depth of leaf litter, and the structure and age of the woodlands in which it breeds. Consequently, it is a good species to monitor as an indicator of forest health.

When the **snake-covers** were placed, it was unknown which species of snake would be most attracted to them. During the fall of 2001 only *Storeria occipitomaculata* (Red-bellied Snake) used the snake covers. The Red-bellied Snake is a small, secretive, viviparous (giving live birth) snake of woodlands and woodland openings. Using data gathered in Vermont through 2006, an adult Red-bellied Snake has a median SVL of 195 mm and a median TBL of 240 mm (n=79). A neonate Red-bellied Snake in Vermont has a median SVL of 88 mm and a median TBL of 110.5 mm (n= 62) (Andrews, 2006). They are found throughout the state in forested areas (Andrews, 2007). They have a state rank of S5 and are the third most reported species in the state. They have a brown, gray, or black dorsum (back) and a bright red venter (belly). Three light spots can be seen on the neck: one in the middle and one on each side. They are harmless and quite docile. They feed primarily on slugs but will also eat other invertebrates (Mitchell, 1994). We have one record of a female Red-bellied Snake collected (legally) in Bridport, VT and brought into captivity. She then gave birth to 14 young on July 29. Determining the sexes of snakes can be difficult as there are no obvious external characteristics. Generally the males have a longer tail relative to their total body length although there is often some overlap. Male Red-bellied Snakes generally have a tail length of 21-25% of their TBL while females generally have a tail length of 17-22% of their TBL (Ernst and Barbour 1989). As we continue to collect more data and improve our techniques we should be able to draw some conclusions regarding the sexual make up of the snakes using the snake covers.

Since 2001 two additional species have been located under the snake-covers: Milksnakes and *Thamnophis sirtalis* (Common Gartersnake). Milksnakes were not seen in 2006 or in 2007.

The Common Gartersnake is known to reach a total body length of up to 1000 mm (39 inches) in Vermont, though most adults are closer to 600 (~24 inches). The largest Common Gartersnake recorded in Vermont was found in Guilford Vermont in 2007, she measured 970 mm (38 inches). They are the most common snake in the state (Andrews, 2007) and are widespread at all elevations and in a wide variety of habitats but are most abundant near a combination of water, small open areas, and exposed

rock. Their primary food item is amphibians but worms, insects, spiders, and other small invertebrates are also eaten. Male Common Gartersnakes mature in one to two years at an SVL of 360 mm – 390 mm, females usually mature in two to three years at an SVL of 420 mm to 550 mm. Litter sizes average 27 with a range from 1 to 101. Young Gartersnakes are born from mid-June to early November with most appearing in August and September. Neonates average 178 TBL (120mm – 278mm), and have a tendency to aggregate together (Ernst and Ernst, 2003). We have one record of a pregnant Gartersnake run over on August 8th. Ten babies (also run over) were counted around her body (Andrews, 2007). Based on our records through 2006 for adult and juvenile Common Gartersnakes found in Vermont the average SVL is 336 mm and TBL is 412 mm and the median SVL is 350 and the TBL is 438 (Andrews, 2006). Male Common Gartersnakes generally have a tail length that is 21-30% of their TBL and females have a tail length that is 17-22% of TBL (Ernst and Barbour, 1989).

The Milksnake is known to reach lengths of 1100 mm (43 inches) in Vermont and adults are generally larger than Gartersnakes. This snake is the second most reported snake in Vermont, though this may in part be the result of its large size and its tendency to live near overgrown human dwellings, foundations, and barns. Milksnakes are oviparous (egg laying), smooth scaled, and eat a wide variety of prey including small mammals, birds, other snakes, and invertebrates. They often will shake their tails when irritated and are frequently confused with Rattlesnakes as a result of this behavior. The sex of the Milksnake is not possible to determine based on tail length because there is too much overlap between males and females (Ernst and Barbour 1989).

Results and Discussion

Egg-mass counts

In 2007 egg-mass counts were performed on seven dates (April 4, April 18, April 25, May 2, May 17, May 23, and May 30) at the four ponds that were selected for monitoring in 1999. All four ponds are man-made with well-defined shorelines and within easy migration distance of hardwoods. Since all of these ponds are permanent or semipermanent they usually hold some water even through dry years.

The results of this year's counts are shown in Tables 1-4. The 2006-2007 winter was generally warmer than average, but the first two weeks in April were below average for temperature and above average for precipitation (weather data provided by the NOAA National Climatic Data Center local climatological data). In early April, Lincoln, VT received more snow than rain. Movement occurred in the Champlain lowlands at the end of March, but in the mountains a warm rainy evening did not occur until Monday, April 23. Rain lasted only for a brief period, but the frogs moved nonetheless, and egg masses were seen on April 25th. Some hatching was seen by May 2 in Lower Fred Pierce. In all four ponds the egg masses were gone and Wood Frog Tadpoles were seen by May 17. In 2006 hatching had been completed by May 11. High counts for Wood Frog egg masses took place on April 25th at all four ponds. In 2006, high counts were spread out between April 14 and April 27.

Spotted Salamander

The first spermatophores and adults were seen on April 25th. Egg masses were seen for the first time at all ponds on May 2. High-count dates for all ponds occurred in May but on different dates for different ponds. Although the high count at Lower Fred Pierce was on May 30, some egg masses at other ponds were already partially hatched and larvae were visible.

At all ponds, except Upper Fred Pierce, the number of Spotted Salamander egg-masses was up from last year. However, tables 5-8 show that none of the counts were at record high levels. For all ponds except Guthrie, the record high counts for Spotted Salamander egg-masses occurred in 2002. The record low

counts were in 1999 and 2000 in Guthrie, Wells, Lower Fred Pierce, and Upper Fred Pierce respectively. Although in 1999 some of the early egg masses were missed. The combined high count for all ponds was above average.

Annual variation in these numbers is to be expected, and can be seen in Tables 5-8 and Figures 1a and 1b. Although there is year-to-year variation, it is not consistent from pond to pond (see Figure 1a), there are not enough data to make any statistically significant conclusions, but it appears that the high count indices are either level or on an upward trend, except Guthrie which has a very slight downward trend (see Figure 1b). According to Bishop (1941) breeding adult females lay from 2-4 egg-masses during their brief egg-laying period. Using an average of 3 masses per adult and just the high count indices, this suggests that in 2003 the number of breeding females ranged from ~27 at Upper Fred Pierce to ~87 at Lower Fred Pierce**.** In 2004, the number of females ranged from ~31 at Upper Fred Pierce to ~55 at Lower Fred Pierce. In 2005 the number of breeding females ranged from ~28 in Guthrie to ~46 at Lower Fred Pierce. In 2006 the number of breeding females ranged from ~32 at Wells to ~53 at Lower Fred Pierce. In 2007 the number of breeding females ranged from ~38 at Upper Fred Pierce to ~60 Lower Fred Pierce. Assuming the larvae survive to metamorphosis, Lower Fred Pierce has consistently been the most productive for Spotted Salamanders.

Wood Frogs

The combined number of Wood Frog egg-masses from all ponds was at an all-time high of 1141 this year. Last year's combined total was 947. These high numbers may have more to do with low over wintering mortality than the quality of local foraging or breeding habitat. Over time, we will be able to tease out different factors that seem to be the most significant. As was the case with the Spotted Salamanders, the greatest number of Wood Frog egg-masses this year was also found at Lower Fred Pierce. Five-hundred and fifty-four egg masses were counted on April 25th. This is 100 more than the 2006 high count on April 20th and the highest number ever seen in a single year. Lower Fred Pierce was also the most productive pond for Wood Frog masses in 2005. In previous years Guthrie had been the most productive for Wood Frogs and this year it still held a large number of masses (427). Annual variation in these numbers is to be expected, and can be seen in Tables 5-8 and Figures 2a and 2b. Although there is year-to-year variation, it is not consistent from pond to pond (see Figure 2a). There are not enough data to make any statistically significant conclusions but it appears that the population index reflects an upward trend for Lower Fred Pierce and Guthrie (see Figure 2b). The number of egg-masses appears to be declining slightly in Wells and Upper Fred Pierce. From 2004 through 2006 there was a great deal of Wood Frog egg-mass destruction in Upper Fred Pierce. We hypothesize that the destruction was due to the Green Frog tadpoles that forage for algae on the masses and subsequently break them apart. In 2004 and 2005, the destruction was such that we did not see a single Wood Frog tadpole. In 2006 on May 4th we estimated about 250 Wood Frog tadpoles. Unfortunately, we did not see any still alive on either May 11th or May 25th, 2006. However, it is possible that some were under leaves on the bottom or out in the middle of the pond. We did find Green Frog tadpoles in 2004, 2005, and 2006, and noticed at one point as many as five tadpoles around a single egg mass (Andrews and Talmage 2007). In 2007 we only saw one Green Frog tadpole during the season (May 30). We recorded adults throughout the month of May. This year we also recorded 107 egg masses, the highest in four years and above average for Upper Fred Pierce. More importantly, we also estimated more than 9000 tadpoles on May 17.

Again this year, the later egg deposition of Spotted Salamander versus Wood Frog is clearly seen (see Figure 3, 4a, and 4b). In addition to species-specific differences, the timing of breeding also depends on elevation, aspect, spring temperatures, rainfall, and the amount of snow accumulated.

To establish useful baseline indices, I had previously recommended at least five years of egg-mass counts. We now have nine years of data from the ponds, however the first year was poorly timed. Annual counts are now helping us to determine breeding trends and responses to weather events, predators, and habitat

changes. What this gives us is a rough, relatively inexpensive indicator of the productivity of these ponds and their surrounding woodlands for these two species.

Numerous birds were seen or heard in the vicinity of the ponds during the egg-mass counts including; American crow, American goldfinch, American raven, American robin, Black and white warbler, Black-capped chickadee, Black-throated green warbler, Broad-winged hawk, Common grackle, Dark-eyed junco, Downy woodpecker, Eastern phoebe, Evening grosbeak, Golden-crowned kinglet, Gray catbird, Hermit thrush, Mourning dove, Northern cardinal (pair), Ovenbird, Purple finch, Red-eyed vireo, Red-breasted nuthatch, Red-winged blackbird, Ruffed grouse, Ruby-throated hummingbird, Song sparrow, White-throated sparrow, Wild turkey, Yellow-bellied sapsucker, and Yellow-rumped warbler. Although we wrote down bird species seen or heard this in no way constitutes a complete list of the birds on the property.

We saw a variety of insects including black flies, water boatman, caddis flies, tiger swallowtails, and a plethora of diving beetles. We also saw deer, moose, and raccoon tracks. We noted that the shad and marsh marigold were blooming on May 9.

During egg-mass counts we also found Eastern Newts (*Notophthalmus viridescens*) and Green Frogs at all of the breeding ponds. Both of these common species spend their adult lives in or near still water. Eastern Newts lay individual eggs attached to vegetation and Green Frogs lay egg masses during the summer, consequently they are not suitable for spring egg-mass monitoring. On April 4th we saw two (one live and one dead) Ambystoma larvae in Upper Fred Pierce that had over wintered in that pond. One Spring Peeper (*Pseudacris crucifer)* was heard while at Guthrie on April 25. This is a common spring-breeding species but it does not deposit conspicuous egg-masses, so it is not as convenient a species to monitor. We heard a Gray Treefrog (*Hyla versicolor*) calling near Lower Fred Pierce on May 30, 2007. That is the first time we have recorded a Gray Treefrog calling during the egg mass count period. In 2004 we heard one while checking the snake cover boards on Sept. 8. This species calls whenever the temperature is warm enough rather than according to any calendar. We also found an adult Pickerel Frog (*Rana palustris*) on May 9th at Lower Fred Pierce and a Pickerel Frog egg mass was found on May 17th at Guthrie. The egg mass was not seen again during the next two searches. Three Pickerel Frog masses were seen in Huntington on May 11th and also were not seen a week later (Andrews 2007). It is possible that these masses hatched in the interim. Hatching time for Pickerel Frog eggs in Vermont is not known but is likely between 10 and 21 days (Harding 1997). Warm weather speeds egg development and hatching. These masses could have been nearly a week old when originally found, so they could have had almost two weeks to hatch. Pickerel Frog egg-masses are similar to Wood Frog's as they are both round globular clusters of eggs with up to 3,000 eggs per mass. Pickerel Frog egg-masses often have a brownish hue due to the brown and yellow eggs while a Wood Frog mass appears slightly grayish due to the black and white eggs (Harding 1997).

Cover-boards

The cover-boards were checked on seven dates: Sept 5, 12, 19, 26, Oct. 3, 10, and 17 (Table 10 and 11). This year we stopped the counts in the fall once we determined the number of salamanders seen each week was decreasing.

The species found under the cover-boards are almost exclusively the Eastern Red-backed Salamander. However, Eastern Newts in the Red Eft stage have been found using the cover-boards. One Red Eft was found this year (Oct 3). An additional, six Efts were found as we walked along the trail. No Northern Two-lined Salamanders (*Eurycea bislineata*) were found under cover-boards in 2007. They had been found in 2004, 2005, and 2006. However, this is not particularly surprising or significant since the boards were not located in their preferred habitat of saturated soils.

In 2007 the high count for numbers of Eastern Red-backed Salamanders found under the cover-boards on one day was 164 (Sept. 5, Table 10). In 2006 the high count of 123 was also on Sept 5. In 2005 the high count of 101 was found on Sept 7. In 2004 it was 92 (9/29), in 2003 it was 119 (9/19), in 2002 it was 109 (9/12), and in 2001 it was 94 (9/16) (see Table 12 and Figure 4). With the exception of 2001 and 2004, the high count has always been the first count in the fall. Consistent with this trend, our high count this year was on our first count, but the numbers remained fairly high and 113 were found on Sept 12, and 89 were found on Sept. 19th. This year's high count of 164 was an all-time record. We had previously thought that since there is no obvious weather change of significance that corresponds with the drop in numbers after the first check, the quick decline was possibly a result of disturbance. To check this, in 2003 and 2004 we checked all cover-boards on the first check, but only one half of the cover-boards on the following check, and every other subsequent check. Interestingly, the rate of decline was almost identical for those covers checked every two weeks and those checked every week. Apparently, checking at one or two week intervals did not have any impact on board use as a result of disturbance (Andrews and Talmage 2005). This is in accordance with the results published by Marsh and Goicochea (2003). They also found no difference between covers checked every week and covers checked every three weeks.

We have seen fall migrations of Red-backed Salamanders at other sites. It appears this movement reflects the leaving of wetter substrates for up slope over wintering locations that are better drained. This seasonal migration may have something to do with our annual fall declines under the cover boards. Another possible explanation for declining numbers through the fall may be the result of the fact that Red-backed Salamanders start mating in the autumn and continue through the spring. One study found a population in NY started mating in the second week in October. Females have the ability to keep sperm in their cloacae through late April (Petranka 1998). Perhaps the high early fall numbers are due to salamanders moving to mating areas before disappearing underground for over wintering.

Based on Vermont data, juvenile Red-backed Salamanders are most often found from late July through November (Andrews 2007). This suggested to us, that the peak population size under the cover-boards should also be in the fall as opposed to the summer. In 2005 we tested this by doing additional counts in the summer. Counts were made on June 28 and August 3. As we had hypothesized, the high counts were in the early fall (Andrews and Talmage 2006). This year we found four juveniles. They were found on Sept 5 (2), Sept 12 (1), and Oct 17 (1).

The increasing number of Red-backed Salamanders found under the cover-boards over the last few years seems to reflect improving conditions for this species in the monitoring area. Whether this is due to local management, other local factors, or is part of a larger regional trend due to weather or other conditions is not known. Eastern Red-backed numbers at our Mt. Mansfield monitoring site have also been increasing over the past few years, although we have not yet analyzed the 2007 data. Monitoring at multiple sites allows us to make these comparisons. Long-term monitoring allows us to see if these changes are sustained or if they quickly reverse themselves.

It is important to note that individuals are not marked, and the total number of salamanders caught is not known. The same individuals may well have been counted on more than one date. However, for purposes of comparison from year to year we do not need to know the number of individuals. We can compare averages, high counts, and size-class information from the high count days (Figure 5, Figure 6, and Table 12). As mentioned previously in this report, Caitlin Corey's results suggest that there is an upper limit to the number of adults that we can theoretically find under the boards, since the cover-boards may exclude same sex adults (Corey, 2002). As we are still seeing annual variation, and an overall increase in the high count it appears we have not yet reached this upper limit (Figure 5). Corey's results also suggest that there is an apparent active exclusion of same sex adults and possible predation upon younger juveniles; therefore, the age-class data generated by the cover-boards may not be representative of those in the larger populations. It is still important data to collect. In theory, once we reach the upper

limit, the age class data under the cover-boards would remain relatively stable. At the same time there may be other factors we have yet to discover that influence the age classes of the salamanders found under the cover-boards. As this study continues it will be interesting to see if Corey's hypotheses are correct.

Occasionally we can surmise that we are seeing the same salamander more than once, for example this year we measured eight lead phase salamanders representing four different individuals. Three of which we saw more than once. We surmise they are the same salamander because each was found under the same cover board with the same (or very similar) measurements on more than one occasion. One salamander was measured three times at cover board 4, one measured twice at cover board 11, one measured twice at cover board 6, and one was measured once at cover board 31.

Many invertebrates were found using the cover-boards. This year we noted camel crickets, ground beetles, earthworms, millipedes, big and small slugs and springtails. We made only one bird-related note while checking the boards: an Eastern wood peewee was heard singing on Sept. 5. This seemed quite late in the season.

Other amphibians noted while checking the cover-boards this year were: Spring Peepers, Eastern Newts, and a Green Frog. These were not found under the covers, but along the route.

Snake-covers

All snake-covers were checked 11 times at weekly intervals starting on Aug 29 with subsequent checks on Sept 5, 12, 19, and 26, Oct 3, 10, 17, 24, and 31, and Nov 7 (Table 13 and 14). In 2002, we saw the species total rise from one to three and the total number of captures rise from five to 31, in 2003 the number of captures was 16, in 2004: 34, in 2005: 19, 2006: 113, and in 2007 it was 54 (Table 15). The three species regularly captured are Common Gartersnake, Milksnake, and Red-bellied Snake. None of these species are rare in Vermont.

Assuming that we have multiple captures of the same snakes over the course of the monitoring period, it is interesting to try to determine how many individual snakes these captures include. To do this, we look closely at on our size and location data along with other notes. This year we have estimated the number of individual snakes was 39 out of a total of 54 captures (Table 15). This is the second highest number of estimated individuals since we started monitoring, second only to last year. However, this is the second year in a row that we did not capture any Milksnakes. Now that we have a few good year's data to work with, we will be examining the data carefully to see how to generate the most useful population indices for each species in long-term comparisons.

As described in the species description section, Common Gartersnakes and Red-bellied Snakes give birth in the late summer. The eggs of egg-laying snakes also hatch in the late summer or early fall. We check our snake-covers in the fall so that we will be able to include the young of the year in our data. It appears this was again a productive year for both Gartersnakes and Red-bellied Snakes. With the exception of one snake, all of the Common Gartersnakes were neonates (TBL < 278 mm). Of the Red-bellied Snakes, 10 out of the 15 individuals caught were neonates (TBL < 109 mm). This year we measured two of the smallest Red-bellied Snakes ever recorded in Vermont. One was found on August 29 and measured 62 mm SVL and 80 mm TBL, another was found on November 7 and measured 63 mm SVL and 79 mm TBL. For the second year in a row we massed each snake. The results of that work are seen in Table 13 and 14.

Although this is the seventh year of results, these results should be considered only the sixth year of data using this method. After the first fall of data gathering, many of our snake covers broke during mowing. All the covers were replaced with thicker slabs that would resist breaking. Unlike year one, these

remained in place successfully throughout the year. In addition, the local microhabitat that exists in and around the covers was still stabilizing over the first year. Vegetation under the covers was dying and small mammals and invertebrates were colonizing them. The small mammals and invertebrates create tunnels in which the snakes travel and the invertebrates serve as food and may be creating over wintering microhabitat (see the 2002 report for details). Changes in vegetation immediately surrounding the cover-board, colonization, and tunneling are ongoing. For a few snake-covers, there has been a change in the distance the covers are from the edge of the woods. Although the fields are cut regularly, in some areas the woods are gradually growing out into the edge of the field and branches are reaching out over them. This year we cut back some of the brush and branches in late August prior to our surveys.

As a result of our multiple years of data, we are now noticing some patterns. Certain snake-covers seem to attract more snakes than others. To look at this closely we looked at the number of snake captures per snake-cover over the entire study (Figure 7). Snakes have been found under certain covers while never appearing under others. For example, numerous snakes have been measured at covers 20, 21, 22, and 25 (17, 44, 22, and 24 snakes respectively), while no snakes have been seen under covers 23 and 24. Many snakes have also been found under covers 39 (16 snakes) and 40 (55 snakes). Milksnakes have only been found from covers 20 through 40 (i.e. only in the lower field). Factors that may influence cover board usage could include relative distances to forested rocky areas (natural cover), birthing or prime feeding sites, the hedge row (natural cover), the road (potential mortality) or combinations of these features. Another possibility is that frequent usage is the result of higher temperatures at some covers. Next year we plan to record the temperatures of the top surface, between the slates, and on the ground below covers that have been successful and those that have not, to see if there are any consistent differences. Temperature differences could reflect different sun and wind exposure.

As usual, many invertebrates were found using the snake-covers. These were rarely identified to species and this is not a comprehensive list. However, in 2007 we noted blister beetles, earthworms, ground beetles, camel crickets, field crickets, Isabella tiger moth larvae, millipedes, pill bugs, red and black ants, and slugs. Small mammal tunnels were visible under many of the covers. We heard an Eastern wood peewee in the vicinity of the snake covers on Sept 5.

Summary

We now have eight years of **egg-mass** data and are able to look at longer-term trends. Like last year, the high count for Wood Frog egg-masses from all four ponds set a new record. We counted a total of 1141 egg masses compared to last year's combined total of 947. Although, this trend could reverse itself quickly, and we don't know the causal factors, at this point, the Wood Frog population is doing very well. We will continue to watch with great interest the interaction between the Wood Frogs and the Green Frog tadpoles at all the pools, especially at Upper Fred Pierce. The numbers of Spotted Salamander egg-masses were slightly above average with no records broken either with high or low counts. In 2006 we found Pickerel Frog egg-masses for the first time; and in 2007 we found one adult and one egg mass. It will be interesting to see if we find more next year.

We now have seven solid years of data from the **cover-boards.** For the second year in a row the high count was a record count, in 2006 with 123, and in 2007 with 164. I suspect that this may be related to regional weather conditions, rather than local habitat changes and we hope to explore that more in the future. As usual, our high count of Eastern Red-backed Salamanders was in September. We have begun collecting mass information regularly and this is another important step in understanding this species' natural history.

We also have six solid years of data from the **snake-covers**. Our total captures this year were down from last year but still they were the second highest total so far. Although we continue to catch Common Gartersnakes and Red-bellied Snakes, this is the second year in a row that we did not capture any

Milksnakes. Milksnakes have usually been the least abundant species captured. They are known to feed on other snakes. It is interesting to note that in 2004 when the Milksnakes were at their highest numbers, they were more frequently caught than the Red-bellied Snakes. Perhaps they were feeding on them.

We are gathering additional data on the mass of the snakes and the temperature of the covers. We have also begun to sex snakes using probes on larger snakes and hemipene eversion on neonates and juveniles. We hope to gather more data on sex next year.

We are now seeing definite preferences in cover-boards with some covers never producing snakes and others regularly producing snakes. We hope to put some more thought into why this might be and measure some variables between productive and non-productive covers. It would be useful to add four more pairs of covers along the edge of the field on the other side of the hedge row to the north to help us determine what some of the significant variables are.

Opportunities for long-term monitoring are both exceptionally rare and very valuable. Most funding for this type of project is short-term. This greatly limits the type of data that can be gathered. We appreciate the opportunity that has been created for us through the Colby Hill Ecological Project.

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Table 1. Spring 2007 egg-mass data from Lower Fred Pierce Pond on Lester Anderson lands in Lincoln, Vermont.

Date	Ambystoma maculatum **egg-masses**	***Rana sylvatica* egg-masses**	**Notes**
April 4	0	0 Visibility ok – cloudy with a little breeze. All the ice is gone, but no activity seen.	There was movement in Champlain Lowlands on good nights in last 2 weeks; a few Spotted Salamanders and Wood Frogs were seen, but no calling was heard. The ponds in Starksboro still had ice as of 3/28/07. Snow is predicted for tonight. Visibility ok – cloudy with a little breeze. All the ice is gone, but no activity seen.
April 18	0	0	There was snowfall Sunday night, 10 cm of snow at Guthrie. Cloudy/rain/snow most of the past few days. Visibility ok - harder to see in deep areas.
April 25	0 Three big clumps of spermatophores seen in the pond.	554 Two adults found in amplexus.	Spring was late this year. Over the weekend it finally got warm. It was between 60 and 70F. No rainy nights except Monday (April 23) for an hour or so, but the frogs moved at some point! Visibility ok - sun in and out of clouds.
May 2	158 Some are very fresh and not expanded. Others are covered with silt. There are some big piles of eggs on the bottom. Five are opaque.	405 Some were floating in middle. There were a few relatively new ones. The masses on the sunny side are spreading out and turning green, some have hatched! A few on the edge are dead like they dried out or froze.	Yesterday was sunny and cool. Visibility was good to excellent - sunny and no wind, but water is a little green and cloudy.
May 17	142 Two egg masses were opaque, at least 4 look pretty fresh, and at least 10 are showing white eggs.	0 No egg mass remnants left; there are more than 38,000 tadpoles.	It was rainy yesterday; a cold front moved in, it was a chilly cloudy morning. Visibility was poor, it was cloudy, all of the scum is gone from the surface. Polarizing glasses were used.
May 23	163 Three egg masses were opaque, 8 looked pretty fresh.	0 Tadpoles everywhere! More than 42,000.	Cloudy but getting sunny and warm as morning goes on. Visibility ok to good, still cloudy. Polarizing glasses were used.
May 30	181	0 More than 30,000 tadpoles.	Yesterday was clear with seasonal temperatures. Visibility good.

Table 2. Spring 2007 egg-mass data from Upper Fred Pierce Pond on Lester Anderson lands in Lincoln, Vermont.

Date	*Ambystoma maculatum* **egg-masses**	**Rana sylvatica egg-masses**	**Notes**
April 4	0 Saw *Ambystoma* larvae from last year.	0	There was movement in Champlain Lowlands on good nights in last 2 weeks; a few Spotted Salamanders and Wood Frogs were seen, but no calling was heard. The ponds in Starksboro still had ice as of 3/28/07. Snow is predicted for tonight. Visibility ok - cloudy, windy, but can still edges ok. Scuzz in water, looks about an inch lower than last year, but hard to say.
April 18	0	0	There was snowfall Sunday night, 10 cm of snow at Guthrie. Cloudy/rain/snow most of the past few days. Visibility ok.
April 25	0 Nine clumps of spermatophores seen, some fairly large (1 – 1.5 meters long). One adult seen.	107 Most egg masses by inlet, they look pretty fresh. No Green Frog tadpoles seen	Spring was late this year. Over the weekend it finally got warm. It was between 60 and 70 F. No rainy nights except Monday (April 23) for an hour or so, but the frogs moved at some point! Visibility ok - sun peeking out.
May 2	115 Some very fresh, they have not expanded. Used binoculars to count masses in middle 2 were opaque.	102 Some egg masses on branches in the middle. No Green Frog tadpoles were seen.	Yesterday was sunny and cool. Visibility excellent - sunny, some floating stuff on water, not much wind, polarizing glasses not used.
May 17	100	0 More than 9000 tadpoles seen.	It was rainy yesterday; a cold front moved in, it was a chilly cloudy morning. Visibility was poor, it was cloudy, all of the scum is gone from the surface. Polarizing glasses were used.
May 23	94 A little hard to see clump in middle	0 More than 4000 tadpoles seen.	Cloudy morning but getting sunny and warm. Visibility ok to good, still cloudy, polarizing glasses used. Still no Green Frog tadpoles seen; although adults were seen.
May 30	106 Some partially hatched, can see a few developing embryos.	0 More than 6000 tadpoles seen.	Yesterday was clear with seasonal temps. Water dropped a little (~1") in last week. Visibility okay to good, some shading, water slightly cloudy. One Green Frog tadpole seen.

Table 3. Spring 2007 egg-mass data from Guthrie Pond on Lester Anderson lands in Lincoln, Vermont.

Date	*Ambystoma maculatum* egg-masses	Rana sylvatica egg-masses	Notes
April 4	0	0	There was movement in Champlain Lowlands on good nights in last 2 weeks; a few Spotted Salamanders and Wood Frogs were seen, but no calling was heard. The ponds in Starksboro still had ice as of 3/28/07. Snow is predicted for tonight. Visibility ok - cloudy, little breeze - all ice is gone, but no activity seen. The water level is up since last time we were there - the big rock is covered by 7 cm of water.
April 18	0	0	There was snowfall Sunday night, 10 cm of snow at Guthrie. Cloudy/rain/snow most of the past few days. Visibility good - pond higher then 2 weeks ago, ice is all gone, five cm of water on edge of rock, cattails seem to be denser in pond then we remember.
April 25	0 No egg masses but lots of spermatophores.	427 Some eggs on shore. Possibly had been pulled out and eaten. Most were very fresh, 3 masses were slightly older, 1 mass looks mostly dead. Two leeches seen in egg masses, looked like they were within the egg mass.	Spring was late this year. Over the weekend it finally got warm. It was between 60 and 70 F. No rainy nights except Monday (April 23) for an hour or so, but the frogs moved at some point! One *R. sylvatica* egg mass on edge looks like it was laid in a string, and didn't ball together in the same way the other masses did. Two dead and headless adults were found on shore along with the eggs. Perhaps some of the eggs on shore were from the insides of those frogs. Visibility good, no wind.
May 2	108 No spermatophores seen.	392 One looked fresh, most looked older and are starting to spread out. Some masses along edge look as if they froze. Embryos are visible in some of the masses.	Yesterday was sunny and cool. Visibility good to excellent, sun and clouds, slight wind, polarizing glasses not used. Tire has plants growing in it - can only see edge of tire.
May 17	95 A few seem somewhat fresh, a few are green - none have noticeably hatched.	0 More than 1000 tadpoles.	Rainy yesterday, cold front moved in, chilly cloudy morning. Visibility ok, pretty cloudy, polarizing glasses used. Also saw a Pickerel Frog egg mass.
May 23	118 Five fairly fresh, they were laid on green cattails, most are pretty green.	0 Huge mass of tadpoles, more than 21,000!	Cloudy morning but getting sunny and warm. Visibility good, polarizing glasses used.
May 30	117 Mostly hatched, a few have fallen apart, a few still have lots of embryos.	0 Big mass of tadpoles swimming together; more than 6000.	Yesterday clear with seasonal temps. Water dropped r at least 6" since last week. Visibility good to excellent, polarizing glasses used.

Table 4. Spring 2007 egg-mass data from Wells Pond on Lester Anderson lands in Lincoln, Vermont.

Location/Date	*Ambystoma maculatum* egg-masses	Rana sylvatica egg-masses	Notes
April 4	0	0 One dead frog in bottom of pool (probably from last year).	There was movement in Champlain Lowlands on good nights in last 2 weeks; a few Spotted Salamanders and Wood Frogs were seen, but no calling was heard. The ponds in Starksboro still had ice as of 3/28/07. Snow is predicted for tonight. Visibility ok - cloudy, little breeze - lots of branches have fallen into water (we pulled some out - from the aspen on shore that fell over).
April 18	0 No egg masses or spermatophores.	0	There was snowfall Sunday night, 10 cm of snow at Guthrie. Cloudy/rain/snow most of the past few days. Visibility ok - some new branches in water.
April 25	0 No egg masses or spermatophores.	53 They were all beneath the tree that overhangs the pond and not in the "normal cattail" spot at the opposite side of the pool. Adults seen	Spring was late this year. Over the weekend it finally got warm. It was between 60 and 70 F. No rainy nights except Monday (April 23) for an hour or so, but the frogs moved at some point! Visibility ok - cloudy, no wind.
May 2	120 Some very fresh, they have not expanded.	46 Most egg masses are falling apart, cattail grew through egg mass and eggs dried out.	Yesterday was sunny and cool. Visibility good to excellent, no clouds, but there was a slight breeze. Polarizing glasses were not used.
May 17	107	0 Saw over 2000 tadpoles.	Rainy yesterday, cold front moved in, chilly cloudy morning. Visibility poor, cloudy, windy, polarizing glasses used.
May 23	110 Masses on stick are very green and a little hard to discern individual masses.	0 Saw over 3000 tadpoles.	Cloudy but getting sunny and warm as morning goes on. Visibility poor to good, still cloudy, water somewhat cloudy, polarizing glasses used.
May 30	84	0 Greater than 2000 tadpoles grouped together in swarms and dispersed in sunny spots.	Yesterday clear with seasonal temps. Visibility okay, hard to see the masses in the middle, water cloudy, polarizing glasses used.

Table 5. Maximum counts of egg-masses in the Lower Fred Pierce Pond on the Lester and Monique Anderson lands in Lincoln from 1999 to 2007.

Lower Fred Pierce Pond	*Ambystoma maculatum*	*Rana sylvatica*	Notes
1999 count dates: 5/5, 5/18	134	1	Early masses missed.
2000 count dates: 4/17, 4/29, 5/14	122	155	Timed well, early eggs of *R. sylvatica* nonviable.
2001 count dates: 5/1, 5/7, 5/14, 5/21	178	101	Timed well, very dry spring.
2002 count dates: 4/23, 5/1, 5/10, 5/20	270	170	Timed well, irregular spring with late snow.
2003 count dates: 4/17, 4/25, 5/3, 5/9, 5/20	260	210	Timed well, cool spring, April drier than normal.
2004 count dates: 4/9, 4/15, 4/22, 4/29, 5/6, 5/12	166	228	Timed well.
2005 count days: 4/13, 4/20, 4/26, 5/4, 5/11, 5/25	137	365	Timed well, went slightly later than normal.
2006 count days: 4/14, 4/20, 4/27, 5/4, 5/11, 5/25	158	454	Timed well, went slightly later than normal.
2007 count days 4/4, 4/18, 4/25, 5/2, 5/17, 5/23, 5/30	181	554	Timed well – spring started late but went quickly.

Table 6. Maximum counts of egg-masses in the Upper Fred Pierce Pond on the Lester and Monique Anderson lands in Lincoln from 1999 to 2007.

Upper Fred Pierce Pond	*Ambystoma maculatum*	*Rana sylvatica*	Notes
1999 count dates: 5/5, 5/18	63	20	Early masses missed.
2000 count dates: 4/17, 4/29, 5/14	54	62	Timed well, early eggs of *R. sylvatica* nonviable.
2001 count dates: 5/1, 5/7, 5/14, 5/21	72	66	Timed well, very dry spring.
2002 count dates: 4/23, 5/1, 5/10, 5/20	137	95	Timed well, cool spring, April drier than normal.
2003 count dates: 4/17, 4/25, 5/3, 5/9, 5/20	80	144	Timed well, cool spring, April drier than normal.
2004 count dates: 4/9, 4/15, 4/22, 4/29, 5/6, 5/12	92	71	Timed well.
2005 count days: 4/13, 4/20, 4/26, 5/4, 5/11, 5/25	113	60	Timed well, went slightly later than normal.
2006 count days: 4/14, 4/20, 4/27, 5/4, 5/11, 5/25	125	102	Timed well, went slightly later than normal.
2007 count days 4/4, 4/18, 4/25, 5/2, 5/17, 5/23, 5/30	115	107	Timed well – spring started late but went quickly.

Table 7. Maximum counts of egg-masses at Guthrie Pond on the Lester and Monique Anderson lands in Lincoln from 1999 to 2007.

Guthrie Pond	*Ambystoma maculatum*	*Rana sylvatica*	Notes
1999 count dates: 5/5, 5/18	50	5	Early masses missed.
2000 count dates: 4/17, 4/29, 5/14	138	538	Timed well, early eggs of *R. sylvatica* nonviable
2001 count dates: 5/1, 5/7, 5/14, 5/21	183	340	Timed well, very dry spring.
2002 count dates: 4/23, 5/1, 5/10, 5/20	121	133	Timed ok, may have missed high count for *R. sylvatica* irregular spring with late snow.
2003 count dates: 4/17, 4/25, 5/3, 5/9, 5/20	230	330	Timed well, cool spring, April drier than normal.
2004 count dates: 4/9, 4/15, 4/22, 4/29, 5/6, 5/12	96	450	Timed well.
2005 count days: 4/13, 4/20, 4/26, 5/4, 5/11, 5/25	83	280	Timed well, went slightly later than normal.
2006 count days: 4/14, 4/20, 4/27, 5/4, 5/11, 5/25	111	328	Timed well, went slightly later than normal.
2007 count days 4/4, 4/18, 4/25, 5/2, 5/17, 5/23, 5/30	118	427	Timed well – spring started late but went quickly.

Table 8. Maximum counts of egg-masses in the Wells Pond on the Lester and Monique Anderson lands in Lincoln from 1999 to 2007.

Wells Pond	*Ambystoma maculatum*	*Rana sylvatica*	Notes
1999 count dates: 5/5, 5/18	66	50	Early masses missed.
2000 count dates: 4/17, 4/29, 5/14	96	91	Timed well, early eggs of *R. sylvatica* nonviable.
2001 count dates: 5/1, 5/7, 5/14, 5/21	111	80	Timed well, very dry spring.
2002 count dates: 4/23, 5/1, 5/10, 5/20	126	62	Timed well, irregular spring with late snow.
2003 count dates: 4/17, 4/25, 5/3, 5/9, 5/20	110	71	Timed well, cool spring, April drier than normal.
2004 count dates: 4/9, 4/15, 4/22, 4/29, 5/6, 5/12	110	59	Timed well.
2005 count days: 4/13, 4/20, 4/26, 5/4, 5/11, 5/25	106	74	Timed well, went slightly later than normal.
2006 count days: 4/14, 4/20, 4/27, 5/4, 5/11, 5/25	97	63	Timed well, went slightly later than normal.
2007 count days 4/4, 4/18, 4/25, 5/2, 5/17, 5/23, 5/30	120	53	Timed well – spring started late but went quickly.

Table 9: Combined high counts, for all ponds of egg-masses for *Ambystoma maculatum* and *Rana sylvatica* found on Lester Anderson lands in Lincoln, Vermont.

Lester Anderson Lands (total egg masses)	***Ambystoma maculatum***	***Rana sylvatica***
1999 count dates: 5/5, 5/18	313	76
2000 count dates: 4/17, 4/29, 5/14	410	846
2001 count dates: 5/1, 5/7, 5/14, 5/21	544	587
2002 count dates: 4/23, 5/1, 5/10, 5/20	654	460
2003 count dates: 4/17, 4/25, 5/3, 5/9, 5/20	680	755
2004 count dates: 4/9, 4/15, 4/22, 4/29, 5/6, 5/12	464	808
2005 count dates: 4/13, 4/20, 4/26, 5/4, 5/11, 5/25	439	779
2006 count dates: 4/14, 4/20, 4/25, 5/4, 5/11, 5/25	491	947
2007 count dates: 4/4, 4/18, 4/25, 5/2, 5/17, 5/23, 5/30	534	1141

Table 10. Fall 2007 cover-board results from the Lester Anderson lands on the Bristol/Lincoln border in Vermont. The species being monitored is Eastern Red-backed Salamander (*Plethodon cinereus*).

Snout to Vent Length							
Date	1-20 mm	21-30 mm	31-40 mm	41-50 mm	51-60 mm	Unk.[1]	Total
9/5/07	2	46	87	28	0	1	164
9/12/07	1	21	62	28	0	1	113
9/19/07	0	22	44	23	0	0	89
9/26/07	0	12	18	16	0	1	47
10/3/07	0	13	35	19	0	2	69
10/10/07	0	5	19	16	0	1	41
10/17/07	1	10	18	7	0	0	36
Total	**4**[2]	**129**[2]	**283**[2]	**137**[2]	**0**[2]	**6**[2]	**559**[2]

[1] Salamanders escaped before measurements were taken.
[2] Salamanders may have been caught on more than one occasion throughout the field season.

Table 11. Percentage of totals for each cohort of Eastern Red-backed Salamanders (*Plethodon cinereus*) found during fall 2007 cover-board monitoring on the Lester Anderson lands on the Bristol/Lincoln border in Vermont.

Snout to Vent Length							
Date	1-20 mm	21-30 mm	31-40 mm	41-50 mm	51-60 mm	Unk.[1]	Total[2]
9/5/07	1.22%	28.05%	53.05%	17.07%	0.00%	0.61%	100.00%
9/12/07	0.88%	18.58%	54.88%	24.78%	0.00%	0.88%	100.00%
9/19/07	0.00%	24.72%	49.44%	25.84%	0.00%	0.00%	100.00%
9/26/07	0.00%	25.53%	38.30%	34.04%	0.00%	2.13%	100.00%
10/3/07	0.00%	18.84%	50.73%	27.54%	0.00%	2.89%	100.00%
10/10/07	0.00%	12.20%	46.34%	39.02%	0.00%	2.44%	100.00%
10/17/07	2.78%	27.78%	50.00%	19.44%	0.00%	0.00%	100.00%
Average	**0.70%**	**22.24%**	**48.96%**	**26.82%**	**0.00%**	**1.28%**	**100.00%**

[1] Salamanders escaped before measurements were taken.
[2] Salamanders may have been caught on more than one occasion throughout the field season.

Table 12. Percentage of totals for each cohort of Eastern Red-backed Salamanders (*Plethodon cinereus*) found on high counts days during cover-board monitoring on the Lester Anderson lands on the Bristol/Lincoln border in Vermont (2001-2007).

Snout to Vent Length						
Date	1-20 mm	21-30 mm	31-40 mm	41-50 mm	51-60 mm	Unk.[1]
2001 (9/16)	0.00%	20.21%	63.83%	12.77%	1.06%	1.08%
2002 (9/12)	0.00%	8.26%	79.82%	10.09%	0.00%	1.83%
2003 (9/19)	1.68%	10.08%	66.39%	21.01%	0.00%	0.84%
2004[2] (9/29)	0.00%	36.96%	54.35%	6.52%	0.00%	2.17%
2005 (9/7)	0.99%	20.79%	66.34%	9.90%	0.00%	1.98%
2006 (9/5)	7.32%	11.38%	50.41%	28.46%	0.81%	1.62%
2007 (9/5)	1.22%	28.05%	53.05%	17.07%	0.00%	0.61%
Average/Year	**1.60%**	**19.53%**	**62.03%**	**15.12%**	**0.27%**	**1.45%**

[1]Salamanders escaped before measurements were taken.
[2]Approximate totals had both cover-boards been checked, based on the doubling of the number of salamanders found under odd numbered cover-boards in 2004.

Table 13. Fall 2007 snake-cover results from the Lester Anderson lands on the Bristol/Lincoln border in Vermont for the Common Gartersnake (*Thamnophis sirtalis*). This is the seventh year of results. In 2007 there were thirty-four snakes and one shed skin recorded. (A record **113** snakes were found and measured in 2006.) Two species were caught: the Common Gartersnake, and the Red-bellied Snake (*Storeria occipitomaculata).*

Date	*Species*	S-V length in mm	Total length in mm	Location Cover # - Cover Area	Mass and Physical Info
Aug. 29	*T. sirtalis*	160	210	#14 - between	
Aug. 29	*T. sirtalis*	140	180	#21 - between	
Aug. 29	*T. sirtalis*	155	195	#21 - between	
Aug. 29	*T. sirtalis*	165	215	#32 - ground	
Sept. 5	*T. sirtalis*	170	210	#11 - ground	3.3 g
Sept. 5	*T. sirtalis*	143	178	#25 - ground	2.2 g
Sept. 5	*T. sirtalis*	145	190	#25 - ground	2.3 g
Sept. 5	*T. sirtalis*	145	195	#25 - ground	2.9 g
Sept. 5	*T. sirtalis*	150	195	#25 - ground	2.8 g
Sept. 5	*T. sirtalis*	150	195	#25 - ground	3.1 g
Sept. 5	*T. sirtalis*	170	215	#25 - ground	3.7 g
Sept. 5	*T. sirtalis*	170	220	#25 - ground	4.2 g
Sept. 5	*T. sirtalis*	150	195	#25 – ground	2.7 g
Sept. 5	*T. sirtalis*	160	205	#25 – ground	2.6 g
Sept. 5	*T. sirtalis*	160	205	#25 – ground	2.8 g
Sept. 5	*T. sirtalis*	160	200	#25 – ground	2.9 g
Sept. 5	*T. sirtalis*	165	210	#25 – ground	2.8 g
Sept. 5	*T. sirtalis*	170	210	#25 – ground	3.6 g
Sept. 12	*T. sirtalis*	320	402	#21 - ground	18.8 g
Sept. 12	*T. sirtalis*	155	200	#25 – ground	2.6 g
Sept. 12	*T. sirtalis*	160	205	#25 – ground	3.2 g
Sept. 19	*T. sirtalis*	145	187	#14 – ground	2.7 g
Sept. 19	*T. sirtalis*	346	402	#21 – ground	SHED SKIN
Sept. 19	*T. sirtalis*	180	230	#21 – crawled to it	3.0 g
Sept. 19	*T. sirtalis*	330	412	#21 - ground	>10 g
Sept. 19	*T. sirtalis*	205	265	#21 – ground	5.9 g
Sept. 19	*T. sirtalis*	240	312	#25 - ground	5.9 g
Sept. 19	*T. sirtalis*	160	205	#25 – ground	3.8 g
Sept. 19	*T. sirtalis*	165	215	#25 – ground	2.7 g
Sept. 19	*T. sirtalis*	165	215	#25 – ground	2.9 g
Sept. 19	*T. sirtalis*	165	213	#25 – ground	3.2 g
Sept. 19	*T. sirtalis*	170	225	#33 – between	3.3 g
Sept. 26	*T. sirtalis*	166		#21 - between	dead
Sept. 26	*T. sirtalis*	167	213	#26 - between	3.8 g dead
Oct. 3	*T. sirtalis*	152	198	#25 – ground	1.0 g

Table 14. Fall 2007 snake-cover results from the Lester Anderson lands on the Bristol/Lincoln border in Vermont for the Red-bellied (*Storeria occipitomaculata*). This is the seventh year of results. In 2007 there were twenty Red-bellied Snakes and one shed skin recorded.

Date	Species	S-V length in mm	Total length in mm	Location Cover # - Cover Area	Mass and Physical Info
Aug. 29	*S. occipitomaculata*	62	80	#17 - between	Very, very tiny
Aug. 29	*S. occipitomaculata*			#21 - between	SHED SKIN
Aug. 29	*S. occipitomaculata*	155	200	#22 - between	
Sept. 5	*S. occipitomaculata*	215	265	#11 - ground	5.6 g
Sept. 5	*S. occipitomaculata*	175	235	#25 - ground	4.1 g
Sept. 19	*S. occipitomaculata*	90	115	#1 – ground	0.6 g
Sept. 19	*S. occipitomaculata*	158	203	#22 – between	2.4 g dark brown
Sept. 19	*S. occipitomaculata*	225	275	#22 – between	6.6 g light brown
Sept. 19	*S. occipitomaculata*	80	110	#25 – between	0.5 g
Sept. 19	*S. occipitomaculata*	180	227	#26 – between	3.3 g
Sept. 19	*S. occipitomaculata*	212	262	#39 – between	7.1 g
Sept. 26	*S. occipitomaculata*	195	245	#22 – ground	4.2 g - dead
Oct. 3	*S. occipitomaculata*	155	200	#21 – ground	2.3 g
Oct. 10	*S. occipitomaculata*	190	245	#22 – between	3.9 g
Oct. 10	*S. occipitomaculata*	79	100	#3 – ground	0.6 g
Oct. 24	*S. occipitomaculata*	81	100	#21 – between	0.5 g
Oct. 24	*S. occipitomaculata*	160	211	#21 – between	2.5 g
Oct. 31	*S. occipitomaculata*	90	115	#21 – ground	0.4 g
Oct. 31	*S. occipitomaculata*	210	264	#39 – between	6.2 g
Nov. 7	*S. occipitomaculata*	63	79	#21 – ground	0.25 g
Nov. 7	*S. occipitomaculata*	87	109	#21 – ground	0.5 g

Table 15. Total individuals captured under snake-covers and estimated total individuals seen over entire season (2001-2007) on Lester Anderson lands in Lincoln, Vermont. (T = Total Snakes Captured, E = Estimated Total Snakes seen, V = number of Total Visits)

Species	*2001*			*2002*			*2003*			*2004*			*2005*			*2006*			*2007*		
	V	T	E[1]	V	T	E[1]	V	T	E[1]	V	T	E[1]	V	T	E[1]	V	T	E[1]	V	T	E[1]
S. occipitomaculata	7	5	5	8	19	14	9	6	***5***	***10***	***6***	***6***	***7***	***9***	***9***	***7***	***61***	***46***	***11***	***20***	***15***
T. sirtalis	7	0	0	8	9	8	9	5	***3***	***10***	***18***	***13***	***7***	***8***	***7***	***7***	***52***	***27***	***11***	***34***	***24***
L. triangulum	7	0	0	8	3	3	9	5	***3***	***10***	***10***	***10***	***7***	***2***	***2***	***7***	***0***	***0***	***11***	***0***	***0***
Total	7	5	5	8	31	25	9	16	***11***	***10***	***34***	***29***	***7***	***19***	***19***	***7***	***113***	***73***	***11***	***54***	***39***

[1]Since accuracy of measurement can vary slightly and young snakes grow quickly, we estimated that snakes might be the same snake if caught at nearby sites (within 2 cover-boards either direction) and were within +/- 10% of the same snout-vent length, unless other distinguishing characteristics were recorded, allowing us to determine they were different snakes.

Figure 1a: High Counts of *Ambystoma maculatum* egg masses on Lester Anderson Lands, Lincoln Vermont (1999-2007)

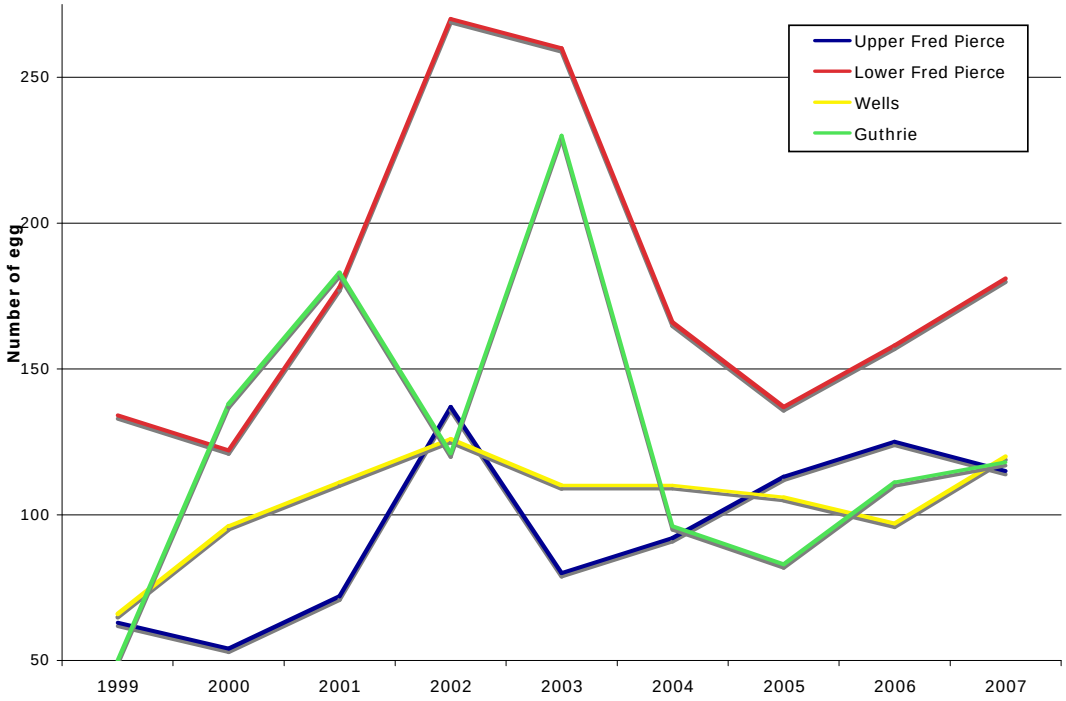

Figure 1b: High-count Trend Lines for *Ambystoma maculatum* egg masses on Lester Anderson Lands, Lincoln Vermont (1999-2007)

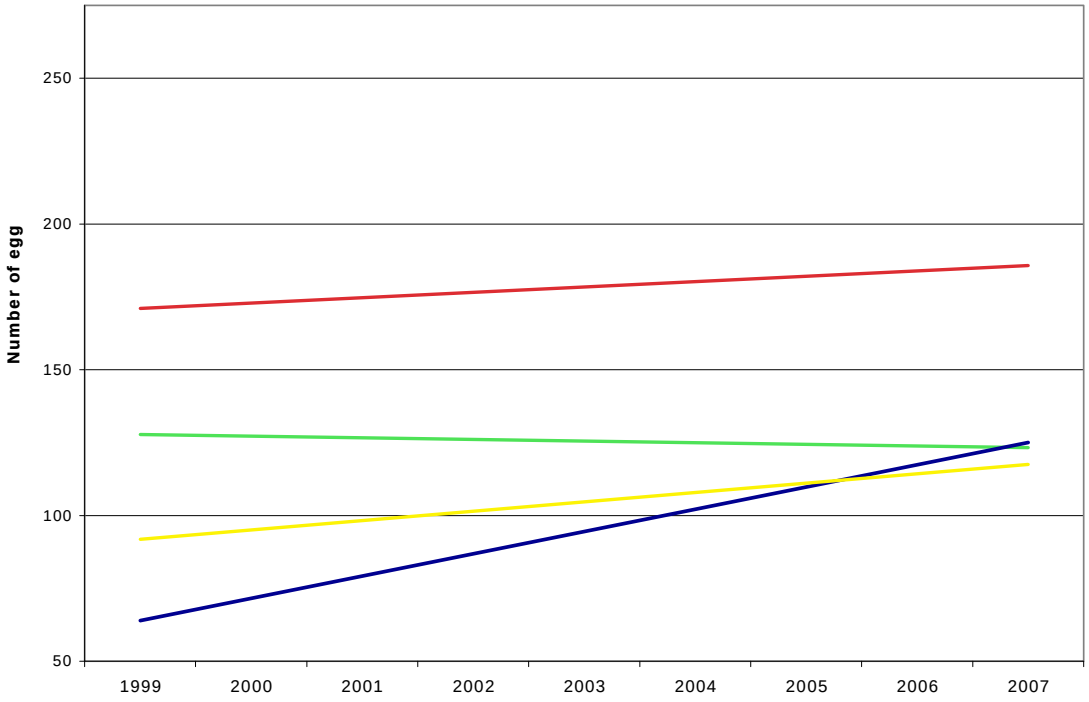

Figure 2a: High Counts of *Rana sylvatica* egg masses on Lester Anderson Lands, Lincoln, Vermont (2000-2007)

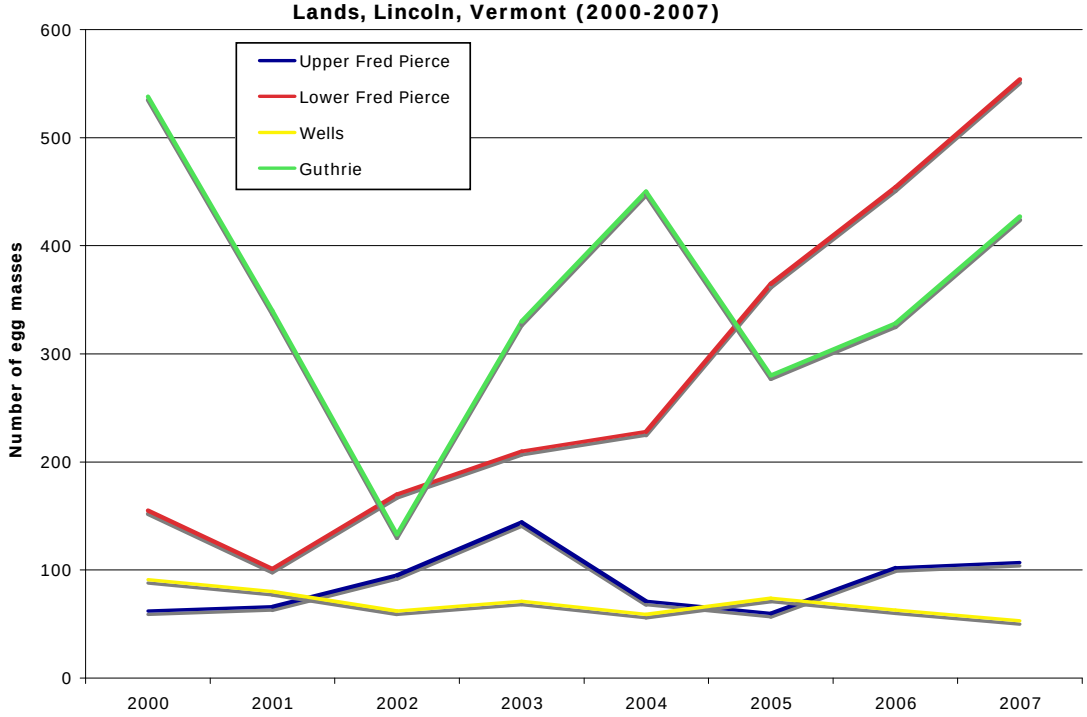

Figure 2b: High-count Trend Lines for *Rana sylvatica* egg masses on Lester Anderson Lands, Lincoln, Vermont (2000-2007)

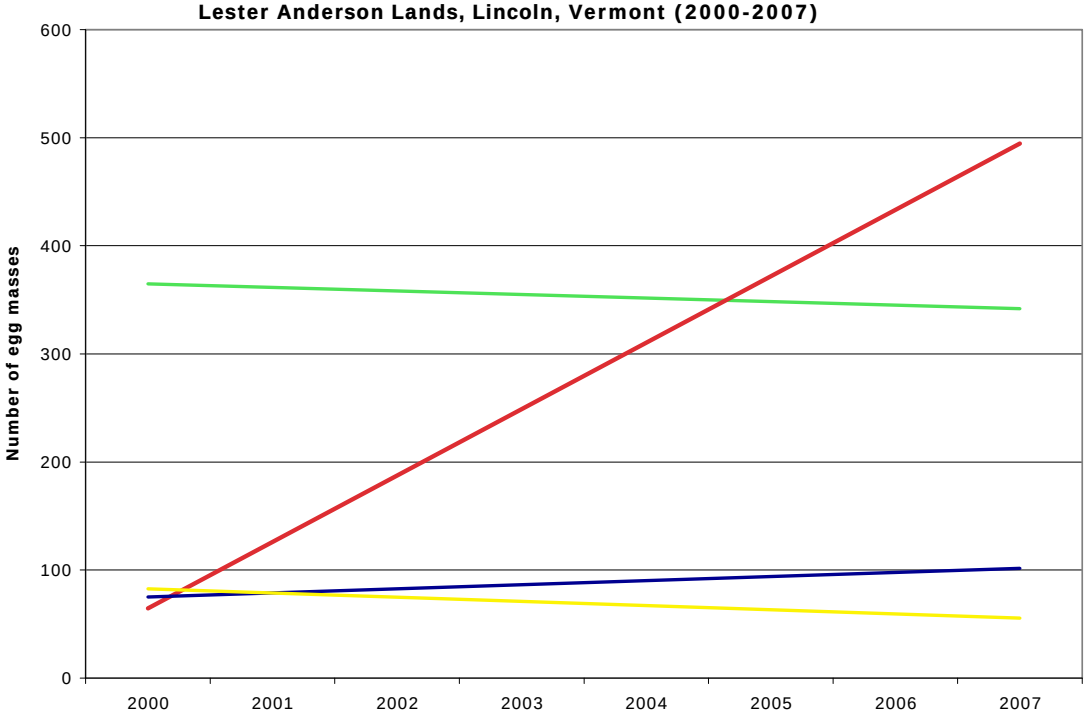

Figure 4a: Number of *Ambystoma maculatum* egg masses throughout the spring of 2007 on Lester Anderson Lands, Lincoln Vermont.

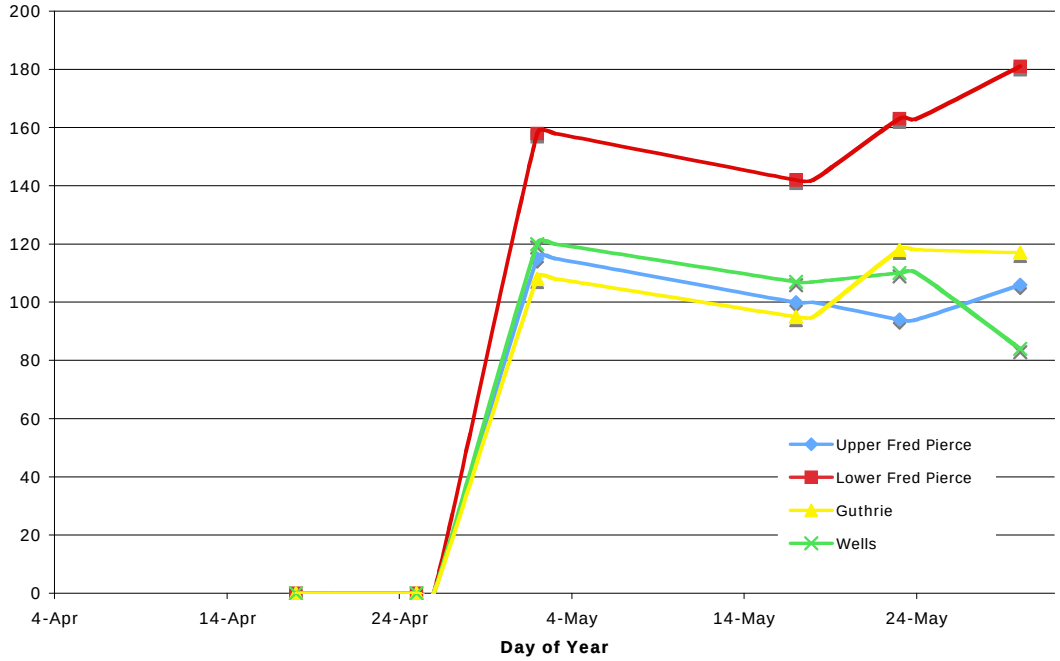

Figure 4b: Number of *Rana sylvatica* egg masses throughout the spring of 2007 on Lester Anderson Lands, Lincoln Vermont

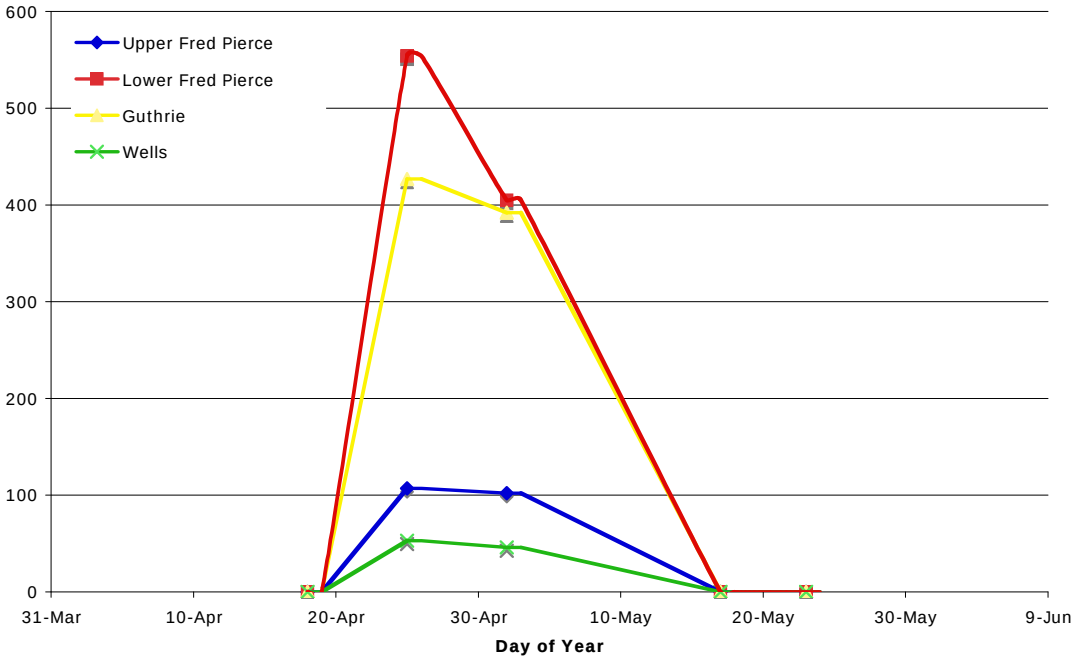

Figure 6: Size-class categories on high-count days for *Plethodon cinereus* on Lester Anderson Lands, Lincoln, Vermont (2001-2007)

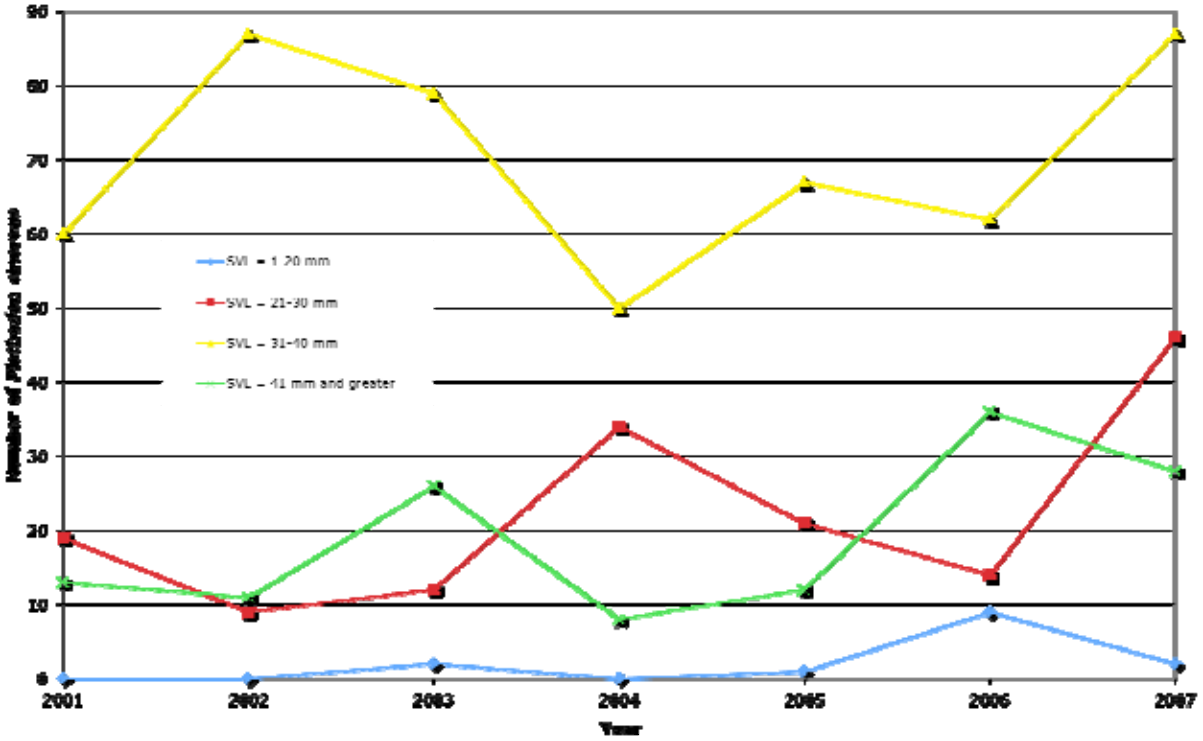

Figure 7: Number of total snakes seen at each snake cover (2001-2007) on Lester Anderson Lands, Lincoln, Vermont