National Park Service
U.S. Department of the Interior

Northeast Region
Boston, Massachusetts

Weir Farm National Historic Site Amphibian and Reptile Inventory March - September 2000

Technical Report NPS/NER/NRTR--2005/029

ON THE COVER
Weir Pond and spillway
Photograph by: courtesy of Weir Farm National Historic Site

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Technical Report NPS/NER/NRTR--2005/029

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November 2005

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This report was accomplished under Cooperative Agreement 1443CA4520-98-017 with assistance from the NPS. The statements, findings, conclusions, recommendations, and data in this report are solely those of the author(s), and do not necessarily reflect the views of the U.S. Department of the Interior, National Park Service.

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Please cite this publication as:

Brotherton, D. K., R. P. Cook, J. L. Behler. November 2005. Weir Farm National Historic Site Amphibian and Reptile Inventory March – September 2000. Technical Report NPS/NER/NRTR—2005/029. National Park Service. Boston, MA.

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Summary

Under a National Park Service/Wildlife Conservation Society Cooperative Agreement, an inventory of amphibians and reptiles at Weir Farm National Historic Site in Connecticut was conducted from March through September 2000. Six standardized sampling methods were employed; anuran call counts, egg-mass counts, time-constrained search, coverboards, turtle traps, and minnow traps. In addition, animals encountered outside of standardized surveys (temporally or spatially) were recorded as incidental encounters.

Eighteen amphibian and reptile species were documented in 2000 and a 19th, the marbled salamander, was incidentally recorded in 1998. These represent 63% (19/30) of the species likely to have occurred historically in the vicinity of Weir Farm. These included seven frog/toad species, five salamander species, four turtle species, and three snake species. Spring peeper, red-spotted newt, painted turtle, and eastern gartersnake were the most abundant and widely distributed species in each taxonomic group, based on total numbers of adults encountered and total number of locations recorded from. The only "listed' species found was the eastern box turtle, a species of *Special Concern* in Connecticut. Two adult eastern box turtles were found, one adjacent to Weir Pond and another in Field #1. Of the 30 species likely to have occurred historically in the vicinity of Weir Farm, 19 species recorded in 1998-2000 and seven not recorded appear to be stable in terms of their population trends. Four species not recorded in 2000 were considered to be "declining" based on regional population trends.

Each survey method was useful in sampling different habitats and specific species, and it is recommended that any future inventories targeting the entire herpetofauna include each method, and sample both upland and wetland habitats. Conversely, an inventory targeted at a particular species will need to sample specific habitats using only one or two methods. The "method" that documented the most species was incidental encounters, which recorded 16 of 18 species found in 2000. Nine species were recorded during pond time-constrained searches, seven each with anuran call counts and woodland time-constrained searches, six each with field time-constrained searches, minnow trapping, turtle trapping, and coverboards, five with stream time-constrained searches, and one species with egg-mass counts. Sixteen species were documented in wetland habitats, followed by 12 in uplands, and five in streams. Of the 21 localities (16 standardized sites and 5 incidental encounter locations) at which amphibians and reptiles were recorded, 52% (11) were uplands, 33% (7) were wetlands, and 14% (3) were streams. While a detailed plan for monitoring is beyond the scope of this inventory, the results suggest that, in terms of both feasibility and priority, a monitoring program based on time or spatially constrained search, anuran call counts, coverboards, and aquatic minnow trapping would be the most useful methods for generating quantitative data useful for trends analysis.

Acknowledgments

Funding for this project was provided by the National Park Service, and numerous people helped with fieldwork as well as with logistics. Natalie Marioni and Becky Kipp spent long days and many hours in the field, organized and summarized the data gathered, researched the park history, and provided draft reports summarizing the findings. Zookeepers from both the Bronx and Staten Island zoos helped out with fieldwork near the end of the season, when help was most needed. Weir Farm staff, particularly Greg Waters, provided valuable information about the park, species observations in the park, land use practices, and previous research conducted in the park. Dennis Skidds helped with data review and created the maps.

Introduction

With the assistance of the Weir Farm Trust, Weir Farm National Historic Site (WEFA) was established by Congress on October 31, 1990 to preserve the life and work of landscape artist J. Alden Weir (1852-1919), one of the founders of the Impressionist tradition in American art. WEFA is one of only two sites within the National Park system that focus primarily on art, and it is the only National Park unit in Connecticut (NPS 1995). Weir Farm Trust works with the National Park Service to protect and preserve WEFA and the adjoining open space. WEFA is one component of a network of nearly 300 acres of contiguous open space that includes 113 acres in Weir Preserve, 67 acres at WEFA, 33 acres of Town of Ridgefield conservation land, and 86 acres belonging to CT Dept of Transportation.

WEFA is located in southwestern Connecticut in a part of the towns of Wilton and Ridgefield known as Branchville in Fairfield County (41^{o} 15' N, 73^{o} 27' W), approximately 183 m (600') above sea level. It is within the Norwalk River watershed in the Southwest Hills Ecoregion, a coastal upland within 40 km (25 mi) of Long Island Sound characterized by schist and gneiss bedrock and granitic soils creating the foundation for its sloping terrain (Dowhan and Craig 1976). The geology yields higher levels of conductivity and pH of the primary water sources, compared to other Connecticut lakes (Farris and Chapman 1999). The forests of the area are primarily mixed oak, hickory, poplar, ash, and hemlock (Connecticut DEP 1991). WEFA's 24.3 ha (60 ac) are predominately deciduous forest, but also include open fields, an artificial permanent pond, a natural permanent pond, and numerous temporary ponds and small streams.

In 1998, a Cooperative Agreement between the National Park Service and the Wildlife Conservation Society was formed to assess amphibian and reptile assemblages within the parks of the "New England Cluster" of the National Park Service. As part of this inventory project, WEFA was surveyed from March through September 2000. While the goals of the project vary between parks, they generally are as follows:

- Inventory and record at least 90% of the species currently estimated to occur in the park.
- Determine the occurrence and status of species of management concern (e.g., state and federal *Threatened*, *Endangered*, and *Special Concern Species*, and other declining species).
- Determine abundance categories, distribution, and habitat use of documented species.
- Identify critical habitats of *Threatened*, *Endangered*, and *Special Concern* species.
- Provide basis for future development of a long term monitoring program.
- Analyze species occurrence against historical occurrence and evaluate the state of the park's herpetofauna, on a site and regional scale.

Determining the "historic" herpetofauna of WEFA was problematic, given the park's recent establishment. The only prior herpetofaunal surveys in and around WEFA and Weir Preserve were in the early 1980's (Klemens 1980a, 1980b, 1980c, 1982a, 1982b, 1982c). However, these surveys only involved a couple of days' fieldwork and were not designed to be comprehensive (M. Klemens, personal communication to R. Cook). General ecological surveys (Connecticut

DEP 1991) and recent natural history observations by NPS employees complement these surveys, but still are not comprehensive. Complicating the process of determining the "historic" herpetofauna of WEFA are the landscape changes that have occurred over the past few hundred years since Europeans arrived. Woodland-dominated landscapes were largely converted to agrarian, then largely abandoned to woodland succession. More recently, the return of woodlands is being countered by suburbanization. All these changes would have affected the area's herpetofauna in both positive and negative ways, depending on species, and make it difficult to specify which point in time "historic" represents. Moreover, since the only surveys occurred fairly late in this time scale, they are more a reflection of modern rather than historic conditions.

Assuming that species are more likely to have been lost than gained since European arrival, we considered species present in the 1980's or recently recorded as likely to have been present "historically". Thus, to provide the best estimate of which species likely occurred historically at WEFA, we used records from in and around WEFA, as well as additional records from Ridgefield, Wilton, Redding and Weston (Klemens 1993). These towns are located within approximately 16.1 km (10 miles) of WEFA. We included species recorded from these towns if the appropriate habitats were found in the park. Collectively, these sources suggest that 30 species potentially occurred in the vicinity of WEFA (Appendix A).

A combination of six standardized survey methods were used in the inventory. Incidental encounters were also recorded to provide additional information on species presence and distribution in the park. The habitat type of all sites where amphibians and reptiles were found was described, and the species and the habitat types they occupied were analyzed.

Study Area

WEFA is located in Fairfield County, southwestern Connecticut, approximately 97 km (60 miles) northeast of New York City. Deciduous forest dominates the landscape of the park covering 15.8 ha (39 ac) or 65% of the park, followed by wetland covering 6.1 ha (15 ac) or 25% of the park, and field covering 2.4 ha (6 ac) or 10% of the park (Farris and Chapman 1999). The dominant forest type is red oak (*Quercus rubra*)/maple-leaved viburnum (*Viburnum acerifolium*), followed by sugar maple (*Acer saccharum*)/white ash (*Fraxinus americana*), and red maple (*Acer rubrum*) (Connecticut DEP 1991). To the southwest, the Nature Conservancy manages the 45.8 ha (113 ac) Weir-Leary-White Preserve, to the northeast the Town of Ridgefield owns approximately 13.4 ha (33 ac) of conservation land, and also to the northeast, the Connecticut Department of Transportation owns approximately 34.8 ha (86 ac). Residential areas border WEFA on the northwestern and southeastern boundaries of the property (NPS 1995). Pelham Lane bisects the park from the west and intersects with Nod Hill Road, which bisects the park from the north and south. Numerous dirt trails are found throughout the park, primarily to the east of Nod Hill Road, and a single trail to the south connects WEFA with the Weir Preserve.

Aquatic habitats in WEFA include several streams; Weir Pond, a 1.6 ha (4 ac) artificial permanent pond in the northeast section of the park; one other permanent pond and several temporary ponds and marshes (Melberg 1993; Farris and Chapman 1999). Streams in the western side of the park feed into Weir Pond.

Land Use History

In 1882, J. Alden Weir received 61.9 ha (153 ac) of land in Branchville, Connecticut from the art collector Erwin Davis in exchange for a painting that Weir owned. Prior to Weir, two families, the Webbs and the Beers, owned much of the land. Before his death in 1919, Weir had acquired 96.4 ha (238 ac) (Child Associates and Zaivetsky 1996). During the first eighteen years he owned the farmland, Weir built various buildings, including a house and a studio just east of Nod Hill Road. In 1896, Weir Pond was constructed by damming, and was used for fishing and ice cutting, and a structure was built on an island in the pond. Various correspondence and paintings suggest that before 1900 much of the eastern side of Nod Hill Road was used for farming. These fields were likely used to raise livestock. By 1919, the landscape consisted primarily of open, rocky fields flanked by stonewalls with scattered hedgerows (Child Associates and Zaitzevsky 1996).

In comparing maps from 1919 to modern maps and field observations in 2000, changes in the landscape are apparent, primarily reflecting successional change in upland habitats. East of present day Pond D, what was open field in 1919 is now deciduous forest. Aerial photographs from 1941 and 1951 illustrate open land undergoing successional growth, with mature trees visible in later maps. These trees likely acted as field and wetland boundary markers as early as 1919 (Child Associates and Zaitzevsky 1996).

After Weir's death in 1919, the land changed hands many times before becoming property of the state of Connecticut. Between 1920 and 1957 less emphasis was placed on farming and maintaining the land, allowing for the woodland succession to occur (Child Associates and Zaitzevsky 1996). When Sperry and Doris Andrews purchased the farm in 1957 they envisioned the land as a place for visitors and potential artists, thus making it a priority during their ownership to preserve the landscape for future generations. They were the last private owners before the land became part of the National Park System in 1990.

Current Land Use Practices

Today, most of the park is passively managed, with occasional trail maintenance and removal of vines, seedling trees, and invasive species such as barberry (*Berberis thunbergii*), multi-flora rose (*Rosa multiflora*), and winged euonymus (*Euonymus alatus*). The 2.4 ha (6 ac) of field habitat are mowed annually in November and paths through fields are mowed as needed in the summer.(G. Waters pers. comm.).

Methods

Both general and targeted standard survey methods were used in stream, wetland, and upland habitats. Multiple methods were used in a given habitat because these habitats often support diverse amphibian and reptile species and require several methods to sample the entire herpetological community. Three habitat types were used (stream, wetland, and upland) along with seven sub-habitat categories (Appendix B) to provide a general description of each survey site.

Site selection for standardized surveys was designed to sample across the range of habitat types available, as well as be geographically encompassing (Table 1, Figure 1, Appendix B). Based on existing maps of wetland and upland habitats, as well as field reconnaissance, all of the streams, ponds/wetlands, field and woodland habitats were identified. Due to the park's relatively small size, the number of ponds/wetlands and streams were limited, such that all were sampled. Similarly, woodland habitat in the park was partitioned into five "sections" and all were sampled. Two areas of field habitat were selected for sampling.

Incidental encounter locations represent specific points or areas where animals were encountered outside of formal standardized surveys. The measure of a species' overall distribution was obtained by combining the number of standardized survey sites and incidental encounter locations at which it was recorded. This summed term is referred to as "localities". There were 21 localities. Of these, 16 were standardized survey sites, 12 were standardized survey sites at which incidental encounters occurred, and 5 were incidental encounter locations only.

Table 1. Overview of standardized survey sites and sampling methods used at each site.

Site	Habitat	Call Count	Egg Mass Count	TCS Pond	TCS Stream	TCS Field	TCS Woodland	TCS Coverboard	Turtle Trap	Minnow Trap
Pond A	temporary pond	X		X					X	X
Pond C	temporary pond	X	X	X					X	X
Pond D	temporary pond	X		X					X	X
Pond H	temporary pond	X	X	X					X	X
No Name Pond	permanent pond	X		X					X	X
Weir Pond	permanent pond	X		X					X	X
Stream #1	intermittent stream				X					
Stream #2	permanent stream				X					
Stream #3	permanent stream				X					
Field #1	field					X		X		
Field #2	field					X		X		
Woodland #1	deciduous forest						X	X		
Woodland #2	deciduous forest						X			
Woodland #3	deciduous forest						X	X		
Woodland #4	deciduous forest						X	X		
Woodland #5	deciduous forest						X	X		

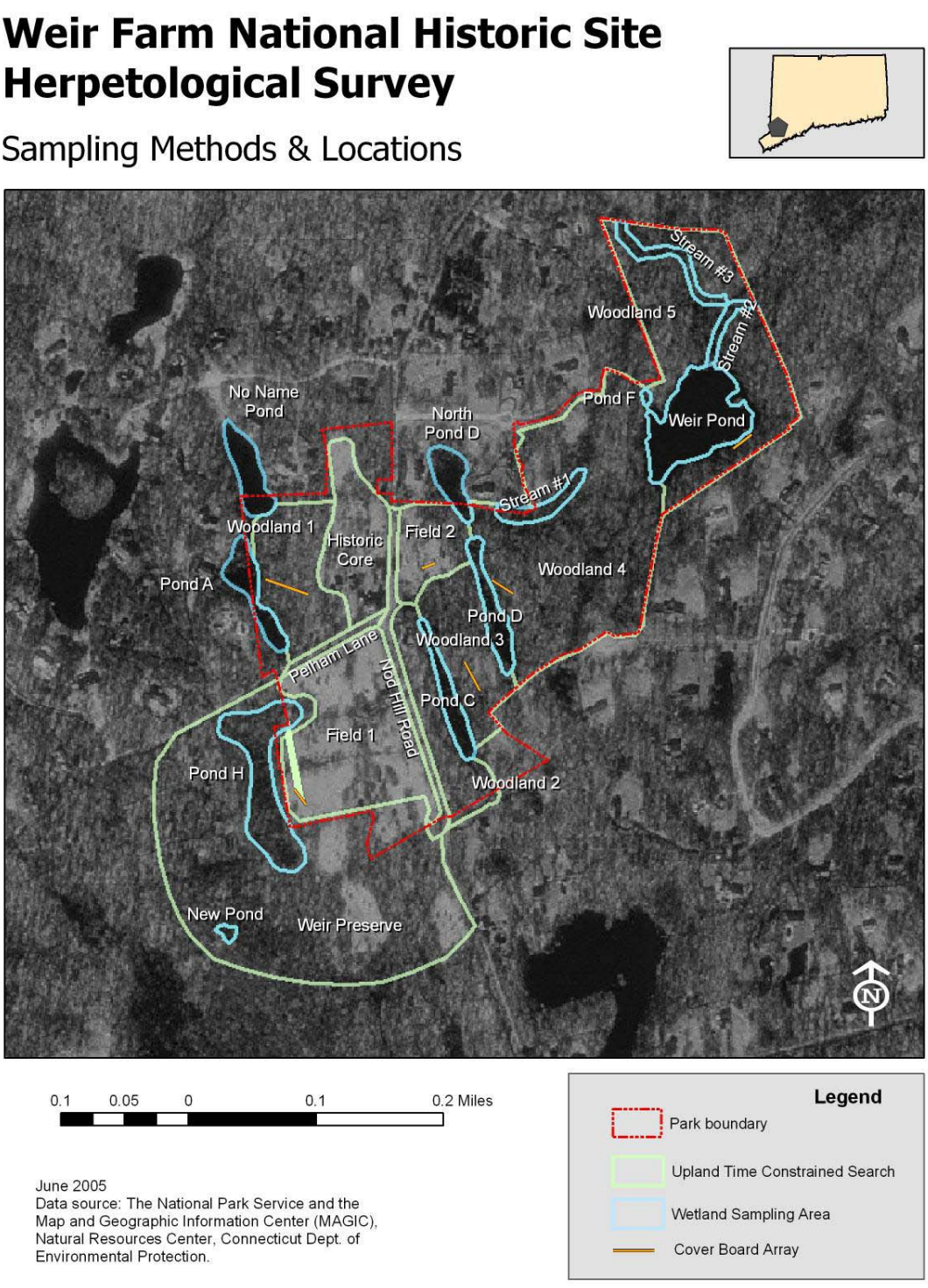

Figure 1. Location of standardized sampling sites and time-constrained search areas used in herpetofaunal inventory of Weir Farm National Historic Site.

Quantifying overall abundance was problematic due to the fact that each of the methods used provides a sample biased towards a particular species or group of species. However, since sampling effort was fairly evenly divided among the different methods and sampling biases were thus more or less compensated for, an overall measure of abundance for each species was derived by summing the number of adult form (as opposed to eggs or larvae) individuals encountered during each of the seven survey methods. For time-constrained search, coverboard checks, turtle and minnow trapping, and incidental encounters, the numbers of adults of a given species encountered during each sampling occasion were summed. Since amphibians were not marked for individual identification, for the purposes of quantifying overall abundance, reptiles were also treated as though they had not been marked. Since anuran call counts and egg mass counts do not directly count adults, the numbers of adults represented by these samples was estimated as follows. For spotted salamanders, Cook (1978) determined that, on average, each egg mass represented 0.633 females. Thus, the number of females present at a site was estimated as 0.633 times the number of egg masses. While males were obviously also present, they are not readily estimated and are not included. For wood frog egg mass counts, each egg mass represented the presence of one adult female (Crouch and Paton 2000). For anuran call counts, index values were converted to conservative estimates of the number of calling males present, based on data collected at Cape Cod National Seashore where both index values and estimates of numbers calling were made (Cook, unpublished data). Conservatively estimated numbers are as follows: northern green frog (*Rana clamitans melanota*) Index 1=2 males, Index 2=8 males, Index 3=12 males; American bullfrog (*Rana catesbeiana*) Index 1=2 males, Index 2=5 males; grey treefrog (*Hyla versicolor*) Index 1=3 males; pickerel frog (*Rana palustris*) Index 1=2 males, Index 2=7 males; wood frog Index 1=1 male; spring peeper (*Pseudacris crucifer*) Index 1=3 males, Index 2=7 males, Index 3=20 males; Fowler's toad (*Bufo fowleri*) Index 1=2 males. For anuran species with no estimates from Cape Cod, conservative estimates for calling anurans were as follows: Index 1=1 male, Index 2=11 males, Index 3=35 males (Crouch and Paton 2002). Estimates of calling male anurans do not include those females that may be present.

While these estimates are the best available of overall abundance, the reader is cautioned not to place too much stock in the actual numbers. They are best interpreted not so much as absolute numbers but rather, as a reasonably accurate representation of ranked relative abundance and differences between species in the order of magnitude of their abundance.

Common and scientific names and spellings are those of Crother (2000) (Appendix C). A Garmin III Plus Global Positioning System (GPS) unit was used to record the coordinates of each site surveyed during standardized surveys and locations identified during incidental encounters (Appendix D). GPS locality data were recorded as Universal Transverse Mercator (UTM) grid coordinates X=x-axis or Easting, and Y=y-axis or Northing, using NAD83. Given the low-impact nature of this study, voucher specimens of live animals were not collected.

Anuran Call Counts

Anuran call counts were conducted using the Wisconsin frog and toad survey method (Heyer et al. 1994) at six ponds. Anuran call counts record the presence of species at specific sites and provide an index of abundance based on the calling intensity of species heard. Call index values and criteria for assigning them are; 0 = no calls, 1 = individuals can be counted (no overlapping

of calls), 2 = overlapping of calls (can still be counted), 3 = full chorus-calls are constant and individually indistinguishable. The surveyors arrived at each sample site at least one half-hour after dusk. Surveyors listened for anuran calls for five minutes, recording species heard, the number of individuals heard, if any, and the call index for each species.

Of the six anuran call count sites, one was surveyed seven times and five were surveyed nine times each between 22 March and 18 June 2000. Multiple call counts at a site, conducted over the entire spring and early summer months, are necessary to document species presence over time, as different anuran species are active at different times of the season (Conant and Collins 1998; Crouch and Paton 2002).

Survey sites were

1. No Name Pond-9 sampling occasions
2. Pond A-9 sampling occasions
3. Pond C-9 sampling occasions
4. Pond D-9 sampling occasions
5. Pond H-7 sampling occasions
6. Weir Pond-9 sampling occasions

Egg Mass Counts

Amphibians such as spotted salamanders (*Ambystoma maculatum*) and wood frogs (*Rana sylvatica*) migrate to ponds in the early spring to breed, depositing gelatinous egg masses. These masses are attached to branches and vegetation in the water (Petranka 1998). Egg mass counts were conducted to record species presence and to document evidence of breeding by these and other pond-breeding amphibians (Albers and Prouty 1987; Mitchell 2000). Amphibian egg mass counts were conducted on 7 April at Pond C and 3 May at Pond H. In counting egg masses, the entire pond was traversed, visually searching for egg masses, identifying and counting all egg masses observed and recording developmental stage and % mortality. While every effort was made to count all masses present in a pond, because spawning is only loosely synchronized, counts based on a single survey may underestimate total numbers of egg masses laid. Since only one egg mass count was conducted at each of these sites, numbers of egg masses and species presence is likely underestimated.

Time Constrained Search (TCS)

Habitat specific time-constrained search (TCS) was conducted in all habitats likely to support amphibians and reptiles, i.e., streams, woodlands, fields, and ponds. Searches were conducted by moving through the habitat at a given site and searching under the best available cover (i.e., rocks, logs) favored by amphibians and reptiles (Bury and Raphael 1983), and by dip netting ponds (Heyer et al. 1994). An Index of Abundance (IA) for each species was calculated by dividing the total number of individuals recorded by the total search effort (search hours) spent for each search. Search hours are the total amount of time spent searching, multiplied by the number of people participating in the search.

Streams

Three stream sites were searched seven times each between 23 March and 4 September 2000. Total search time ranged from 6.7 to 8.4 search hours/stream. Starting and ending times (Eastern Standard Time) and the number of people searching were recorded. Investigators systematically moved upstream, using a dip net in the stream to capture amphibians as rocks were overturned. Rocks, logs, and debris in the splash zone and on the bank were overturned and searched under. Identification and life stage (adult or larva) were recorded for each animal captured. The adult life stage was defined as any individual not in the larval stage and the larval stage, was defined as an individual with gills, showing pre-metamorphic characteristics.

Survey sites were:

1. Stream #1 – intermittent, flows east from the north end of Pond D
2. Stream #2 – permanent, flows north from Weir Pond dam
3. Stream #3 – permanent, flows southeast to the north of Weir Pond

Woodlands

Five woodland areas were searched seven times each between 24 March and 8 September 2000. Total search time ranged from 6.6 to 8.3 search hours/area. Start and end times, number of searchers, and the identification, number, and sex of individuals found were recorded.

Survey areas were:

1. Woodland #1 – oak/maple leaf viburnum forest between Pond A and Weir House
2. Woodland #2 – maple/ash/New York fern forest between Nod Hill Road and Pond C
3. Woodland #3 – successional forest between Pond C and Pond D
4. Woodland #4 – forest bordered by Pond D to the west and Weir Pond to the east
5. Woodland #5 – forest to the northeast of Weir Pond

Fields

Two fields were searched (Field #1-five times, 9.3 search hours; Field #2-seven times, 14.7 search hours) between 4 April and 8 September 2000. Start and end times, number of searchers, and the identification, number, and sex of individuals found were recorded.

Survey areas were:

1. Field #1 – southwest quadrant of the park, to the west of Nod Hill Road
2. Field #2 – east of Nod Hill Road and north east of Field #1

Ponds

Six ponds were searched seven times each between 23 March and 7 September 2000. Total search time ranged from 6.2 to 7.3 search hours/pond. Searches were conducted after dusk, a time when amphibians are most active, by walking along the water's edge using spotlights, spotting scopes, and dip-nets to identify amphibians and reptiles in and around the ponds. Start

and end times, number of searchers, and the identification, number and sex of individuals found were recorded.

Survey sites were:

1. Pond A – temporary pond
2. Pond C – temporary pond
3. Pond D – temporary pond
4. Pond H – temporary pond
5. Weir Pond – permanent pond
6. No Name Pond – permanent pond

Coverboards

Coverboards (Grant et al. 1992) were used primarily to inventory snakes. Coverboards located near wetlands were also expected to provide cover for terrestrial amphibians. Boards were 0.6m x 1.2m (2' x 4') and made of corrugated sheet metal or plywood. In March 2000, coverboards were deployed on top of vegetation at four woodland and two field sites. Six boards were placed five meters apart in linear "arrays" consisting of alternating wood and metal boards. One to two arrays were set at each survey site, depending on the size of the habitat area. Corn kernels were scattered under each coverboard in order to attract rodents and ultimately snakes. Coverboards were checked one to four times each in April and May, twice in June, and three times during August and September.

Woodland arrays were:

1. Woodland #1 – one array
2. Woodland #3 – one array
3. Woodland #4 – one array
4. Woodland #5 – one array

Field arrays were:

1. Field #1 – two arrays
2. Field #2 – one array

Capture rates (CR) were calculated as the number of snakes captured under boards divided by the total number of board checks for each site. Each time a board was checked constituted a "board check". Therefore, a site with 12 boards visited six times equaled 72 board checks. The number of snakes captured per 100 coverboard checks were calculated as:

$$CR = \frac{(\text{\# of individual snakes captured})}{(\text{total \# of board checks})} \times 100$$

Turtle Traps

Welded-wire crab traps measuring 30.5cm x 30.5cm x 60.1cm (12”x12”x 24”), with a mesh size of 1.3cm x 2.5cm (0.5” x 1”), were primarily used to sample shallow areas (Ponds A, C, D, H), for small aquatic/semi-aquatic turtles while funnel traps made of D-shaped metal hoops and 2.6cm (1”) nylon mesh were used to sample deeper pond areas (Weir Pond and No Name Pond) for aquatic turtles such as painted (*Chrysemys picta*) and snapping turtles (*Chelydra serpentina*) (Harless and Morlock 1989). Traps, baited with sardines in vegetable oil and checked daily, were set for five-day periods between 4 April and 19 June 2000. Each turtle was assigned a unique, individual identification number and, using a three-sided file, triangular notches were made on marginal scutes, to represent that number (Cagle 1939).

Trap sites were:

1. Pond A (4, 5-day trapping periods, 2 to 6 traps)
2. Pond C (4, 5-day trapping periods, 2 to 6 traps)
3. Pond D (4, 5-day trapping periods, 2 to 6 traps)
4. Pond H (4, 5-day trapping periods, 2 to 4 traps)
5. Weir Pond (2, 5-day trapping periods, 10 traps)
6. No Name Pond (2, 5-day trapping periods, 3 traps)

Minnow Traps

Wire mesh minnow traps measuring 15.2cm x 15.2cm x 30.5cm (6”x 6”x 12”) were used to sample shallow pond areas for adult and larval salamanders, adult and larval anurans, and aquatic snakes (Heyer et al. 1994). Two to six traps were deployed at six sites for five-day periods between 22 March and 8 September 2000. Since this method primarily captures amphibians, which were not marked for individual recognition, abundance was quantified as total captures (rather than unique individuals) per 100 trap nights.

Trap sites were:

1. Pond A (7, 5-day trapping periods, 4 to 5 traps)
2. Pond C (7, 5-day trapping periods, 4 traps)
3. Pond D (7, 5-day trapping periods, 4 traps)
4. Pond H (7, 5-day trapping periods, 2 to 3 traps)
5. Weir Pond (7, 5-day trapping periods, 4 to 6 traps)
6. No Name Pond (7, 5-day trapping periods, 3 traps)

Incidental Encounters

Any encounter with an amphibian or reptile not recorded as data in one of the standardized surveys was considered an incidental encounter. These were recorded on observation cards (“Green Cards”) to augment data collected during formal surveys, and include credible observations made by park staff and visitors. For each incidental encounter, species, life stage, method of documentation, as well as location, habitat, and UTM coordinates were recorded, though some of these data were sometimes missing from visitor reports.

Data Storage

Data collected during the course of this study are stored on computer disk attached to this report. The original data sheets (Volumes I and II) are archived with the Northeast Temperate Inventory and Monitoring Network, Woodstock, Vermont.

Results

Overview of Park Herpetofauna

A total of 18 species, 11 amphibian and seven reptile were recorded in 2000. A 19th species, the marbled salamander (*Ambystoma opacum*), was recorded incidentally in 1998 by Greg Waters, but is not included in our tabulations. Amphibians dominated the herpetofaunal community, accounting for 89.1% of the 3140 individuals recorded. By taxonomic group, anurans comprised 80.5% of all individuals, turtles 9.8%, salamanders 8.1%, and snakes 1.1%. The most abundant species in each taxonomic group, based on total numbers of adults recorded were spring peeper, red-spotted newt (*Notophthalmus v. viridescens*), painted turtle, and eastern gartersnake (*Thamnophis s. sirtalis*) (Table 2).

Animals were captured at 21 localities (16 standardized sample sites plus 5 incidental encounter locations) (Figures 2,3,4,5). Based on frequency of occurrence, the most widespread species in each taxonomic group was spring peeper (18 or 85.7% of all localities), red-spotted newt (13 or 61.9%), painted turtle (4 or 19.0%), and eastern gartersnake (5 or 23.8%) (Table 3). Weir Pond was the most species rich site with 10 of 18 (56%) species found, and Pond C accounted for the greatest number of individuals (919 individuals or 29.3%) (Table 4).

By habitat, relative abundance (number of adults) was greatest in wetland (86.2% of individuals recorded), followed by upland (13.0%), and stream (0.8%) (Table 2). Similarly, species richness was greatest in wetlands, 13 species, followed by 12 species in uplands, and 5 species in streams. Within the seven sub-habitat categories, species richness was greatest in temporary ponds (12 species, 67% of recorded species), in permanent ponds and deciduous forest (11 species or 61%), and in fields (9 species or 50.0%) (Table 2).

Table 2. Number of adult amphibians and reptiles encountered during all surveys by habitat category in Weir Farm National Historic Site, March to September 2000. Numbers include all captures and observations, not necessarily unique individuals. Relative abundance (RA) is number of individuals/species divided by total number of adults of all species (n=3140), multiplied by 100.

	Stream		Wetland		Upland				
	int.	perm.	temporary pond	permanent pond	field	deciduous forest	road	Total	RA (%)(Rank)
FROGS									
spring peeper	2	2	783	269	134	49		1239	39.45 (1)
northern green frog	1	12	308	125		12	1	459	14.61 (2)
gray treefrog			357	38				395	12.58 (3)
wood frog	4		268			6		278	8.85 (5)
pickerel frog		3	19	32	24	9	1	88	2.80 (7)
American bullfrog			9	48	2			59	1.88 (9)
Fowler's toad			2	20	1	1		24	0.76 (12)
SALAMANDERS									
red-spotted newt			43	26	20	48		137	4.36 (6)
E. red-backed salamander					2	67		69	2.20 (8)
spotted salamander			36	5	3	3		47	1.50 (10)
N. two-lined salamander		2						2	0.06 (15)
TURTLES									
painted turtle			25	270				295	9.39 (4)
snapping turtle				8				8	0.25 (14)
eastern box turtle					1	1		2	0.06 (15)
spotted turtle			2					2	0.06 (15)
SNAKES									
eastern gartersnake					20	3	2	25	0.80 (11)
northern watersnake			1	9				10	0.32 (13)
northern ring-necked snake						1		1	0.03 (16)
TOTAL # ADULTS	7	19	1853	850	207	200	4	3140	
TOTAL # SPECIES	3	4	12	11	9	11	3	18	
	5			13		12			

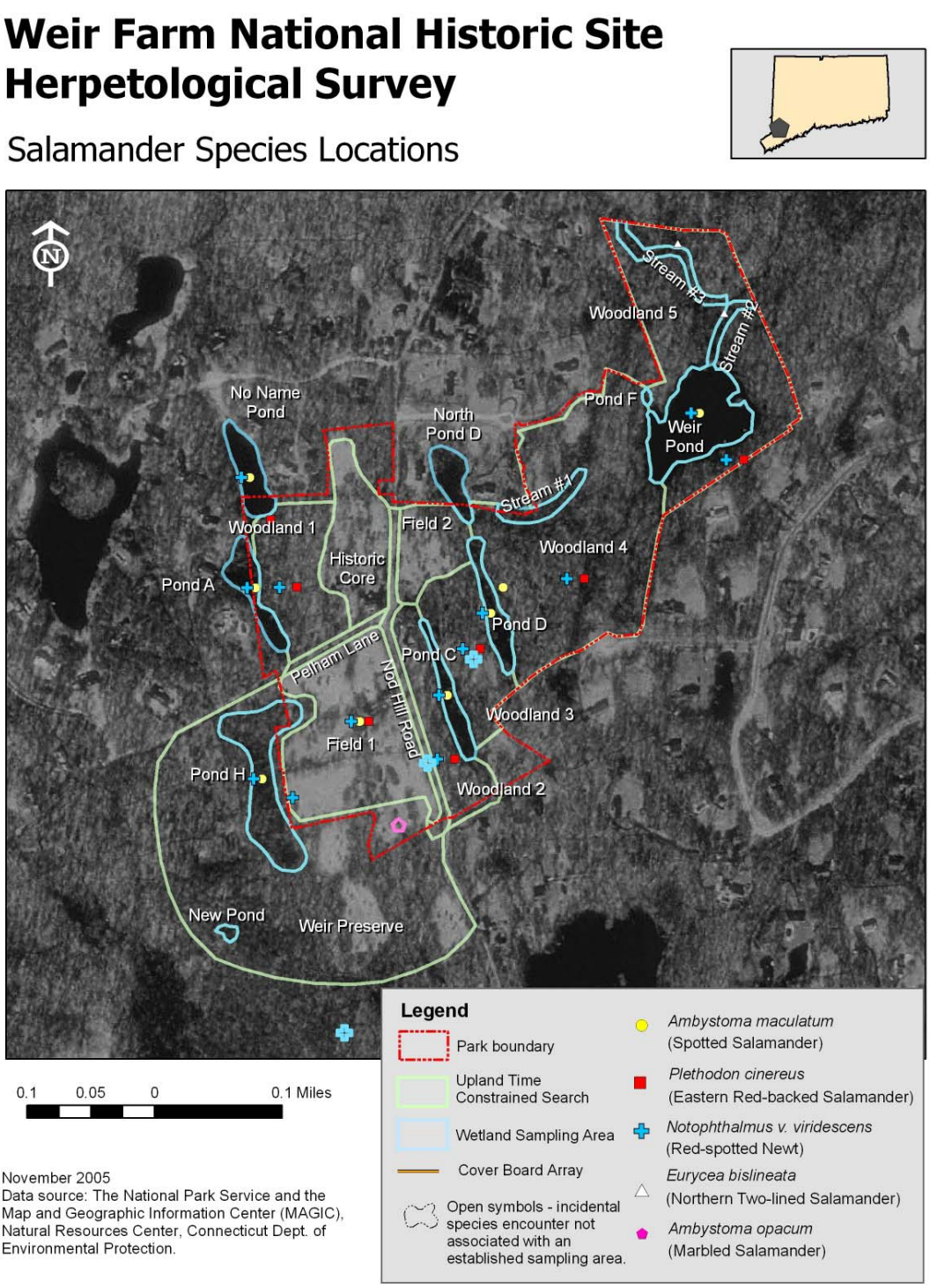

Figure 2. Location of salamanders recorded at Weir Farm National Historic Site in 2000. Marbled salamander shown was recorded in 1998. Solid symbols indicate a given species was recorded within a given area or pond. Open symbols show actual location.

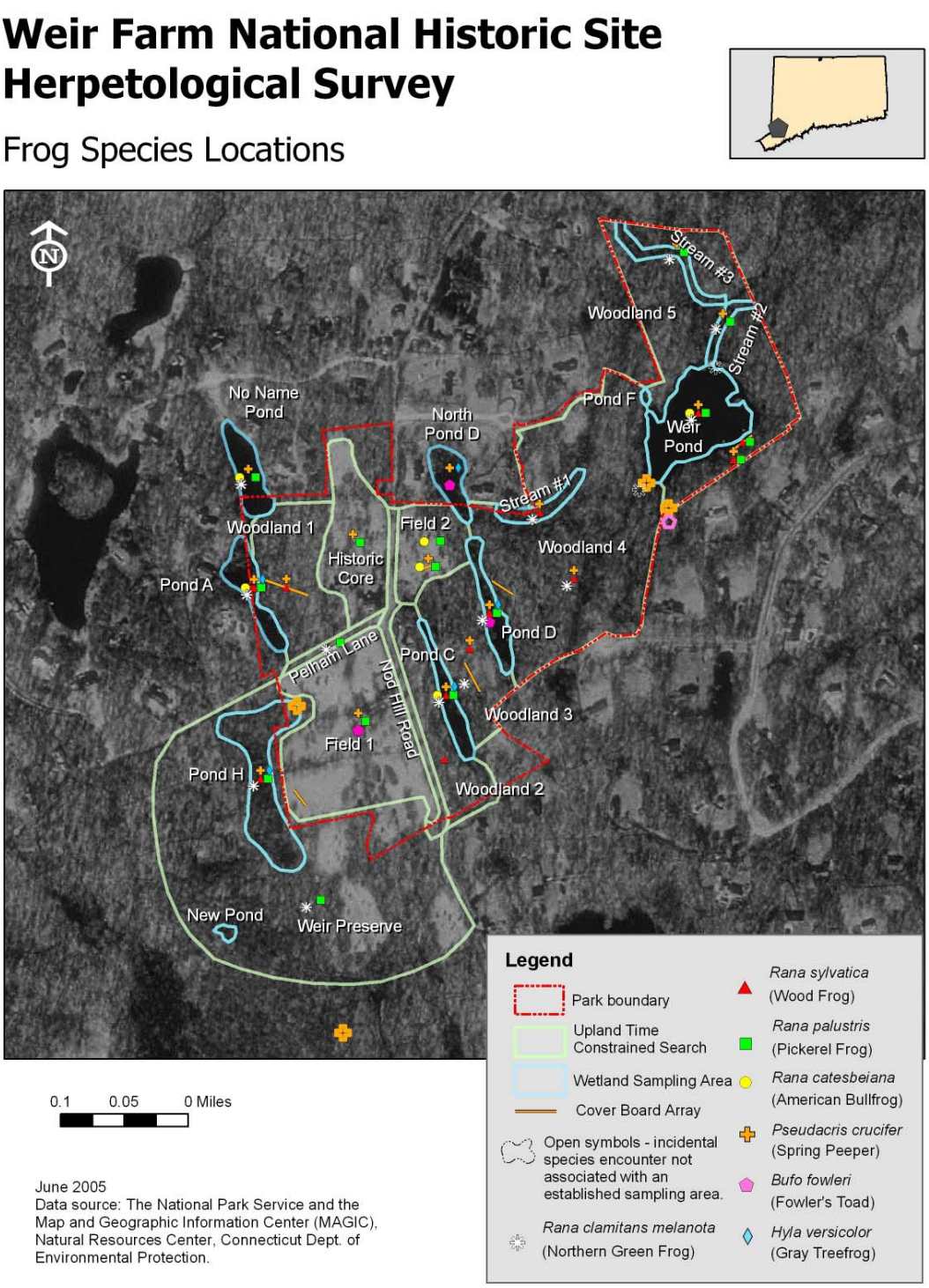

Figure 3. Location of frog species detected at Weir Farm National Historic Site in 2000. Solid symbols indicate a given species was recorded within a given area or pond. Open symbols show actual location.

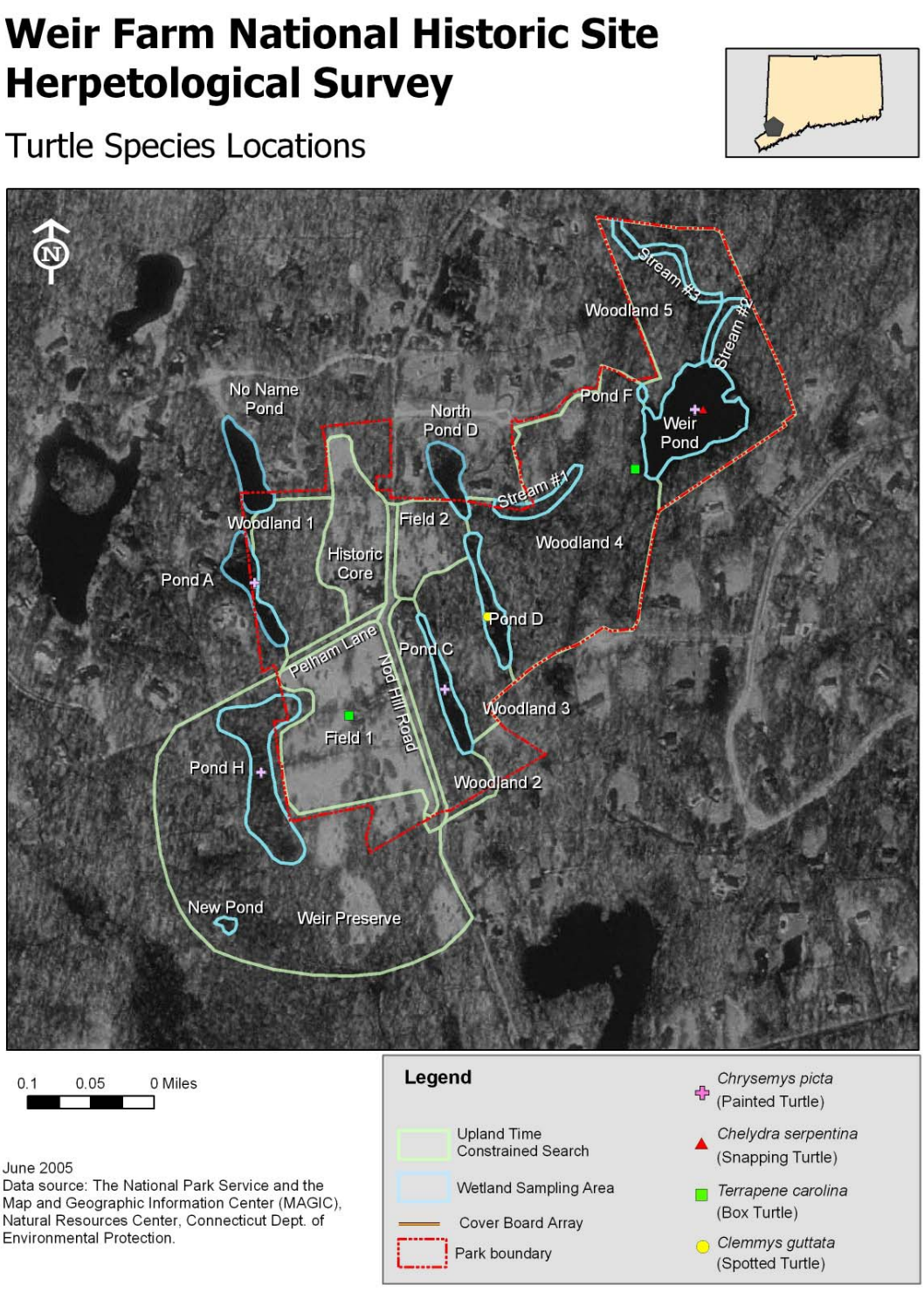

Figure 4. Location of turtles recorded at Weir Farm National Historic Site in 2000. Solid symbols indicate a given species was recorded within a given area or pond. Open symbols show actual location.

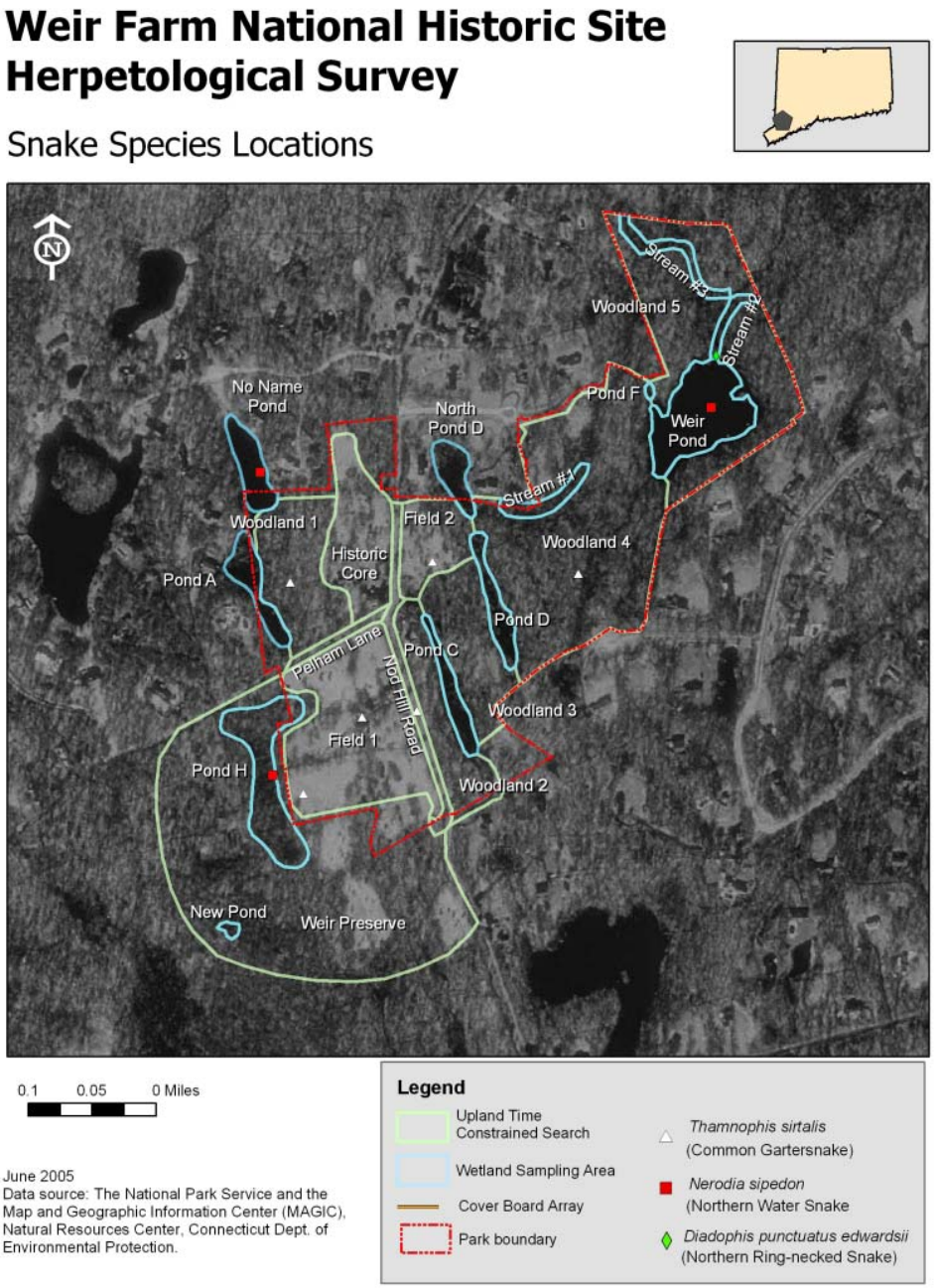

Figure 5. Location of snakes recorded at Weir Farm National Historic Site in 2000.

Table 3. Number of locations recorded from, by habitat category, of 18 species of amphibians and reptiles recorded at Weir Farm National Historic Site in 2000. Frequency of Occurrence (FO) is the percent of localities at which a species was recorded.

	Stream		Wetland		Upland				
	int.	perm.	temporary pond	permanent pond	field	deciduous forest	road	Total	FO (%)
FROGS									
spring peeper	1	2	4	3	3	5		18	85.7
pickerel frog		2	4	2	3	2	1	14	66.7
northern green frog	1	2	4	2		3	1	13	61.9
wood frog	1		4	1		5		11	52.4
gray treefrog			4	1				5	23.8
American bullfrog			2	2	1			5	23.8
Fowler's toad			1	1	1	1		4	19.0
SALAMANDERS									
red-spotted newt			4	2	1	6		13	61.9
spotted salamander			4	2	1	1		8	38.1
eastern red-backed salamander					1	5		6	28.6
northern two-lined salamander		2						2	9.5
TURTLES									
painted turtle			3	1				4	19.0
eastern box turtle					1	1		2	9.5
snapping turtle				1				1	4.8
spotted turtle			1					1	4.8
SNAKES									
eastern gartersnake					2	2	1	5	23.8
northern watersnake			1	2				3	14.3
northern ring-necked snake						1		1	4.8
TOTAL # of LOCALITIES	1	2	4	3	3	6	2	21	

Table 4. Number of adults recorded and species richness (S) at 16 standardized survey sites and 5 incidental encounter locations in Weir Farm National Historic Site. Numbers include all captures and observations, not necessarily unique individuals. Frequency of Occurrence is number of localities a species was recorded from, divided by total number of localities (21). L=larvae.

Localities	spring peeper	pickerel frog	N. greenfrog	wood frog	gray treefrog	American bullfrog	Fowler's toad	red-spotted newt	spotted salamander	E. red-backed salamander	N. two-lined salamander	painted turtle	E. box turtle	snapping turtle	spotted turtle	E. gartersnake	N. watersnake	N. ring-necked snake	# of adults	% of total	S
Standardized Survey Sites																					
Field #1	25	5					1	20	3	2			1			19			76	2.4	8
Field #2	102	18				2										1			123	3.9	4
No Name Pond	49	4	21			23		2	2								3		104	3.3	7
Weir Pond	217	28	112	L		25		24	3			270		8			6		693	22.0	10
Pond A	186	2	76	84	14	4		9	3			13							391	12.5	9
Pond C	336	5	122	95	326	5		14	5			11							919	29.3	9
Pond D	185	5	42	86	14		2	13	10						2				359	11.6	9
Pond H	76	7	60	3	3			7	18			1					1		176	5.9	9
Stream #1	2		1	4															7	0.2	3
Stream #2	1	1	6								1								9	0.3	4
Stream #3	1	2	6								1								10	0.3	4
Woodland #1	11			1				3		12						2			29	0.9	5
Woodland #2				1				5		6									12	0.4	3
Woodland #3	3		1	1				6		15									26	0.8	5
Woodland #4	24		1	1			1	10	3	23			1			1			65	2.0	9
Woodland #5	7	7		2				1		11								1	29	0.9	6

Table 4. Number of adults recorded and species richness (S) at 16 standardized survey sites and 5 incidental encounter locations in Weir Farm National Historic Site. Numbers include all captures and observations, not necessarily unique individuals. Frequency of Occurrence is number of localities a species was recorded from, divided by total number of localities (21). L=larvae (continued).

Localities	spring peeper	pickerel frog	N. greenfrog	wood frog	gray treefrog	American bullfrog	Fowler's toad	red-spotted newt	spotted salamander	E. red-backed salamander	N. two-lined salamander	painted turtle	E. box turtle	snapping turtle	spotted turtle	E. gartersnake	N. watersnake	N. ring-necked snake	# of adults	% of total	S
Incidental Encounter Locations																					
Weir House Historic Core	7	1																	8	0.3	2
Nod Hill Road																2			2	0.1	1
North Pond D	3				38		20												61	1.9	3
Pelham Lane		1	1																2	0.1	2
Weir Preserve	4	2	10					23											39	1.2	4
Total # of Adults	1239	88	459	278	395	59	24	137	47	69	2	295	2	8	2	25	10	1	3140	100.0	18
Total # of Localities Recorded	18	14	13	11	5	5	4	13	8	6	2	4	2	1	1	5	3	1			
Frequency of Occurrence	85.7	66.7	61.9	52.4	23.8	23.8	19.0	61.9	38.1	28.6	9.5	19.0	9.5	4.8	4.8	23.8	14.3	4.8			

Survey Method Summaries

Incidental encounters detected 16 of the 18 species recorded in 2000 (Tables 5 and 6) and accounted for more individuals than any other method (54.5% of all adult form individuals recorded) (Table 7). For 12 species, it was the most productive method (i.e., produced the greatest number of individuals) (Table 7). Of the standardized surveys, Pond TCS produced the greatest number of species (9), and produced 15.0% of all individuals recorded. Amphibian call counts and Woodland TCS recorded seven species each, representing 14.2% and 4.4% of all individuals respectively. Woodland TCS was the most productive method for detecting eastern red-backed salamander. Field TCS recorded six species, 4.8% of all individuals recorded. Minnow trapping recorded six species, 3.5% of all individuals recorded and was the most productive method for the red-spotted newt. Turtle trapping recorded six species, 1.1% of all individuals recorded, and was the most productive method for two species (snapping turtle and spotted turtle). Coverboards produced six species, 0.9% of all individuals recorded. Stream TCS produced five species, 0.8% of all individuals recorded, and was the most productive method for northern two-lined salamander. Egg-mass counts recorded one species (spotted salamander), accounted for 0.6% of all individuals recorded, but because of limited sampling, were of limited usefulness.

Table 5. Number of amphibians recorded by each survey method in Weir Farm National Historic Site from March to September, 2000. Survey methods are: ACC=Anuran Call Count; EMC=Egg Mass Count; TCS=Time Constrained Search; CB=Coverboard; TT=TurtleTrap; MT=Minnow Trap, and IE=Incidental Encounter. Life stage of animals is: A=Adult, L=Larvae.

	Amphibians																		
Survey Method	spring peeper		northern green frog		gray treefrog		wood frog		pickerel frog		American bullfrog		Fowler's toad	red-spotted newt	eastern red-backed salamander	spotted salamander		northern two-lined salamander	# of Amphibian Spp.
	A	L	A	L	A	L	A	L	A	L	A	L	A	A	A	A	L	A	
ACC	334		16		38		37		10		13		2						7
EMC																19			1
TCS-stream	4		13				4		3									2	5
TCS-woodland	42		1				4		1					21	66				6
TCS-field	122								18		1		1			3			5
TCS-pond	189	180	104	18	123		24	6	11	1	14	22		3		2	16		8
CB			1				1		4					14		3			5
TT			7	4								10		3					3
MT	18	1	16	114			2	47				6		51		19			6
IE	530		301	1	234	4	206		41		31		21	45	3	1	1		10
Total	1239	181	459	137	395	4	278	53	88	1	59	38	24	137	69	47	17	2	11

Table 6. Number of reptiles recorded by each survey method in Weir Farm National Historic Site from March to September, 2000. Survey methods are: TCS=Time Constrained Search; CB=Coverboard; TT=TurtleTrap; MT=Minnow Trap, and IE=Incidental Encounter.

	Reptiles							
Survey Method	painted turtle	snapping turtle	spotted turtle	eastern box turtle	eastern gartersnake	northern watersnake	northern ring-necked snake	# of Reptile Species
TCS-woodland					3			1
TCS-field					7			1
CB					6			1
TT	15	6	2			1		4
MT						4		1
IE	280	2		2	9	5	1	6
Total	295	8	2	2	25	10	1	7

Table 7. Percentage of adult form individuals of each species detected by each survey method. Derived from Tables 5 and 6.

Survey Method	spring peeper	northern green frog	gray treefrog	wood frog	pickerel frog	American bullfrog	Fowler's toad	red-spotted newt	eastern red-backed salamander	spotted salamander	northern two-lined salamander	painted turtle	snapping turtle	spotted turtle	eastern box turtle	eastern gartersnake	northern watersnake	northern ring-necked snake	Total # Inds.	% Total Inds.	Species Richness
ACC	27.0	3.5	9.6	13.3	11.4	22.0	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	450	14.3	7
EMC	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19	0.6	1
TCS-stream	0.3	2.8	0.0	1.4	3.4	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26	0.8	5
TCS-woodland	3.4	0.2	0.0	1.4	1.1	0.0	0.0	15.3	95.7	0.0	0.0	0.0	0.0	0.0	0.0	12.0	0.0	0.0	138	4.4	7
TCS-field	9.8	0.0	0.0	0.0	20.5	1.7	4.2	0.0	0.0	6.3	0.0	0.0	0.0	0.0	0.0	28.0	0.0	0.0	152	4.8	6
TCS-pond	15.3	22.7	31.1	8.6	12.5	23.7	0.0	2.2	0.0	4.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	470	15.0	8
CB	0.0	0.2	0.0	0.4	4.5	0.0	0.0	10.2	0.0	6.3	0.0	0.0	0.0	0.0	0.0	24.0	0.0	0.0	29	0.9	6
TT	0.0	1.5	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	5.1	75.0	100.0	0.0	0.0	10.0	0.0	34	1.1	6
MT	1.5	3.5	0.0	0.7	0.0	0.0	0.0	37.2	0.0	40.4	0.0	0.0	0.0	0.0	0.0	0.0	40.0	0.0	110	3.5	6
IE	42.8	65.6	59.2	74.1	46.6	52.5	87.5	32.8	4.3	2.1	0.0	94.9	25.0	0.0	100.0	36.0	50.0	100.0	1712	54.5	16
% Total Inds	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100		100	
Total # of Inds	1239	459	395	278	88	59	24	137	69	47	2	295	8	2	2	25	10	1	3140		18

Anuran Call Counts

Seven anuran species were heard during call counts at six sites. Spring peeper was the most widespread species, heard from all six sites. Wood frog, northern green frog, and American bullfrog were heard from 50% of the sites, followed by pickerel frog and gray treefrog, each heard from 33% of the sites, and Fowler's toad, heard from 17% of sites (Table 8). Spring peeper was also the most abundant species (334 adults) based on call count index values, followed by gray treefrog (38 adults), wood frog (37 adults), northern green frog (16 adults), American bullfrog (13 adults), pickerel frog (10 adults), and Fowler's toad (2 adults) (Table 8). Comparisons between sites are valid since each site received equal sampling effort (nine occasions) with the exception of Pond H, which received seven.

Table 8. Maximum calling index value (CI) and estimated number of calling males present (#) for species detected during anuran calling surveys at Weir Farm National Historic Site, 2000.

				Species														
Site	First Date	Last Date	# of Surveys	Fowler's toad		gray treefrog		spring peeper		American bullfrog		northern greenfrog		pickerel frog		wood frog		Species Richness
				CI	#	CI	#	CI	#	CI	#	CI	#	CI	#	CI	#	
No Name Pond	22-Mar	18-Jun	9		-		-	3	33	1	4	1	4	1	2		-	4
Pond A	22-Mar	18-Jun	9		-	1	3	3	80		-		-		-	1	2	3
Pond C	22-Mar	18-Jun	9		-	3	35	3	67	1	2	1	6		-	2	12	5
Pond D	22-Mar	18-Jun	9	1	2		-	3	67		-		-		-	2	23	3
Pond H	3-Apr	18-Jun	7		-		-	2	17		-		-		-		-	1
Weir Pond	22-Mar	18-Jun	9		-		-	3	70	2	7	1	6	2	8		-	4
		Number of Sites		1		2		6		3		3		2		3		
		Number of Adults		2		38		334		13		16		10		37		

Egg Mass Counts

Ponds C and H were the only sites where egg mass counts were conducted, on 7 April and 3 May 2000 respectively. Six spotted salamander egg masses were recorded at Pond C and 24 at Pond H, representing four and 15 adults respectively.

Time Constrained Search (TCS)

Stream TCS: Five species were detected during TCS in three streams. Spring peeper and northern green frog were the most widespread species, recorded from all streams surveyed. These were followed by northern two-lined salamander (*Eurycea bislineata*) and pickerel frog, each recorded from 67% of streams, and wood frog recorded from 33% of streams (Table 9). The northern green frog was the most abundant species (IA=0.58 inds/search hour), followed by spring peeper and wood frog (IA=0.18 for each), pickerel frog (IA=0.13) and northern two-lined salamander (IA=0.09) (Table 9). Wood frog was only found from Stream #1, an intermittent stream. Streams #2 and #3 (permanent streams), were slightly more species rich with four species each compared to three species for Stream #1.

Table 9. Number of amphibians and reptiles recorded during stream time-constrained surveys in Weir Farm National Historic Site, 2000. The Index of Abundance (IA) is number recorded divided by total search effort.

Site	First Date	Last Date	# of Surveys	Search Effort (search hrs)	Number Recorded (IA)						
					northern two-lined salamander	spring peeper	northern greenfrog	pickerel frog	wood frog	Total	Species Richness
Stream #1	3/23	9/4	7	7.3		2 (0.27)	1 (0.14)		4 (0.55)	7 (0.96)	3
Stream #2	3/23	9/4	7	8.4	1 (0.12)	1 (0.12)	6 (0.71)	1 (0.12)		9 (1.07)	4
Stream #3	3/23	9/4	7	6.7	1 (0.15)	1 (0.15)	6 (0.90)	2 (0.30)		10 (1.49)	4
		Total	21	22.5	2	4	13	3	4	26	5
				IA	0.09	0.18	0.58	0.13	0.18	1.16	

Woodland/Field: Seven species were detected during woodland TCS in five areas. The eastern red-backed salamander (*Plethodon cinereus*) and red spotted newt were the most widespread species, both recorded from all five areas surveyed. These were followed by spring peeper and wood frog (80% of areas), eastern gartersnake (40% of areas), and pickerel frog and northern green frog (20% of areas) (Table 10). The eastern red-backed salamander was the most abundant species (IA=1.75 inds/search hour), and pickerel frog and northern green frog were the least abundant (IA=0.03 for each) (Table 10). Woodland TCS area #4 had the greatest species richness with six species recorded and also the greatest number of animals recorded (40% of individuals) (Table 10).

Six species were detected during field TCS in two areas. Spring peeper, pickerel frog, and eastern gartersnake were recorded from both field TCS areas. Spotted salamander, Fowler's toad, and American bullfrog were recorded from 50% of areas (Table 10). Spring peeper was the most abundant species (IA=5.08) and Fowler's toad and American bullfrog were the least abundant (IA=0.04 for each) (Table 10). Five and four species were recorded from Fields #1 and #2 respectively. Woodland TCS was slightly more species rich with seven species recorded versus six recorded from fields. However, species were generally more abundant in fields (IA=6.33) compared to woodlands (IA=3.70) (Table 10). Eastern red-backed salamander, red-spotted newt, wood frog and northern green frog were recorded from woodland TCS areas and not from fields. Conversely, spotted salamander, Fowler's toad, and American bullfrog were recorded from field TCS areas and not from woodlands.

Table 10. Number of amphibians and reptiles recorded during woodland and field time-constrained surveys in Weir Farm National Historic Site, 2000. The Index of Abundance (IA) is number recorded divided by total search effort. S is species richness.

HABITAT CATEGORY	Site	First Date	Last Date	# of Surveys	Search Hours	Number Recorded (IA)											
						E. red-backed salamander	red-spotted newt	spotted salamander	spring peeper	wood frog	pickerel frog	northern greenfrog	Fowler's toad	American bullfrog	eastern gartersnake	Total	S
WOODLAND	Woodland #1	3/25	9/6	7	7.1	11 (1.55)	3 (0.42)		11 (1.55)	1 (0.14)					2 (0.28)	28 (3.94)	5
	Woodland #2	3/24	9/5	7	7.6	6 (0.79)	4 (0.53)			1 (0.13)						11 (1.45)	3
	Woodland #3	3/24	9/5	7	8.2	15 (1.83)	4 (0.49)		3 (0.37)	1 (0.12)						23 (2.80)	4
	Woodland #4	3/24	9/5	7	8.3	23 (2.77)	9 (1.08)		21 (2.53)	1 (0.12)		1 (0.12)			1 (0.12)	56 (6.75)	6
	Woodland #5	3/24	9/7	7	6.6	11 (1.67)	1 (0.15)		7 (1.06)		1 (0.15)					20 (3.33)	4
			Total	35	37.8	66 (1.75)	21 (0.56)	0	42 (1.11)	4 (0.11)	1 (0.03)	1 (0.03)	0	0	3 (0.08)	138 (3.70)	7
FIELD	Field #1	4/4	9/6	7	14.7			3 (0.20)	20 (1.36)		2 (0.14)		1 (0.07)		6 (0.41)	32 (2.18)	5
	Field #2	5/4	9/8	5	9.3				102 (11.0)		16 (1.72)			1 (0.11)	1 (0.11)	120 (12.9)	4
			Total	12	24.0	0	0	3 (0.13)	122 (5.08)	0	18 (0.75)	0	1 (0.04)	1 (0.04)	7 (0.29)	152 (6.33)	6

Pond TCS: Eight species were detected during pond TCS at six sites. Eight species were recorded in temporary ponds and six in permanent ponds. Gray treefrog and wood frog were found in temporary ponds but not in permanent. Overall, spring peeper and northern green frog were the most widespread species, recorded at all six sites, followed by pickerel frog (83% of sites), wood frog (67% of sites), American bullfrog (50% of sites), red-spotted newt, spotted salamander, and gray treefrog (33% of sites) (Table 11). Northern green frog was the most abundant species in permanent ponds (IA=2.0 inds/search hour, represents adults observed plus adult males vocalizing), followed closely by spring peeper (IA=1.78, represents adults observed plus adult males vocalizing). Spring peeper was the most abundant species in temporary ponds (IA=5.92, represents adults observed plus adult males vocalizing), and gray treefrog was nearly as abundant (IA=4.41, represents adults observed plus adult males vocalizing) (Table 11).

Table 11. Number of amphibians and reptiles recorded during pond time-constrained surveys in Weir Farm National Historic Site. The Index of Abundance (IA) is number recorded divided by search effort. S is species richness.

HABITAT CATEGORY	Site	First Date	Last Date	# of Surveys	Search Hours	Number Recorded (IA)																				
						red-spotted newt	spotted salamander	spring peeper			northern greenfrog			gray treefrog		pickerel frog	American bullfrog			wood frog					
						adl	adl	lrv	adl	lrv	voc	adl	lrv	voc	adl	voc	adl	lrv	adl	lrv	voc	adl	lrv	voc	S
PERMANENT	Weir Pond	3/23	9/5	7	7.3	2 (0.27)	1 (0.14)		3 (0.41)		20 (2.74)	16 (2.19)	6 (0.82)	8 (1.10)			7 (0.96)				5 (0.68)						6
	No Name Pond	3/24	9/7	7	6.2				1 (0.16)			3 (0.48)	3 (0.48)					1 (0.16)	5 (0.81)	22 (3.55)						4
	Total (IA)			14	13.5	2 (0.15)	1 (0.07)		4 (0.30)		20 (1.48)	19 (1.41)	9 (0.67)	8 (0.59)			7 (0.52)	1 (0.07)	5 (0.37)	22 (1.63)	5 (0.37)						6
TEMPORARY	Pond A	3/24	9/7	7	6.7		1 (0.15)		5 (0.75)			15 (2.24)		2 (0.30)					4 (0.60)				1 (0.15)			5
	Pond C	3/23	9/5	7	7				126 (18.0)	135 (19.3)		30 (4.29)	9 (1.29)	8 (1.14)	80 (11.43)	35 (5.0)	1 (0.14)					1 (0.14)	1 (0.14)	11 (1.57)		5
	Pond D	3/23	9/5	7	7.2	1 (0.14)			14 (1.94)	20 (2.78)	20 (2.78)	11 (1.53)			5 (0.690	3 (0.42)	2 (0.23)					1 (0.14)	2 (0.23)	11 (1.53)		5
	Pond H	3/24	9/7	7	7			16 (2.29)		25 (3.57)		11 (1.57)					1 (0.14)						2 (0.29)			5
	Total (IA)			28	27.9	1 (0.04)	1 (0.04)	16 (0.57)	145 (5.20)	180 (6.45)	20 (0.72)	67 (2.40)	9 (0.32)	10 (0.36)	85 (3.05)	38 (1.36)	4 (0.14)		4 (0.14)			2 (0.07)	6 (0.22)	22 (0.79)		8

Coverboards

Six eastern gartersnakes were the only snakes detected using coverboards (Table 12). All were captured under five coverboards in Field #1. Four were captured under wooden coverboards and 2 under metal. One capture was in May and five were in June. Based on the number of individuals and capture rate (CR), the red-spotted newt was the most abundant species found under coverboards (n=14, CR=2.81 inds/board check), though because these were unmarked, many were likely recaptures. Red-spotted newt was also the most widespread species, recorded at 33% (2/6) of coverboard sites, and was the only species found in both woodland and field sites. Other species captured under coverboards were spotted salamander (1 woodland), northern green frog (1 woodland), pickerel frog (1 woodland), and wood frog (1 woodland). Woodlands were more species rich with five species compared to two species found in fields. Red-spotted newt was the only amphibian captured under coverboards in field (Table 12).

Table 12. Species richness (S) and number of amphibians and reptiles recorded during woodland and field coverboard surveys in Weir Farm National Historic Site, 7 April to 8 September 2000. Capture Rate (CR) is number captured/100 board checks. Board checks are number of boards/site, multiplied by number of site visits.

HABITAT	Site	Numbers Captured (CR)													
		spotted salamander	red-spotted newt	northern green frog	pickerel frog	wood frog	eastern garter-snake	# of Snakes	# of Amphib.	S	Snake CR	# of Boards/ Site[1]	# of Site Visits	Board Checks	# of Boards with Snakes
WOODLAND	Woodland #1							0	0	0	0	6	11	66	0
	Woodland #3			1 (1.39)				0	1	1	0	6	12	72	0
	Woodland #4	3 (4.0)	1 (1.33)					0	4	2	0	6	13	75	0
	Woodland #5				4 (6.35)	1 (1.59)		0	5	2	0	6	12	63	0
	Total (CR)	3 (1.09)	1 (0.36)	1 (0.36)	4 (1.45)	1 (0.36)	0	0	10	5	0	24	48	276	
FIELD	Field #1		13 (8.84)[2]				6 (4.08)	6	13	2	4.08	12	13	147	5
	Field #2							0	0	0	0	6	13	75	0
	Total (CR)	0	13 (5.86)	0	0	0	6 (2.70)	6	13	2	2.7	18	26	222	5
	Total	3	14	1	4	1	6[3]	6	23	6	1.20	42	74	498	5
	Overall CR	0.60	2.81	0.20	0.80	0.20	1.20								

[1]only 3 boards deployed by first visit, remaining boards added by second visit
[2]these were unmarked and many captured after the first visit are likely recaptures
[3]4 were found under wood and 2 under metal boards

Turtle Traps

Seven species (three turtle and four amphibian) were detected during turtle trapping at six sites. Painted and snapping turtles were captured in permanent ponds and painted and spotted turtles (*Clemmys guttata*) were captured at temporary ponds (Table 13). Painted turtle was the most abundant turtle species in permanent ponds (n=14, IA=13.46 inds/100 trap nights), followed by snapping turtle (n=6, IA=5.77). Spotted turtle was only captured from Pond D (temporary) (n=2, IA=0.61). American bullfrog (larvae) was the only amphibian species captured during trapping in permanent ponds. Temporary ponds had the greatest species richness with five species, and of the temporary ponds, Pond C was most speciose, with three species. Weir Pond had the greatest number of turtle species (n=2, painted and snapping turtles) (Table 13).

Table 13. Species richness (S) and number of amphibians and reptiles captured during turtle trapping in Weir Farm National Historic Site, 2000. Index of Abundance (IA) is numbers captured per 100 trap nights.

HYDROPERIOD	Site	First Date	Last Date	# of Traps	# of Trap Nights	Numbers Captured (IA)								
						painted turtle	snapping turtle	spotted turtle	northern greenfrog		American bullfrog	red-spotted newt	northern watersnake	
						Adl	Adl	Adl	Adl	Lrv	Lrv	Adl	Adl	S
PERMANENT	Weir Pond	23-May	19-Jun	10	80	14 (17.50)	6 (7.50)							2
	No Name Pond	23-May	19-Jun	3	24						10 (41.67)			1
				Total (IA)	104	14[1] (13.46)	6[2] (5.77)				10 (9.62)			3
TEMPORARY	Pond A	4-Apr	19-Jun	2 to 6	88				2 (2.27)	4 (4.55)		2 (2.27)		2
	Pond C	4-Apr	19-Jun	2 to 6	88	1 (1.14)			2 (2.27)			1 (1.14)		3
	Pond D	4-Apr	19-Jun	2 to 6	88			2 (2.27)						1
	Pond H	4-Apr	19-Jun	2 to 4	62				3 (4.84)				1 (1.61)	2
				Total (IA)	326	1 (0.31)		2 (0.61)	7 (2.15)	4 (1.23)		3 (0.92)	1 (0.31)	5

[1]represents 13 new and 1 recapture
[2]represents 5 new and 1 recapture

Minnow Traps

Seven species were detected at six sites using minnow traps. Weir Pond (permanent) had the greatest species richness, with six species, followed by No Name Pond (permanent) and temporary ponds A, C, D, and H, each with five species (Table 14). Red-spotted newt was the most abundant adult from both permanent (IA=10.22 inds/100 trap nights) and temporary ponds (IA=6.80). Northern green frog (IA=38.22) and wood frog (IA=9.95) were the most abundant larvae from permanent and temporary ponds respectively. Spring peeper was detected in temporary ponds but not in permanent ponds. Conversely, American bullfrog and northern watersnake (*Nerodia sipedon*) were detected in permanent ponds and not in temporary ponds. Red-spotted newt, spotted salamander, and northern green frog were the most widespread species, recorded at all six sites (100%), followed by wood frog (83% of sites), spring peeper (67%), and American bullfrog and northern watersnake (33% of sites) (Table 14).

Table 14. Species richness (S) and number of amphibians and reptiles captured during minnow trapping in Weir Farm National Historic Site, 2000. Index of Abundance (IA) is numbers captured per 100 trap nights.

HYDROPERIOD	Site	First Date	Last Date	# of Traps	# of Trap Nights	Numbers Captured (IA)										
						red-spotted newt	spotted salamander	spring peeper		northern green frog		wood frog		American bullfrog	northern watersnake	
						Adl	Adl	Adl	Lrv	Adl	Lrv	Adl	Lrv	Lrv	Adl	S
PERMANENT	Weir Pond	22-Mar	8-Sep	4 to 6	141	21 (14.89)	2 (1.42)			3 (2.13)	66 (46.81)		6 (4.26)	1 (0.71)	2 (1.42)	6
	No Name Pond	22-Mar	8-Sep	3	84	2 (2.38)	2 (2.38)			1 (1.19)	20 (23.81)			5 (5.95)	2 (2.38)	5
				Total (IA)	225	23 (10.22)	4 (1.78)	0	0	4 (1.78)	86 (38.22)	0	6 (2.67)	6 (2.67)	4 (1.78)	6
TEMPORARY	Pond A	22-Mar	8-Sep	4 to 5	116	7 (6.03)	2 (1.72)	3 (2.59)		1 (0.86)			4 (3.45)			5
	Pond C	22-Mar	8-Sep	4	112	8 (7.14)	1 (0.89)	12 (10.71)	1 (0.89)	2 (1.79)	27 (24.11)	2 (1.79)	10 (8.93)			5
	Pond D	22-Mar	8-Sep	4	112	9 (8.04)	9 (8.04)	2 (1.79)		2 (1.79)	1 (0.89)		1 (0.89)			5
	Pond H	24-Mar	8-Sep	2 to 3	72	4 (5.56)	3 (4.17)	1 (1.39)		7 (9.72)			26 (36.11)			5
				Total (IA)	412	28 (6.80)	15 (3.64)	18 (4.37)	1 (0.24)	12 (2.91)	28 (6.80)	2 (0.49)	41 (9.95)	0	0	5

Incidental Encounters

Incidental encounters recorded 16 species from 17 locations in 2000. Of these, 12 locations were also standardized survey sites. Based on the number of locations recorded, the most widespread species were spring peeper and pickerel frog (12 locations), northern green frog (10 locations), and red-spotted newt (9 locations) (Table 15). Based on number of adult form individuals represented, the most abundant species were spring peeper (30.98%), northern green frog (17.59%), painted turtle (16.36%), wood frog (12.04%), and gray treefrog (13.68%). The least abundant species were northern ring-necked snake (*Diadophis punctuatus edwardsii*) and spotted salamander (0.06% each), and eastern box turtle (*Terrapene c. carolina*) and snapping turtle (each 0.12% of individuals) (Table 15).

Table 15. Number of amphibians and reptiles recorded as incidental encounters at 17 locations in Weir Farm National Historic Site, 8 March to 8 September 2000. Life stage or evidence of presence is: ADL=adult; EFT=juv. Newt; JUV=juvenile; LRV=larvae; KLL=kill; VOC=anuran vocalization; EGG=egg masses. (#E)=number of times a species was encountered; (#L)=number of larvae counted; (#M)=estimated number of males calling; (#F)=estimated number of adult females. Total Adult is total of all adult form individuals, plus estimated numbers of adults represented by egg masses and vocalizations.

		Number of Individuals by Life Stage/Evidence of Presence											
							LRV			VOC		EGG	
Species	# Loc.	Total Adult	% of Total	ADL	EFT	JUV	E	L	KLL	E	M	E	F
spring peeper	12	530	30.98	25						49	505		
northern green frog	10	301	17.59	123		17	1	1	1	44	160		
gray treefrog	5	234	13.68	135			1	4		9	99		
wood frog	5	206	12.04	1						15	205		
pickerel frog	12	41	2.4	4		15			1	8	21		
American bullfrog	4	31	1.81	6						11	25		
Fowler's toad	3	21	1.23	1						5	20		
red-spotted newt	9	45	2.63	7	37				1				
E. red-backed salamander	2	3	0.18	3									
spotted salamander	2	1	0.06				1	1				1	1
painted turtle	4	280	16.36	280									
eastern box turtle	2	2	0.12	2									
snapping turtle	1	2	0.12	2									
eastern gartersnake	2	9	0.53	5		4							
northern watersnake	2	5	0.29	4		1							
N. ring-necked snake	1	1	0.06						1				
Totals		1712	100.00	597	37	37	3	6	4	141	1035	1	1

Discussion

Community Composition and Important Habitats

Of the 30 species of amphibians and reptiles that may have "historically" occurred at WEFA, 18 (60%) were recorded in 2000. In addition, a marbled salamander was recorded in 1998, close enough in time to be considered currently present. Given that amphibians dominate the herpetofauna of WEFA in terms of species richness (63% of species) and in numbers (89% of individuals), the importance of wetland habitats is evident. With the exception of the eastern red-backed salamander, all of the amphibians at WEFA depend on some type of wetland or stream habitat for reproduction. Species richness was greatest at Weir Pond with 10 species found, followed closely by temporary ponds A, C, D, and H, and woodland area #4 with 9 species each (Table 4, Figure 6). Total number of amphibians encountered was greatest at Pond C, accounting for 29% of all amphibians recorded (Table 4). The aquatic resources of WEFA are predominantly lentic, with limited stream habitat, much of it intermittent. Only one stream-dependant species, northern two-lined salamander, was recorded.

Wetlands had the greatest species richness with 13 species, followed by uplands with 12 and streams with 5. Many species were found more frequently in specific habitats. Eastern gartersnake was only found in uplands, primarily fields. Painted turtle, snapping turtle, and northern watersnake were found only in wetlands, primarily permanent ponds (Table 2). Other species predominantly recorded in wetlands were spring peeper, northern green frog, gray treefrog, wood frog, American bullfrog, and spotted salamander. However, while amphibians and reptiles commonly utilize specific habitats for part of the year, their complex life cycles require the use and occupancy of different habitats for breeding, foraging, and dispersal. Aquatic turtles nest in open, upland habitats and Fowler's toad, spring peeper, gray treefrog, wood frog, and spotted salamander, are primarily terrestrial. The predominance of records for these five amphibians in wetlands is because they are most easily detected when concentrated in breeding ponds in the spring. They depart from wetland habitats following the breeding season and forage, aestivate, and hibernate in the uplands (Conant and Collins 1998; Petranka 1998; Klemens 2000).

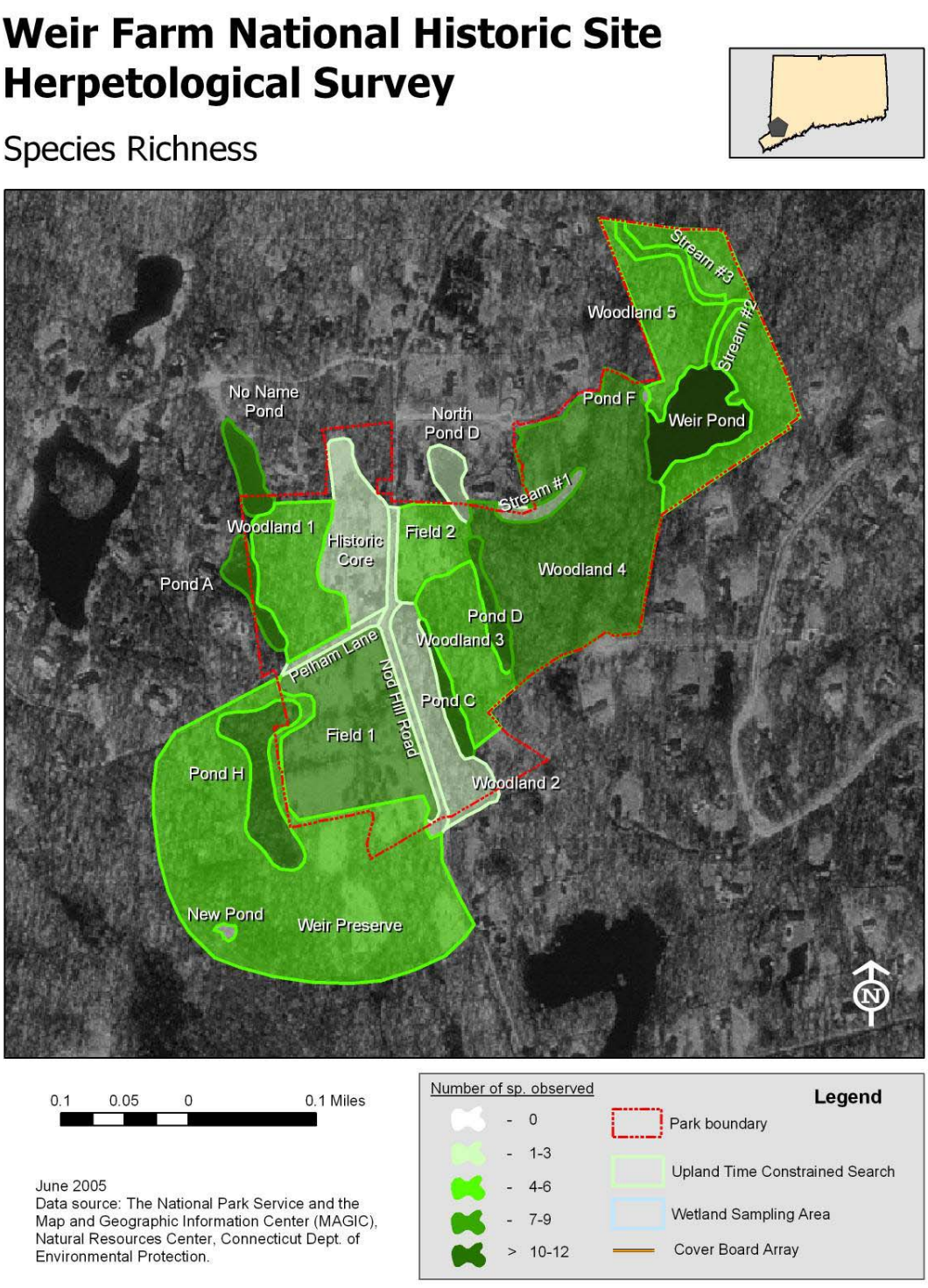

Figure 6. Species richness of areas sampled in 2000 for amphibians and reptiles at Weir Farm National Historic Site.

Species at Risk

Most of the 19 species of amphibians and reptiles documented at WEFA are common in the Northeast (Conant and Collins 1998; Klemens 1993) and widespread in North America. From a preservation of species at risk perspective, WEFA does not support any species that are exceptionally rare. However, the eastern box turtle is listed as a *Special Concern* species in Connecticut. Box turtles have declined throughout their range due to a number of factors, most relating to aspects of development such as habitat fragmentation and road kill (Dodd 2001). In Connecticut, increased development in the low-lying areas of the state challenges the survival of eastern box turtles (Klemens 2000). Based on the two eastern box turtles recorded, the status of this population is uncertain, but from a conservation point-of-view, their occurrence in the park should be considered important. With the regional landscape of woodlands and field becoming increasingly more fragmented by development, eastern box turtles continue to be isolated into fragmented populations surrounded by developed areas, with movement between isolated sites increasingly more difficult. The lands in and adjacent to WEFA are important as part of a larger local landscape supporting this species.

Population Trends

The ability to assess trends in WEFA herpetofauna is complicated by several factors, the first of which is the lack of historic data. Survey data collected by Klemens in the 1980's is still relatively recent and our "historic" list is extrapolated from this work, based on the assumption that species present in the 1980's were likely present during the "historic" period. Second, the "historic" period is a long and vaguely-defined period spanning a few centuries, during which time significant landscape changes occurred, undoubtedly affecting the abundance and distribution of many species over the course of that time. This leaves a vague baseline for comparison. Third, Klemens (1993) incorporates records from several years, as well those from prior published works, and many correspondents and thus represents data accumulated over a longer time period than this one field season inventory. Data accumulated over long time periods are more likely to include rare and hard to detect species than data from a single field season. Thus species actually present in 2000 were possibly missed. At best, our assessment of each species' status and population trend is a subjective process.

Thirty species were considered as potentially present historically. Eighteen of these were found during this survey in 2000 and appear to be stable, i.e., no more or less common or rare now than "historically" (Table 16). Of the remaining twelve, the marbled salamander was recorded in 1998, close enough in time to this survey to be considered as currently present, and also appears stable. For the remaining eleven species, data are insufficient to determine their past or present status, though a number are experiencing regional declines (Klemens 1993) that likely includes WEFA.

Table 16. "Historic" status and apparent trends in amphibians and reptiles at WEFA. Trends of species of "unknown" status is based on interpretation of regional trends detailed in Klemens (1993).

	Stable	→	Declining
Abundant	spring peeper northern green frog red-spotted newt eastern red-backed salamander		
Common	wood frog gray treefrog American bullfrog spotted salamander painted turtle snapping turtle eastern gartersnake northern watersnake pickerel frog		
Uncommon	Fowler's toad northern two-lined salamander eastern box turtle spotted turtle northern ring-necked snake marbled salamander*#		
Unknown	four-toed salamander* Jefferson salamander* American toad* northern black racer* eastern worm snake* northern brownsnake* eastern milksnake*	e. hognose snake*	n. slimy salamander* n. dusky salamander* black ratsnake*

* not recorded in 2000
# recorded in 1998

Stressors

While the data are too sparse to point with any degree of certainty to declines in species at WEFA, there are stressors that could or may be impacting the herpetofauna here. These include global stressors, which tend to affect large geographic areas, often far removed from the ultimate cause or source, and regional/local stressors, which work at a more localized level. Global stressors include ultraviolet-B radiation and atmospherically transported pollutants such as mercury and acid rain. Stressors such as other heavy metals, chemicals found in fertilizers, herbicides, and pesticides, habitat degradation, disease, road mortality, and introduced species (Dunson et al. 1992; Blaustein 1994; Blaustein et al. 1994; Pechman and Wilbur 1994; Hunter et al. 1999; Daszak et al. 2000; Knapp and Matthews 2000) may also be widespread in their scope, but tend to be more variable across the landscape in their extent. Thus their impacts may be at either a regional or local level.

Because amphibians and reptiles utilize both aquatic and terrestrial habitats, they are important indicators of environmental quality. The semi-permeable skin of amphibians makes them more susceptible to changes in their environment than other vertebrates, and they are often among the first species to show effects of environmental change (Pough 2004). The loss of keystone species and important habitats can alter the sustainability of herpetofaunal communities and the ecosystem as a whole. Much evidence has been gathered identifying local and community level extinctions (Pough 2004). Several possible causes of population loss or decline include viral and fungal infections, environmental pollution, and increased ultraviolet (UV-B) radiation (Daszak et al. 2000).

Water pollution can negatively impact amphibians and reptiles. While a preliminary study of WEFA wetlands indicates that water quality is moderate, Weir Pond and Pond C are vulnerable to increased nutrient loading from continuing adjacent residential development and forest clearing projects (Farris and Chapman 1999). Forest clearing and land use changes causing increased runoff could increase turbidity and nutrient loading in these wetlands. Nutrients such as nitrogen and phosphorous can cause dense masses of algae, which is not conducive to laying eggs. Algae blooms can also reduce the amount of oxygen available in the water for amphibian larvae and alter the composition and numbers of the invertebrate communities that are food for larvae. While the current condition of WEFA wetlands is not problematic, the National Park Service needs to ensure that this remain so. Plans to remove some second growth forest to restore historic fields and meadows should incorporate measures to avoid these impacts.

As mentioned earlier, WEFA fields are currently mowed annually in November, and trails through fields are mowed periodically in summer. Since box turtles and snakes are most active from late April through October, mowing in November presents few threats and should be continued. The small scale mowing of trails during the warm months has some potential for adverse effects, but this can be minimized by slow and careful mowing, preferably with someone walking ahead of the mower. While it is best to avoid mowing in the summer, should mowing become necessary during the summer months, turtles tend to avoid open areas during times of drought and high heat intensity, making this the best time to mow fields. Adult box turtles travel from forests during May and June to open-canopy nesting areas in field and edge habitats. After

two to three months development, hatchling turtles will emerge from nests in late August and September.

Spotted salamander, marbled salamander, gray treefrog, wood frog, and spotted turtle are declining in Connecticut, due primarily to loss and alteration of wetlands, loss and fragmentation of upland habitats surrounding these wetlands, and road mortality (Klemens 2000). Park-wide declines, as a result of wetland and adjacent upland loss and alteration are, at present, a limited threat in WEFA, though Nod Hill Road is about 100 feet from Pond C. Much of the land adjacent to the park is protected from these impacts. Nevertheless, urban expansion and disturbance to the landscape of the region continues and could indirectly affect the long-term status of the local WEFA herpetofauna by isolating it. While populations at a specific site often appear, disappear, and reappear over time in a contiguous landscape, in an increasingly fragmented, human-altered landscape populations occupying habitat islands are less likely to be re-colonized after a local extinctions (Primack 1993), leading to broader regional extinctions.

Summation

Of the 30 species considered potentially present historically at WEFA, 18 (60%) were documented in 2000. In addition, a marbled salamander was incidentally recorded in 1998. These 19 species appear to be stable in terms of population trends. A diversity of permanent and intermittent streams, permanent and temporary wetlands, fields, and woodlands in a relatively small area provides ample habitat for most of the park's herpetofauna. In conjunction with protected adjacent properties, WEFA is part of an important natural area for local herpetofauna, relatively protected from the urbanization and fragmentation that is spreading through the southwestern region of the state.

While a detailed monitoring plan is beyond the scope of this inventory, a program of anuran calling surveys, stream salamander surveys, and surveys of breeding ponds with minnow traps and egg mass counts are recommended to document changes to the herpetofauna in the park. Such long term monitoring is important to better separate natural fluctuations in populations over time from anthropogenic declines (Pechmann et al. 1991; Pechmann and Wilbur 1994; Stebbins and Cohen 1995). In addition, a more in-depth analysis of changes in wetland and terrestrial habitat quality will better identify potential causes of changes in the herpetofauna. Though it is based on incomplete baseline information, the herpetofauna of WEFA appears to have maintained reproducing populations in a diversity of wetland and upland habitats.

Species Accounts

Frogs

Spring Peeper (*Pseudacris crucifer*)

Spring peepers are commonly found in permanent and semi-permanent wetlands surrounded by woodlands, and wetlands containing trees and bushes in and near the water (Conant and Collins 1998). In Connecticut, they are tolerant of slightly brackish waters and are found in a wide variety of habitats including moist deciduous woodlands, coniferous forest, grassy meadows, fields and sandy coastal plain habitat (Klemens 1993). The unique, high-pitched breeding call of the spring peeper is oftentimes displayed in a deafening chorus of hundreds of individuals. In most of the Northeast, it is the most ubiquitous and readily detected anuran.

Spring peeper was the most common species identified in the park with 1239 adults (RA=39.45%) recorded from 18 (FO=85.7%) sites in all habitat types. The majority of individuals recorded (63.2%) were from temporary ponds. The two most important breeding ponds were Pond C and Weir pond, accounting for 27.1% and 17.5% of individuals recorded respectively (Tables 2, 3, and 4). The spring peeper is widespread and ubiquitous in Connecticut (Klemens 1993) and has been reported from WEFA (Klemens 1980a) and nearby north of Weir Preserve (Klemens 1982b). This species is abundant and widespread at WEFA, and has likely been so in the past.

Northern Green Frog (*Rana clamitans melanota*)

The northern green frog is a common and widespread species in the Northeast and mid-Atlantic regions, and is found throughout Connecticut (Conant and Collins 1998; DeGraff and Rudis 1983; Klemens 1993). It utilizes a broad range of freshwater habitats, especially permanent bodies of water, which it requires for successful reproduction. Dorsolateral ridges extending down the back help distinguish the northern green frog from the bullfrog; in bullfrogs, these ridges are absent. This species can typically be found in and around ponds, streams, and marshes, and also along roads during rainy nights.

The northern green frog was the second most common species at WEFA, with 459 adults (RA=14.61%) recorded from 13 sites (FO=61.9%) in all habitat types. Similar to spring peeper, the majority of individuals recorded were from temporary ponds (67.1%). This is an abundant and widely occurring species at WEFA, with breeding activity concentrated at Pond C and Weir Pond, which accounted for 26.6% and 24.4% of all recorded individuals, respectively (Tables 2, 3, and 4). Though adults breed in and generally inhabit permanent and semi-permanent ponds, dispersing juvenile northern green frogs commonly use streams as travel corridors. We found 2.8% of northern green frogs in stream habitat. Northern green frog has previously been recorded at WEFA (Connecticut DEP 1991, NPS natural history observation 1998), and adults have been heard calling and were collected from a marshy area near the Weir Pond dam (Klemens 1980a). It has been and continues to be abundant and widespread at WEFA.

Gray Treefrog (*Hyla versicolor*)

The gray treefrog is widely distributed in Connecticut, but numbers of breeding sites have been declining since the 1930's due to habitat loss and pollution (Babbitt 1937; Klemens 1993, 2000). This arboreal species has large suction-cup toe pads and descends at night to call and breed in permanent or semi-permanent wetlands, swamps, bogs, and roadside ditches (Behler and King 1979; DeGraff and Rudis 1983). This species is recognized by its bright yellow patches on the rear thighs and gray to green mottled coloration.

The gray treefrog was the third most common species at WEFA, with 395 adults (RA=12.58%) recorded from 5 wetland sites (FO=23.8%). The majority of these (82.5%) were from Pond C, a temporary pond and important breeding site (Tables 2, 3, and 4). Previously undocumented in WEFA, the gray treefrog has been recorded from nearby Redding and Weston (Klemens 1993). While its historic status at WEFA is undocumented, given that many populations have declined and disappeared in Connecticut due to development, the fact that it is currently common in the relatively rural, undeveloped landscape surrounding WEFA suggests it was also common historically at WEFA.

Wood Frog (*Rana sylvatica*)

The wood frog is found throughout the Northeast (Degraff and Rudis 1983) and is widespread in Connecticut (Klemens 1993). This is a terrestrial species, occupying moist woodlands except during the breeding season when they breed in fishless vernal pools (Conant and Collins 1998, Klemens 2000). Breeding early in the spring (late-February-March), the wood frog is an explosive breeder. Often a large percentage of a population migrates to ponds in a short window of time, laying eggs together in large floating masses. The wood frog will often travel away from water in the summer and will hibernate in leaf litter during the winter (Behler and King 1979).

The majority (96.4%) of wood frogs at WEFA were recorded from temporary ponds. This temporary pond breeder is common in these habitats during the spring, and disperses to woodlands during the remainder of the year. Deciduous woodlands and stream accounted for 2.2% and 1.4% of individuals recorded, respectively (Tables 2, 3, and 4). The lack of a historic record makes it hard to assess trends, but its current status as common suggests it has not declined. In all likelihood, its population is at least stable, though it is also possible that it has increased over the past century with the reversion of a rural landscape back to a forested one.

Pickerel Frog (*Rana palustris*)

The pickerel frog is common and widespread in the Northeast and mid-Atlantic regions (Conant and Collins 1998), and is found throughout Connecticut in both permanent and ephemeral wetlands (Klemens 1993). This species is distinguished from the northern leopard frog by a dorsal pattern of brown squares arranged symmetrically, and the inner surfaces of the hind legs are orange or yellow (Klemens 2000).

The pickerel frog was relatively common and moderately widespread, with 88 adults (RA=2.80%) recorded from 14 sites (FO=66.7%) in all habitat types. The majority of individuals

(31.8%) were recorded from Weir Pond (Table 4). Pickerel frog was reported from WEFA in a woodland marsh (Klemens 1980a). As best as can be determined with limited knowledge of its historic presence, the pickerel frog was and continues to be a common and widely occurring species at WEFA, though highly dependent on Weir Pond for breeding.

American Bullfrog (*Rana catesbeiana*)

The American bullfrog is a widespread and common species throughout much of the Northeast, and is common in Connecticut (Behler and King 1979; Klemens 1993). Bullfrogs require two or more years for their tadpoles to metamorphose, hence it occurs primarily in permanent bodies of water such as lakes and permanent ponds (Conant and Collins 1998). Their primary habitat requirement is a permanent water body with abundant emergent and shoreline vegetation (Hunter et al. 1999). This species is an aggressive predator whose prey includes other frogs, young turtles, small snakes, and many invertebrates in its diet. It is adept at colonizing new habitats, especially those constructed or modified by humans (Lacki et al.1992) and is relatively urban tolerant (Klemens 1993). While native to WEFA, when introduced to areas where they are not native, bullfrogs can displace native species (Adams 1999; Stumpel 1992) and their tadpoles may dramatically alter aquatic community structure (Kupferberg 1994).

In 2000, 59 American bullfrogs (RA=1.88%) were recorded from five sites (FO=23.8%), four of which were wetlands (Tables 2, 3, and 4). WEFA's two permanent ponds, Weir Pond and No Name Pond accounted for most individuals recorded, 42.4% and 39.0% respectively. Bull frogs were heard calling from No Name Pond (est. # of males=4) and Weir Pond (est. # of males=7) during anuran call surveys (Table 8). The preference of American bullfrogs for WEFA's two permanent ponds is expected, given this species requirements for successful reproduction. Bullfrogs were previously heard calling from Weir Pond (Klemens 1980a) and while it is primarily limited to two ponds, American bullfrogs still remain common at WEFA.

Fowler's Toad (*Bufo fowleri*)

The Fowler's toad is confined to coastal areas of the state and the Central Connecticut Lowland, and has been reported to hybridize with the American toad (Klemens 1993, 2000). The Fowler's toad is distinguished from the American toad by the number of tubercles in the pigmented spots on its back. American toads have no more than two tubercles per spot, whereas Fowler's toad has three or more (Klemens 2000). Also, the parotoid gland does not contact the ridge behind the eyes on the American toad (Wright and Wright 1995). Similar to spring peeper and wood frog, it is a terrestrial species, utilizing a wide range of temporary and permanent wetlands for reproduction.

The Fowler's toad was among the least common species with 24 adults (RA=0.76%) found at four localities (FO=19.0%). These were a temporary and permanent pond, a field and a woodland (Tables 2, 3, and 4). Many of the adults (83%) were breeding males heard calling at North Pond D (an important breeding site) in May (Tables 4 and 15). Fowler's toad was previously recorded at WEFA from a deciduous woodland near rock ledges and on Weir Pond dam (Klemens 1980a, Klemens 1980b) and it was also recorded nearby in a scarified area 1.6 km (1 mile) southwest of Branchville, just north of the Wilton town line (Klemens 1982c). Based on

these previous records and the results from 2000, Fowler's toad has likely been an uncommon resident of WEFA in recent times and its status has changed little. Changes in its status over longer time periods are unknown.

American Toad (*Bufo americanus*)

The American toad is a terrestrial species similar in appearance to the Fowler's toad but easily distinguished by its prolonged, high pitched, trilling call heard in the spring. These toads breed in a variety of shallow aquatic habitats including temporary ditches, flooded meadows, marshes and ponds (Klemens 1993). The American toad is widespread in Connecticut. It has been recorded from nearby Ridgefield, Redding, and Weston (Klemens 1993), but never at or near WEFA. Only Fowler's toad has been found at WEFA (Klemens 1980a, 1982a,c). Given the lack records of American toads, the presence of Fowler's toads, and the affinity of American toads for moister and more heavily forested landscapes than Fowler's toad (Lazell 1976, Klemens 1993), it is likely that colonial era conversion of woodland to farmland had favored Fowler's toads over American toads at WEFA, and that, despite recent woodland succession, American toads have not yet been able to recolonize.

Salamanders

Red-spotted Newt (*Notophthalmus viridescens viridescens*)

The life history of the red-spotted newt differs from other salamanders, in that it generally metamorphoses twice. Adults primarily occur in still bodies of water such as ponds and lakes and are aquatic. Following a typical aquatic embryonic and larval stage, juveniles transform into a terrestrial juvenile stage known as red efts. The eft, bright orange with red spots, may be found under logs and brush or seen moving in woodlands and grassy areas, particularly during rainy conditions (Petranka 1998; Pfingsten and Downs 1989). The efts may spend 2-7 years on land before returning to water and transforming into an aquatic adult, taking on the adult's green coloration and keeled tail (Healy 1974). While red efts may be handled safely by humans, they have toxic skins that deter potential predators (Hurlbert 1970). The newt is considered to be a keystone predator in temporary pond communities where they control insect populations and anuran species composition (Kurzava and Morin 1994). Clear-cut timbering may significantly effect newt populations (Petranka et al. 1993) and repopulation may take 30-60 years (Pough et al. 1987).

The red-spotted newt was the most abundant salamander (RA=4.36%), recorded at 13 sites (FO=61.9%). It occurred nearly equally in wetlands (6 sites) and uplands (7 sites) (Tables 2,3, and 4). Weir Pond accounted for 17.5% of all individuals, more than any other wetland (Table 4) and upland habitats accounted for nearly the same number of individuals as wetlands, 68 and 69 respectively. Terrestrial stage individuals of this species have been recorded from WEFA under bark in a wet deciduous woodland (Klemens 1980a), from the adjacent Weir Preserve in a field and woodland (Klemens 1980b, Klemens 1982b), and also nearby in Ridgefield (Klemens 1982c). It is also known to occur in Redding and Weston (Klemens 1993). These accounts suggest the red-spotted newt was relatively common in the area and it still appears to be abundant at WEFA in both wetland and upland habitats.

Eastern Red-backed Salamander (*Plethodon cinereus*)

This species is common in the forests of the northeastern United States and southeastern Canada, with the greatest densities in well-drained, mature forests (Petranka 1998; Pfingsten and Downs, 1989). It is the most common salamander species in Connecticut, and it occurs as a number of different color morphs, with the red striped and all gray unstriped the two most common and widespread in New England (Klemens 1993). Of 51 individuals for which color morph was recorded in this inventory, there were 43 red-striped and 8 unstriped.

Red-backed salamanders have been reported in woodlands at WEFA (Klemens 1980a), at Weir Preserve (Klemens 1980b), and nearby in Ridgefield (Klemens 1982c). In 2000, 69 adults were recorded from six sites, including throughout all five woodland search areas (RA=2.20%, FO=28.6%) (Tables 2, 3, 4). In the past, the eastern red-backed salamander appears to have been abundant and widespread at WEFA, particularly in woodlands. Its status appears unchanged.

Spotted Salamander (*Ambystoma maculatum*)

The spotted salamander is a terrestrial species that depends on ponds for embryonic and larval development. Adults migrate on rainy spring nights from underground burrows to breeding ponds, where they are most easily detected. Mating occurs in the ponds and females attach gelatinous egg masses to twigs and vegetation in the pond (Petranka 1998).

Spotted salamanders were intermediate in abundance compared to other species (47 adults, RA=1.50%) and were slightly more widespread (FO=38.1%) than eastern red-backed salamanders (Tables 2 and 3). Most (76.6%) spotted salamanders were recorded from temporary ponds, with Pond H accounting for 38.3% of spotted salamanders recorded (Table 4). The spotted salamander is Connecticut's most widespread mole salamander and is found throughout the state (Klemens 2000). It has previously been reported from WEFA (Klemens 1980a, larvae), at Weir Preserve (Klemens 1982b, egg mass), in nearby Ridgefield (Klemens 1982c, adult), and in Wilton (Klemens 1980c). Greg Waters (pers. comm. October 2004), recently reported an adult in the park. As best can be determined, the spotted salamander was common and widespread at WEFA and still is, with breeding populations concentrated in temporary ponds.

Northern Two-lined Salamander (*Eurycea bislineata*)

The northern two-lined salamander is likely the most widespread and abundant stream salamander in New England and is the most urban tolerant (Klemens 1993), even occurring in a small length of remnant stream at the heavily urbanized Saugus Iron Works NHS in Saugus Massachusetts (R. Cook, pers. obs.). This stream salamander is typically more aquatic in nature than the northern dusky salamander, often found in the stream and splash zones of cool, swift moving streams. Females deposit eggs singly on the underside of flat rocks in the stream (Petranka 1998; Pfingsten & Downs 1989).

The northern two-lined salamander was among the least abundant (RA=0.06%) and least widespread species (FO=9.5%) found at WEFA (Tables 2 and 3). Its limited distribution reflects that it is a stream specialist, and observations were limited to two adults captured during time-

constrained searches in streams. An adult was also found in a dry but moist stream-bed draining Weir Pond in 1998 (NPS natural history observation 1998). Considering that only two northern two-lined salamanders were recorded in seven replicated stream surveys totaling 22.5 hours, it appears to be uncommon at WEFA. While it was recorded in the 1980's from Ridgefield, Redding, and Weston (Klemens 1993), it was not found at WEFA or adjacent properties (Klemens 1980 a,b,c, 1982 a,b), suggesting it was uncommon at that point in time as well. Thus, it appears to be stable over the recent past, but it is not possible to assess any longer term trends.

Marbled Salamander (*Ambystoma opacum*)

The marbled salamander is widely distributed over the low-lying sections of Connecticut and is considered rare in the state (Klemens 2000). They are terrestrial, migrating to temporary or semi-permanent ponds in the late summer or autumn to breed (August and November in Rhode Island-Shoop and Doty 1972). Females dig nests and deposit eggs in the dry pond basin or along the margins of a reduced pond, and then exit the pond and return to the surrounding woodlands. Ground water, precipitation, and snow melt fill these ponds, initiating hatching followed by larval development in the spring (Petranka 1998; Pfingsten and Downs 1989).

Locally, marbled salamanders have been recorded from Redding, Weston, and Wilton (Klemens 1993). In 1998, Greg Waters (pers. comm.) found an adult in a pile of rotten wood adjacent to wetland B of Melberg (1993). This is the only record of marbled salamander at WEFA. While none were recorded in WEFA in 2000, the 1998 record here, and the difficulty finding this species suggest it has been present for some time. Although uncommon, it may be more abundant than our results show. More targeted surveys at Ponds A, C, D, and H in September and larval surveys in the spring are recommended.

Northern Dusky Salamander (*Desmognathus fuscus*)

The northern dusky salamander is widespread through eastern North America and has been found throughout Connecticut (Conant and Collins 1998; Klemens 1993). This is a streamside species typically found under rocks and logs in the water and along the edge of cool woodland streams, springs, and seeps. Females typically deposit egg clusters in a scooped out depression under rocks or logs along the edge of a stream, and will brood the eggs for a period of time before they hatch (Hunter et al. 1999; Petranka 1998; Pfingsten and Downs 1989). The northern dusky salamander is considered common in Connecticut except for Fairfield County where it is rare due to habitat degradation (Klemens 1993). The dusky salamander is known to decline as urbanization increases (Klemens 1993) and it has also declined from relatively pristine areas such as Acadia NP (Bank et al. *in press*). While it has been recorded from nearby towns, no northern dusky salamanders have been recorded from WEFA, nor were any found in 2000. Given the northern dusky salamander is sensitive to environmental change and is considered rare in Fairfield County, it is likely that if this species did occur in WEFA, it has declined and is no longer present.

Four-toed Salamander (*Hemidactylium scutatum*)

These salamanders are found throughout Connecticut under rocks, logs, and debris in wet areas with sphagnum moss in mature forests, marsh and bog habitats, and dry woodlands (Klemens 1993). Females deposit clusters of eggs, oftentimes in communal nests, in "sphagnum cliffs". These are areas of sphagnum moss/sedge clumps rising up from the water of small ponds, temporary ponds, and marshes that are used by nesting salamanders. The nests are created in these clumps so as the larvae hatch, they will be able to descend the moist moss and enter the water where they will develop and eventually metamorphose and exit the pond or marsh (Petranka 1998; Pfingsten and Downs 1989). The four-toed salamander is widespread in Connecticut, but often localized in low-lying areas. It has been recorded from several sites in Ridgefield, Wilton, and Redding (Klemens 1993). Wet areas with limited sphagnum moss are present in WEFA, suggesting that suitable habitat for this species may be available. While this comparatively hard to find species was considered potentially part of the WEFA herpetofauna, it was not found in 2000. Its status is unknown.

Northern Slimy Salamander (*Plethodon glutinosus*)

The northern slimy salamander is a terrestrial salamander and gets its name from the sticky, glue-like substance it exudes from the tail when it is disturbed. They are found under rocks, logs, and other debris in eastern deciduous forests, bottomland hardwoods, swamp forests, and wet pinewoods (Petranka 1998; Pfingsten & Downs 1989). Listed as *Threatened* in Connecticut, the northern slimy salamander is restricted to a few areas in Fairfield County, including one site in Ridgefield (Klemens 1993, 2000). Slimy salamanders are rare east of the Hudson Valley and southwestern New England is their northeastern range limit (Klemens 1993). At the eastern range limit in, this species is restricted to mature second growth forest, suggesting that it requires older growth forest. Deforestation has occurred over the past few hundred years, first for conversion to agricultural land, including the WEFA property, and more recently for commercial and residential development. While this rare species only occurs at a few sites with mature forests in Connecticut, and has never been recorded from WEFA, it is likely that if it had been present "historically", it has likely been absent from the park for a few hundred years.

Jefferson Salamander (*Ambystoma jeffersonianum*)

Jefferson salamanders often migrate to ice covered ponds in New York (Bishop 1941), sometimes as early as January in Pennsylvania (D. Brotherton pers. obs.). Females deposit gelatinous egg masses on twigs and leaves in the pond, then leave the pond, dispersing into adjacent woodlands (Petranka 1998; Pfingsten and Downs 1989). Common in southern New England, hybrids of *A. jeffersonianum* (*A. jeffersonianum* complex) and blue-spotted (*A. laterale*) (*A. laterale* complex) are found in Connecticut, although these parental groups utilize different habitats. *A. jeffersonianum* complex breed in vernal ponds and are found primarily in deciduous forest in steep terrain, whereas *A. laterale* complex prefer wooded swamps in low elevations woodlands (Klemens 1993). *A. jeffersonianum* complex are also less tolerant of habitat disturbance than *A. laterale* complex, and both are considered species of *Special Concern* in Connecticut (Klemens 1993, 2000). *A. jeffersonianum* complex were considered as potentially part of the herpetofaunal community at WEFA rather than *A. laterale* complex because *A.*

jeffersonianum complex salamanders are found in Ridgefield and Redding (Klemens 1993), and WEFA provides habitat more suitable for *A. jeffersonianum* complex. However, no *A. jeffersonianum* complex salamanders were found in 2000. Since we do not know their previous status, and can only say that it is either rare or absent at present, their status and trend is undetermined. Additional, intensive surveys at Ponds A, C, D, H and other potential breeding sites in February and March are recommended to better determine their status at WEFA.

Turtles

Painted Turtle (*Chrysemys picta*)

This aquatic species is common in the United States, and is recognized as four subspecies across its range. The two subspecies that occur in Connecticut are the eastern painted turtle (*Chrysemys picta picta*), and the midland painted turtle (*Chrysemys picta marginata*) (Klemens 1978). The eastern painted turtle has an unmarked yellow plastron and the seams on the carapace are aligned, whereas the midland painted turtle has a variable dark marking on the plastron and alternating seams on the carapace (Ernst et al. 1994). The painted turtle is widespread and common at low elevations throughout Connecticut (Klemens 1993) and is found in shallow, permanent, standing bodies of water (Conant and Collins 1998).

The painted turtle was the fourth most common species found during this study with 295 individuals observed from four sites (RA=9.39%, FO=19.0%), and was the most common turtle (Tables 2 and 3). The majority of these (91.5%) were observed from Weir Pond. Since many of these were adults observed basking repeatedly, it is likely that these do not all represent unique individuals (Table 4). The remaining observations (8.5%) were from temporary ponds. Previous records describe painted turtles from a woodland near Weir Pond (Klemens 1980a), in a shallow flooded meadow nearby in Ridgefield (Klemens 1982c), and basking around Weir Pond (15 inds.-NPS natural history observation 1998). A common resident in the past, the painted turtle continues to be common in the park, with the majority in Weir Pond.

Snapping Turtle (*Chelydra serpentina*)

The snapping turtle is the largest freshwater turtle in the northeastern United States. It is widespread in North America and is found throughout Connecticut, in all types of fresh water wetlands as well as in brackish water (Klemens 1993). These primarily aquatic turtles are common and females are frequently seen crossing roads and traveling over land in the spring and early summer in search of nesting areas. Females dig nests and deposit eggs in loose sand or soil, and the hatchlings emerge in the late summer or early fall (Ernst et al. 1994).

Snapping turtles were among the least abundant and least widespread species found at WEFA (RA=0.25%, FO=4.8%) (Tables 2 and 3). All snapping turtles were captured at Weir Pond during turtle trapping and as an incidental encounter (Tables 4, 13 and 15). This is consistent with their occurring primarily in permanent water bodies. One snapping turtle was recaptured during trapping. Hatchlings were observed in a field near the visitor's center in fall of 2000 (G. Waters pers. comm.). A town record for Redding is the closest documented occurrence of the snapping turtle (Klemens 1993). Snapping turtles have gone undetected at WEFA, but they have

likely been common in Weir Pond and continue to remain common at this site. Additional trapping at permanent wetlands is likely to discover more snapping turtles.

Eastern Box Turtle (*Terrapene carolina carolina*)

A small terrestrial turtle with a hinged plastron, the eastern box turtle is found in open forests, old fields, and marshy meadows across eastern North America (Conant and Collins 1998; Ernst et al. 1994). It is restricted to the lower elevation areas of Connecticut (Klemens 1993). This is a long-lived species known to live more than a century (Oliver 1955; Graham and Hutchison 1969)

The two eastern box turtles found were incidental encounters, one in Field #1 and one in woodland #4 near Weir Pond (Tables 4 and 15). Eastern box turtles have been recorded at Weir Preserve, at the edge of a field, and observed on roads in the area (Klemens 1980b). Klemens (1980c) also reported an adult female constructing a nest and depositing eggs near Arrowhead Road in Wilton, approximately 11.3 km (7 miles) south of WEFA. These previous records suggest the eastern box turtle was an uncommon resident in WEFA, with individuals likely traveling into and out of the park. The two individuals found in 2000 are presumably members of a larger population extending from within the park into the adjacent landscape. Although difficult to positively determine their status in the park, the eastern box turtle likely remains an uncommon resident, primarily utilizing old field and woodland habitats.

Box turtles are declining throughout much of their range due to the cumulative impacts of urbanization and habitat fragmentation (Dodd 2001). Listed as a *Special Concern* species in Connecticut, New York, and Massachusetts, the eastern box turtle has declined due to habitat destruction and fragmentation, over-collecting, and road mortality (Klemens 1993). Since box turtles spend much of their time at the edge between fields and woodlands (Reagan 1974), and use fields for nesting in June-July, field maintenance activities (mowing) should continue to be scheduled for November, and trail mowing in summer be done slowly and carefully to avoid impacts to box turtles.

Spotted Turtle (*Clemmys guttata*)

A small aquatic turtle with distinct yellow spots on a black carapace, the spotted turtle is found in shallow swamps, bogs, wet pastures, and fresh to slightly brackish marshes during most of the year. Spotted turtles can also spend a considerable amount of time on land during certain times of the year (Ernst et al. 1994; J. Behler pers. obs.). The spotted turtle is widely distributed in Connecticut, and is most common in the low-lying areas of the state (Klemens 1993). Although widespread in the state, the long-term outlook suggests the spotted turtle is declining in lower Fairfield County due to urban development (Klemens 1993, 2000).

In 2000, two spotted turtles were captured at Pond D during turtle trapping. It was among the least abundant and least widespread species recorded in the park (RA=0.06%, FO=4.8%) (Tables 2 and 3). Previously, spotted turtles were reported from a wooded swamp behind the Burlingham inholding on the Weir Preserve (Klemens 1982b), and in a wet meadow in WEFA (July 1998-G. Waters pers. comm.). With increasing development in Fairfield County, this species has become rare in this area of the state. Therefore, WEFA represents an important protected area for the

spotted turtle. The few records of this species in and near the park, and limited captures in 2000 suggest this species was, and continues to be, an uncommon resident in WEFA.

Snakes

Eastern Gartersnake (*Thamnophis sirtalis sirtalis*)

The eastern gartersnake is common in the United States and is recognized as many different subspecies. It is found in a variety of habitats including meadows, marshes, woodlands, and cultivated and developed areas (Behler and King 1979), and is the most widespread and ubiquitous snake in Connecticut (Klemens 1993).

The eastern gartersnake was common and moderately widespread in the park, with 25 records from fields, woodlands, and along a road (RA=0.80%, FO=23.8%) (Tables 2 and 3). Nineteen of the 25 (76.0%) were found in Field #1 (Table 4). Previous records from the Weir Preserve (Klemens 1980b, 1982b) and from a field in Ridgefield immediately northeast of Weir Preserve (Klemens 1982c) suggest it has been common and widespread in and around WEFA and our results show that it remains so.

Northern Watersnake (*Nerodia sipedon*)

This aquatic snake inhabits swamps, bogs, ponds, and streams throughout the Northeastern and northern Midwestern United States (Conant and Collins 1998). In Connecticut, it is widespread and common in and near ponds, streams, swamps, and vernal ponds (Klemens 1993, 2000).

The northern watersnake was among the least common species encountered in 2000, with RA of 0.32% (Tables 2 and 3). It was moderately widespread among wetlands (FO=14.3%), found in No Name and Weir Ponds (permanent ponds) and Pond H (temporary pond) (Table 4). Previously recorded from Weir Pond (Klemens 1982a, NPS natural history observation 1998), this snake is relatively common in the permanent ponds of WEFA and has likely been so for a while.

Northern Ring-necked Snake (*Diadophis punctuatus edwarsii*)

The northern ring-necked snake is common throughout the Northeastern United States (Degraaf and Rudis 1983) and found in a wide diversity of habitats (Klemens 1993). A small, inconspicuous species, the northern ring-necked snake is typically found in moist woodlands with abundant cover and is primarily nocturnal (Hunter et al. 1999; Conant and Collins 1998). It is found from near sea level to Connecticut's highest elevation in the northwest corner of Litchfield County, and is common in eastern and south-central Connecticut (Klemens 1993, 2000).

A single northern ring-necked snake was found dead on the dam at Weir Pond (Table 4). This was the least common and least widespread species. There is only a single prior record, of two adults found at Weir Preserve (Klemens 1982b), suggesting it was uncommon. However, since it is generally not observed out in the open even where it is common, it may be more common than

existing records suggest. Nonetheless, based on 2000 field work, it appears relatively uncommon at WEFA.

Eastern Milksnake (*Lampropeltis triangulum triangulum*)

The eastern milksnake ranges throughout most of the eastern United States and into southern Canada (Degraaf and Rudis 1983). It is widespread in Connecticut with high population densities occurring in the uplands of the Taconic Uplift (Klemens 1993). This is a secretive species most active at night and found in habitats ranging from woods, meadows, bogs, streams, and farmland. It is frequently associated with old farm fields, dilapidated structures, and trash piles, and thrives in human altered habitats (Klemens 1993). Identifying characteristics include a "Y" shaped, cream-colored patch on the nape, and a black and white checkerboard pattern on the belly (Conant and Collins 1998; Hunter et al. 1999). Though it was previously recorded at Weir Preserve in a field (Klemens 1980b) none were recorded in 2000. Given its secretive nature, its fairly recent occurrence at Weir Preserve and that it occurs in most state parks, forests, game management areas, and private sanctuaries in Connecticut (Klemens 1993) the eastern milksnake may well occur at WEFA. Further searches in fields and woodlands, around buildings, stonewalls, and hedge rows, and more intensive use of coverboards might yet document this species here.

Eastern Hognose Snake (*Heterodon platirhinos*)

The eastern hognose snake is widely distributed in the eastern United States and is found throughout Connecticut, most frequently at inland sites of moderate elevations (Conant and Collins 1998; Klemens 1993). It prefers sandy, well-drained soils in woodlands and fields, and feeds primarily on toads (Klemens 1993). Their upturned rostral scale at the tip of the snout and their somewhat bizarre defensive behaviors identify these snakes. When threatened, the eastern hognose snake will puff up and hiss loudly, and sometimes attempt to strike with a closed mouth. The snake will regurgitate its last meal, turn on its back with its mouth open, and feign death. The eastern hognose snake has been recorded from Redding and Wilton, although the Wilton record is prior to 1940. There are no records of this species in WEFA and none were found during searches in 2000. Given the eastern hognose snake is often killed by humans, is now a *Special Concern* species in Connecticut, and it might be declining in southern New England (Klemens 1993), it is likely that if this species did occur in WEFA in the past, it has probably declined.

Black Ratsnake (*Elaphe obsoleta obsoleta*)

The black ratsnake ranges extensively over the eastern and Midwestern United States, and in Connecticut, is found mostly in the central and southern portions of the state (Klemens 1993). They are more widespread at low elevations but appear to have declined in southwestern Connecticut (Fairfield and New Haven counties) because of habitat fragmentation and urbanization (Klemens 1993). There is a single record of this species from Wilton, along Route 7 (Klemens 1980c), and none have been recorded from WEFA. Given this record from Wilton, and its decline in Fairfield County, it is likely that black ratsnake once occurred in and around WEFA and has likely declined in recent decades.

Northern Black Racer (*Coluber constrictor constrictor*)

This snake is common in fields and open woodlands from southern Maine to northeastern Alabama, and is widespread in Connecticut (Conant and Collins 1998; Klemens 1993). Large sheets of corrugated sheet metal and plywood are commonly utilized by this species, along with other debris along woodlands (Klemens 1993). The northern black racer has been recorded from Redding and Weston (Klemens 1993). However, there are no historic records of northern black racer from WEFA, and none were recorded in 2000. Since this is a large, active and conspicuous species for which suitable habitat has long existed, the lack of records, past or present, suggests it was, and continues to be, rare or non-existent at WEFA.

Eastern Wormsnake (*Carphophis amoenus amoenus*)

The eastern wormsnake ranges from southern New England to South Carolina, Georgia and Alabama (Conant and Collins 1998; Klemens 1993). Scattered populations are known from Connecticut, occurring primarily at elevations below 61 m (200 feet), but also reaching 274 m (900 feet) (Klemens 1993). A secretive species, the eastern wormsnake is found in well-drained soils in or near deciduous woodlands, under stones and boards, in rotting logs, and will often burrow underground (Conant and Collins 1998; Klemens 1993). It was recorded in Ridgefield just northeast of Weir Preserve, under a stone in sandy soil along Nod Hill Road (Klemens 1982c). This is the only record of this species close to the park. Other records are from Redding, Weston, and eastern New York (Klemens 1993). No eastern wormsnakes were found in 2000. Since it is generally not often observed out in the open even where it is common, and searching is only effective if the snakes are active on or near the surface, it is difficult to determine the past and present status and trends of this species.

Northern Brownsnake (*Storeria dekayi*)

This inconspicuous species, ranging over most of the northeastern United States and Canada, inhabits moist upland and lowland habitats, and can be common in unpolluted urban and suburban areas (Conant and Collins 1998; Klemens 1993). It is widespread in southern New England, found from sea level up to 396m (1300 feet) (Klemens 1993). Locally, this urban and disturbance tolerant species has likely faired well amidst the urban development in Fairfield County over the years. This species has never been recorded from in and around WEFA, but does occur in nearby Redding and Wilton (Klemens 1993). None were found at WEFA in 2000. The lack of records, past or present, suggest it was, and continues to be either absent or at best rare at WEFA.

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Appendix A. Summary of literature documenting amphibians and reptiles in or near Weir Farm National Historic Site.

SPECIES	Klemens AMNH Field Notes Weir Farm 24 May 1980a.	Klemens AMNH field notes Weir Preserve 24 May 1980b.	Klemens AMNH Field Notes Wilton approx 7 mi. S of Weir Farm 1980c.	Klemens AMNH Field Notes Weir Pond 29 May 1982a.	Klemens AMNH field notes Weir Preserve 29 May1982b.	Klemens AMNH Field Notes Ridgefield NE of Weir Preserve 29 May 1982c.	Klemens 1993	Connecticut DEP 1991	NPS Obs. 28 July 1998 R. Cook & G. Waters	NPS Obs. 24 Sept. 1998 G. Waters	NPS Obs. Oct 2004 G. Waters
FROGS											
American Toad							**X**				
Fowler's toad	**X**			**X**		**X**	**X**				
wood frog							**X**		**X**		
American bullfrog	**X**						**X**				
northern green frog	**X**						**X**	**X**	**X**		
gray treefrog							**X**				
spring peeper	**X**					**X**	**X**		**X**		
pickerel frog	**X**						**X**				
SALAMANDERS											
red-spotted newt	**X**	**X**			**X**	**X**	**X**				
N. two-lined salamander							**X**		**X**		
northern dusky salamander							**X**				
four-toed salamander			**X**				**X**				
E. red-backed salamander	**X**				**X**	**X**	**X**				
N. slimy Salamander (T)							**X**				

Appendix A. Summary of literature documenting amphibians and reptiles in or near Weir Farm National Historic Site (continued).

SPECIES	Klemens AMNH Field Notes Weir Farm 24 May 1980a.	Klemens AMNH field notes Weir Preserve 24 May 1980b.	Klemens AMNH Field Notes Wilton approx 7 mi. S of Weir Farm 1980c.	Klemens AMNH Field Notes Weir Pond 29 May 1982a.	Klemens AMNH field notes Weir Preserve 29 May1982b.	Klemens AMNH Field Notes Ridgefield NE of Weir Preserve 29 May 1982c.	Klemens 1993	Connecticut DEP 1991	NPS Obs. 28 July 1998 R. Cook & G. Waters	NPS Obs. 24 Sept. 1998 G. Waters	NPS Obs. Oct 2004 G. Waters
spotted salamander	**X**		**X**		**X**	**X**	**X**				**X**
Jefferson salamander (SC)							**X**				
marbled salamander							**X**			**X**	
TURTLES											
eastern box turtle (SC)		**X**	**X**				**X**				
painted turtle	**X**					**X**	**X**		**X**		
snapping turtle							**X**				
spotted turtle					**X**		**X**		**X**		
SNAKES											
northern watersnake				**X**			**X**		**X**		
eastern milksnake		**X**					**X**				
eastern gartersnake		**X**			**X**	**X**	**X**				
eastern hognose snake (SC)							**X**				
northern ring-necked snake					**X**		**X**				

Appendix A. Summary of literature documenting amphibians and reptiles in or near Weir Farm National Historic Site (continued).

SPECIES	Klemens AMNH Field Notes Weir Farm 24 May 1980a.	Klemens AMNH field notes Weir Preserve 24 May 1980b.	Klemens AMNH Field Notes Wilton approx 7 mi. S of Weir Farm 1980c.	Klemens AMNH Field Notes Weir Pond 29 May 1982a.	Klemens AMNH field notes Weir Preserve 29 May1982b.	Klemens AMNH Field Notes Ridgefield NE of Weir Preserve 29 May 1982c.	Klemens 1993	Connecticut DEP 1991	NPS Obs. 28 July 1998 R. Cook & G. Waters	NPS Obs. 24 Sept. 1998 G. Waters	NPS Obs. Oct 2004 G. Waters
black ratsnake			**X**				**X**				
northern black racer							**X**				
eastern wormsnake						**X**	**X**				
northern brownsnake							**X**				

Appendix B. Habitat types of herpetological survey sites in Weir Farm National Historic Site. Sub-habitat types are grouped into three main habitat categories.

Habitat Category	Habitat Type	Description
STREAMS	Permanent Stream	Narrow (<3m wide), flowing body of water with water flowing throughout the year.
	Intermittent Stream	Narrow (<3m wide), flowing body of water that dries up for a period of time during the year.
WETLANDS	Temporary Pond	Open or closed canopy body of water that holds water for part of the year, drying during late summer months, and is void of fish. Identified by water stained leaves and buttressed tree trunks (i.e., Pin Oak (*Quercus palustris*); Black Gum (*Nyssa sylvatica*)). Invertebrates present include fairy shrimp, predacious diving beetles, copepods, cladocerans, and caddisfly larvae.
	Permanent Pond	Open body of water (<2 ha), holds water the entire year, and fish are usually present. Borders of the pond are well defined.
UPLANDS	Deciduous Forest	Forest dominated by deciduous trees (i.e., oak (*Quercus* spp.); maple (*Acer* spp.); birch (*Betula* spp.).
	Field (grass/forbs)	Open area dominated by grasses and sedges
	Road	Paved roads, not a 'natural' habitat

Appendix C. Code, common name, and scientific name of amphibian and reptile species historically reported from Weir Farm National Historic Site. Common and scientific names and spellings are from Crother (2000).

Code	Common Name	Scientific Name
AMMA	Spotted Salamander	*Ambystoma maculatum*
BUFO	Fowler's Toad	*Bufo fowleri*
CHPI	Painted Turtle	*Chrysemys picta*
CHSE	Snapping Turtle	*Chelydra serpentina*
CLGU	Spotted Turtle	*Clemmys guttata*
DIPU	Northern Ring-necked Snake	*Diadophis punctuatus edwarsii*
EUBI	Northern Two-lined Salamander	*Eurycea bislineata*
HYVE	Gray Treefrog	*Hyla versicolor*
NESI	Northern Watersnake	*Nerodia sipedon*
NOVI	Red-spotted Newt	*Notophthalmus v. viridescens*
PLCI	Eastern Red-backed Salamander	*Plethodon cinereus*
PSCR	Spring Peeper	*Pseudacris crucifer*
RACA	American Bullfrog	*Rana catesbeiana*
RACL	Northern Green Frog	*Rana clamitans melanota*
RAPA	Pickerel Frog	*Rana palustris*
RASY	Wood Frog	*Rana sylvatica*
TECA	Eastern Box Turtle	*Terrapene c. carolina*
THSI	Eastern Gartersnake	*Thamnophis s. sirtalis*

Appendix D. Survey localities, habitat type, and GPS positions for 16 standardized surveys sites and 5 incidental encounter locations in Weir Farm National Historic Site, 2000.

Site	Habitat	Survey Method	GPS Positions			
			UTM X	UTM Y	UTM X	UTM Y
Standardized Survey Sites						
			629178	4568016	629163	4568036
		CB	629156	4568127	629150	4568106
Field #1	field	IE,TCS	629178	4568016		
		CB	629341	4568321	629325	4568315
Field #2	field	IE,TCS	629341	4568321		
No Name Pond	permanent pond	IE,MT,TCS,TT	629117	4568393		
Pond A	temporary pond	IE,MT,TCS,TT	629129	4568340		
Pond C	temporary pond	IE,MT,TCS,TT	629363	4568209		
Pond D	temporary pond	IE,MT,TCS,TT	629426	4568239		
Pond H	temporary pond	IE,MT,TCS,TT	629157	4568123		
Stream #1	intermittent stream	TCS	629498	4568391	629407	4568379
Stream #2	permanent stream	TCS	629665	4568600	629637	4568734
Stream #3	permanent stream	TCS	629711	4568663	629779	4568759
Weir Pond	permanent pond	IE,MT,TCS,TT	629636	4568392		
		CB	629181	4568282	629127	4568301
Woodland #1	deciduous forest	TCS	629181	4568282		
Woodland #2	deciduous forest	IE,TCS	629351	4568075		
		CB	629398	4568160	629378	4568197
Woodland #3	deciduous forest	IE,TCS	629398	4568160		
		CB	629440	4568283	629413	4568300
Woodland #4	deciduous forest	IE,TCS	629440	4568283		
		CB	629718	4568466	629741	4568484
Woodland #5	deciduous forest	IE,TCS	629718	4568466		
Incidental Encounter Locations						
Weir House Historic Core	field	IE	629195	4568400		
Nod Hill Road	road	IE	629346	4568354		
North Pond D	permanent pond	IE	629392	4568655		
Pelham Lane	road	IE	629140	4568183		
Weir Preserve	deciduous forest	IE	629225	4567729		

As the nation's primary conservation agency, the Department of the Interior has responsibility for most of our nationally owned public land and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS D-29 November 2005

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