2006. Proceedings of the Indiana Academy of Science 115(2):82–88

RESULTS OF A SHORT-TERM BIOBLITZ OF THE AQUATIC AND TERRESTRIAL HABITATS OF OTTER CREEK, VIGO COUNTY, INDIANA

Daryl R. Karns[1], **Donald G. Ruch**[2], **Robert D. Brodman**[3], **Marion T. Jackson**[4], **Paul E. Rothrock**[5], **Peter E. Scott**[6], **Thomas P. Simon**[7], and **John O. Whitaker, Jr.**[8]: [1]Rivers Institute and Biology Department, Hanover College, Hanover, Indiana 47243 USA; [2]Department of Biology, Ball State University, Muncie, Indiana 47306 USA; [3]Biology Department, St. Joseph's College, Rensselaer, Indiana 47978 USA; [4]Life Sciences, Indiana State University, Terre Haute, Indiana 47809 USA; [5]Environmental Center, Taylor University, Upland, Indiana 46989 USA; [6]Department of Ecology and Organismal Biology, Indiana State University, Terre Haute, Indiana 47809 USA; [7]Division of Fishes, Aquatic Research Center, Indiana Biological Survey, 6440 Fairfax Road, Bloomington, Indiana 47401 USA; [8]Department of Ecology and Organismal Biology, Indiana State University, Terre Haute, Indiana 47809 USA

ABSTRACT. A short-term (approximately three hours) BioBlitz (rapid assessment of the species living in a particular area at one time) was conducted in the vicinity of Otter Creek, a tributary of the Wabash River in Vigo County, Indiana on 7 October 2005. A total of 35 scientists and naturalists divided into aquatic, terrestrial animal, and terrestrial plant teams to survey different taxonomic groups. The teams recorded a total of 370 species: 205 plant species, 43 fungus, 9 insect, 8 bivalve, 2 crayfish, 52 fish, 6 amphibian, 34 bird, and 11 mammal species (with some additional aquatic and mammal sampling outside the three-hour period). Species found were representative of the lower Wabash River drainage. BioBlitz events vary in scientific value, but can provide valuable scientific information as well as serve as a vehicle for public education about the natural world and conservation issues. We compare the results of the Otter Creek survey to other BioBlitz events in the Midwest.

Keywords: BioBlitz, biodiversity, Vigo County, Indiana

A BioBlitz, short for Biodiversity Blitz, is a rapid assessment of the species living in a particular area at a given point in time and is usually conducted over a 24-hour period. To complete a successful BioBlitz, the natural history talents of scientists and naturalists in an area (or state) are recruited to document the biodiversity present (Lundmark 2003). A one-day event can only begin to document all the species present in an area. Because the species assemblage changes throughout the year, species will inevitably be missed. However, the BioBlitz gives a "snapshot in time" of the species present in a particular area.

The BioBlitz concept is an outgrowth of formal biodiversity survey programs, such as the Rapid Assessment Program (RAP) of Conservation International and the BIOTROP program of the Neotropical Biological Diversity Program at the University of Kansas (Wilson 1992), generated by growing awareness and concern for biological diversity. The first BioBlitz took place in May, 1996 in Kenilworth Park and the Aquatic Gardens National Park, Washington D.C. (Post 2003; Droege 2006). Since that event, the BioBlitz concept has been adopted by numerous government agencies and private groups. Post (2003) notes that, as of 2003, there have been 58 BioBlitzes held in 25 states, with an additional 15 in six other countries. The number of events has grown steadily. Some BioBlitzes have become ongoing, annual or semi-annual events (e.g., Minnesota and Connecticut BioBlitz events sponsored by the Bell Museum of Natural History, University of Minnesota and the Connecticut Museum of Natural History, University of Connecticut; Bell Museum 2006;

University of Connecticut 2006). A wide variety of localities have been sampled, from relatively undisturbed, protected areas to heavily developed urban landscapes.

When the concept of biodiversity [the variety of living things] is mentioned, most people tend to think of tropical rainforests or coral reefs (Conniff 2000), not a Midwestern farm state in the United States. However, Indiana exhibits considerable biological diversity across the state, both east to west and north to south. Despite over two centuries of research, the distribution, occurrence, and patterns of plant and animal species nowhere on this planet, including Indiana, are completely documented.

On 7 October 2005, the Rivers Institute at Hanover College in collaboration with the Biodiversity and Natural Areas Committee of the Indiana Academy of Sciences (IAS) hosted a short-term BioBlitz on Otter Creek, a tributary of the Wabash River, in Terre Haute, Indiana. The BioBlitz was held in conjunction with the 2005 symposium on the Wabash River that is featured in this issue of the *Proceedings* of the Indiana Academy of Science. The event was short-term because it occurred primarily within a three-hour time-block following the annual meeting of the Academy. Because of the short duration of the event, less emphasis was placed on species inventory, that is, voucher specimens were not collected. This paper reports the diversity of life recorded during the Otter Creek BioBlitz, compares the results of this BioBlitz to other Midwest BioBlitz events, and discusses the value of the BioBlitz concept.

METHODS

The short-term BioBlitz focused on both the aquatic species of Otter Creek and the terrestrial species associated with habitats adjacent to the creek. Participating scientists and volunteer naturalists were divided into three teams: the aquatic group, the terrestrial animal group, and the terrestrial plant group. The majority of sampling effort occurred from 1400–1700 h on 7 October 2005. In addition, the fish, crayfish, and mussel group sampled in the morning and the afternoon of 7 October, and the mammal group deployed live and snap-traps on the night of 6–7 October. Weather conditions were sunny and dry with air temperatures between 22–25 °C during the three-hour event on 7 October.

Aquatic survey methods.—The aquatic group consisted of three observers led by Thomas P. Simon, U.S. Fish and Wildlife Service, and Brant E. Fisher, Indiana Department of Natural Resources. They collected fish, mussels and clams, and crayfish in Otter Creek, a tributary of the Wabash, at two locations in Vigo County: 1) the U.S. 41 bridge (upstream and downstream about 300 m) in Fayette Township, approximately 5 km north of the Terre Haute Township limits on U.S. 41 (39°33′22″ N, 87°23′36″ W), 2) the Markles Mill Dam (downstream about 150 m) in Markles Mill Park, Otter Creek Township, approximately 1 km northeast of the Terre Haute Township limits (39°31′40″ N, 87°20′46″ W). Sampling was done at the U.S. 41 site in the morning and at Markles Mill Park in the afternoon. In addition, Ronald A. Hellenthal (Notre Dame University) and volunteers sampled aquatic macroinvertebrates at Markles Mill Park, but that species report is not included here.

Fish, crayfish, and mussel assemblages were collected during daytime inventories. Sampling included distances of 150 m or about 35 times mean stream width, and sampling was conducted for 1800 sec in each zone. This distance is the equivalent of two habitat cycles (Leopold et al. 1964). In larger segments, two riffle-pool/run series were collected. All habitats in the stream reach were sampled relative to their abundance. Fish and crayfish were collected using a Smith-Root Model 12-B® battery-powered backpack electrofishing unit, while mussels were collected by sight observation while wading through the zone. No crayfish burrows were observed in either zone, possibly because of the late date of collection.

Field collections of fish and crayfish were identified in the field using standard taxonomic references (Smith 1979; Etnier & Starnes 1993). Only two crayfish were preserved in 70% ethanol and verified in the laboratory using standard taxonomic references (Page 1985). Mussels were ranked as live, fresh dead, or fossil based on shell characteristics. Any anomalies present on fish such as deformities, eroded fins, lesions, and tumors (DELTs) were noted.

Terrestrial survey methods.—Both the

terrestrial plant and animal groups worked in Forest Park (39°31′28″ N, 87°20′32″ W), a private park owned by First Financial Bank, Terre Haute, located immediately south of the Markles Mill Park. Forest Park is a 154 ha mosaic of mowed parkland, second-growth forest, and old fields; an approximately 1 ha pond is on the property. Otter Creek runs through the park.

The terrestrial plant group consisted of 15 observers led by Marion T. Jackson, Indiana State University, and Paul E. Rothrock, Taylor University. Their survey included a range of local community types such as mature hardwood forest, wooded ravines, swamp woods, woodland ecotones, mowed turf, early successional disturbance areas, and pond margins. The fungus group consisted of three collectors led by Donald G. Ruch, Ball State University. They surveyed in mixed deciduous forest. Both the plant and fungus groups made field identifications and also collected some taxa for later identification. For vascular plants, nomenclature and species concepts followed that of Rothrock (2004).

The terrestrial insect group consisted of one observer, Robert Jean, Indiana State University. He searched in upland second growth forest (some areas of old growth), lawn pastures, around the pond, and in the floodplain near Otter Creek.

The amphibian and reptile group consisted of four observers led by Robert D. Brodman, St. Joseph's College. They searched deciduous forest edge and interior, the pond and shoreline, the edges of Otter Creek, and open parkland by overturning rock and wood cover objects and debris. They recorded four amphibian species; the aquatic team recorded two additional species in Otter Creek. The nomenclatural authority used for amphibians and reptiles was Crother et al. (2001).

The bird group consisted of six observers led by Peter Scott, Indiana State University. They searched upland deciduous forest edges and interior (70% of survey time), a pond (~1 ha in size) and its shoreline (5% of time), and early successional shrubs and herbs in a power line corridor within the forest (25% of time). The nomenclatural authority used for birds was Banks et al. (2003).

The mammal group consisted of three observers led by John O. Whitaker, Jr., Indiana State University. They deployed 450 snap-traps and 50 live traps for one night (6–7 October; 500 trap-nights). They trapped in weedy, grassy areas along a mowed field, along Otter Creek, and in a cornfield. They also made visual and aural observations during the trapping and collecting period. The nomenclatural authority used for mammals was Mumford & Whitaker (1982).

RESULTS AND DISCUSSION

The biological diversity recorded by 35 observers within a three-hour time block (with some additional effort for mammals and aquatic species) on the afternoon of 7 October 2005 was 370 species: 205 plant species (4 phyla), 43 fungus species (2 phyla), 9 insect species (5 families), 8 bivalve species (2 families), 2 crayfish species (1 family), 52 fish species (9 families), 6 amphibian species (4 families), 34 bird species (21 families), and 11 mammal species (7 families). Due to space considerations, a summary table with the number of species listed by phyla (plants and fungi) and by class and family (all other taxa) is provided here (Table 1). A complete listing of the species observed is posted on the Indiana Academy website (http://www.indianaacademyofscience.org/), available through the Biodiversity and Natural Areas Committee of the Academy, and from the first author. None of the survey groups recorded species that were new records for the geographic area or that are listed as federally or state endangered. Species recorded were representative of the taxa expected to be found in a suburban/rural mosaic of forest patches, residential areas, and agricultural land use in the lower Wabash River drainage in southwestern Indiana.

Of the 205 plant species observed during the short-term BioBlitz, 173, or 84.4%, were native and 32, or 15.6%, were non-native. Using the floristic quality assessment program (Wilhelm & Masters 1999; Rothrock 2004), the following information was generated: Floristic Quality Index (FQI) for native species only is 48.4, while the FQI for all species is 44.5,and the mean C (e.g., Coefficient of Conservatism) for only the native plants is 3.7, while for all plant species, the mean C = 3.1. These numbers suggest that the area of Forest Park appraised contains some remnants of the region's natural heritage. Nevertheless, because the difference between the native mean

Table 1.—Summary list of the number of terrestrial and aquatic species identified during the short-term BioBlitz, Otter Creek, Vigo County, Indiana. Species numbers are listed by phyla (plants and fungi) and by class and family (all other taxa). See text for details regarding collection location and methods.

Taxon (Common name)	Number of species
Plants	
Equisetophyta (horestails)	2
Polypodiophyta (ferns)	6
Coniferophyta (conifers)	1
Magnoliophyta (angiosperms)	
native	164
non-native	32
Fungi	
Ascomycota (sac fungi)	3
Basidiomycota (club fungi)	40
Insects	
Apidae (bumble bees, honey bees & allies)	2
Nymphalidae (brush-footed butterflies)	3
Lycaenidae (gossamer-winged butterflies)	1
Pieridae (whites, sulfurs & allies)	1
Acrididae (short-horned grasshoppers)	2
Crustaceans	
Cambaridae (crayfish)	2
Bivalves	
Unionidae (unionid mussls)	7
Corbiculidae (Asian clams)	1
Fish	
Clupeidae (herrings)	1
Cyprinidae (minnows)	19
Catostomidae (suckers)	7
Ictaluridae (catfish)	4
Fundulidae (topminnows)	1
Moronidae (temperate basses)	1
Centrarchidae (black basses & sunfish)	10
Percidae (perch & darters)	9
Sciaenidae (freshwater drums)	1
Amphibians	
Proteidae (mudpuppies)	1
Plethodontidae (lungless salamanders)	3
Hylidae (treefrogs)	1
Ranidae (frogs)	1
Birds	
Anatidae (swans, geese, & ducks)	1
Phasianidae (upland game birds)	1
Ardeidae (wading birds)	1
Cathartidae (New World vultures)	1
Accipitridae (diurnal raptors)	1
Strigidae (owls)	2
Apodidae (swifts)	1
Picidae (woodpeckers)	4
Tyrannidae (tyrant flycatchers)	1
Corvidae (jays & crows)	2
Paridae (titmice & chickadees)	1
Sittidae (nuthatches)	1
Troglodytidae (wrens)	2
Regulidae (kinglets)	2
Turdidae (thrushes)	1
Bombycillidae (waxwings)	1
Parulidae (wood-warblers)	3
Emberizidae (sparrows)	3
Cardinalidae (cardinals & allies)	2
Icteridae (icterids)	1
Fringillidae (finches)	1
Mammals	
Talpidae (moles)	1
Soricidae (shrews)	1
Leporidae (rabbits)	1
Sciuridae (squirrels)	3
Cricetidae (mice & voles)	3
Procyonidae (raccoons)	1
Cervidae (deer)	1
Total	370

C and the mean C for all species is greater than 0.5, this suggests that the natural flora has been compromised by the non-native species (Swink & Wilhelm 1994; Rothrock & Homoya 2005). However, due to the short duration and single-season sample of the Otter Creek BioBlitz, these numbers should be interpreted with caution.

A total of 40 species of fish was recorded from the Highway 41 site and 44 species from the Markles Mill Dam site, for a total of 52 different fish species from the combined sites. The Markles Mill Dam site is notable for its stability in physical characteristics over the last 180 years and its high species diversity (Whitaker 1976). Whitaker (1976) reported the composition of the fish assemblage collected at the Markles Mill Dam over a 12-year (28 collections) period; a total of 57 fish species was recorded. This data set has been analyzed multiple times in a series of papers dealing with theoretical aspects of community

structure (e.g., Grossman et al. 1985). It is noteworthy that the BioBlitz reported here recorded 44 species from Markles Mill Dam in a one-day sampling period, compared to 57 species over a 12-year period.

The number of species recorded during a BioBlitz is dependent on a number of variables, such as seasonality, weather conditions preceding and during the survey, the number and type of wetlands on the site, the number of collectors, and taxonomic expertise of the collectors. We sampled during the day, in early fall, with dry weather conditions. For this reason, it is not surprising that we recorded only six species of amphibians. Four of the species were found in the vicinity of a forested ravine with a small stream, and the other two were collected by the aquatic team in Otter Creek. Alternatively, depending on moisture levels, fall is a good time for locating fungus species, and 43 species were recorded. A full BioBlitz typically lasts 24 hours (although some run longer), and nocturnal species would have been observed that we did not record. Our survey groups were strongly biased toward plants (15 of 35 collectors) and vertebrates (15 of 35 collectors). Invertebrates, especially insects, are clearly underrepresented in the survey, and more expertise with invertebrates would have added a significant number of species to the inventory.

Other Midwestern U.S. BioBlitzes have been conducted that provide a basis of comparison among regional BioBlitz events. The Allerton BioBlitz (the first BioBlitz in Illinois) was conducted on 29–30 June 2001 at Robert Allerton Park near Monticello, Illinois in Piatt County. The Calumet BioBlitz was conducted on 23–24 August 2002 on the southeast side of Chicago in Cook County, Illinois and in adjacent Hammond in Lake County, Indiana (Parker 2002; Post 2003). These BioBlitz events were sponsored by several government and private agencies. At the Allerton BioBlitz, over 160 scientists recorded 2047 species in 24 hours from a protected natural area. At the Calumet BioBlitz, over 130 scientists, divided into 26 taxonomic teams, recorded a total of 2257 species in the 24-hour collecting period, despite the fact that the general area of the BioBlitz has been the location of major industrial activities for over a century.

The Bell Museum of Natural History, University of Minnesota, has organized a smaller scale BioBlitz since 2004 (Bell Museum 2006). On 19–20 May 2006, over a 24-hour period, 40 researchers and experienced volunteers (similar in number to our short-term BioBlitz) sampled an area that included a city neighborhood, farm fields, a university campus, suburban housing, and a golf course. They recorded a total of 876 species (456 plant species, 54 fungus, 78 mammal, 232 insect, 2 fish, 2 reptile, 3 amphibian, 18 spider, 3 mollusk, and 8 other invertebrate species). In 2004 they recorded 750 species over a 24-hour period at a nature center and just under 1000 species in 2005 at the Minnesota National Wildlife Refuge over a 24-hour period.

We have assembled an inventory of BioBlitz events held in Indiana. We recognize that this may not be a complete list due to the manner in which BioBlitz events are often reported (via news media outlets and websites). The 2002 Calumet BioBlitz took place in both Illinois and Indiana and, to the best of our knowledge, was the first BioBlitz held in Indiana. The second BioBlitz held in Indiana was conducted on 17 April 2004 at Camp Lawrence, a 139-acre children's summer camp in Porter County. There were 17 biologists, naturalists, and volunteer participants involved and over 300 visitors (Alan Resetar, Field Museum, personal communication). A total of 366 species (including 8 fish species, 8 amphibian and reptile, 44 bird, 9 mammal, and 189 plant species) was recorded in seven hours. The 2005 Otter Creek short-term BioBlitz reported here is the third BioBlitz held in Indiana. A fourth BioBlitz was conducted by ACRES land trust at the Kokiwanee Nature Preserve in Wabash County in northeastern Indiana on 9–10 June 2006; the event was a full 24-hour BioBlitz with at least 10 scientists (Kimmel 2006). Three short-term BioBlitzes, hosted by the Purdue University Cooperative Extension Service and the Floyd County Soil and Water Conservation District, were held at Loop Islands Wetlands, New Albany (20 July 2006), Charlestown State Park, Charlestown (27 July 2006), and the Mount Saint Francis Wildlife Sanctuary, Floyd Knobs (10 August 2006) in southern Indiana. A six-hour BioBlitz was held 23 September 2005 at St. Patrick's County Park in South Bend, Indiana. Thus, we have been able to identify eight BioBltiz events of variable

scope that took place in Indiana between 2001 and 2006.

BioBlitzes vary widely in the number of participants, taxonomic expertise, duration, and size of the area surveyed. Details of the BioBlitz (number collectors, species list) are sometimes not easily available. However, a crude comparison can be made by dividing the total number of species observed by the number of person-hours invested (number collectors times number of hours), when this information can be obtained. We calculated that the Otter Creek, 2005 BioBlitz (370 species, 35 collectors, 3 hours) recorded 3.5 species per collector/hour; Camp Lawrence 2004 (366, 17, 7): 3.1; Minnesota 2006 (876, 40, 24): 0.9; Calumet 2002 (2257, 130, 24): 0.7; and Allerton Park 2001 (2047, 160, 24): 0.3. Thus, not surprisingly, the 24-hour BioBlitzes record more species than short-term BioBlitz events, but the number of species per collector-hour is lower. Considering the short duration and lack of taxonomic coverage of the Otter Creek short-term BioBlitz, the total of 370 species recorded is somewhat surprising and impressive.

The scientific usefulness of BioBlitz events varies considerably; some are conducted as formal, intensive surveys with the participation of many taxonomic specialists and qualified naturalists (e.g., Calumet BioBlitz, the BioBlitz reported here), others are primarily public education events in which the quality of the scientific results of the survey is not as important as the educational experience provided. BioBlitzes cannot provide a complete species inventory nor be used as the basis of a formal monitoring program. However; they can provide valuable scientific information through documentation of species occurrences (Droege 2006; Lundmark 2006). For example, BioBlitzes can identify sites where rare or unique native species are found, identify invasive species (as done in this report) that may need to be monitored or controlled, and they can jumpstart a more complete species inventory of an area. BioBlitz events bring together specialists from diverse disciplines that might not normally interact and may result in synergy among disciplines and agencies.

Just as important, a BioBlitz event provides a valuable service of public education that attracts non-specialists and allows them to interact with the scientific community in ways that might not otherwise be possible. Children, in particular, find BioBlitzes exciting, which can generate much needed interest in science. BioBlitzes can generate considerable media attention and help increase general awareness about the natural world and generate interest in conservation issues (Droege 2006). The Biodiversity and Natural Areas Committee of the Indiana Academy of Sciences is investigating the development of a BioBlitz program for the State of Indiana.

ACKNOWLEDGMENTS

We would like to thank the Biodiversity and Natural Areas Committee of the Indiana Academy of Science and the Rivers Institute of Hanover College for support of the Otter Creek short-term BioBlitz. One component of the mission of the Biodiversity and Natural Areas Committee of the IAS is to disseminate information about and to help preserve the biological diversity of the state. The Rivers Institute, created in 2004 through a grant from the Lilly Foundation, Inc., is devoted to the interdisciplinary and collaborative study of river systems using the disciplines of the liberal arts. This paper is Contribution Number 06-09 of the Rivers Institute at Hanover College. We also thank the Vigo County Parks Department for permission to work at Markles Mill Park and First Financial Bank of Terre Haute for permission to work at Forest Park. A total of 35 scientists and volunteer naturalists participated in the BioBlitz. In addition to the taxonomic team leaders listed as authors, participants included (in alphabetical order): Kemmuel Badger, Holly Baltzar, Alicia Bever, Jake Bursky, Cliff Chapman, Ellen Cunningham, Mary Damm, Liz Day, David Didion, M. Everidge, Brant Fisher, Rodger Hedge, Barbara Hellenthal, Ronald Hellenthal, Mike Homoya, Ellen Jacquart, Robert Jean, Kelly Jones, Eric Knox, C.H. Lin, Janna McIndoe, J. Moore, Timothy Roth, Dale Sparks, Jodi Sparks, Dave Stanley, and S. Schwartz.

LITERATURE CITED

Banks, R.C., C. Cicero, J.L. Dunn, A.W. Kratter, P.C. Rasmussen, J.V. Remsen, Jr., J.D. Rising & D.F. Stotz. 2003. Forty-fourth supplement to the American Ornithologists' Union Checklist of North American Birds. The Auk 120:923–931.

Bell Museum of Natural History: Minnesota BioBlitz. Accessed July, 9, 2006. ⟨http://www.bellmuseum.org/bioblitz/⟩.

University of Connecticut: BioBlitz. Accessed 7 July 2006. ⟨http://web.uconn.edu/mnh/bioblitz/⟩.

Conniff, R. 2000. Wanted, dead or alive. Smithsonian 31(1):21–24.

Crother, B.I. 2001. Scientific and standard names of amphibians and reptiles of North America north of Mexico, with comments regarding confidence in our understanding. Society for the Study of Amphibians and Reptiles. Herpetological Circular No. 29. 82 pp.

Droege, S. BioBlitz: A tool for biodiversity exploration, education, and investigation. Accessed 7 July 2006. ⟨http://www.pwrc.usgs.gov/blitz/⟩.

Etnier, D.A. & W.C. Starnes. 1993. The Fishes of Tennessee. The University of Tennessee Press, Knoxville, Tennessee. 704 pp.

Grossman, G.D., M.C. Freeman, P.B. Moyle, & J.O. Whitaker, Jr. 1985. Stochasticity and assemblage characteristics in an Indiana stream fish assemblage. American Naturalist 126(2):275–285.

Kimmel, T. 2006. The ACRES Quarterly 45(3):4–5.

Leopold, L.B., M.G. Woolman, & J.P. Miller. 1964. Fluvial Processes in Geomorphology. W.H. Freeman, San Francisco, California. 535 pp.

Lundmark, C. 2003. BioBlitz: Getting into backyard biodiversity. Bioscience 53(4):329.

Mumford, R.E. & J.O. Whitaker, Jr. 1982. Mammals of Indiana. Indiana University Press, Bloomington, Indiana. 537 pp.

Page, L.M. 1985. The crayfishes and shrimps of Illinois. Bulletin Illinois Natural History Survey 33(4):335–448.

Parker, D. 2002. Calumet BioBlitz. Chicago Wilderness Magazine 4(1):10–13.

Post, S.L. 2003. Biodiversity Blitz: A Day in the Life of . . . The Illinois Steward 12(1):1–8.

Rothrock, P.E. 2004. Floristic quality assessment in Indiana: The concept, use, and development of coefficients of conservatism. Final report for ARN A305-4-53, EPA Wetland Program Development Grant CD975586-01. Available at http://www.in.gov/idem/water/planbr/401/publications.html.

Rothrock, P.E. & M.A. Homoya. 2005. An evaluation of Indiana's floristic quality assessment. Proceedings of the Indiana Academy of Science 114:9–18.

Smith, P.W. 1979. The Fishes of Illinois. University of Illinois Press, Champaign, Illinois. 352 pp.

Swink, F. & G. Wilhelm. 1994. Plants of the Chicago region. 4th edition. Indiana Academy of Science, Indianapolis, Indiana. 921 pp.

Whitaker, J. 1976. Fish community changes at one Vigo County, Indiana locality over a twelve year period. Proceedings of the Indiana Academy of Science 85:191–207.

Wilhelm, G. & L. Masters. 1999. Floristic quality assessment computer program version 1.0. Conservation Research Institute, 324 New York Street, Elmhurst, Illinois 60126.

Wilson, E.O. 1992. The Diversity of Life. Belknap Press of Harvard University Press. Cambridge, Massachusetts. 424 pp.

Manuscript received 8 September 2006.