



# 2007 Jug Bay BioBlitz

## Technical Report of the Jug Bay Wetlands Sanctuary



# 2007 Jug Bay BioBlitz Report

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## Introduction

A BioBlitz is a 24-hour field survey and inventory of organisms in a well-defined area such as a park or other natural area. The objective of this intensive survey is to generate a catalog or list of all species that are identified or collected during the brief survey period. The first BioBlitz in the United States was conducted in 1996 in Washington, DC. Today dozens of BioBlitzes are held annually in the United States (see Wikipedia Encyclopedia; <http://en.wikipedia.org/wiki/BioBlitz>). A BioBlitz increases local knowledge of biodiversity and involves local naturalists and the public in coordinated fieldwork and observation. The surveys raise the awareness among the general public about the natural world and the importance of biodiversity. The species distribution and occurrence information that is obtained from a BioBlitz also provides resource managers with a deeper understanding of the natural lands under their management, thus enabling improved habitat stewardship.

The 2007 Jug Bay BioBlitz took place at the Jug Bay Wetlands Sanctuary over a 24-hour period, from 12:00 (noon) on 15 September to 12:00 on 16 September. We organized this event in order to take advantage of the growing interest in biodiversity by the public and to tap in to the community of active, highly skilled naturalists in the Washington DC/Baltimore area. For this first-time effort we concentrated the field surveys on groups of organisms for which local biogeographical information was poor or incomplete (for example, ants, ground bees, spiders and zooplankton), rather than on the groups for which our knowledge on distribution was relatively thorough such as birds and herps. Depending on priorities and the availability of experts, future BioBlitzes will focus on groups of organisms that were not surveyed in 2007.

Biodiversity has been a central focus of ecological research at the Sanctuary for many years (see References). For example, the Great Herp Search was designed as a mini-BioBlitz specifically for reptiles and amphibians. By conducting the Great Herp Search in the same way for over 20 years (1986-2006), we have gained an understanding of local herp diversity and of the habitats where these animals are found (Smithberger and Swarth 1993, Molines 1995, Molines and Wright 1998, Swarth 2000). More recently, entomologists have conducted surveys of sand-dwelling beetles and bees at the Glendening Preserve (Droege 2005, Droege et al. 2007, Mawdsley 2007) and invertebrate zoologists have discovered two new species of earthworms in the Sanctuary (Csuzdi and Szilávecz 2002; 2003). Monitoring surveys for birds, turtles, fish, aquatic insects, and wetland plants also take place annually under the direction of Sanctuary naturalists.

Many of the expert leaders who helped with our BioBlitz are teachers and ecologists who frequently lead field trips; several leaders serve on the Sanctuary's Scientific Advisory Committee. We received assistance from a total of twenty-five scientists and specialists from various organizations, including the Smithsonian Institution, U.S. Geological Survey, Johns Hopkins University, Washington Area Butterfly Club, Maryland Entomological Society, Maryland Native Plant Society, and several other colleges and organizations (see Table I for the names of the team leaders).

<p>This report is dedicated to the memory of Nancy Kreiter. Nancy died on December 30, 2007, after a scuba diving accident in Florida. We greatly enjoyed Nancy's knowledge about spiders and the natural world which she shared so enthusiastically with us.</p>
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**Acknowledgements**

A total of 97 observers participated in the Jug Bay BioBlitz. In addition to the experts noted in Table 1, the following individuals helped on the field teams: Sera Baghdadi, Kristina Benefyle, Lisa Bierer-Garrett, Zoe Black, Anne Carnes, Kathy Chow, Peter Chow, Steven Chow, Matthew Chow, Pati Delgado, Desiree Demauro, Rachael Dickey, Julie Diewald, Adrien Downey, Shannon Earle, Kim Elliott, Anna Eshelman, Ellen Farr, Kelly Franklin, Kata Frederick, Rosemary Frezza, Elaine Friebele, Lynette Fullerton, Bob Gardiner, Chris Garrett, John Gilman, Kristen Hall, Sue Hamilton, Darcy Herman, Molly Houseman, Beth Johnson, Dominique Jordon, Phil Kean, Svetlana Klimenko, Miriam Lemus, Kyle Maduro, Susan Matthews, Karen McDonald, Mimi McKindley-Ward, Steve McKindley-Ward, Rob Mitchell, Dawn Miller, Candace Morrell, Jennifer Muro, William Needham, Lorrie Oakes, Diana Ogilvie, Jan Owings, Beth Pieper, Nicolay Perrin, Ashleigh Pfarr, Sandy Poland, Sue Ricciardi, Justin Rodriguez, Tim Rule, Patty Satz, Fred Seitz, Chris Seitz, Gabi Shenot, Josh Shenot, Sam Shenot, Lisa Siciliano, Les Silva, Shelby Silvernell, Alex Steininger, Satoshi Tasumi, Yuka Tasumi, Pete Uimonen, Darlene Walker, Brianne Walsh, Bobby Whitkop, Mary Zastrow, and Tim Zastrow.

Table 1. Team leaders, their affiliations, and areas of expertise.

Team Leader/Expert	Organization	Area of Expertise
Nancy Kreiter	College of Notre Dame, Baltimore	Spiders; Insects
Daniel Kjar	Elmira College, Elmira, New York	Ants
Tim Foard	ICR Lab	Ants
Kathy Szlavecz	Johns Hopkins University	Earthworms; Isopods
Kathy Ellett	Jug Bay Wetlands Sanctuary	Plankton
Robert Frezza	Jug Bay Wetlands Sanctuary	Herps
Lindsay Hollister	Jug Bay Wetlands Sanctuary	Nocturnal Mammals
Karyn Molines	Jug Bay Wetlands Sanctuary	Fish; Plants; Herps
Dotty Mumford	Jug Bay Wetlands Sanctuary	Birds
Dave Perry	Jug Bay Wetlands Sanctuary	Plants; Butterflies
Mike Quinlan	Jug Bay Wetlands Sanctuary	Herps; Birds
Jeff Shenot	Jug Bay Wetlands Sanctuary	Birds; Butterflies
Chris Swarth	Jug Bay Wetlands Sanctuary	Herps; Birds
Fred Paraskevoudakis	Maryland Entomological Society	Butterflies & other Insects
Joe Metzger	Maryland Native Plant Society	Plants
Richard Orr	Mid-Atlantic Invertebrate Field Studies	Dragonflies; Damselflies
Jonathan Mawdsley	Natural History Museum, Smithsonian Institution	Insects; Tiger Beetles
Ben Hollister	Prince George's Community College	Insects
Dennis Whigham	Smithsonian Environmental Research Center	Plants
Jeff Campbell	University of Maryland, Baltimore County	Fish
David Farr	USDA, Beltsville Lab	Mushrooms
Sam Droege	USGS, Patuxent Wildlife Research Center	Bees
Pat Durkin	Washington Area Butterfly Club	Butterflies
Dick Smith	Washington Area Butterfly Club	Butterflies; Day-flying moths

We especially thank Jeff Campbell for setting up the Access database program; Kim Elliott for data entry; Lisa Siciliano for creating colorful & informative posters highlighting biodiversity; and Jennifer Muro for the artwork and attractive poster boards that we used each morning to assemble the teams. Thanks to James Trager of the Missouri Botanical Garden for commenting on ant nomenclature and identification.

We are very grateful for the support of the Anne Arundel County Recreation and Parks Department, the Chesapeake Bay National Estuarine Research Reserve – Maryland, and the Friends of Jug Bay.

### **Sanctuary Location and Habitats**

The Jug Bay Wetlands Sanctuary is a 1,500 acre ecological research station and environmental education center located in southern Anne Arundel County on the Patuxent River estuary. The Sanctuary is operated by the county's Recreation and Parks Department and is part of the Chesapeake Bay National Estuarine Research Reserve in Maryland. The Sanctuary is about 18 miles south of Annapolis and about 15 miles east of Washington, DC. The McCann Wetlands Center, near the middle of the Sanctuary, is located at 38° 47' 05" W; 76° 42' 06" N.

Jug Bay is a shallow embayment located near the head of tide on the estuary. Tidal amplitude is about 0.75m, and salinity varies from 0 for most of the year to a maximum of about 2 ppt in late summer and early fall. The Sanctuary contains about 600 acres of freshwater tidal wetlands and about 5 miles of shoreline on the east side of the Patuxent River. Habitats within the Sanctuary consist of tidal marsh, scrub wetland and swamp; mixed hardwood forests; managed meadows; old horse pastures; and stream valleys. Much of the uplands were logged and farmed during the past 250 years. The forests are 50 to 75 years old, with trees perhaps surpassing a century in age found along the slopes of stream valleys. The Sanctuary contains about fifteen miles of hiking trails, boardwalks and roads.

### **Methods**

Several parks in the Washington metropolitan region have conducted BioBlitzes. As a result, we talked with local naturalists and park employees to gain knowledge directly from them. The first phase of organizing the event was to identify specialists who had the time and interest to help us. Using our contacts from around the region we recruited experts for three to four months prior to the BioBlitz. At the outset we wanted to put less field effort on the better-studied groups of organisms (for example, birds, plants, mammals, amphibians and reptiles) and more emphasis on organisms (especially invertebrates) that are not as well known in our area. Therefore we made a special effort to recruit among the entomological community and with other invertebrate specialists. Fortunately most experts were enthusiastic about being part of our BioBlitz and they committed early to helping with the project. Having a group of committed experts made it easier for us to attract others to help on the search teams. The team leaders and experts are shown in Table 1.

We created a field survey schedule through e-mails and phone calls with the leaders. We found that some leaders could help on one day but not on the other. Some preferred working during the warmer parts of the day, others at night, and some had no preferences. To organize the team leaders and search participants we produced a matrix of three-hour time slots (for example, noon to 3 pm.; 3 to 6 pm; 6 to 9 pm; etc.). At optimal times during the day, participants had the option of choosing among several search events that were scheduled at the same time. Participation by the public was limited to adults and older teens. We tried to spread participants evenly among groups but this was not always possible. Two groups surveyed different areas of the Sanctuary at night. Some participants spent the night in the Wetlands Center. Greater search effort and more searchers worked on Saturday than on Sunday.

We divided the Sanctuary into 39 search areas (see two Sanctuary maps in Appendix A). Some areas were the same as those used on the Great Herp Search. Area size and shape were determined by habitat type and were bounded by hiking trails and roads. Search areas varied from 2 to 28 ha, but most were 4 to 8 ha in size. There were about 20 areas in the Sanctuary north of Wrighton Rd. (the Parris Glendening Nature Preserve) and twenty areas south of Wrighton Rd. A summary of the leaders, times and the areas they searched is shown in Appendix B.

Leaders and participants arrived at 10:00 am so that we had adequate time to go over survey objectives, maps, data sheets, and other details before the 12:00 start. By 11:45 am the teams were assembled and ready to depart the Wetlands Center at noon.

Leaders were given one data sheet for recording searcher names and contact information, habitats and search times, and another data sheet for listing species, locations, and notes. Data sheets are shown in Appendices C and D. Each team leader was given a map showing the northern and southern search areas. After the BioBlitz was completed the data were transferred from the field sheets to an Access database and Excel spreadsheets.

Teams covered 19 of 39 designated search areas, representing about 30% of the 1,500 acre sanctuary. Search Areas 1 through 12, 20, 33, 34( a, b, and c) 37, and 39 were covered (see maps). Tidal wetlands were not searched extensively, except along the Marsh Boardwalk, Railroad Bed and River Pier.

Approximately 23 teams, each composed of 1 to 10 searchers, conducted the BioBlitz. Average team size was about 5. Almost 500 searcher-hours were devoted to this effort (Table 2). Most teams searched for one or two 3-hour search periods. The Tree Team led by Dave Perry and the Herp Team led by Mike Quinlan searched for three three-hour periods over both days.

Table 2. Search effort by field teams.

Species Groups	Number of Searchers	Searcher-Hours
Meadow Plants	9	36
Trees	12	36
Vines	9	30
Mushrooms	7	21
Plankton	3	9
Earthworms & Isopods	3	9
Spiders	5	15
Ants	3	9
Bees & Wasps	5	12
Tiger Beetles	4	12
Butterflies & Moths	20	54
Dragonflies & Damselflies	10	30
Insects (general)	11	33
Fish	3	9
Reptiles & Amphibians	48	118
Birds (diurnal)	8	23
Birds (nocturnal)	7	21
Mammals	5	15
<b>Total</b>	<b>172</b>	<b>492</b>

Teams mostly searched by walking slowly through the search areas inspecting the leaf litter, shrubs and trees, or looking through the soil. Some used insect sweep nets to capture butterflies, dragonflies and damselflies. Pitfall traps were set overnight in a meadow for ground dwelling insects and bees. Wood and sheet metal cover boards were placed in open meadows to attract snakes or other animals. The Fish team used short seines and nets to collect fish in Galloway Creek, in the vicinity of grid poles 543-G, 542-H, and 542-I. The plankton team used a plankton net at the River Pier. About 10 5-gallon pitfall buckets at the Wet Forest Trap site (near grid poles 515-N) were opened on 14 September and checked in the evening on 15 September. Two teams searched at night for nocturnal mammals and birds. We did not set small mammal traps or use mist nets during the BioBlitz.

The greatest field effort (118 searcher-hours) was expended by three herp teams. Butterflies were also well surveyed by three teams which devoted 54 searcher-hours in the field. The fewest hours were spent observing and collecting plankton, ants, earthworms, isopods, and fish. The plant team effort was spent primarily on trees, vines, and on plants in meadows; little effort was made to identify plants (except vines) in tidal or non-tidal wetlands, or stream floodplains.

Leaders who surveyed plankton, ants, and bees, collected and preserved their specimens in order to determine their specific identity. Their results and species' confirmations were sent to us later.

Air temperature was recorded throughout much of the BioBlitz period at a weather station in the Meadow about 100m northeast of the Wetlands Center.

The nomenclature used in this report for flowering plants, birds, and amphibians and reptiles is based primarily on the following references:

- Manual of Vascular Plants of Northeastern United States and Adjacent Canada. Gleason and Cronquist. 1991. 2<sup>nd</sup> Edition.
- American Ornithologist's Union Checklist of North American Birds. 1998. 7<sup>th</sup> edition.
- Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico, with Comments Regarding Confidence in our Understanding. Crother, et al. 2008. 6<sup>th</sup> Edition.

**Weather on the BioBlitz**

Weather conditions during the 24-hour BioBlitz on 15 and 16 September 2007 were ideal for field work, and air temperature was somewhat cooler than the long-term monthly average. September 2007 was “warm and very sunny” according to the Atlantic Coast Observer’s Network [www.jhuapl.edu/weather/education/ACONdata.html](http://www.jhuapl.edu/weather/education/ACONdata.html). The mean long-term maximum air temperature for September in Maryland is about 29° C and the mean long-term low temperature is 15° C. The warmest part of the survey period occurred at 3:00 p.m. on 15 September (24° C; 76° F) and the coolest temperatures were at 7:00 a.m. on 16 September (6° C; 42° F). A record of the air temperature throughout the survey period is shown in Table 3. Both days were breezy, and it was overcast on Saturday. The second of four September rain events occurred on the 14th and the morning of the 15<sup>th</sup> when a storm dropped about 6 mm (0.25 in.) of rain across the state. We measured 18 mm (0.7 in.) in the Sanctuary rain gauge on 14 September, however no rain fell during the survey period.

Table 3. Hourly record of air temperature on the BioBlitz.

15 Sept.		16 Sept.	
Time	Temp (C)	Time	Temp (C)
13:00	23.6	1:00	8.6
14:00	23.6	2:00	
15:00	23.9	3:00	7.2
16:00	23.3	4:00	
17:00	21.7	5:00	
18:00		6:00	
19:00		7:00	6.1
20:00	13.3	8:00	10.0
21:00		9:00	15.0
22:00	10.6	10:00	
23:00	9.4	11:00	18.1
24:00	8.9	12:00	19.4

## BioBlitz Results

A total of 500 species of fungi, plants, and animals were identified on the BioBlitz. Table 4 provides a summary of the number of species observed in each organism group. Observers recorded 156 plant species, the group with the highest number of species. Other groups with high species numbers were birds (100 species), hymenopterans (60), and butterflies (37). Species lists for each group are shown in Tables 6 to 23. Within most tables the species are arranged alphabetically by genus, however, the birds and mammals are arranged alphabetically by common name.

Table 4. Groups and number of species observed.

Group of Organisms	Species Observed
Vascular Flowering Plants (herbs and shrubs)	96
Ferns	1
Trees	59
Mushrooms	16
Plankton	5
Earthworms	5
Isopod Crustaceans	3
Spiders	13
Ants	34
Bees & Wasps	26
Beetles	14
Butterflies	37
Moths	13
Damselflies & Dragonflies	18
Other Insects	16
Fish	11
Amphibians	14
Reptiles	13
Birds	100
Mammals	7
<b>Total Species Observed</b>	<b>500</b>

This report is a summary of the species that we observed on the BioBlitz. For the vast majority of species, observers noted “presence” (no count data) on the data sheets. This was intentional because we did not want to take time to do counts or estimates of individuals. However, for some species we do have additional information on the numbers observed, habitats, natural history and behavior. You may contact the Sanctuary staff if you would like view this additional information.

At least two species of State listed rare plants, 11 species of rare and State listed invertebrates, and six rare bird species were observed (Table 5). The earthworm, *Diplocardia patuxentis*, which was described as a species new to science in 2002 (Csuzdi, C. and K. Szilávecz 2002), was observed again by Kathy Szlavecz on the BioBlitz. This small native earthworm is found in the moist soil of ravines that contain shallow, intermittent streams. The Sand Barren (Area 37) and Pine Barren (Area 33) areas in the Glendening Preserve were singled out for intensive surveys by entomologist leaders because these open sandy areas have been recognized recently as important habitats for certain rare ground nesting bees, tiger beetles, and ants.

Meadow plants were well covered by Joe Metzger and Plant Team members (Table 6). The Vine Team led by Dennis Whigham noted 19 vine species. The Tree Team, led by Dave Perry, succeeded in their goal of finding every tree species known to occur in the Sanctuary (36 species) , including 13 oak species, the rare pumpkin ash, the uncommon fringe-tree, and the big-toothed aspen (Table 7).

Spiders were surveyed for the first time here by Nancy Kreiter. Her team worked mostly along the Otter Point Trail and along the edges of the beaver pond on Two-run Creek where they identified 13 spider species (Table 12).

Of great interest was the high diversity of ants, bees, butterflies, dragonflies and damselflies. Ant Team leaders Dan Kjar, Fred Paras and Timothy Foard discovered and identified 34 ant species, three of which are considered rare and one (*Formica vinculans*) which may be a new state record (see Tables 5 and 13 ). The Bee Team led by Sam Droege identified 36 species of bees and wasps (Table 14) , including the first Maryland record for the ground bee *Perdita bequaerti* (Table 3). Fred Paraskevoudakis retained ant voucher specimens for a state ant survey, and other leaders collected insects and invertebrates for their private collections.

Table. 5. Rare species observed on the BioBlitz.

Anglepod ( <i>Matelia carolinensis</i> )	Maryland "Highly State Rare" status
Pumpkin Ash ( <i>Fraxinus profunda</i> )	Maryland "Highly State Rare" status
Earthworm ( <i>Diplocardia patuxentis</i> )	Kathy Szlavec: "a new species to science, first discovered in the Sanctuary in 2001."
Fungus Gardening Ant ( <i>Trachymyrmex septentrionalis</i> )	Timothy Foard: "Unusual this far north."
Ant ( <i>Formica vinculans</i> )	Fred Paras: "A possible new state record."
Ant ( <i>Hypoconera opacior</i> )	Fred Paras: "Rare west of the Chesapeake Bay."
Ground bee ( <i>Epeolus autumnalis</i> )	Sam Droege: "Very rare."
Ground bee ( <i>Epeolus pusillus</i> )	Sam Droege: "Very rare."
Ground bee ( <i>Perdita bequaerti</i> )	Sam Droege: "A new state record."
Ground bee ( <i>Perdita boltoniae</i> )	Sam Droege: "A sand specialist; rare."
Ground bee ( <i>Pseudopanurgus rugosa</i> )	Sam Droege: "Rare."
Damselfly ( <i>Somatochlora linearis</i> )	Maryland "Watch" list status
Tiger Beetle ( <i>Cicindela scutellaris</i> )	Maryland "Watch" list status
Least Bittern	Maryland "State Rare" status
Sora	Maryland "Highly State Rare" status
Bald Eagle	Maryland "State Threatened" status
Common Nighthawk	Maryland State "Watch" list status
Magnolia Warbler	Maryland State "Watch" list status
Black-throated Blue Warbler	Maryland State "Watch" list status

The Butterfly Teams led by Pat Durkin, Dick Smith, Fred Paras, Sue Ricciardi, and Jeff Shenot observed 37 species (Table 16). This represents 71% of the 52 species that are known to occur in the Sanctuary. The teams worked mostly along the meadows (Area 3) and Pine Barrens (Area 33) at the Glendening Preserve, and near the warm season grass meadows at the River Farm (Area 20). These areas are known to harbor many plants that are important for butterflies.

The Odonate Team under Richard Orr's leadership observed 18 species of dragonflies and damselflies (Table 18). This represents about 42% of the 43 species that are known to occur in this area.

Reptiles and amphibians ("herps") were exceptionally well surveyed and observed by leaders Mike Quinlan and Robert Frezza. Sixty-six percent (27 of the 41 species) of the species that are known to occur in the Sanctuary were encountered on the BioBlitz (Tables 20 and 21). The eastern mud salamander was most uncommon of the herps that the team observed.

Birds are perhaps the easiest animal group to survey because of their conspicuous behavior, calls and songs. Bird experts Dotty Mumford and Jeff Shenot worked together and separately, with contributions from several others, to record 100 bird species (Table 22). Bird diversity is especially high at Jug Bay in mid-September. At this time many neotropical migrant songbirds that breed at Jug Bay have not yet departed for the tropics, whereas good numbers of migratory species that breed to our north and west are already passing through Maryland's Coastal Plain. For example, local breeders observed on the BioBlitz included

chimney swift, eastern kingbird, Acadian flycatcher, red-eyed vireo, scarlet tanager, summer tanager, wood thrush and ovenbird. Non-breeding migrants included sharp-shinned hawk, northern pintail, northern shoveler, green-winged teal, blue-winged teal, northern harrier, herring gull, ring-billed gull, greater yellowlegs, blackpoll warbler, Tennessee warbler, and Wilson's warbler.

In addition to the rare birds listed in Table 5, other notable species identified by the bird teams were glossy ibis (late summer migrant), Cooper's hawk (uncommon local breeder), red-breasted nuthatch (uncommon winter visitant) and rose-breasted grosbeak (uncommon fall migrant).

Three resident, non-native birds were noted: mute swan, rock dove, and European starling. Mute swans are not common at Jug Bay and occur in only small numbers (usually no more than five), but in the lower parts of the Patuxent River estuary they are more abundant. Rock doves frequently roost on utility wires at the Glendening Preserve (Plummer House area).

Great-horned owls and barred owls were heard by the two "nocturnal" search teams, but whip-poor-will, southern flying squirrel and raccoon were not detected and no bats were identified.

## **Discussion**

The consensus of participants in Jug Bay's first BioBlitz was that it was fun, educational and productive. Our leaders were friendly and they enjoyed instructing team members in search techniques. In addition to teaching the public about ecology, field sampling and biodiversity, our other objective was to collect new scientific information about biodiversity within the Sanctuary. We confirmed the presence many common flowering plants, trees and vertebrates, but more importantly we added over thirty new invertebrate species to our list of resident fauna.

The success of the event is due in large part to the leaders who donated their time and talents to spending a day or two in the field at Jug Bay. These professionals and serious amateurs possess the field skills, the knowledge of animal behavior and habitats, and the collecting expertise that ensured a successful biodiversity survey. The leaders indicated to us that their time was well used, and they appreciated the help provided by the search team members.

Leaders and team members remarked that the event was well organized. By creating an organizational matrix early in the planning phase to organize and schedule leaders, participants could easily decide which group or groups they wanted to work with. The schedule of three-hour time blocks made it possible to fill gaps by assigning leaders to specified search times and to help participants decide their involvement based on time and the group of organisms they were interested in. Data recording worked well, but leaders must be encouraged to complete all the required data entry fields on the data sheets and to strive for accuracy when doing so. Good penmanship is also necessary, especially when scientific names are used.

The results of this survey will assist us with identifying key habitats that may be unique or that may harbor rare or sensitive species. We now have a better basis for protecting and managing the various habitats within the Sanctuary. For example, the Sand Barrens and Pine Barrens at the Glendening Preserve support a varied community of rare, sand-loving insects – ants, solitary bees, and tiger beetles. Protecting these areas from inadvertent damage will become an important management objective. Wet ravines that support native earthworms will be similarly protected and the public will be discouraged from walking through these areas. Armed with new knowledge about Sanctuary biodiversity will also help us mount focused investigations that look more closely at life history strategies, habitat use, reproductive biology and other areas of interest. We will also encourage universities to use the Sanctuary for ecological studies by graduate students who could carry out multi-year studies.

We were surprised that some common vertebrates known to be present in the Sanctuary were missed during the survey. For example, no one observed the red-backed salamander, queen snake, northern water snake or eastern garter snake. The probable reasons for these "misses" are because search teams did not spend much time in tidal wetlands or that they did not search thoroughly for soil dwelling salamanders. Examples of birds that were certainly present in the Sanctuary yet were missed, include eastern towhee, blue-gray gnatcatcher, and

marsh wren. It is not unusual for searchers conducting a survey such as this one to fail to find all species that are present. On the other hand, the fact that we did not see or hear bobwhite or whip-poor-will lends further support to the consensus among birders that these species are no longer a part of the Sanctuary's avifauna.

Comments that we received later from several leaders were interesting and provided useful suggestions for future BioBlitzes:

"It was fun on Sunday. I keep telling people that the great volunteers I had with me really made my day"  
– Dr. Nancy Kreiter.

"You may want to consider adding a survey of your Orthoptera to your list of things to do in the future. The results would be interesting, productive and I think there is a good chance of identifying a couple of good indicator species for measuring the health of the various plant communities of the uplands and river marsh." – Richard Orr.

"The mystery plant we were looking at... may turn out to be Pinweed." – Joe Metzger.

"The ant faunal composition is very unusual for central Maryland, containing a number of species more common in drier habitats, such as would be present in the southern part of the Eastern Shore." – Timothy Foard.

"Yep, these are crab spiders. Both (species) feed the same way – disguising themselves in a flower and waiting for unsuspecting nectar drinkers and pollen collectors to make a mistake".  
– Dr. Nancy Kreiter.

"Sorry that it took all winter before I finished doing this, but I have pinned and finished identifying the six small day-flying moths I collected for identification purposes on the September 16, 2007 Jug Bay BioBlitz." – Dick Smith.

"More common in the early morning" – Fred Paraskevoudakis commenting about finding the ant *Prenolepis imparis* in the afternoon.

"I can't believe I found all three color phases of the Yellow Bear (an arctiid moth) on one plant at the beaver pond and I did not have to pose them (for a photo)." – Richard Orr.

Several leaders suggested that we hold a future BioBlitz earlier in the summer so that overnight temperatures would be higher making it easier to observe more insect activity. We plan to focus our next BioBlitz on aquatic insects, wetland plants, mosses, bats, small mammals and other groups that we did not survey on the 2007 event.

Table 6. Vascular plant species observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Yarrow	<i>Achillea millefolium</i>	Joe Metzger
Field Garlic	<i>Allium vineale</i>	Joe Metzger
Green Amaranthus	<i>Amaranthus retroflexus</i>	Team 01
Pigweed	<i>Amaranthus</i> sp.	Joe Metzger
Common Ragweed	<i>Ambrosia artemisiifolia</i>	Joe Metzger
Canadian Serviceberry	<i>Amelanchier canadensis</i>	Dave Perry
Porcelainberry	<i>Ampelopsis brevipedunculata</i>	Dennis Whigham
Hog Peanut	<i>Amphicarpaea bracteata</i>	Dennis Whigham
Ground-nut	<i>Apios Americana</i>	Dennis Whigham
Dogbane	<i>Apocynum cannabinum</i>	Joe Metzger
Devil's Walking Stick	<i>Aralia spinosa</i>	Dave Perry
Burdock	<i>Arctium</i> sp.	Joe Metzger
Red Chokeberry	<i>Aronia arbutifolia</i>	Dave Perry
Common Milkweed	<i>Asclepias syriaca</i>	Joe Metzger
Aster	<i>Aster</i> sp.	Joe Metzger
False Nettle	<i>Boehmeria cylindria</i>	Joe Metzger
Paper Mulberry	<i>Broussonetia papyrifera</i>	Dave Perry
Bulbostylis Sedge	<i>Bulbostylis capillaris</i>	Joe Metzger
Trumpet-creeper	<i>Campsis radicans</i>	Dennis Whigham
Small-flowered Partridge Pea	<i>Cassia nictitans</i>	Joe Metzger
Common Hackberry	<i>Celtis occidentalis</i>	Dave Perry
Sandbur	<i>Cenchrus longispinus</i>	Joe Metzger
Buttonbush	<i>Cephalanthus occidentalis</i>	Dave Perry
White Turtlehead	<i>Chelone glabra</i>	Lynette Fullerton
Goosefoot	<i>Chenopodium</i> sp.	Joe Metzger
Ox-eye Daisy	<i>Chrysanthemum leucanthemum</i>	Joe Metzger
Chickory	<i>Cichorium intybus</i>	Joe Metzger
Thistle	<i>Cirsium</i> sp.	Joe Metzger
Virgin's Bower	<i>Clematis virginiana</i>	Dennis Whigham
Horse-weed	<i>Conyza canadensis</i>	Joe Metzger
Tooth-leaved Croton	<i>Croton glandulosus</i>	Karyn Molines
Dodder	<i>Cuscuta gronovii</i>	Dennis Whigham
Sedge	<i>Cyperus</i> sp.	Joe Metzger
Queen Anne's Lace	<i>Daucus carota</i>	Joe Metzger
Water-willow	<i>Decodon verticillatus</i>	Dennis Whigham
Small-leaved Tick-trefoil	<i>Desmodium ciliare</i>	Joe Metzger
Narrow Tick-trefoil	<i>Desmodium marilandicum</i>	Joe Metzger
Deptford Pink	<i>Dianthus armeria</i>	Joe Metzger
Deer-tongue Witchgrass	<i>Dichanthelium clandestinum</i>	Joe Metzger
Crabgrass	<i>Digitaria</i> sp.	Joe Metzger
Rough Buttonweed	<i>Diodia teres</i>	Joe Metzger
Wild Yam	<i>Dioscorea villosa</i>	Dennis Whigham
Indian Strawberry	<i>Duchesnea idica</i>	Joe Metzger
Beech-drops	<i>Epifagus virginiana</i>	Nancy Kreiter
Purple Love Grass	<i>Eragrostis spectabilis</i>	Joe Metzger
Fireweed	<i>Erechtites hieraciifolia</i>	Joe Metzger

Daisy-fleabane	<i>Erigeron annuus</i>	Joe Metzger
Late Eupatorium	<i>Eupatorium serotinum</i>	Joe Metzger
Common Flat-topped Goldenrod	<i>Euthamia graminifolia</i>	Joe Metzger
Gill-over-the-ground	<i>Glechoma hederaceae</i>	Joe Metzger
Witch-hazel	<i>Hamamelis virginiana</i>	Dave Perry
Ivy-leaved Morning-glory	<i>Ipomoea hederacea</i>	Dennis Whigham
White Morning-glory	<i>Ipomoea lacunose</i>	Dennis Whigham
Path Rush	<i>Juncus tenuis</i>	Joe Metzger
Mountain Laurel	<i>Kalmia latifolia</i>	Dave Perry
Pinweed	<i>Lechea leggettii</i>	Joe Metzger, Karyn Molines
Cuneate Bush-clover	<i>Lespedeza cuneata</i>	Joe Metzger
Japanese Honeysuckle	<i>Lonicera japonica</i>	Dennis Whigham
Virginia Water-horehound	<i>Lycopus virginicus</i>	Joe Metzger
Anglepod	<i>Matelia carolinensis</i>	Chris Swarth
Asian Stiltgrass	<i>Microstegium vimineum</i>	Joe Metzger
Climbing Hempweed	<i>Mikania scandens</i>	Dennis Whigham
Bee-balm	<i>Monarda punctata</i>	Richard Orr
Spatterdock	<i>Nuphar advena</i>	Dennis Whigham
Eastern Prickly Pear	<i>Opuntia humifusa</i>	Joe Metzger
Wood-sorrel	<i>Oxalis stricta</i>	Joe Metzger
Virginia Creeper	<i>Parthenocissus quinquefolia</i>	Dennis Whigham
Perilla Mint	<i>Perilla frutescens</i>	Joe Metzger
Common Timothy	<i>Phleum pretense</i>	Joe Metzger
Ground Cherry	<i>Physalis</i> sp.	Joe Metzger
Pokeweed	<i>Phytolacca americana</i>	Joe Metzger
Ribgrass	<i>Plantago</i> sp.	Joe Metzger
Halberd-leaved Tearthumb	<i>Polygonum arifolium</i>	Dennis Whigham
Smartweed	<i>Polygonum cespitosum</i>	Joe Metzger
Arrow-leaved Tearthumb	<i>Polygonum sagittatum</i>	Dennis Whigham
False Buckwheat	<i>Polygonum scandens</i>	Dennis Whigham
Heal-all	<i>Prunella vulgaris</i>	Joe Metzger
Winged Sumac	<i>Rhus copallina</i>	Dave Perry
Poison Ivy	<i>Rhus radicans</i>	Dennis Whigham
Multiflora Rose	<i>Rosa multiflora</i>	Dennis Whigham
Sheep Sorrel	<i>Rumex acetosela</i>	Joe Metzger
Bitter Dock	<i>Rumex obtusifolius</i>	Joe Metzger
Foxtail-grass	<i>Setaria faberi</i>	Joe Metzger
Glaucous Catbrier	<i>Smilax glauca</i>	Dennis Whigham
Greenbrier	<i>Smilax rotundifolia</i>	Dennis Whigham
Horse-nettle	<i>Solanum carolinense</i>	Joe Metzger
Common Goldenrod	<i>Solidago canadense</i>	Joe Metzger
Goldenrod	<i>Solidago rugosa</i>	Joe Metzger
Poison Sumac	<i>Toxicodendron vernix</i>	Dave Perry
Blue Curls	<i>Trichostema dichotomum</i>	Joe Metzger
Purpletop	<i>Tridens flava</i>	Joe Metzger
Eastern Gramma Grass	<i>Tripsacum dactyloides</i>	Joe Metzger
Common Mullein	<i>Verbascum thapsus</i>	Joe Metzger
White Vervain	<i>Verbena urticifolia</i>	Joe Metzger

Summer Grape	Vitis aestivalis	Dennis Whigham
Frost Grape	Vitis vulpine	Dennis Whigham
Sensitive Fern	Oncoclea sensibilis	Joe Metzger

Table 7. Trees observed and identified on BioBlitz.

Common Name	Scientific Name	Observers
Boxelder	Acer negundo	Dave Perry
Norway Maple	Acer platanoides	Dave Perry
Red Maple	Acer rubrum	Dave Perry
Tree-of-Heaven	Ailanthus altissima	Dave Perry
Mimosa	Albizzia julibrissin	Dave Perry
Common Alder	Alnus serrulata	Dave Perry
Paw-paw	Asimina triloba	Dave Perry
River Birch	Betula nigra	Dave Perry
American Hornbeam	Carpinus caroliniana	Dave Perry
Pignut Hickory	Carya glabra	Dave Perry
Mockernut Hickory	Carya tomentosa	Dave Perry
American Chestnut	Castanea dentata	Dave Perry
Chinese Chestnut	Castanea mollissima	Dave Perry
Allegheny Chinquapin	Castanea pumila	Dave Perry
Redbud	Cercis canadensis	Dave Perry
Fringe-tree	Chionanthus virginicus	Dave Perry
Flowering Dogwood	Cornus florida	Dave Perry
Persimmon	Diospyros virginiana	Dave Perry
American Beech	Fagus grandifolia	Dave Perry
White Ash	Fraxinus americana	Dave Perry
Green Ash	Fraxinus pennsylvanica	Dave Perry
Pumpkin Ash	Fraxinus profunda	Dave Perry
American Holly	Ilex opaca	Dave Perry
Black Walnut	Juglans nigra	Dave Perry
Red Cedar	Juniperus virginiana	Dave Perry
Sweetgum	Liquidambar styraciflua	Dave Perry
Tuliptree	Liriodendron tulipifera	Dave Perry
Sweetbay	Magnolia virginiana	Dave Perry
White Mulberry	Morus alba	Dave Perry
Red Mulberry	Morus rubra	Dave Perry
Black Gum	Nyssa sylvatica	Dave Perry
Princess Tree	Paulownia tomentosa	Dave Perry
Norway Spruce	Picea abies	Dave Perry
White Pine	Pinus strobus	Dave Perry
Loblolly Pine	Pinus taeda	Dave Perry
Virginia Pine	Pinus virginiana	Dave Perry
Sycamore	Platanus occidentalis	Dave Perry
Big-toothed Aspen	Populus grandidentata	Dave Perry
Black Cherry	Prunus serotina	Dave Perry
Bradford Pear	Pyrus calleryana	Dave Perry
White Oak	Quercus alba	Dave Perry

Swamp White Oak	<i>Quercus bicolor</i>	Dave Perry
Scarlet Oak	<i>Quercus coccinea</i>	Dave Perry
Southern Red Oak	<i>Quercus falcata</i>	Dave Perry
Black-jack Oak	<i>Quercus marilandica</i>	Dave Perry
Swamp Chestnut Oak	<i>Quercus michauxii</i>	Dave Perry
Cherrybark Oak	<i>Quercus pagoda</i>	Dave Perry
Pin Oak	<i>Quercus palustris</i>	Dave Perry
Willow Oak	<i>Quercus phellos</i>	Dave Perry
Rock Chestnut Oak	<i>Quercus prinus</i>	Dave Perry
Northern Red Oak	<i>Quercus rubra</i>	Dave Perry
Post Oak	<i>Quercus stellata</i>	Dave Perry
Black Oak	<i>Quercus velutina</i>	Dave Perry
Black Locust	<i>Robinia pseudoacacia</i>	Dave Perry
Black Willow	<i>Salix nigra</i>	Dave Perry
Sassafras	<i>Sassafras albidum</i>	Dave Perry
Basswood	<i>Tilia americana</i>	Dave Perry
American Elm	<i>Ulmus americana</i>	Dave Perry
Smooth Blackhaw	<i>Viburnum prunifolium</i>	Dave Perry

Table 8. Mushroom species observed and identified on the Bioblitz.

Common Name	Scientific Name	Observers
Mushroom	<i>Amanita citrina</i>	David Farr
Mushroom	<i>Amanita</i> sp.	David Farr
Earth Star	<i>Astreus</i> sp.	Joe Metzger
	<i>Boletus</i> sp.	David Farr
Mushroom	<i>Clitocybe tabescens</i>	David Farr
	<i>Fistula hepatica</i>	David Farr
	<i>Gymnopilus</i> sp.	David Farr
White Polypore	<i>Irpex lacteus</i>	David Farr
Mushroom	<i>Oudemansiella radicata</i>	David Farr
Mushroom	<i>Pleurotes ostreatus</i>	David Farr
Mushroom	<i>Pluteus</i> sp.	David Farr
Mushroom	<i>Polyporum</i> sp.	David Farr
Mushroom	<i>Russula laura-ceraceus</i>	David Farr
	<i>Schizophyllum commune</i>	David Farr
Mushroom	<i>Stereum</i> sp.	David Farr
Mushroom	<i>Trametes versicolor</i>	David Farr

Table 9. Plankton observed on the Bioblitz.

Scientific Name	Group	Observers
<i>Nitzschia</i> sp.	Diatom	Kathy Ellett
<i>Brachionus</i> sp.	Rotifer	Kathy Ellett
Copepod sp.	Crustacean	Kathy Ellett
Flagellate sp.	Protozoan	Kathy Ellett
<i>Gymnodium</i> sp.	Dinoflagellate	Kathy Ellett

Table 10. Earthworm species observed and identified on the Bioblitz.

Scientific Name	Observers
<i>Amyntas hilgendorfi</i>	Kathy Szlavecz, Dan Kjar, Chris Swarth
<i>Diplocardia patuxentis</i>	Kathy Szlavecz, Dan Kjar, Chris Swarth
<i>Eisenoides lönnbergi</i>	Kathy Szlavecz, Dan Kjar, Chris Swarth
<i>Lumbricus rubellis</i>	Kathy Szlavecz, Dan Kjar, Chris Swarth
<i>Octalasion lacteum</i>	Kathy Szlavecz, Dan Kjar, Chris Swarth

Table 11. Isopod (Crustacea) species observed on the BioBlitz.

Scientific Name	Observers
<i>Armadillidium nasatum</i>	Kathy Szlavecz, Dan Kjar, Chris Swarth
<i>Philoscia muscorum</i>	Kathy Szlavecz, Dan Kjar, Chris Swarth
<i>Trachelipus rathkei</i>	Kathy Szlavecz, Dan Kjar, Chris Swarth

Table 12. Spiders observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Grass Spider	<i>Agelenopsis pennsylvanica</i>	Nancy Kreiter
Marbled Orb Weaver	<i>Araneus marmoreus</i>	Nancy Kreiter
Dewdrop Spider	<i>Argyrodes</i> sp.	Nancy Kreiter
Six-spotted Fishing Spider	<i>Dolomedes triton</i>	Nancy Kreiter
Orchard Spider	<i>Leucauge venusta</i>	Nancy Kreiter
Basilica Orbweaver	<i>Mecynogea lemniscata</i>	Nancy Kreiter
Orb Weaver	<i>Metapiera</i> sp.	Nancy Kreiter
Spiny-backed Spider	<i>Microthema gracillus</i>	Nancy Kreiter
Goldenrod Crab Spider	<i>Misumena vatia</i>	Nancy Kreiter
Yellow Crab Spider	<i>Misumenoides formosipes</i>	Nancy Kreiter; Steve McKindley-Ward
Wolf Spider	<i>Pardosa</i> sp.	Nancy Kreiter
Nursery Web Spider	<i>Pisaurina mira</i>	Nancy Kreiter
Long-jawed Spider	<i>Tetragnatha elongata</i>	Nancy Kreiter

Table 13. Ant species observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Myrmicine Ant	<i>Aphaenogaster fulva</i>	Dan Kjar
Myrmicine Ant	<i>Aphaenogaster lamellidens</i>	Fred Paras
Myrmicine Ant	<i>Aphaenogaster rudis</i>	Dan Kjar
Myrmicine Ant	<i>Aphaenogaster treatae</i>	Timothy Foard, Dan Kjar
Carpenter Ant	<i>Camponotus americanus</i>	Dan Kjar
Black Carpenter Ant	<i>Camponotus pennsylvanicus</i>	Dan Kjar
Carpenter Ant	<i>Camponotus subbarbatus</i>	Dan Kjar
Chestnut Carpenter Ant	<i>Camponotus castaneus</i>	Dan Kjar
Myrmicine Acrobatic Ant	<i>Crematogaster cerasi</i>	Fred Paras
Lined Acrobatic Ant	<i>Crematogaster lineolata</i>	Tim Foard, Dan Kjar
Formicine Dolichoderine Ant	<i>Dorymyrmex bureni</i>	Dan Kjar
Formicine Dolichoderine Ant	<i>Dorymyrmex grandulus</i>	Tim Foard
Formicine Ant	<i>Formica integra</i>	Dan Kjar
Formicine Ant	<i>Formica dolosa</i>	Dan Kjar

Formicine Ant	<i>Formica subsericea</i>	Dan Kjar
Formicine Ant	<i>Formica vinculans (neogagates?)</i>	Fred Paras
Ponerine Ant	<i>Hypoponera opacior</i>	Tim Foard
Cornfield Ant	<i>Lasius alienus</i>	Dan Kjar
Formicine Ant	<i>Lasius murphyi</i>	Tim Foard
Myrmicine Little Black Ant	<i>Monomorium emarginatum</i>	Tim Foard
Little Black Ant	<i>Monomorium minimum</i>	Fred Paras; Dan Kjar
Myrmicine Ant	<i>Myrmica latifrons</i>	Tim Foard
Myrmicine Ant	<i>Myrmica pinetorum</i>	Tim Foard
Myrmicine Ant	<i>Myrmecina americana</i>	Dan Kjar
Formicine Ant	<i>Paratrechina parvula</i>	Tim Foard
Myrmicine Ant	<i>Pheidole bicarinata</i>	Tim Foard
Myrmicine Ant	<i>Pheidole davisii</i>	Dan Kjar
Myrmicine Ant	<i>Pheidole dentata</i>	Tim Foard
Myrmicine Ant	<i>Pheidole pilifera</i>	Tim Foard
Formicine Ant	<i>Prenolepis imparis</i>	Tim Foard; Dan Kjar
Myrmicine Ant	<i>Solenopsis molesta</i>	Tim Foard
Dolichoderine Odorous House Ant	<i>Tapinoma sessile</i>	Tim Foard
Myrmicine Pavement Ant	<i>Tetramorium caespitum</i>	Tim Foard
Northern fungus gardening ant	<i>Trachymyrmex septentrionalis</i>	Tim Foard; Dan Kjar

Table 14. Bee and wasp species observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
	<i>Agapostemon virescens</i>	Sam Droege
Andrenine bee	<i>Andrena aliciae</i>	Sam Droege
European Honeybee	<i>Apis mellifera</i>	Sam Droege
Common Eastern Bumblebee	<i>Bombus impatiens</i>	Sam Droege
	<i>Calliopsis andreniformis</i>	Sam Droege
	<i>Coelioxys octodentata</i>	Sam Droege
	<i>Coelioxys sayi</i>	Sam Droege
	<i>Colletes compactus</i>	Sam Droege
	<i>Epeolus autumnalis</i>	Sam Droege
	<i>Epeolus pusillus</i>	Sam Droege
	<i>Halictus poeyi</i>	Sam Droege
Sweat Bee	<i>Lasioglossum nelumbonis</i>	Sam Droege
Sweat Bee	<i>Lasioglossum pilosum</i>	Sam Droege
Sweat Bee	<i>Lasioglossum rohweri</i>	Sam Droege
Sweat Bee	<i>Lasioglossum vierecki</i>	Sam Droege
Leaf-cutting Bee	<i>Megachile campanulae</i>	Sam Droege
Leaf-cutting Bee	<i>Megachile mendica</i>	Sam Droege
	<i>Melissodes denticula</i>	Sam Droege
Metallic Solitary Bee	<i>Perdita bequaerti</i>	Sam Droege
panurgine bee	<i>Perdita boltoniae</i>	Sam Droege
panurgine bee	<i>Perdita octomaculata</i>	Sam Droege
	<i>Pseudopanurgus rugosa</i>	Sam Droege
Large Carpenter Bee	<i>Xylocopa virginica</i>	Sam Droege
Cricket Wasp	<i>Liris sp.</i>	Richard Orr
European Hornet	<i>Vespa crabro</i>	Ben Hollister
Yellowjacket	<i>Vespula maculifrons</i>	Sam Droege

Table 15. Beetles, flies, orthopterans and other insects observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Cutworm	<i>Agrotis</i> sp.	Ben Hollister
Wheel Bug	<i>Arilus cristatus</i>	Ben Hollister
Boxelder Bug	<i>Boisea trivittata</i>	Fred Paras
Caterpillar Hunter	<i>Calosoma scrutator</i>	Fred Paras
Goldenrod Soldier Beetle	<i>Chauliognathus pennsylvanicus</i>	Fred Paras
Green Lacewing	<i>Chrysopa</i> sp.	Ben Hollister
Tiger Beetle	<i>Cicindela punctulata</i>	Jonathon Mawdsley
Tiger Beetle	<i>Cicindela scutellaris</i>	Jonathon Mawdsley; Fred Paras
Tiger Beetle	<i>Cicindela tranquebarica</i>	Jonathon Mawdsley
Leaf Beetle	<i>Diabrotica undecimpunctata</i>	Fred Paras
Carolina Grasshopper	<i>Dissosteira carolina</i>	Richard Orr, Elaine Friebele
Blister Beetle	<i>Epicauta</i> sp.	
Dark Flower Scarab	<i>Euphoria sepulcralis</i>	Fred Paras
Earth Boring Dung Beetle	<i>Geotropes splendidus</i>	Ben Hollister
Field Cricket	<i>Gryllus</i> sp.	Ben Hollister
Restless Bush Cricket	<i>Hapithus agitator</i>	Richard Orr
Carabid Beetle	<i>Harpalus</i> sp.	Fred Paras
Bee-like Robber Fly	<i>Laphria</i> sp.	Fred Paras
Long-horned Beetle	<i>Megacyllene robiniae</i>	Fred Paras; Joe Metzger
Ant Lion	<i>Myrmeleo</i> sp.	Chris Swarth
Bess Beetle	<i>Odontotaenius disjunctus</i>	Richard Orr, Elaine Friebele
Large Milkweed Bug	<i>Oncopeltus fasciatus</i>	Fred Paras
Red-headed Meadow Katydid	<i>Orchelimum erythrocephalum</i>	Richard Orr
Firefly Beetle	<i>Photuris</i> sp.	Lindsay Hollister
Handsome Trig Cricket	<i>Phyllopalpus pulchellus</i>	Richard Orr, Elaine Friebele
Carabid Beetle	<i>Platynus</i> sp.	Jonathon Mawdsley
Katydid sp.	<i>Pterophylla</i> sp.	Richard Orr, E. Friebele; B. Hollister
Phantom Crane-fly	<i>Bittacomorpha clavipes</i>	Nancy Kreiter
Dung Beetle	<i>Stephanuca areata</i>	Fred Paras
Crane-fly sp.	<i>Tipularia</i> sp.	Mike Quinlan

Table 16. Butterflies observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Least Skipper	<i>Ancyloxypha numitor</i>	Jeff Shenot; Fred Paras
Hackberry Emperor	<i>Asterocampa celtis</i>	Fred Paras
Sachem	<i>Atalopedes campestris</i>	Jeff Shenot; Pat Durken, Dick Smith, Sue Ricciardi; Fred Paras
Orange Sulphur	<i>Colias eurytheme</i>	Pat Durkin, Dick Smith, Sue Ricciardi; F. Paras
Common Sulphur	<i>Colias philodice</i>	Pat Durken, Dick Smith, Sue Ricciardi
Monarch	<i>Danaus plexippus</i>	Jeff Shenot; Pat Durken, Dick Smith, Sue Ricciardi; Fred Paras
Silver Spotted Skipper	<i>Epargyreus clarus</i>	Pat Durkin
Horace's Duskywing	<i>Erynnis horatius</i>	Mike Quinlan
Dun Skipper	<i>Euphyes vestris</i>	Pat Durken, Dick Smith, Sue Ricciardi; F. Paras
Variegated Fritillary	<i>Euptoieta claudia</i>	Jeff Shenot; Fred Paras
Sleepy Orange	<i>Eurema nicippe</i>	Pat Durken
Eastern Tailed Blue	<i>Everes comyntas</i>	Pat Durken, Dick Smith, Sue Ricciardi; F. Paras
Fiery Skipper	<i>Hylephila phyleus</i>	Jeff Shenot
Buckeye	<i>Junonia coenia</i>	Pat Durken, Dick Smith, Sue Ricciardi
Skipper	<i>Lerodea iherminier</i>	Fred Paras
Viceroy	<i>Limenitis archippus</i>	Mike Quinlan
White Admiral	<i>Limenitis arthemis</i>	Fred Paras
American Copper	<i>Lycaena phlaeas</i>	Pat Durken, Dick Smith, Sue Ricciardi; F. Paras
Swarthy Skipper	<i>Nastra iherminier</i>	Pat Durkin
Long-winged Skipper	<i>Panoquina ocola</i>	Pat Durken
Tiger Swallowtail	<i>Papilio glaucus</i>	Jeff Shenot; Pat Durken, Dick Smith, Sue Ricciardi; Fred Paras
Spicebush Swallowtail	<i>Papilio troilus</i>	Jeff Shenot
Cloudless Sulphur	<i>Phoebis sennae</i>	Jeff Shenot; Fred Paras
Pearl Crescent	<i>Phyciodes tharos</i>	Jeff Shenot; Pat Durken, Dick Smith, Sue Ricciardi; Fred Paras
Cabbage White Butterfly	<i>Pieris rapae</i>	Jeff Shenot; Fred Paras; Pat Durkin
Broad-winged Skipper	<i>Poanes viator</i>	Pat Durken, Dick Smith, Sue Ricciardi
Zabulon Skipper	<i>Poanes zabulon</i>	Jeff Shenot
Crossline Skipper	<i>Polites origenes</i>	Pat Durken, Dick Smith, Sue Ricciardi; F. Paras
Comma	<i>Polygonia comma</i>	Pat Durken, Dick Smith, Sue Ricciardi
Question Mark	<i>Polygonia interrogationis</i>	Jeff Shenot; Fred Paras
Checkered White	<i>Pontia protodice</i>	Pat Durkin
Common Checkered Skipper	<i>Pyrgus communis</i>	Pat Durken, Dick Smith, Sue Ricciardi; F. Paras
Appalachian Brown	<i>Satyrodes appalachia</i>	Jeff Shenot
Great Spangled Fritillary	<i>Speyeria Cybele</i>	Jeff Shenot; Pat Durkin
Gray Hairstreak	<i>Strymon melinus</i>	Jeff Shenot; Fred Paras
Red Admiral	<i>Vanessa atalanta</i>	Fred Paras
American Painted Lady	<i>Vanessa virginiensis</i>	Pat Durken, Dick Smith, Sue Ricciardi; F. Paras

Table 17. Moth species observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Celery Looper	<i>Anagrapha falcifera</i>	Dick Smith
Ailanthus Webworm Moth	<i>Atteva punctella</i>	Richard Orr, Elaine Friebele; Ben Hollister
Forage Looper	<i>Caenurgina erechtea</i>	Dick Smith
Arge Tiger Moth	<i>Grammia arge</i>	Dick Smith
Green Cloverworm Moth	<i>Hypena scabra</i>	Dick Smith
White Flannel Moth	<i>Norape ovina</i>	Pat Durken, Dick Smith, Sue Ricciardi
Turbulent Phosphila	<i>Phosphila turbulenta</i>	Steve McKindley-Ward
Variable Reddish Pyrausta	<i>Pyrausta rubricalis</i>	Dick Smith; Bob Patterson
Virginian Tiger Moth	<i>Spilosoma virginica</i>	Pat Durken, Dick Smith, Sue Ricciardi; Rich Orr
Arcigera Flower Moth	<i>Schinia arcigera</i>	Fred Paras
Snowy Urola Moth	<i>Urola nivalis</i>	Dick Smith
Scape Moth	<i>Ctenuchidae sp.</i>	Fred Paras
Tussock Moth Caterpillar	Unidentified species	Joe Metzger

Table 18. Dragonflies and damselflies observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Shadow Darner	<i>Aeshna umbrosa</i>	Richard Orr
Common Green Darner	<i>Anax junius</i>	Richard Orr
Familiar Bluet	<i>Enallagma civile</i>	Richard Orr
Orange Bluet	<i>Enallagma signatum</i>	Richard Orr
Common Pondhawk	<i>Erythemis simplicicollis</i>	Richard Orr
Fragile Forktail	<i>Ischnura posita posita</i>	Richard Orr
Rambur's Forktail	<i>Ischnura ramburii</i>	Richard Orr
Eastern Forktail	<i>Ischnura verticalis</i>	Richard Orr
Slaty Skimmer	<i>Libellula incesta</i>	Richard Orr
Common Whitetail	<i>Libellula lydia</i>	Richard Orr
Blue Dasher	<i>Pachydiplax longipennis</i>	Richard Orr
Wandering Glider	<i>Pantala flavescens</i>	Richard Orr
Spot-winged Glider	<i>Pantala hymenaea</i>	Richard Orr
Eastern Amberwing	<i>Perithemis tenera</i>	Richard Orr
Mocha Emerald	<i>Somatochlora linearis</i>	Richard Orr
Autumn Meadowhawk	<i>Sympetrum vicinum</i>	Richard Orr
Carolina Saddlebag	<i>Tamea carolina</i>	Richard Orr
Black Saddlebag	<i>Tamea lacerata</i>	Richard Orr

Table 19. Fish observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Rosyside Dace	<i>Clinostomus funduloides</i>	Karyn Molines; Jeff Cambell, Yuka Tasumi
Creek Chubsucker	<i>Erimyzon oblongus</i>	Karyn Molines; Jeff Cambell, Yuka Tasumi
Tesselated Darter	<i>Etheostama olmstedii</i>	Karyn Molines; Jeff Cambell, Yuka Tasumi
Mosquitofish	<i>Gambusia affinis</i>	Karyn Molines; Jeff Cambell, Yuka Tasumi
Least Brook Lamprey	<i>Lampetra aepytera</i>	Karyn Molines; Jeff Cambell, Yuka Tasumi
Pumpkinseed	<i>Lepomis gibbosus</i>	Karyn Molines; Jeff Cambell, Yuka Tasumi
Bluegill	<i>Lepomis macrochirus</i>	Karyn Molines; Jeff Cambell, Yuka Tasumi
Golden Shiner	<i>Notemigonus crysoleucas</i>	Karyn Molines; Jeff Cambell, Yuka Tasumi
Swallowtail Shiner	<i>Notropis procne</i>	Karyn Molines; Jeff Cambell, Yuka Tasumi
Blacknose Dace	<i>Rhinichthys atratulus</i>	Karyn Molines; Jeff Cambell, Yuka Tasumi
Eastern Mudminnow	<i>Umbra pygmaea</i>	Karyn Molines; Jeff Cambell, Yuka Tasumi

Table 20. Amphibians observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Northern Cricket Frog	<i>Acris crepitans crepitans</i>	Mike Quinlan
Spotted Salamander	<i>Ambystoma maculatum</i>	Robert Frezza
Marbled Salamander	<i>Ambystoma opacum</i>	Robert Frezza; Mike Quinlan
American Toad	<i>Anaxyrus americanus</i>	Mike Quinlan
Fowler's Toad	<i>Anaxyrus fowleri</i>	Robert Frezza
Northern Dusky Salamander	<i>Desmognathus fuscus</i>	Robert Frezza
Northern Two-lined Salamander	<i>Eurycea bislineata</i>	Robert Frezza
Bullfrog	<i>Lithobates catesbeiana</i>	Lindsay Hollister
Green Frog	<i>Lithobates clamitans</i>	Robert Frezza
Pickerel Frog	<i>Lithobates palustris</i>	Robert Frezza
Florida Leopard Frog	<i>Lithobates sphenoccephala</i>	Mike Quinlan
Wood Frog	<i>Lithobates sylvatica</i>	Mike Quinlan
Northern Spring Peeper	<i>Pseudacris crucifer crucifer</i>	Mike Quinlan
Eastern Mud Salamander	<i>Pseudotriton montanus montanus</i>	Mike Quinlan

Table 21. Reptiles observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Six-lined Racerunner	<i>Aspicoscelis sexlineata sexlineata</i>	Mike Quinlan
Worm Snake	<i>Carphophis amoenus amoenus</i>	Robert Frezza
Snapping Turtle	<i>Chelydra serpentina</i>	Mike Quinlan
Eastern Painted Turtle	<i>Chrysemys picta picta</i>	Chris Swarth
Northern Black Racer	<i>Coluber constrictor constrictor</i>	Mike Quinlan; Chris Swarth
Eastern Mud Turtle	<i>Kinosternon subrubrum subrubrum</i>	Mike Quinlan
Eastern Ratsnake	<i>Pantherophis alleghaniensis</i>	Mike Quinlan; David Farr; Joe Metzger
Five-lined Skink	<i>Plestiodon fasciatus</i>	Chris Swarth
Red-bellied Turtle	<i>Pseudemys rubriventris</i>	Chris Swarth
Eastern Fence Lizard	<i>Sceloporus undulatus</i>	Mike Quinlan
Eastern Box Turtle	<i>Terrapene carolina carolina</i>	Mike Quinlan
Eastern Ribbon Snake	<i>Thamnophis sauritus</i>	Chris Swarth
Smooth Earth Snake	<i>Virginia valeriae valeriae</i>	Chris Swarth

Table 22. Birds observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Acadian Flycatcher	<i>Empidonax virescens</i>	Jeff Shenot
American Crow	<i>Corvus brachyrhynchos</i>	Dotty Mumford & Jeff Shenot
American Goldfinch	<i>Carduelis tristis</i>	Dotty Mumford & Jeff Shenot; Mike Quinlan
American Kestrel	<i>Falco sparverius</i>	Sue Hamilton
American Redstart	<i>Setophaga ruticilla</i>	Dotty Mumford & Jeff Shenot
American Robin	<i>Turdus migratorius</i>	Dotty Mumford & Jeff Shenot
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Dotty Mumford & Jeff Shenot
Barred Owl	<i>Strix varia</i>	Dotty Mumford & Jeff Shenot; Mike Quinlan
Belted Kingfisher	<i>Ceryle alcyon</i>	Jeff Shenot; Mike Quinlan
Black Vulture	<i>Coragyps atratus</i>	Dotty Mumford & Jeff Shenot
Black-and-white Warbler	<i>Mniotilta varia</i>	Jeff Shenot
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>	Dotty Mumford & Jeff Shenot
Blackpoll Warbler	<i>Dendroica striata</i>	Jeff Shenot
Black-throated Blue Warbler	<i>Dendroica caerulescens</i>	Jeff Shenot
Black-throated Green Warbler	<i>Dendroica virens</i>	Jeff Shenot
Blue Grosbeak	<i>Guiraca caerulea</i>	Dotty Mumford & Jeff Shenot
Blue Jay	<i>Cyanocitta cristata</i>	Dotty Mumford & Jeff Shenot
Blue-winged Teal	<i>Anas discors</i>	Jeff Shenot
Brown Thrasher	<i>Toxostoma rufum</i>	Jeff Shenot; Mike Quinlan
Brown-headed Cowbird	<i>Molothrus ater</i>	Dotty Mumford & Jeff Shenot
Canada Goose	<i>Branta canadensis</i>	Dotty Mumford & Jeff Shenot
Cape May Warbler	<i>Dendroica tigrina</i>	Jeff Shenot
Carolina Chickadee	<i>Poecile carolinensis</i>	Dotty Mumford & Jeff Shenot
Carolina Wren	<i>Thryothorus ludovicianus</i>	Dotty Mumford & Jeff Shenot
Cedar Waxwing	<i>Bombcilla cedrorum</i>	Dotty Mumford & Jeff Shenot
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>	Jeff Shenot
Chimney Swift	<i>Chaetura pelagica</i>	Jeff Shenot
Chipping Sparrow	<i>Spizella passerina</i>	Dotty Mumford & Jeff Shenot
Common Grackle	<i>Quiscalus quiscula</i>	Jeff Shenot
Common Nighthawk	<i>Chordeiles minor</i>	Dotty Mumford & Jeff Shenot
Common Yellowthroat	<i>Geothlypis trichas</i>	Dotty Mumford & Jeff Shenot
Cooper's Hawk	<i>Accipiter cooperii</i>	Dotty Mumford & Jeff Shenot
Double-crested Cormorant	<i>Phalacrocorax auritus</i>	Dotty Mumford & Jeff Shenot
Downy Woodpecker	<i>Picoides pubescens</i>	Dotty Mumford & Jeff Shenot
Eastern Bluebird	<i>Sialia sialis</i>	Dotty Mumford & Jeff Shenot
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Dotty Mumford & Jeff Shenot
Eastern Phoebe	<i>Sayornis phoebe</i>	Dotty Mumford & Jeff Shenot
Eastern Wood-Pewee	<i>Contopus virens</i>	Dotty Mumford & Jeff Shenot
European Starling	<i>Sturnus vulgaris</i>	Dotty Mumford & Jeff Shenot
Field Sparrow	<i>Spizella pusilla</i>	Dotty Mumford & Jeff Shenot
Fish Crow	<i>Corvus ossifragus</i>	Dotty Mumford & Jeff Shenot
Forster's Tern	<i>Sterna forsteri</i>	Dotty Mumford & Jeff Shenot
Glossy Ibis	<i>Plegadis falcinellus</i>	Dotty Mumford & Jeff Shenot
Gray Catbird	<i>Dumetella carolinensis</i>	Dotty Mumford & Jeff Shenot
Great Blue Heron	<i>Ardea herodias</i>	Dotty Mumford & Jeff Shenot
Great Egret	<i>Ardea albus</i>	Dotty Mumford & Jeff Shenot

Great Horned Owl	<i>Bubo virginianus</i>	Jeff Shenot; Lindsay Hollister
Greater Yellowlegs	<i>Tringa melanoleuca</i>	Dotty Mumford & Jeff Shenot
Green Heron	<i>Butorides virescens</i>	Dotty Mumford & Jeff Shenot
Green-winged Teal	<i>Anas crecca</i>	Jeff Shenot
Hairy Woodpecker	<i>Picoides villosus</i>	Dotty Mumford & Jeff Shenot
Herring Gull	<i>Larus argentatus</i>	Dotty Mumford & Jeff Shenot
Indigo Bunting	<i>Passerina cyanea</i>	Dotty Mumford & Jeff Shenot
Killdeer	<i>Charadrius vociferus</i>	Jeff Shenot
Laughing Gull	<i>Larus atricilla</i>	Dotty Mumford & Jeff Shenot
Least Bittern	<i>Ixobrychus exilis</i>	Jeff Shenot
Magnolia Warbler	<i>Dendroica magnolia</i>	Jeff Shenot
Mallard	<i>Anas platyrhynchos</i>	Dotty Mumford & Jeff Shenot
Mourning Dove	<i>Zenaida macroura</i>	Dotty Mumford & Jeff Shenot
Mute Swan	<i>Cygnus olor</i>	Dotty Mumford & Jeff Shenot
Northern Cardinal	<i>Cardinalis cardinalis</i>	Dotty Mumford & Jeff Shenot
Northern Flicker	<i>Colaptes auratus</i>	Jeff Shenot
Northern Harrier	<i>Circus cyaneus</i>	Dotty Mumford & Jeff Shenot
Northern Mockingbird	<i>Mimus polyglottos</i>	Dotty Mumford & Jeff Shenot
Northern Parula	<i>Parula americana</i>	Jeff Shenot
Northern Pintail	<i>Anas acuta</i>	Jeff Shenot
Northern Shoveler	<i>Anas clypeata</i>	Dotty Mumford & Jeff Shenot
Northern Waterthrush	<i>Seiurus noveboracensis</i>	Dotty Mumford & Jeff Shenot
Osprey	<i>Pandion haliaetus</i>	Dotty Mumford & Jeff Shenot
Ovenbird	<i>Seiurus aurocapillus</i>	Jeff Shenot
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Dotty Mumford & Jeff Shenot
Pine Warbler	<i>Dendroica pinus</i>	Jeff Shenot
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	Dotty Mumford & Jeff Shenot
Red-breasted Nuthatch	<i>Sitta canadensis</i>	Dotty Mumford & Jeff Shenot
Red-eyed Vireo	<i>Vireo olivaceus</i>	Dotty Mumford & Jeff Shenot
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	Jeff Shenot; Nancy Kreiter
Red-shouldered Hawk	<i>Buteo lineatus</i>	Dotty Mumford & Jeff Shenot
Red-tailed Hawk	<i>Buteo jamaicensis</i>	Jeff Shenot
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Dotty Mumford & Jeff Shenot
Ring-billed Gull	<i>Larus delawarensis</i>	Dotty Mumford & Jeff Shenot
Rock Dove	<i>Columba livia</i>	Sue Hamilton
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	Jeff Shenot
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	Dotty Mumford & Jeff Shenot
Rufous-sided Towhee	<i>Pipilo erythrophthalmus</i>	Jeff Shenot
Scarlet Tanager	<i>Piranga olivacea</i>	Dotty Mumford & Jeff Shenot
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Jeff Shenot
Sora	<i>Porzana carolina</i>	Jeff Shenot
Summer Tanager	<i>Piranga rubra</i>	Jeff Shenot
Tennessee Warbler	<i>Vermivora peregrina</i>	Jeff Shenot
Tree Swallow	<i>Tachycineta bicolor</i>	Jeff Shenot
Tufted Titmouse	<i>Baeolophus bicolor</i>	Dotty Mumford & Jeff Shenot
Turkey Vulture	<i>Cathartes aura</i>	Dotty Mumford & Jeff Shenot
Virginia Rail	<i>Rallus limicola</i>	Jeff Shenot
White-breasted Nuthatch	<i>Sitta carolinensis</i>	Dotty Mumford & Jeff Shenot
White-eyed Vireo	<i>Vireo griseus</i>	Dotty Mumford & Jeff Shenot
Wilson's Warbler	<i>Wilsonia pusilla</i>	Jeff Shenot
Wood Duck	<i>Aix sponsa</i>	Dotty Mumford & Jeff Shenot

Wood Thrush	<i>Hylocichla mustelina</i>	Dotty Mumford & Jeff Shenot
Yellow Warbler	<i>Dendroica petechia</i>	Jeff Shenot

Table 23. Mammals observed and identified on the BioBlitz.

Common Name	Scientific Name	Observers
Beaver	<i>Castor canadensis</i>	visitors
Eastern Chipmunk	<i>Tamias striatus</i>	visitors
Eastern Cottontail	<i>Sylvilagus floridanus</i>	visitors
Gray Squirrel	<i>Sciurus griseus</i>	Mike Quinlan
Muskrat	<i>Ondatra zibethica</i>	visitors
Red Fox	<i>Vulpes vulpes</i>	Karyn Molines
White-tailed Deer	<i>Odocoileus virginiana</i>	Mike Quinlan

## References

[Checklists, reports, and publications about the biodiversity within the Jug Bay Wetlands Sanctuary]

Checklist of Amphibians and Reptiles of the Jug Bay Wetlands Sanctuary. 2006.  
Prepared by Christopher Swarth.

Checklist of Birds the Patuxent River, Jug Bay Area. 2004.  
Published by the Chesapeake Bay National Estuarine Research Reserve.

Checklist of Butterflies of the Jug Bay Wetlands Sanctuary. 2000.  
Prepared by staff of the Jug Bay Wetlands Sanctuary.

Checklist of the Dragonflies and Damselflies of the Jug Bay Wetlands Sanctuary. 2007.  
Prepared by Richard Orr.

Checklist of Fish of the Jug Bay Wetlands Sanctuary. 2000. Prepared by Karyn Molines.

Checklist of Mammals of the Jug Bay Wetlands Sanctuary. 1995. Prepared by Christopher Swarth.

Csuzdi, C. and K. Szilávecz. 2002. *Diplocardia patuxentis* sp. n., a new earthworm species from Maryland, North America (Oligochaeta: Acanthodrilidae). *Annals Historica-Naturales Musei Nationalis Hungarici* 94:45-51.

Csuzdi, C. and K. Szilávecz. 2003. *Lumbricus friendi* Cognetti, 1904 a new exotic earthworm in North America. *Northeastern Naturalist* 10:77-82.

Drinker, K. 1993 (Fall). Plants and more plants: the vegetative communities of Jug Bay. *Marsh Notes* (newsletter of Jug Bay Wetlands Sanctuary) 8 (3).

Droege, S. 2005 (Summer). Rare native bees discovered. *Marsh Notes* (newsletter of Jug Bay Wetlands Sanctuary) 10(2).

Droege, S., C. Davis, W. Steiner and J. Mawdsley. 2007. The lost micro-deserts of the Patuxent River: Using landscape history, insect and plant specimens, and fieldwork to detect and define a unique community. Unpublished manuscript.

- Dubill, A. 1994. Comparison of breeding season bird populations in natural and created wetlands. Technical Report of the Jug Bay Wetlands Sanctuary.
- Friebele, E. and J. Zambo. 2004. A Guide to the Amphibians and Reptiles of Jug Bay. Publication of the Chesapeake Bay National Estuarine Research Reserve, Maryland.
- Friebele, E. 2001 (Fall). New species appears at sanctuary (Diamond-backed Terrapin: *Malaclemys terrapin*). Marsh Notes (newsletter of Jug Bay Wetlands Sanctuary) 16(3).
- Kiviat, E. 1995. Short-term visitor activities, Smithsonian Environmental Research Center. Report to the Smithsonian Institution.
- Mansueti, R. 1955. An ecological and distributional study of the fishes of the Patuxent River Watershed, Maryland. PhD dissertation. University of Maryland, College Park.
- Mawdsley, J. R. 2007. The tiger beetle fauna of an anthropogenic sand barrens site in central Maryland, U.S.A. (Coleoptera: Cicindelidae). *Cicindela* 38(1-4):47-58.
- Molines, K. 1995 (Summer). Seventh "Great Herp Search" held. Marsh Notes (newsletter of Jug Bay Wetlands Sanctuary) 10(2).
- Molines, K and B. Wright. 1998 (Fall). Herp Search expands in area and species. Marsh Notes (newsletter of Jug Bay Wetlands Sanctuary) 13(3).
- Molines, K. 2004. Determination of stream biotic integrity based on fish population surveys. National Water Quality Monitoring Council conference. Chattanooga, Tennessee. (Abstract)
- Molines, K. 2005. Herpetofauna of isolated wetlands of the Jug Bay Wetlands Sanctuary. Maryland Water Monitoring Council conference. Linthicum, Maryland. (Abstract)
- Molines, K., C. Bravo, G. Burton, M. Burton, T. Englar, L. Hollister, D. Perry, L. Siciliano, B. Smith, and S. Teliak. 2007. Diversity and abundance of trees within the upland forests of the Parris N. Glendening Nature Preserve at Jug Bay. Technical report of the Jug Bay Wetlands Sanctuary. 40 pages.
- Quinlan, M. 2000 (Summer). A banner year for Northern Saw-whet Owls. Marsh Notes (newsletter of Jug Bay Wetlands Sanctuary) 15(2).
- Shone, S.M., Glass, G.E., and Norris, D.E. 2005. Targeted trapping of mosquito vectors in the Chesapeake Bay area of Maryland. *Journal of Medical Entomology* 43: 151-158.
- Smithberger, S. and C. Swarth. 1993. Reptiles and amphibians of the Jug Bay Wetlands Sanctuary. *The Maryland Naturalist* 37:28-46.
- Swarth, C., J. Burke and K. Molines. 1998. Using Volunteers to Study Biodiversity in Maryland. Maryland Department of Natural Resources Conference on Biodiversity. Annapolis, Maryland. (Abstract)
- Swarth, C. 1998. Monitoring turtles in wetlands. *The Volunteer Monitor* (EPA publication) 10:20-21.
- Swarth, C. 1998. The Ecology and Population Status of Turtles at Jug Bay, Patuxent River (Maryland). Technical Report of the Jug Bay Wetlands Sanctuary Technical Report. 83 pgs.
- Swarth, C and J. Burke. 1999 (Summer). Census of waterbirds covers Patuxent. Marsh Notes (newsletter of Jug Bay Wetlands Sanctuary) 14(2).
- Swarth, C. W. and J. Burke. 1999. Patuxent River Waterbird Census; February 1999. Technical Report of the Jug Bay Wetlands Sanctuary. 29 pgs.

Swarth, C., and J. Burke. 2000. Waterbirds in Freshwater Tidal Wetlands: Population Trends and Habitat Use in the Non-breeding Season. Technical Report of the Jug Bay Wetlands Sanctuary. 37 pgs.

Swarth, C. 2000. The Great Herp Search: a survey technique for inventorying reptiles and amphibians. The Volunteer Monitor (EPA publication) 12: 1; 4 - 5.

Swarth, C. 2000 (Fall). New frog species (Green Treefrog: *Hyla cinera*) found. Marsh Notes (newsletter of Jug Bay Wetlands Sanctuary) 15(3).

Swarth, C. 2001 (Summer). Third Patuxent River waterbird census confirms patterns. Marsh Notes (newsletter of Jug Bay Wetlands Sanctuary) 16(2).

Swarth, C. 2003 (Winter). Vernal pool study reveals diverse herp community. Marsh Notes (newsletter of Jug Bay Wetlands Sanctuary) 18(4).

Swarth, C. 2007. Distribution and abundance of wintering waterbirds on the Patuxent River Estuary. Technical report of the Jug Bay Wetlands Sanctuary. 17 pages.

Appendix A.

Maps of the north and south sections of the Jug Bay Wetlands Sanctuary, indicating the Search Areas used in the 2007 BioBlitz.

Appendix B. Summary of leaders and the areas searched.

Team	Date	Leaders	Time Period	Search Areas
Amphibians	15 Sept	Robert Frezza & Karyn Molines	6 – 7 pm	4 (Including Wet Forest pitfall traps)
Ants	15 Sept	Fred Paraskevoudakis	12 – 3 pm	32 & 33
Bees	15 Sept	Sam Droege	12 – 3 pm	3, 34A & 37
Birds	15 Sept	Dotty Mumford	12 – 3 pm	20
Birds	15 Sept	Jeff Shenot	3 – 6 pm	20
Butterflies	15 Sept	Jeff Shenot	12 – 3 pm	37

Butterflies	15 Sept	Pat Durkin	12 – 3 pm	3 & 20
Dragonflies	15 Sept	Richard Orr	12 – 3 pm 3 – 6 pm	3, 8, 9 & 11
Fish	15 Sept	Karyn Molines; Jeff Campbell	3 – 6 pm	36
Herps	15 Sept	Chris Swarth	12 – 3 pm 3 – 6 pm	3, 5 & 8
Herps	15 Sept	Mike Quinlan	12 – 3 pm	1, 2, 3, 4, 6 & 7
Herps	15 Sept	Mike Quinlan	3 – 6 pm	33
Herps	15 Sept	Robert & Rosemary Frezza	12 – 3 pm	39
Insects	15 Sept	Ben Hollister	12 – 3 pm	3
Insects	15 Sept	Fred Paraskevoudakis & Timothy Foard	12 – 3 pm	33
Meadow Plants	15 Sept	Joe Metzger	12 – 3 pm 3 – 6 pm	33 & 34
Mushrooms	15 Sept	David Farr	3 – 6 pm	1, 5, 6 & 11C
Nocturnal animals	15 Sept	Lindsay Hollister	9 pm – midnight	11
Owls	15 Sept	Mike Quinlan	9 pm – midnight	20
Plankton	15 Sept	Kathy Ellett	3 – 6 pm	11C (River Pier)
Trees	15 Sept	Dave Perry	12 – 3 pm	1, 2, 3, 9 & 11
Trees	15 Sept	Dave Perry	3 – 6 pm	34A
Vines	15 Sept	Dennis Whigham	12 – 3 pm	34
Vines	15 Sept	Dennis Whigham	3 – 6 pm	1 & 11
Ants	16 Sept	Dan Kjar	9 am – 12 pm	
Beetles	16 Sept	Jonathan Mawdsley	9 am – 12 pm	33 & 37
Birds	16 Sept	Jeff Shenot	6 am – 12 pm	7 & 11
Birds	16 Sept	Dotty Mumford	6 – 9 am	1, 9, 11 & 10
Butterflies	16 Sept	Pat Durkin	9 am – 12 pm	33, 34A & 34B
Earthworms	16 Sept	Kathy Szlavecz; Dan Kjar	9 am – 12 pm	1 & 2
Herps	16 Sept	Mike Quinlan	9 am – 12 pm	8, 13 and 14
Moths	16 Sept	Dick Smith	9 am – 12 pm	33, 34A & 34B
Spiders	16 Sept	Nancy Kreiter	9 am – 12 pm	1, 6, 9 & 10
Trees	16 Sept	Dave Perry	9 am – 12 pm	1 & 20

Appendix C. Species tally sheet used in 2007 BioBlitz.

Team  
Leader

Date

Site Information: If all the same					Taxonomic Information: If All the Same				
Line#	UTM E ----- UTM N	GMP	Distance (m)	Bearing (to GMP)	Phylum	Class	Order	Number	Notes
					(Order, if different) Family	Genus	Species		
1									
2									
3									
4									
5									
6									
7									
8									

Appendix D. Observer and habitat sheet used in the 2007 BioBlitz

Team Leader \_\_\_\_\_

Address \_\_\_\_\_

Phone \_\_\_\_\_ email \_\_\_\_\_

Other Volunteers:

Name				
Address				
City, State ZIP				
Phone				
Email				
Name				
Address				
City, State ZIP				
Phone				
Email				

**GENERAL HABITAT INFORMATION**

UTM E \_\_\_\_\_ UTM N \_\_\_\_\_ GMP \_\_\_\_\_

General Site Information: \_\_\_\_\_

Nearest Trail / Intersection: \_\_\_\_\_

**Tidal**

- Low Marsh
- High Marsh
- Phragmites
- Scrub Shrub
- Swamp
- Intertidal mudflats
- Intertidal sand/gravel

**Rivers and Streams**

- Deep water river (Patuxent)
- Year-round stream
- Intermittent stream—lower
- Intermittent stream—upper

**Non-Tidal**

- Shallow emergent
- Shrub swamp
- Seepage swamp
- Seep
- Bottomland forest
- Vernal pool
- Beaver Pond
- Quarry pond

**Terrestrial**

- Mixed hardwood
- Evergreen (Pine)
- Stream banks
- Managed meadow

**Disturbed or Open**

- Gardens, planted areas
- Lawns / cleared lands
- Railroad bed
- Abandoned sand mine
- Old fields