An Amphibian Survey of Killbuck Marsh Wildlife Area, Ohio[1]

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ABSTRACT. We surveyed Killbuck Marsh Wildlife Area, Ohio, for amphibians during a 4-year period, from 1998-2002. Sampling techniques used were visual encounter surveys (hand-collecting in terrestrial and aquatic habitats), call surveys for anurans, and sampling larvae using nets. We located 439 individuals of 16 species; of these, 7 were caudates and 9 were anurans. Specimens collected included 6 township records (Wayne County, Franklin Township: *Plethodon glutinosus*, *Rana sylvatica*; Wayne County, Wooster Township: *R. clamitans melanota*, *R. pipiens*; Holmes County, Prairie Township: *Eurycea l. longicauda*, *Bufo a. americanus*). The most common species were *R. clamitans melanota* and *R. pipiens*. The wildlife area contains extensive marshland and abundant temporary aquatic habitats (ponds, roadside ditches) that serve as breeding areas for anurans and pond breeding caudates (Ambystomatidae) that cannot coexist with predatory fish. Forested upland areas provide habitat for woodland salamanders (*Plethodon*) and their predators such as *Pseudotriton r. ruber* and *Diadophis punctatus edwardsii*. We compared our data to those of a previous survey. The amphibian community at Killbuck Marsh Wildlife Area appears to have changed little during the last 40 years, but increases in the number of forest dwelling species may be a result of continuing forest maturation at KMWA.

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INTRODUCTION

Amphibians are particularly sensitive to environmental change because of their permeable skin and, for many species, use of multiple habitat types to complete their life cycles. There is evidence that some amphibian populations may be declining due to habitat destruction, introduction of non-native species, and various other factors (for example, Barinaga 1990; Wake 1991). Many amphibian population stability studies have been short-term projects, and caution should be used when interpreting their data because natural population fluctuations may, particularly in short-term studies, appear to be population declines (as discussed in Pechmann and others 1991, Blaustein and others 1994). Recently more emphasis has been placed on conducting long-term population studies and establishing baseline population estimates to which future research can be compared (for example, Pechmann and others 1991). The number of studies making historical comparisons is increasing as well (for example, Drost and Fellers 1996; Brodman and others 2002; Lehtinen 2002). These types of studies can, along with short-term studies, contribute to determining the causes and extent of global amphibian decline.

We surveyed Killbuck Marsh Wildlife Area (KMWA) in Wayne and Holmes counties, OH, for amphibians, to determine which species are present and to estimate their abundances. From 1957–1962, Allen (1963) surveyed Wayne County for amphibians. Six of his study sites were in Franklin Twp., 4 of which are presently in the KMWA. Given the concerns for a possible global amphibian decline, we herein compare the results of our survey to those from 40 years earlier.

Killbuck Marsh Wildlife Area includes portions of Clinton, Franklin, and Wooster townships in Wayne County, and Prairie Twp. in Holmes County. The 5492-acre site lies within the Glaciated Allegheny Plateau physiographic section of Ohio and is characterized by open marsh, wooded lowlands, wooded slopes, and open agricultural land. Initial purchase of the land by the Ohio Division of Wildlife occurred in 1969. Management has consisted of maintaining the land in purchased condition. Agricultural land continues to be farmed, forested land is left undisturbed, and marshland continues to be managed for waterfowl (Kevin Higgins, Killbuck Wildlife Area Supervisor, pers. comm.). The maintenance of wetland areas for other species may benefit amphibians by reducing habitat destruction. Continued maturation of forested areas is beneficial to woodland amphibians that cannot tolerate habitat disturbance. Overall, amphibian habitat within Killbuck Marsh Wildlife Area has probably improved since the initial purchase of the land.

MATERIALS AND METHODS

Our survey was conducted from June 1998–May 2002. Before beginning the survey, we compiled a list of species that could potentially be found within KMWA based on historical records for Wayne and Holmes counties (Table 1). For some of these species, KMWA is at the edge of their geographic range; for others, suitable habitat may not exist in the wildlife area. Common and scientific names are in accordance with Collins and Taggart (2002).

We sampled 20 collection sites (Table 2) that included all 4 habitat types (open marsh, wooded lowlands, wooded slopes, open agricultural land) in KMWA. Collection sites selected were those that contained suitable

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TABLE 1

Amphibians known to occur in Wayne and Holmes counties, OH. The "Known from County" and "Known from Township" columns were assembled from Walker (1946), Pfingsten (1998), Pfingsten and Downs (1989), and Davis and Menze (2000). The "Known from Township" column includes only records for Clinton, Franklin, and Wooster townships (Wayne Co.) and Prairie Township (Holmes Co.). The "Reported by Allen (1963)" column indicates species found in Allen's (1963) survey. The "Our survey" column indicates species found in the current survey of Killbuck Marsh Wildlife Area. Abbreviations: W = Wayne Co.; H = Holmes Co.; C = Clinton Twp.; F = Franklin Twp.; O = Wooster Twp.; P = Prairie Twp.; nk = species is not known from a township studied in this survey; ***** *= township record.*

Species	Common Name	Known from county	Known from township	Reported by Allen (1963)	Our survey
CAUDATA					
Ambystoma jeffersonianum	Jefferson salamander	WH	F		
A. maculatum	Spotted salamander	WH	F	F	F
A. platineum †	Silvery salamander	W	F		
A. texanum	Smallmouth salamander	W	FO	F	O
A. tigrinum	E. tiger salamander	WH	C		
Cryptobranchus a. alleganiensis	E. hellbender	W	nk		
Desmognathus fuscus	N. dusky salamander	WH	CFOP	F	
Eurycea bislineata	N. two-lined salamander	WH	FOP	F	FP
E. l. longicauda	Longtail salamander	WH	FO	F	FP *
Gyrinophilus p. porphyriticus	N. spring salamander	H	nk		
Hemidactylium scutatum	Four-toed salamander	W	C		
Necturus maculosus	Common mudpuppy	W	nk		
Notophthalmus v. viridescens	Red-spotted newt	W	F	F	
Plethodon cinereus	N. redback salamander	WH	OP		
P. electromorphus ◆	N. ravine salamander	WH	CFOP	F	F
P. glutinosus	N. slimy salamander	WH	OP		F *
Pseudotriton r. ruber	N. red salamander	WH	F		F
ANURA					
Bufo a. americanus	E. American toad	WH	CFO	F	FP *
B. fowleri	Fowler's toad	WH	nk		
Hyla versicolor	Gray treefrog	WH	FOP	F	FO
Pseudacris c. crucifer	N. spring peeper	WH	CFOP	F	F
P. triseriata	Western chorus frog	WH	CFO	F	FO
Rana catesbeiana	Bullfrog	WH	CFP	F	FO*P
R. clamitans melanota	Green frog	WH	CFP	F	CFO *
R. palustris	Pickerel frog	WH	FOP	F	F
R. pipiens	N. leopard frog	WH	CFO	F	FO
R. sylvatica	Wood frog	W	CO		F *

† Triploid hybrid of *A. jeffersonianum* x *A. laterale*; no longer a viable species (see Petranka 1998, for a review).
◆Formerly *P. r. richmondi* (Highton 1999).

habitat for amphibians. These sites were large (Table 2) and we often sampled selected subsites within them. Terrestrial habitats were sampled by walking through the sites and hand-collecting any amphibians that were found active on the surface or under cover objects. Aquatic sites were sampled by capturing adults and larvae by hand or using nets and by monitoring anuran reproductive calls. Each adult, juvenile, larva and tadpole was counted as an individual (Table 3). Each site was sampled for at least 1 person-hour (Table 2). Some sites were sampled repeatedly (most of these included sub-sites, see Table 2); these were sampled for up to 10 person-hours. Although animals were not marked, the 9 sites that were sampled repeatedly are not likely to have

TABLE 2

Site descriptions for the sites sampled in this study: general habitat type, longitude and latitude coordinates at the center of the site, size of the site and number of subsites (when applicable), and number of person-hours worked at each site. Abbreviations for habitat types: OA = open agricultural land; OM = open marsh; WL = wooded lowlands; WS = wooded slopes.

Site number	Coordinates*		Habitat type	Size (acre)/ No. subsites	No. times sampled	Person-hours
1	40 43 48.4 N	81 58 22.8 W	WL	3.0/3	5	4:55
2	40 43 38.2 N	81 59 31.4 W	WL	0.2	1	1:00
3	40 43 59.6 N	81 57 53.2 W	OM	10.0/5	3	2:40
4	40 43 59.8 N	81 56 59.9 W	OA	6.0/3	7	5:20
5	40 43 22.0 N	81 59 54.9 W	WL	0.2	1	1:00
6	40 42 02.6 N	82 00 17.5 W	WL	0.2	1	0:30
7	40 41 18.4 N	81 58 53.5 W	WS	10.0/7	8	17:50
8	40 40 55.3 N	81 58 18.0 W	OM	0.2	1	0:20
9	40 41 50.2 N	81 58 34.5 W	OM	0.2	2	1:25
10	40 43 30.4 N	81 58 19.2 W	WL	7.0/4	5	5:05
11	40 41 50.1 N	81 58 29.2 W	OM	10.0/4	2	1:10
12	40 40 38.6 N	81 57 12.5 W	WS	10.0/4	1	4:00
13	40 42 14.0 N	81 58 33.5 W	WS	0.5	1	0:40
14	40 42 27.7 N	81 58 53.6 W	OM	0.2	1	0:30
15	40 41 57.7 N	81 58 42.5 W	OA	0.2	1	0:40
16	40 41 39.8 N	81 58 49.2 W	OM	0.2	1	0:30
17	40 41 04.2 N	81 57 26.2 W	WS	5.0	1	3:00
18	40 40 00.9 N	81 56 52.7 W	OA	0.2	3	1:20
19	40 39 46.5 N	81 57 38.5 W	OA	0.2	1	0:40
20	40 38 47.3 N	81 56 17.6 W	WS	0.2	2	1:20

*A map of KMWA is available at http://www.dnr.state.oh.us/wildlife/hunting/wildlifeareas/northeast/northea.htm

included repeated captures of the same individuals because 1) animals were only located on one of the sampling days, 2) different species were located on different sampling days, 3) subsites that were not repeatedly sampled, or 4) repeat sampling of subsites was separated by at least 11 months, which reduces dramatically the likelihood that the same individuals were counted more than once. Voucher specimens were collected and deposited at Cleveland Museum of Natural History (CMNH).

RESULTS

During the course of our study, we identified 441 individuals of 16 species of amphibians at our 20 sites (Tables 1 and 3). The most common species, *Rana clamitans melanota* and *R. pipiens*, each occurred at 8 (38.1%) of our 20 sites. These 2 anuran species were also the most abundant on the KMWA (n = 104 and n = 117, respectively; Table 3), comprising 50.3% of all individual amphibians observed. Each of the other 14 species we found occurred at 1, 2, 3, or 4 of our 20 sites. Those that were found at 4 sites were 2 caudate species (*Ambystoma texanum*, *Plethodon electromorphus* [formerly *P. r. richmondi*: Highton 1999]) and 2 anuran species (*Bufo a. americanus*, *R. catesbeiana*). Other species that were abundant included *Eurycea l. longicauda* (n = 80) and *P. electromorphus* (n = 50).

We found 6 species that were township records. Records were determined using the following references: for caudates, Pfingsten (1998) and Pfingsten and Downs (1989); for anurans, Davis and Menze (2000) (Table 1; records are indicated with asterisks). We documented township records for *E. l. longicauda* (CMNH 8803, Holmes Co., Prairie Twp., Site 20), *P. glutinosus* (CMNH 8815, Wayne Co., Franklin Twp., Site 17), *B. a. americanus* (CMNH 8823, Holmes Co., Prairie Twp., Site 19), *R. catesbeiana* (Wayne Co., Wooster Twp., no voucher), *R. clamitans melanota* (Wayne Co., Wooster Twp., no voucher), and *R. sylvatica* (CMNH 8805, Wayne Co., Franklin Twp., Site 17). These records fill small gaps in the geographic ranges of species that were already known to occur in the area.

TABLE 3

Abundances of amphibians collected at KMWA from sites 1-20. Sites 1–17 are in Wayne Co.: 1–4 in Wooster Twp., 5–6 in Clinton Twp., and 7–17 in Franklin Twp. Sites 18–20 are in Holmes Co., Prairie Twp.

Species	Total	Site number																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
CAUDATA																					
A. maculatum	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
A. texanum	13	7	-	3	-	-	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-
E. bislineata	12	-	-	-	-	-	-	3	-	-	-	-	1	-	-	-	-	-	-	-	8
E. l. longicauda	80	-	-	-	-	-	-	79	-	-	-	-	-	-	-	-	-	-	-	-	1
P. electromorphus	50	-	-	-	-	-	-	36	-	-	-	-	6	1	-	-	-	7	-	-	-
P. glutinosus	15	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-	1	-	-	-
P. r. ruber	3	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
ANURA																					
B. a. americanus	6	-	-	-	1	-	-	-	-	-	-	-	1	-	-	3	-	-	-	1	-
H. versicolor	3	-	-	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
P. c. crucifer	14	-	-	-	-	-	-	11	-	-	2	-	-	-	1	-	-	-	-	-	-
P. triseriata	10	3	-	5	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
R. catesbeiana	8	-	-	1	4	-	-	-	-	1	-	-	-	-	-	-	-	-	2	-	-
R. c. melanota	104	-	4	15	24	38	-	8	10	-	4	1	-	-	-	-	-	-	-	-	-
R. palustris	4	-	-	-	-	-	-	3	-	-	-	-	1	-	-	-	-	-	-	-	-
R. pipiens	117	2	-	2	-	-	-	10	-	75	9	3	1	-	-	-	15	-	-	-	-
R. sylvatica	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Total species per site		3	1	6	3	1	0	11	1	2	5	2	5	2	1	1	1	3	1	1	2

DISCUSSION

Rana clamitans melanota and *R. pipiens* were the most frequently encountered amphibians on the site. It was not unusual to see many young *R. clamitans melanota* along the borders of large water-filled tire ruts in the summer months. Newly metamorphosed *R. pipiens* were commonly found in grassy margins adjacent to wet ditches. *Rana catesbeiana* was less common. Although these are common species throughout Ohio, we documented township records for *R. clamitans melanota* and *R. catesbeiana* (Table 1).

Abundant habitat exists on the site for pond breeding caudates of the genus *Ambystoma*, which utilize ephemeral (and hence largely fish-free) bodies of water like those that exist in many of the flooded forest areas in KMWA. We found larvae, recent metamorphs, and juveniles of *A. texanum* in this habitat, and a recent metamorph of an *A. maculatum* in the adjacent uplands. It is possible that other members of the genus (that is, *A. jeffersonianum*, *A. tigrinum*) may be found on the site, but our survey did not reveal any.

Five species of plethodontids (*Plethodon glutinosus*, *Plethodon electromorphus*, *Eurycea l. longicauda*, *E. bislineata*, *Pseudotriton r. ruber*) and one ambystomatid (*A. texanum*) were discovered near a spring-fed pond in Site 7. This area is unusual because it is of relatively high elevation within the KMWA (900 ft; marsh elevation is 837 ft) and, unlike most of KMWA, does not periodically flood. In combination with a substrate of flat rocks, this site provides habitat for amphibian species that do not survive in the surrounding marsh conditions. The 2 species of *Plethodon* found in this area are terrestrial salamanders that require either large downed trees or deep rock crevices for brooding their terrestrial eggs. The 2 species of *Eurycea* are stream breeders and likely utilize the spring at this site for courtship and breeding; *P. r. ruber* also utilizes freshwater springs for reproduction. This site is also unique in that it produced 10 of the 16 species found at KMWA. One adult *P. r. ruber* collected at this site regurgitated a young *E. l. longicauda* when preserved (Reblin and Anthony, 2001).

From 1957–1962, Allen (1963) surveyed Wayne County for amphibians. Six of his collecting sites were in Franklin Township (his other sites were not near KMWA). He reported 15 amphibian species (7 caudates, 8 anurans) from his 6 Franklin Township sites. We found 16 species,

although we surveyed 20 areas within the marsh. We found 13 of the 15 species reported by Allen (1963) and 3 additional species he did not report (*P. glutinosus*, *P. r. ruber*, and *R. sylvatica*). These species are associated with woodlands and we suspect that their presence in the area reflects maturation of forested areas. Explaining the possible absence of the 2 species that Allen (1963) found that we did not (*Notophthalamus v. viridescens* and *Desmognathus fuscus*) is more problematic. Allen (1963) reported *N. v. viridescens* from only 1 KMWA locality. This species is known from only 2 other localities in Wayne County, neither of which are in KMWA, and is not known from Holmes County, thus it may not be common in the general area. Although we sampled in the area described by Allen (1963) and failed to find any specimens, we hesitate to conclude that newts are absent from KMWA. *Desmognathus fuscus* is generally considered to be a common species (Karlin and Pfingsten 1989). Allen (1963) reported that *D. fuscus* was abundant in streams with rocky margins, including areas with low amphibian diversity. He found these salamanders in association with *E. bislineata*, *E. l. longicauda*, and *P. r. ruber*, which are all species that we found in KMWA. We are puzzled by our failure to find *D. fuscus* during our survey because we sampled repeatedly in suitable habitat and we found species with similar habitat requirements that are typically considered less common. We also sampled in appropriate habitat just outside of KMWA and were unable to locate any *D. fuscus*. It is possible that *D. fuscus* was extirpated from the area by human disturbances and has not been able to reinvade (constraints on reinvasion are discussed in Blaustein and others 1994), while other species either were not extirpated or could more successfully reinvade. *Eurycea bislineata*, for example, may be more mobile than *D. fuscus*. Petranka (1998) reviewed studies that showed that, for *E. bislineata*, downstream drifting of larvae is an important dispersal mechanism, eggs can survive in low oxygen water, and 75% of adults do not return from annual migrations (it is unknown what percent of these succumb to predation). The adults of *D. fuscus* are much more sedentary (Petranka 1998). It is possible that, while *D. fuscus* is still locally abundant, it is becoming less common in some areas. Minton (1998) visited a site in Indiana 41 times from 1948–1993 and found that *D. fuscus* was abundant until 1958, after which it became increasingly rare over time. He was unable to find this species after 1979, but presumed that it is still present at the site. Davis and others (1998) examined museum records of *D. fuscus* for Hamilton County, OH, and surveyed the county for amphibians. They reported 23 museum specimens collected before 1940 (one collection at one locality: Davis, pers. comm.), 1 specimen collected between 1940–1979, and 1 between 1980–1995. They suggest, however, that the number of specimens deposited into museums may not be representative of abundance in nature. In their recent surveys, this species was abundant and reproductively active where present, although it was located at only 2 of 15 sites. If this once-common species is truly absent from KMWA, it warrants further attention.

Two caudates, *Hemidactylium scutatum* and *Plethodon cinereus*, are known to occur in the townships we surveyed, but they were not found at KMWA by either Allen (1963) or us. *Hemidactylium scutatum* has a scattered distribution in Ohio and is uncommon where it occurs. It requires bogs in mature or undisturbed forest (Daniel 1989); this habitat is not available at KMWA. There is suitable habitat for *P. cinereus* at KMWA, as this species is generally common in woodland habitat (Pfingsten 1989) similar to our Site 7. It may be absent from this site due to the presence of *P. electromorphus*, as these species are typically mutually exclusive of each other due to competition (Highton 1972; Jaeger 1974) and/or habitat requirement differences (Pfingsten 1989; Hedeen 2000).

The amphibian community at KMWA appears to have changed little since Allen's (1963) survey 40 years ago. Three additional species were found and, of the 2 that were not located, the absence of 1 of these (*D. fuscus*) is of greater concern because it had been abundant. We cannot, however, comment on whether or not abundance of any species has changed over the last 40 years, as Allen (1963) focused on presence/absence rather than abundance. Killbuck Marsh Wildlife Area includes much temporary water in ditches and flooded forest; these are the aquatic habitats that serve as breeding sites for many species of amphibians. Because they dry periodically, they cannot harbor predatory fish. Amphibian species that occupy these habitats are important prey for the small mammals, birds, and snakes that inhabit the Marsh. Reforested upland areas at KMWA also support a diverse and apparently stable amphibian community. This is indicated both by the presence of reproducing populations (individuals of different age classes were found) and by the presence of amphibian predators. Upland areas associated with springs (such as Site 7) appear to be especially diverse. Perhaps as a result of improved habitat quality at KMWA, the amphibian community there appears to be stable.

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