RESURVEY OF ALL KNOWN DUSKY SALAMANDER SITES IN ILLINOIS

FINAL REPORT

by

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RESURVEY OF ALL KNOWN DUSKY SALAMANDER SITES IN ILLINOIS

OBJECTIVES

1. Systematically re-examine each of the 23 known dusky salamander sites in Illinois;
2. Search for new populations in appropriate habitats within the area where the species occurs in Illinois;
3. Compare and evaluate the status of each population and locate each precisely by GPS technology;
4. Compare relative abundance data obtained in time-constrained visual encounter surveys between populations and with the few past inventories that exist for some of them;
5. Record and compare data on population structure (larvae, juveniles, subadults, adult males, adult females);
6. Evaluate this method for monitoring populations by comparing results with data obtained from two study sites in Chestnut Hills Nature Preserve where I carried out density studies in 1978 using a mark-recapture method.

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Doris M. Brandon accompanied me to most sites and served as data recorder, and suffered a bout of ehrlichiosis for her efforts. Scott R. Ballard, IDNR Natural Heritage Biologist for District 23, helped survey several of the sites and was helpful in many other ways. In the 1970s, K. Andrew West, then a District Natural Heritage Biologist with the Illinois Department of Conservation, introduced me to Chestnut Hills Nature Preserve and to Britton Spring. He encouraged my field work with this salamander and shared salamander counts he had made in several of the Chestnut Hills Nature Preserve ravines.

INTRODUCTION

Desmognathus conanti Rossman, 1958, type locality 2.1 miles south of Smithland, Livingston County, Kentucky, originally was described as a subspecies of the northern dusky salamander *D. fuscus* (Rafinesque, 1820). It now is considered to be a separate species (Bonett, 2002; Collins and Taggart, 2002; Titus and Larson, 1996; USGS, 2002).

The taxonomic history of *D. conanti* is outlined by Frost (2004). In 1986, Karlin and Guttman examined isozyme variation within *Desmognathus fuscus* and concluded that northern (*Desmognathus fuscus fuscus*) and spotted (*D. f. conanti*) populations might not represent the same species. In a master's thesis, Moeller (1994) showed that dusky salamanders in Pulaski County, Illinois, and western Kentucky (including the type-locality of *D. f. conanti*) are very similar to each other genetically but differ significantly from *D. fuscus* from eastern Kentucky, Indiana, and Ohio. Titus and Larson (1996), in a mitochondrial DNA study of the phylogeny of desmognathine salamanders, elevated *Desmognathus conanti* to species level but Petranka (1998) continued to treat it as a subspecies because the contact zone between *conanti* and *fuscus* in western Kentucky and central Tennessee had not been studied in detail. Bonett (2002) used allozyme and color pattern analysis to examine this contact zone and confirmed that these two dusky salamanders are distinct species. Bonett (2002) did not examine Illinois material or cite Moeller's work and he mapped the range in Illinois as broader than it actually is.

The spotted dusky salamander is listed as state endangered in Illinois (Phillips et al., 1999) because its range in the state is very limited. It occurs as a relict in forested spring-fed ravines that drain the rolling upland of Pulaski County between the Cache and Ohio rivers (Brandon and Huheey, 1979). The largest aggregate of populations are protected

within Chestnut Hills Nature Preserve (McFall and Karnes, 1995). Aside from one population (Site 24) almost certainly introduced (Moeller, 1994) in northern Johnson County, the species is not known to occur anywhere else in Illinois.

METHODS

Time-constrained visual encounter surveys (Crump and Scott, 1994) were carried out during April, May, June, September, and October, 2006. Each of the 23 known sites was examined at least once and nine of them twice. Two different sections of the ravines at sites 14 and 20 were examined unintentionally. A Magellan Explorist 200 handheld GPS navigator was used to locate each site by latitude and longitude and reference was made later to TopoZone (http://www.topozone.com/) to confirm each location on USGS 7.5-minute topographic quadrangle maps.

Observations of the salamanders and their habitats were recorded in the field on a standard data sheet (Figure 1). Stream water temperature in the shade was recorded and two digital photographs were taken, one looking upstream and one looking downstream. Times of day when the search for salamanders began and ended were recorded. I tried to spend at least 20 minutes (often more and sometimes less because habitat was limited) searching for salamanders under rocks, logs, and piles of leaves in the stream and along its bank.

An attempt was made to capture each salamander observed but a few escaped. Salamanders were captured by hand or with a plastic cup and transferred to a clear plastic bag for examination. Each salamander observed was counted and, unless it escaped, its body length (snout to posterior end of the cloacal opening), sex, and stage (larva, juvenile, subadult, adult male, adult female), and microhabitat were recorded.

Microhabitat and estimated stage (larva, juvenile, adult) also were recorded for salamanders that escaped. Larvae were recognized by their short, white gills; adult males by their mental glands and cloacal conformation; and adult females by cloacal conformation, lack of a mental gland, and yellowish yolking oocytes visible through the body wall. The smallest transformed individuals were scored as juveniles and larger individuals showing no signs of sexual maturity were scored as subadults. After being examined and measured (with a millimeter rule) each salamander was returned immediately to the place where it had been found.

RESULTS AND DISCUSSION

General. All but one of the spotted dusky salamander sites known in Illinois lie within the Ohio River drainage of Pulaski County (Table 1). It also is known from one site in northern Johnson County where it appears to have been introduced and is well established. In Pulaski County, the salamander has been observed in 13 sections of two townships (sections 10, 13, 14, 15, 22, 24, and 29 of T15N, R1E and sections 2, 3, 7, 9, 10, and 31 of T16S, R1W). Twelve sites drain into the Ohio River directly, three by way of Hodges Creek, and two by way of Hess Bayou. Three sites drain into the Cache River directly, one by way of Limekiln Slough, two by way of Boar Creek, and one by way of Dutchman Creek. Approximate elevations above mean sea level of known sites range from 330 to 440 feet (Table 1).

Visual encounter surveys are an appropriate way to compare relative abundances among sites of the same habitat type (Crump and Scott, 1994). Two important features of the most productive dusky salamander sites are (1) cool seep water that flows year round and (2) abundant small rocks and slabs of conglomerate in and along the stream bed that

provide cover for the salamanders. The seep water apparently flows through gravel deposits atop clay to enter the streams. On uplands surrounding the ravines, the Coastal Plain gravels are overlain by loess soils (Parks and Fehrenbacher, 1968). The sites where few or no dusky salamanders were observed are characterized by narrow, entrenched streams with clay sides and bottoms but few if any rocks or conglomerate slabs. At some of the least productive sites there is little flowing water. The dusky salamander populations may be larger than they appear to be at these sites, but there simply is little superficial cover under which to search.

Survey Results. In all, 302 (not counting embryos or hatchlings) southern dusky salamanders were observed during 785 minutes of systematic searching between April 5 and October 6, 2006. Of the total, 24 were larvae, 61 juveniles, 41 subadults, 74 adult males, 67 adult females, and 35 unsexed adults (Table 2). Dusky salamanders were observed at all but three (sites 4, 11, and 18) of the 23 previously known localities (Table 2). Larvae were observed at 8 sites (2, 3, 7, 9, 12, 14, 20, and 24) between 5 April and 25 May, recently transformed juveniles were observed at 4 sites (15, 19, 20, and 22) between 25 May and 1 June, and recently hatched young with brooding females were observed at 3 sites (1, 3, and 17) between September 19 and October 6 (Table 2).

Numbers of dusky salamanders observed per site ranged from 0 to 25 during 10-50 minutes of searching (Table 2), or 0-0.9 salamanders per minute, 0-54.3 per person-hour. The maximum number of salamanders observed per minute probably was limited by the amount of time required to examine a salamander and record the data. It would have been extremely difficult for me to exceed one salamander per minute.

Site water temperatures ranged from 12 to 23 (mean 16.5) degrees C (Table 2). The difference between spring and autumn at six sites examined both times ranged from 1 to 4 degrees. The lowest water temperature was recorded at Jug Spring where water emerged from a cave opening, and the highest was at Site 15. Site 14 is about 1/10 mile and 40 feet elevation downstream from Site 14a in the same ravine. On the same day, water temperature was 16 degrees at Site 14a and 19 degrees at Site 14.

Recently laid eggs and brooding females of the southern two-lined salamander, *Eurycea cirrigera*, were found in two of the *D. conanti* ravines in Chestnut Hills Nature Preserve (sites 1 and 10) and just north of the nature preserve (sites 14 and 14a) and larvae were found in late May at sites 9 and 20a (Table 3). These observations are important because this is the westernmost locality known for this species north of Tennessee. Phillips et al. (1999) indicated it had not been documented in Pulaski County since 1980 but the updated Illinois Natural History Survey map indicates more recent documentation.

Ranking of Populations. Numbers of dusky salamanders observed per person-hour of searching during April, May, and June were highest (49.1-54.3) at sites 3, 10, 12, and 14; relatively high (24.7-38.2) at sites 1, 14a, 20, 20a, and 24; moderate (11.1-20.0) at sites 2, 9, 15, 16, 17, 19, and 22; and low (1.1-6.7) at sites 5, 6, 7, 8, 13, and 21 (Table 4). No dusky salamander was found at sites 4, 11, or 18. The best sites were a ravine (Site 14) just north of Chestnut Hills Nature Preserve, Britton Spring (Site 12) just north of Mounds, a ravine (Site 10) in Chestnut Hills Nature Preserve, and a stream (Site 3) just east of Bethlehem Cemetery. The worst sites appeared to be marginal *D. conanti* habitat. They were limited in extent and more disturbed with little or no running water and had

little superficial cover under which to search. Yellowish water in one ravine (Site 4) smelled of sewage.

Nine of the sites were re-examined during September and October (Table 5). The numbers of dusky salamanders observed during these months were highest (39.0-46.7) at sites 3, 10, 17, and 24; relatively high (20.0-33.3) at sites 1 and 2; and low (2.7-6.0) at sites 5 and 6. No dusky salamander was found at site 7. When spring and autumn data are compared for the nine sites examined both times (Table 6), one population stands out. The number observed per person-hour increased dramatically at site 17.

Comparisons with Past Data. Dusky salamanders have been abundant at sites 1, 2, 3, 10, 12, 14, 15, 16, and 17 since the 1970s (Table 7). Higher numbers were recorded at most of these sites in the 1970 because then at least two people simply walked down the ravines counting numbers observed; individuals were not captured and the counts were not constrained by time. The habitats, except at Site 12, appear to be unchanged since the 1970s.

Dusky salamanders have been scarce since first observed in the 1970s at sites 4, 5, 6, 7, 11, 13, and 18. None was found at sites 4 or 11 in either 2003 or 2006 or at Site 18 in 2006.

Evaluating Monitoring Methods and Comparisons with 1978 Mark-Recapture Data.

Crump and Scott (1994) consider the visual encounter survey an appropriate technique for monitoring studies. They pointed out that alone it is not appropriate for determining population density, but when used along with repeated mark-recapture data a reasonable density estimate can be obtained. The objective of the 2006 surveys was not to estimate actual population densities, but to establish a basis for comparing relative

numbers from one site to another. Obviously, the results will be most meaningful if the same observer examines each site. No two people have the same search strategies or the same biases about which parts of the habitat to search and these are influenced by experience. It might be better to have two people carry out independent surveys and average their results, but this would cause more habitat disturbance, which could be particularly harmful when females are brooding embryos and just after hatching when the young are tiny and fragile.

At two sites, 10 and 20, it is possible to compare salamander counts with estimated population density. During May 1978, a 25-meter by approximately 3-meter study area was established (Brandon, unpublished) in a ravine at Chestnut Hills Nature Preserve, in nearly the same spot as Site 10. During the initial visit to the ravine on 15 May, all 19 dusky salamanders observed were uniquely marked by toe clip and recorded on a detailed map of the study site. As the site was re-examined eleven times between 19 May and 25 August, every dusky salamander seen under superficial cover was examined and recorded and any unmarked animals were marked. Eleven to 20 individuals (mean = 15.9) were seen during each visit (compared with 19 and 13 during 2006, Table 2). By 25 August, a total of 61 salamanders had been marked and only 1 of 10 animals seen on 25 August had not been marked. A Schumacher/Eschmeyer analysis of recapture data estimated 59 individuals or 0.79 salamanders per square yard of habitat in the study area. Thus, on average I observed 26-27% of the dusky salamanders present in the study area on any visit.

A second study site of the same size was established in 1978 in a small ravine between sites 20 and 20a. During the initial visit on 15 May 1978, 16 dusky salamanders

were uniquely marked. The site was re-examined seven times between 19 May and 28 July. On 19 May, ten salamanders were seen (compared with 7 at Site 20 and 14 at Site 20a in 2006, Table 2). As the stream became nearly dry by June 1978, fewer salamanders were seen on subsequent visits (5, 6, 7, 1, 5, and 2). In all, 31 salamanders were marked by 12 July when only five were observed. Over the summer, too few were recaptured to provide a reliable estimate of total number in the study area but the numbers observed at any time during 1978 and 2006 are similar.

Site Descriptions. During the late Cretaceous and early Tertiary periods, some 50 to 80 million years ago, the Mississippi Embayment of the Gulf of Mexico extended into southernmost Illinois where layers of sand, silt, and clay were deposited in bays, deltas, and tidal flats bordering the Embayment (Nelson and Williams, 2004). The physical characteristics of one of these deposits, the Paleocene Porters Creek Clay, make it useful to industry and it has been mined to manufacture various absorbent products. It also is instrumental in providing habitat for the dusky salamander. During the Pliocene, 2-10 million years ago, rivers flowing through the area deposited the coarse Mounds sand and gravel atop the older clays, silts, and sands. Subsequent erosion through these layers and overlying Pleistocene loess has produced the seeping ravines inhabited by the dusky salamander. Nelson and Williams (2004:2) described this geological history as follows:

> "During the late Cretaceous Period, about 70 to 80 million years ago, the region that is now the lower Mississippi Valley was downwarped into a deep trough, open to the south. This trough, known as the Mississippi Embayment, became a northeast-trending arm of the Gulf of Mexico, extending into southernmost Illinois. The Cretaceous Post Creek, McNairy and Owl Creek Formations and the Tertiary Clayton, Porters Creek, and Wilcox Formations were deposited in bays, deltas, and tidal flats bordering the Embayment seaway. Following deposition of the Wilcox about 50 million years ago, the sea again withdrew from southern Illinois and erosion resumed.

The next episode of sedimentation took place late in Tertiary time (roughly 2 to 10 million years ago) when big rivers, related to the ancestral Mississippi and Tennessee Rivers, coursed across the lowlands of the northern Mississippi Embayment. These rivers deposited coarse red and brown sand and gravel now known as the Mounds Gravel. The flood plain was then eroded to approximately the 400-foot elevation contour of today, such that in most of the map area the Mounds Gravel is found at or above 400 feet above sea level."

At present, erosion continues to cut through the loess and Mounds Gravel and into the Porters Creek Clay (Nelson and Williams, 2004). The Mounds Gravel is composed of reddish-orange to brown, well-rounded chert pebbles up to 4 inches across. At its base are small boulders of sandstone, chert, and other sedimentary rocks and the bottom gravel commonly is cemented by iron oxide (Nelson and Williams, 2004). Spring water runs over the clay and through gravel; pieces of sandstone and slabs of conglomerate in and along the water provide excellent cover for the salamanders.

The southern dusky salamander sites examined during 2006 varied greatly in the extent and quality of habitat: stream width, amount of gravel in the stream bottom, number of large flat rocks in the stream bed, and amount of seeping and flowing water. By far the most extensive habitat lies within the ravine systems of Chestnut Hills Nature Preserve. Nine of the 24 known sites (sites 1, 8. 10, 15, 16, 19, 20, 21, and 22) lie within the boundaries of Chestnut Hills Nature Preserve less than two miles northeast of the town of Olmsted. Two other sites (9 and 14) are no more than 0.2 mi north of the nature preserve in similar ravines in contiguous forest.

Site 2 lies just north of the Old Lock and Dam 53 road and is separated from Chestnut Hills Nature Preserve by Dam 53 Road and the dam facility itself. All of these ravine systems drain directly into the Ohio River. All except Site 2 lie between old and new

Lock and Dam 53, between Olmsted Dam Road and the river. These forested ravines represent the largest contiguous *Desmognathus conanti* habitat in Illinois. Most of these spring-fed streams flow year round and appear to be high quality dusky salamander habitat surrounded by a forest buffer. The Porters Creek clay and the overlying layers of Mounds Gravel through which the streams cut on their way to the Ohio River slowly release water into the ravines and the exposed gravel and rocks (including some relatively large slabs of conglomerate) in the stream bed provide ample cover habitat for both larvae and postmetamorphic individuals. Fallen branches and parts of tree trunks provide cover for female*s* brooding their clutches of eggs along the stream banks. In three of the streams (sites 1, 10, and 14), egg clutches of *E. cirrigera* were found attached to the undersides of flat rocks in the stream along with attendant females (Table 3). Decaying vegetation provides an ample food base for aquatic invertebrates such as amphipods, which are eaten by the salamanders. Because fish are predators on salamanders, it is important that the shallow water in these ravines is insufficient to support fish. Upland agricultural fields with sharply eroded sides closely border the headwaters of these ravines and are planted in corn, soy beans, and wheat but the addition of silt to the stream beds from field erosion appears to have been minimal during the past 30 years.

Sites 3, 4, and 5 lie north and west of Olmsted. Site 3 is outstanding, but unusual. The stream at Site 3 passes under Bethlehem Road just east of Bethlehem Cemetery. Downstream of the bridge, dusky salamanders were found under limestone riprap and natural stream rocks. Upstream, where it is crossed by Flags-Up Lane, the head of the ravine has been used as a trash dump but the trash (old truck, kitchen appliances, etc) seems to provide good habitat for the relatively abundant dusky salamanders that live

there. Site 4 is so poor as to merit delisting. When examined on 4/27/06, the upper end of the ravine contained no running water, just a few pools. The narrow, deeply incised loess and clay stream bed contained few rocks or tree branches under which to search for salamanders. Farther downstream, scattered pools were connected by running water that gave off a faint odor of sewage. No dusky salamander was observed and the habitat was classified as poor. Site 5 is a relatively short forested section of the lower end of a tributary of Hodges Creek that runs below a hillside just southwest of the junction of Olmsted Road and Mason Road. Upstream, the tributary runs through open pastureland. The stream is a series of riffles and pools over a broad gravel bed. Many fishes up to three inches long were observed in the pools. Two dusky salamanders were found both spring and autumn under rocks at the side of the stream bed away from water but none under rocks at the water's edge. The limited extent of available habitat and presence of fish probably present serious challenges to the dusky salamander population here.

Site 11, off of N Wind Road about four miles east of the town of Pulaski, appears to be borderline habitat and we observed no dusky salamander there.

Site 18 is a stream passing under Route 37 about a mile north of Olmsted where in 1978 Bloesing and Reason found two larval dusky salamanders and an adult two-lined salamander. I examined the larvae and confirmed their identification at that time. In 2006, I examined two flowing, rocky stream tributaries that passed under Route 37 at Site 18 but found no salamander in either.

Four sites (Sites 6, 12, 13, and 17 are located between Mounds and Villa Ridge. The population at Site 12, Britton Spring, west of Old Villa Ridge Road about a mile north of Mounds, is the second best population surveyed (Table 4) and it is unique when

compared with other Illinois dusky salamander sites. Here, water rises through sand rings at the spring head and seeps from the base of a hill to form a sandy spring run that flows to a nearby creek. Dusky salamanders were abundant under branches and rocks throughout the seeps and in the spring run. Aerial photographs show that, except for trees at the spring head and along the stream, the vicinity of the spring had been completely cleared in 1938, but by 1971 was completely wooded again. Vegetation on both sides of the spring run has been greatly disturbed during the past 25 years but the population seems to be as large as it was 30 years ago. A large tree that formerly sheltered the spring head has fallen within the past three years (I last saw it intact in May 2003) leaving the formerly shaded spring head exposed to the sun. Because of its uniqueness and susceptibility to deterioration, I strongly recommend that this site be protected.

The population at Site 17 appears to be healthy but the suitable stretch of stream is relatively short. The stream begins as a spring-fed ditch alongside Schumaker Road, and then veers from the road between a sparsely wooded meadow and a wooded hillside. The stream is strewn with natural rocks and old bricks and paving blocks.

Sites 6 and 13, SW of Villa Ridge, contain a limited amount of suitable habitat and only modest populations of dusky salamanders. Site 13 is the deeper ravine with more rocks and fallen branches. The ravine at Site 6 is shallower, muddy, and contains little cover for salamanders.

The westernmost sites 7 and 23 drain directly into nearby Cache River. Site 7 contained little water and little salamander cover and for those reasons is considered borderline *D. conanti* habitat. Site 23 was not surveyed because it currently is

undergoing major disturbance as the Mounds Production Company mines the nearby Porters Creek clay. The company is in the process of arranging to have the dusky salamander population monitored as part of their conservation plan for incidental take. Dusky salamanders were found here first in 2005 by John Palis during a preliminary survey for endangered species prior to mining.

An outlying population of dusky salamander was discovered at Jug Spring (Site 24) by Tim Vogt in 1986. From an analysis of tissue enzymes, Moeller (1994) concluded that the population at Site 24 was introduced and was founded by animals collected somewhere well east of Illinois. Individuals from this population do not cluster genetically with others from southern Illinois, western Kentucky, and south central Tennessee populations of *D. conanti*. No other population has been found north of Cache River. Whatever its origin, the population at Site 24 continues to do well in the short, rocky spring run between the spring head and a tributary to Dutchman Creek.

SUMMARY

Twenty-five spotted dusky salamander localities in Pulaski County, Illinois, were examined in time-constrained surveys during April, May, and June 2006. Each site was photographed and located precisely by latitude and longitude using GPS technology. Dusky salamanders were observed at all but three of the localities, at rates of 1.1 to 54.3 individuals per person-hour of searching. No dusky salamander was observed at sites 4, 11, and 18. Populations were small and habitat was marginal at sites 6, 7, 21, 13, 5, and 8. The largest populations and highest quality habitat were found at sites 14, 12, 10, and 3. In relative abundance, populations do not appear to have changed appreciably since

the 1970s. Similar time-constrained surveys in the future can provide comparative data by which to judge the health of these populations.

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Figure 1. Data sheet used to record information in the field.

DUSKY SALAMANDER SURVEY DATA SHEET

Conant Site
Number _____ Date _____ Surveyors _____

Time Search Began _____ Time Search Ended _____ Water Temp._____

Number Observed: Larvae _____ Juveniles_____ Subadults_____ Adults _____

GPS Coordinates: _____

Individuals Found:

SVL (mm) Age or Sex Habitat

Table 2. Results of the 2006 survey of known Illinois *Desmognathus* sites.

Site number	Date	Time began	Time ended	Minutes searched	Water temp. (C)	Number of *D. c.* seen	Number seen per minute	Number of persons	Number/hr	Number/ person/hr	Larvae	Juveniles	Subadults	M	Adult ?[a]	F	
1	4/10/06	1330	1350	20	18	9	0.5	1	27.0	27.0	0	5	1	2	1	0	
1	10/6/06	1315	1333	18	15	10	0.6	1	33.3	33.3	0	1	0	4	1	4	7 hatchlings
2	4/27/06	1132	1202	30	16	20	0.7	2	40.0	20.0	11	0	2	5	0	2	
2	9/26/06	1030	1100	30	-[b]	10	0.3	1	20.0	20.0	0	3	4	2	1	0	
3	4/5/06	1315	1337	22	14.5	18	0.8	1	49.1	49.1	3	0	4	7	3	1	
3	9/19/06	1218	1239	21	18	14	0.7	1	40.0	40.0	0	1	1	6	1	5	15 embryos, 6-7 hatchlings
4	4/27/06	1302	1326	24	14	0	0.0	2	0.0	0.0	0	0	0	0	0	0	
5	4/27/06	1433	1453	20	16	2	0.1	2	6.0	3.0	0	0	0	0	0	2	
5	9/26/06	1229	1249	20	-[b]	2	0.1	1	6.0	6.0	0	0	0	2	0	0	
6	5/5/06	1210	1237	27	15	3	0.1	1	6.7	6.7	0	0	0	0	0	3	
6	10/6/06	1049	1111	22	14	1	0.05	1	2.7	2.7	0	0	0	1	0	0	
7	4/18/06	1411	1430	19	20	2	0.1	1	6.3	6.3	1	0	1	0	0	0	
7	9/26/06	1350	1400	10	-[b]	0	0.0	1	0.0	0.0	0	0	0	0	0	0	
8	5/25/06	1147	1214	27	19	1	0.0	2	2.2	1.1	0	0	0	1	0	0	
9	5/25/06	1045	1104	19	19	7	0.4	2	22.1	11.1	2	1	3	1	0	0	
10	4/10/06	1054	1116	22	13	19	0.9	1	51.8	51.8	0	5	3	4	7	0	
10	10/6/06	1230	1250	20	14	13	0.7	1	39.0	39.0	0	1	4	6	0	2	
11	5/19/06	1422	1440	18	15	0	0.0	2	0.0	0.0	0	0	0	0	0	0	
12	4/18/06	1132	1200	28	16	25	0.9	1	53.6	53.6	2	2	2	3	6	10	
13	5/19/06	1221	1311	50	15	5	0.1	2	6.0	3.0	0	0	0	2	0	3	
14	4/13/06	1216	1237	21	19	19	0.9	1	54.3	54.3	1	11	0	4	2	1	
14a	4/13/06	1108	1125	17	16	9	0.5	1	31.8	31.8	1	3	0	2	1	2	
15	6/1/06	1348	1410	22	23	9	0.4	2	24.5	12.3	0	4	1	0	1	3	3 recently transformed
16	4/26/06	1417	1442	25	14	8	0.3	1	19.2	19.2	0	0	2	2	0	4	
17	4/26/06	1217	1244	27	14	6	0.2	1	13.3	13.3	0	0	0	2	0	4	
17	9/19/06	1354	1412	18	18	14	0.8	1	46.7	46.7	0	2	1	6	2	3	8-10+ hatchlings
18	5/5/06	1405	1425	20	19	0	0.0	1	0.0	0.0	0	0	0	0	0	0	
19	6/1/06	1054	1126	32	20	13	0.4	2	24.4	12.2	0	4	1	1	1	6	4 recently transformed
20	4/10/06	1158	1215	17	15	7	0.4	1	24.7	24.7	1	0	2	2	0	2	
20a	5/25/06	1310	1332	22	19	14	0.6	1	38.2	38.2	0	7	2	3	0	2	6 recently transformed
21	6/14/06	1213	1236	23	-[b]	4	0.2	2	10.4	5.2	0	0	0	1	1	2	
22	6/1/06	1152	1208	16	21	8	0.5	2	30.0	15.0	0	1	2	1	0	4	1 recently transformed
24	4/5/06	1045	1122	37	12	16	0.4	1	25.9	25.9	2	3	5	1	4	1	
24	9/19/06	1040	1101	21	14	14	0.7	1	40.0	40.0	0	7	0	3	3	1	
Totals	34			785		302					24	61	41	74	35	67	

[a] Escaped without being sexed
[b] Water temperature not taken

Table 3. Two-lined salamanders, *Eurycea cirrigera*, observed at Illinois dusky salamander sites during 2006.

Site Number	Date	Time began	Time ended	Minutes searched	Water temp. (C)	Number of *E. c.* seen	Number seen per minute	Number of persons	Number/hr	Number/ person/hr	Larvae	Juveniles	Subadults	Adults	Egg masses
1	4/10/06	1330	1350	20	18	14	0.7	1	42.0	42.0	0	0	0	14	2
1	10/6/06	1315	1333	18	15	2	0.1	1	6.7	6.7	0	0	0	2	0
9	5/25/06	1045	1104	19	19	1	0.1	2	3.2	1.6	1	0	0	0	0
10	4/10/06	1054	1116	22	13	4	0.2	1	10.9	10.9	0	0	0	4	2
14	4/13/06	1216	1237	21	19	7	0.3	1	20.0	20.0	0	0	0	7	3
14a	4/13/06	1108	1125	17	16	4	0.2	1	14.1	14.1	0	0	0	4	1
20a	5/25/06	1310	1332	22	19	2	0.1	1	5.5	5.5	2	0	0	0	0
Totals	7			139		34					3	0	0	31	8

Table 4. April-June abundance rankings among Illinois *Desmognathus conanti* populations expressed as numbers of individuals observed per person-hour of searching.

Rank	Conant site number	Number observed	Observed per pers-hr	Site location
1	14	19	54.3	Tributary of #9
2	12	25	53.6	Britton Spring
3	10	19	51.8	Chestnut Hills Nature Preserve
4	3	18	49.1	Bethlehem Cemetery
5	20a	14	38.2	Chestnut Hills Nature Preserve
6	14a	9	31.8	Tributary of #9
7	1	9	27.0	Chestnut Hills Nature Preserve
8	24	16	25.9	Jug Spring
9	20	7	24.7	Chestnut Hills Nature Preserve
10	2	20	20.0	NW of Old Lock & Dam 53
11	16	8	19.2	Chestnut Hills Nature Preserve
12	22	8	15.0	Chestnut Hills Nature Preserve
13	17	6	13.3	SE of Villa Ridge
14	15	9	12.3	Chestnut Hills Nature Preserve
15	19	13	12.2	Chestnut Hills Nature Preserve
16	9	7	11.1	E of Calvin Cemetary
17	6	3	6.7	Near Old Shiloh Cemetary
18	7	2	6.3	E of Solomon Cemetery
19	21	4	5.2	Chestnut Hills Nature Preserve
20	13	5	3.0	N of Kays Lake
20	5	2	3.0	Tributary of Hodges Creek
22	8	1	1.1	Chestnut Hills Nature Preserve
23	4	0	0.0	Radio Tower NW of Olmsted
23	11	0	0.0	Near I24
23	18	0	0.0	Route 37 W of Calvin Cemetary

Table 5. September-October abundance rankings among nine Illinois *Desmognathus conanti* populations expressed as numbers of individuals observed per person-hour of searching.

Rank	Conant site number	Number observed	Observed per pers-hr	Site location
1	17	14	46.7	SE of Villa Ridge
2	3	14	40.0	Bethlehem Cemetery
2	24	14	40.0	Jug Spring
4	10	13	39.0	Chestnut Hills Nature Preserve
5	1	10	33.3	Chestnut Hills Nature Preserve
6	2	10	20.0	NW of Old Lock & Dam 53
7	5	2	6.0	Tributary of Hodges Creek
8	6	1	2.7	Near Old Shiloh Cemetary
9	7	0	0.0	E of Solomon Cemetery

Table 6. Ranking comparisons among Illinois *Desmognathus conanti* populations examined both spring and autumn.

Site Number	Rank		N observed		N/pers. hr		Site location
	Spring	Autumn	Spring	Autumn	Spring	Autumn	
10	1	4	19	13	51.8	39.0	Chestnut Hills Nature Preserve
3	2	2	18	14	49.1	40.0	Bethlehem Cemetery
1	3	5	9	10	27.0	33.3	Chestnut Hills Nature Preserve
24	4	2	16	14	25.9	40.0	Jug Spring
2	5	6	20	10	20.0	20.0	NW of Old Lock & Dam 53
17	6	1	6	14	13.3	46.7	SE of Villa Ridge
6	7	8	3	1	6.7	2.7	Near Old Shiloh Cemetary
7	8	9	2	0	6.3	0	E of Solomon Cemetery
5	9	7	2	2	3.0	6.0	Tributary of Hodges Creek

Table 7. Counts of dusky salamanders at various localities in Pulaski and Johnson counties, Illinois, between 1974 and 2006. Only the 2003 and 2006 counts were time-constrained; thus they are not comparable to earlier counts.

Site No.	Date	No. *D. conanti* observed
1	9/7/74	large series
	12/14/74	52
	10/12/74	114
	6/3/76	82
	4/10/06	9
	10/6/06	10
2	10/12/74	32
	4/27/06	20
	9/26/06	10
3	10/12/74	2
	4/28/78	23
	5/15/03	23 in 10 min
	4/5/06	18
	9/19/06	14
4	10/18/74	8
	5/15/03	0
	4/27/06	0
5	10/18/74	5
	4/28/78	0
	5/15/03	0
	4/27/06	2
	9/26/06	2
6	10/18/74	5
	5/5/06	3
	10/6/06	1
7	10/18/74	3
	4/18/06	2
	4/18/06	2
	9/26/06	0
8	5/25/06	1
9	5/25/06	7
10	6/25/77	49
	4/7/78	16
	4/14/78	37
	4/10/06	19
	10/6/06	13
11	6/18/76	3
	5/15/03	0
	5/19/06	0

Table 7. Continued.

Site No.	Date	No. *D. conanti* observed
12	6/18/76	141
	10/4/76	good series
	6/25/77	rained out
	5/15/03	58 in 10 min
	4/18/06	25
13	10/4/76	4
	5/15/03	1
	5/19/06	5
14	6/25/77	31
	11/3/77	13
	4/13/06	19
14a	4/13/06	9
15	6/25/77	25
	4/7/78	71
	4/14/78	48
	6/1/06	9
16	4/7/78	43
	4/14/78	18
	4/26/06	8
17	5/17/78	10
	5/15/03	5 in 10 min
	4/26/06	6
	9/19/06	14
18	5/2/78	2
	5/5/06	0
19	6/1/06	13
20	4/10/06	7
20a	5/25/06	14
21	6/14/06	4
22	6/1/06	8
23	7/4/04	7 in 15-20 min
	7/25/04	6
24	3/13/89	12
	4/5/06	16
	9/19/06	14