National Park Service
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Natural Resource Stewardship and Science

Boston Harbor Islands All Taxa Biodiversity Inventory

Discovering the "microwilderness" of an urban island park

Natural Resource Technical Report NPS/BOHA/NRTR—2013/746



ON THE COVER

Images: **Row one** (from left): Thompson Island, tiger beetle (*Cicindela sexguttata*), bumble bee (*Bombus impatiens*); **Row two**: jumping spider (*Peregrina exigua*), Nessus sphinx moth (*Amphion floridensis*), bearded robber fly (*Albiarbefferia albibarbis*); **Row three**: acrobatic ant (*Crematogaster lineolatus*), candy-striped leafhopper (*Graphocephala coccinea*).

Island photograph by Dave Wrobel; all invertebrate images © 2012 The President and Fellows of Harvard College

Boston Harbor Islands All Taxa Biodiversity Inventory

Discovering the "microwilderness" of an urban island park

Natural Resource Technical Report NPS/BOHA/NRTR—2013/746

Jessica J. Rykken, Brian D. Farrell

Museum of Comparative Zoology
Harvard University
26 Oxford Street,
Cambridge, MA 02155

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Executive Summary

The Boston Harbor Islands Partnership (BHIP) and the Museum of Comparative Zoology (MCZ) at Harvard University collaborated to conduct the first phase of an All Taxa Biodiversity Inventory (ATBI) in Boston Harbor Islands national park area, Boston, Massachusetts. This six-year phase of the ATBI focused on the "microwilderness" of the park, a vast realm of invertebrate animals.

The main objectives of this phase of the ATBI were threefold: (1) to document the diversity and distribution of arthropod and mollusk taxa in the park; (2) to engage and educate students and the public about local invertebrate biodiversity; (3) to use biodiversity data to inform park management.

The project relied on the participation of more than fifty students, interns, citizen scientists, and volunteers to collect invertebrates on nineteen islands, and to sort, prepare, image, and database more than 75,000 specimens in the lab. Additionally, more than forty taxonomists from North America and Europe donated their time and expertise to identify 1,732 species and morphospecies. All specimens are permanently housed in the collections at the MCZ.

Exploratory analyses of selected taxa suggested that, as predicted by the theory of island biogeography (MacArthur and Wilson 1967), island size was a reasonable predictor of species richness. However, an island's distance from the mainland was correlated with species richness for only two of six taxa. Additional factors such as habitat diversity and habitat type (i.e., presence of freshwater or mature forests), as well as human-aided transport of species, appeared to be significant drivers of invertebrate distribution patterns across the islands. Numbers of introduced species were proportionally higher on the islands than on the coastal mainland for several beetle families, but comparable data for the mainland were lacking for most taxa, pointing to the lack of basic species distribution data that exist for invertebrates even in temperate, accessible locales. A large proportion of introduced species also had extremely high population counts and widespread distributions across islands, relative to native species.

The ATBI created unprecedented opportunities for outreach. Scientists and staff from the MCZ, together with education and interpretive staff from the BHIP, collaborated to design and implement K-12 curricula and public activities, and to create products to engage and educate students, citizen scientists, and the public. For example, rangers presented ATBI programs to approximately 5,500 middle school students from the Boston area. High resolution and 3D images of all identified species, produced at the MCZ, were used in products such as biodiversity posters, field guides, and an award-winning card game. The incalculable amount of work involved in collecting and curating tens of thousands of specimens also created ideal opportunities for high school students, undergraduates, and others to gain practical, local experience in the process—and excitement—of biodiversity discovery.

Some of the biodiversity information gathered in the ATBI had direct relevance to management. At a species scale, we discovered a milkweed-associated moth (*Cycnia inopinata*) listed as Threatened in Massachusetts. We also documented several new introduced species to the U.S. and North America, including a few known pests (e.g., *Hishimonus sellatus*, a leafhopper pest on mulberry in Asia). At a trophic scale, we implemented a pilot program to assess and monitor pollinator health in the park by tracking changes in native bee abundance and richness over time. Efforts such as this can simultaneously

contribute to cumulative knowledge about biodiversity in the park, and provide practical information about the possible effects of environmental stressors, such as climate change, on park ecosystems.

Acknowledgments

Funding for this project was generously provided by the Stone Foundation, the Green Fund, and the National Park Service.

The success of the ATBI relied on the skills and effort provided by many, many talented people. Staff at the Museum of Comparative Zoology, Harvard University, including Carmen Chavez, Whit Farnum, Amie Jones, Piotr Naskrecki, and Dave Wrobel, designed and maintained the project website, database, and created many of our image-based products. We are indebted to National Park Service staff and others working with the Boston Harbor Islands Partnership for providing logistical support and/or invaluable enthusiasm and talent in their role as educators, including Marc Albert, Jennifer Bourque, Betsy Colby, Brian Conroy, Kelly Fellner, Kristen Hoffman, Beth Jackendoff, Bridget McDonald, Josh Parker, Andrew Pearson, Mary Raczko, Terri Teller, Dawn Tesorero, Gabe Wallman, and David Weinstein. Collectively, members of the youth service group, Boston Harbor Island Ambassadors (some of whom are mentioned below) assisted us on various occasions, in the field, lab, and at public events.

Getting to islands required boats, and we gratefully acknowledge the patience and sound piloting skills of Russ Bowles and his staff at the Division of Marine Operations at the University of Massachusetts Boston. The Hingham Harbormaster also generously provided us with regular transport. Ferry service to Thompson Island was provided by Thompson Island Outward Bound Education Center, and the logistics of our field work on this busy island were facilitated by Jim Scully and other staff.

Countless students, interns, and volunteers suffered biting insects, driving rain, blazing sun, slow trains, high seas, and endless hours hunched over microscopes and keyboards with cheerful enthusiasm and dedicated patience and skill in order to collect and catalog hundreds of thousands of invertebrates. Heartfelt thanks go to: Celina Abundis, Laila Alawa, Jeanne Andersen, Rosalind Becker, Emily Boehm, Dunbar Carpenter, Sung Won Cho, Maesen Churchill, Adam Clark, Betsy Colby, Susannah Corona, Erika D'Andrea, Alex Dolginow, Meredith Eustis, Shannon Fadden, Ashley Fillmore, Marcelle Goggins, Emily Hill, Anna Holden, Sean Hooley, Sean Kent, Daniel Kim, Josette Kimbrough, Lili Kocsis, Veronica Kratman, Ling Lin, Victoria Luu, Stephanie Madden, Amanda Newton, Emily Nguyen, Katie Nishimura, Kelley Nunn, Michael Peters, Alison Ravenscraft, Margaret Ross, Matan Shelomi, Georgia Shelton, Sebastian Velez, L. Ray Watkins, Jessica Worl, and Serena Zhao.

Many thanks to Howard Ginsberg, USGS Patuxent Wildlife Research Center, for reviewing this manuscript.

Lastly, we would have NO data in our database without the generosity of a world-wide community of taxonomists, who shared their valuable time and considerable skill and expertise to make identifications of our invertebrate specimens. The list of participating taxonomists is long, and is included in Appendix C. We are absolutely indebted to these people, professionals and amateurs alike, and look forward to the day when parks will be able to adequately compensate taxonomists for their indispensable contributions to our inventory efforts.

Introduction

Boston Harbor Islands national park area (npa) comprises thirty small islands and four peninsulas lying within 20 km of downtown Boston, Massachusetts (Fig. 1). Most of the islands within the harbor are formed from glacial deposits of till, known as drumlins, and are part of a larger drumlin field that extends throughout the mainland of eastern Massachusetts and into Massachusetts Bay (LaForge 1932; Rosen and FitzGerald 2004). Today, the islands are vegetated by successional meadow, shrub, forest, and maritime communities, as well as by freshwater wetlands and saltmarshes (Bell et al. 2005; Elliman 2005). A long history of use and colonization by both Native and European Americans has altered island landscapes dramatically over the last several hundred years (Richburg and Patterson 2005). Anthropogenic impacts and alterations have come with the establishment and abandonment of fishing settlements and farms, military forts and other institutional buildings, lighthouses, landfills, and sewage treatment plants (Kales 2007). Over the last forty years, several of the islands have become state parks, and the remaining islands and peninsulas are now owned by various municipalities, as well as conservation and educational groups. Despite multiple land ownership, Boston Harbor Islands national park area was created in 1996, and encompasses all 34 islands and peninsulas. The park is unique in that the National Park Service owns only 0.02 ha of land, but serves as a partner together with nine other members in the Boston Harbor Islands Partnership, which also includes a Federal Advisory Council.

A primary mission of the park, as stated in the general management plan (National Park Service 2002) is "to preserve and protect a drumlin island system within Boston Harbor, along with associated natural, cultural, and historic resources." While historic sites and cultural artifacts on the islands have received significant attention over the years (Kales 2007), far less is known about the natural resources which park managers are mandated to protect. As is the case for most national parks, inventories have focused on vertebrate animals (Paton et al. 2005; Trocki et al. 2007) and vascular plants (Elliman 2005), while the "microwilderness" (as renowned and local entomologist, E.O. Wilson, refers to the immense realm of invertebrates) has received disproportionately little attention. A notable exception is the comprehensive macro-Lepidoptera survey conducted by Mello (2005). This yawning knowledge gap, common to almost all national parks, has not gone unnoticed (Ginsberg 1994). Increasingly, there is an awareness that because invertebrates are critical to healthy functioning ecosystems, a better understanding of this vast component of biodiversity is necessary to inform park management decisions (Ginsberg 1994).

In an effort to learn more about the natural resources of the Boston Harbor Islands, park managers and scientists initiated an All Taxa Biodiversity Inventory (ATBI) in 2005. In this first phase of the inventory, the primary objective was to catalog the biodiversity of selected invertebrate taxa in the park. The ATBI concept, initially conceived by Janzen and Hallwachs (1994), has as its ultimate goal the identification and cataloguing of all species occurring within the boundaries of a park or other natural area in a relatively short period of time. Currently, ATBI efforts are underway in known hotspots of biodiversity such as the Dominican Republic (Farrell 2005) and the Great Smoky Mountain National Park (Nichols and Langdon 2007). The Boston Harbor Islands ATBI, a collaborative effort between the Boston Harbor Islands Partnership and the Museum of Comparative Zoology (MCZ) at Harvard University, applies the same approach in an urban island landscape, where biodiversity is expected to be comparatively low due to bioregion, high levels of human disturbance, limited area, and isolation.

From a scientific perspective, conducting an invertebrate inventory on an island archipelago in this historically active harbor is also expected to provide novel information about island colonization on a small spatial scale, species resilience to human disturbance, and the relative dominance of introduced species. MacArthur and Wilson's classic theory of island biogeography (1967) suggested that island size and isolation are strong drivers for patterns of species richness. One of our objectives was to determine whether this also holds true for arthropod colonization on small, near-shore islands with a long history of human activity. Human disturbance and the transport of flora and fauna are also dominant themes on the islands. For instance, the proportion of introduced plant species on the Boston Harbor Islands is high (Elliman 2005), and on individual islands, these proportions relate to factors such as isolation (Long et al. 2009). Because introduced species are of historical and ecological interest, and some are of potential economic concern, we also wanted to investigate these proportions and patterns with invertebrates. The data we collected during the ATBI cover an extremely diverse array of taxa, and the results we present in this report are primarily exploratory. Our intention is that they will suggest topics or particular questions that invite further investigation and focused research.

In the course of documenting biodiversity, ATBIs are intended to bring together and involve many participants, including park staff, academic researchers, amateur naturalists, citizen scientists, and students (Janzen 2003; White 2007). Education and outreach objectives are typically given high priority. For instance, the ATBI at Great Smoky Mountains National Park targets the involvement of the public, schools, and volunteers for one of its five science themes (White 2007). Objectives include the participation of non-scientists in all phases of the inventory, making the results of the ATBI accessible to diverse audiences through various media, and creating educational programs and opportunities for students at all levels (White 2007). Likewise, the ATBI being conducted in the Dominican Republic involves both American and Dominican college students, and aims to broaden its impact to local citizens and school children by producing Spanish language media such as posters showing high resolution images of insects being collected in the inventory (Farrell 2005). Similar outreach goals and methods seemed appropriate for the Boston Harbor Islands ATBI, especially because of the park's location in the heart of New England's largest metropolitan area. This urban setting, and proximity to a large public K-12 school system, as well as more than 30 colleges and universities, provides a virtually limitless pool of students and public to draw into the project for active participation, and also provides an audience to which the project can reach out with educational programs and products.

Lastly, along with the new scientific discoveries and educational opportunities that an ATBI provides, there is also an expectation that biodiversity information can be used to inform management decisions and actions in the park. In addition to knowledge about rare or endemic species, newly introduced pest species, or other species of particular interest, an ATBI can provide information about ecological roles and relationships, and the distribution and habitat associations of species. These kinds of information may help park managers prioritize conservation measures for particular communities, habitats, or areas in the park. For instance, in the Great Smoky Mountains, spatial models of species distributions throughout the park help managers identify potential "hotspots" of biodiversity, or find new sites for rare species (for examples of models see: http://seelab.eecs.utk.edu/alltaxa). The selection of particular taxa (e.g., pollinators) as indicators of ecosystem health can provide parks with valuable tools for measuring the long-term effects of large-scale environmental threats such as climate change or habitat fragmentation (Franzen and Ockinger 2012). Species data from parks can also contribute to larger regional datasets, providing new information for species distribution maps, and for monitoring range shifts over time.

Our overall goal for phase I of the Boston Harbor Islands All Taxa Biodiversity Inventory was to integrate science, education, and management while documenting the microwilderness of an urban island park. Specifically, our primary objectives were to:

(1) Document the diversity of insects and other invertebrate taxa across a subset of islands and peninsulas in the park, with the following questions in mind:
    (a) How complete is our inventory?
    (b) Are there species of regional significance or special interest in the park?
    (c) Do patterns of species richness and composition across islands relate to island size, isolation, and/or habitat diversity?
    (d) Are proportions of introduced species on islands in Boston Harbor high relative to the mainland? Do they vary across islands within the park?
    (e) Do introduced species differ in their distribution and relative abundance across islands compared to native species?

(2) Educate and excite students, citizen scientists, park visitors, and others about local insect biodiversity through visual media, curriculum-based programs, presentations, and opportunities for participation.

(3) Use biodiversity data to inform park management by:
    (a) Documenting and monitoring exotic and pest species introductions;
    (b) Locating significant habitats for species or communities of interest;
    (c) Contributing data to regional or nation-wide databases;
    (d) Identifying effective indicator taxa of ecosystem health for long-term monitoring.

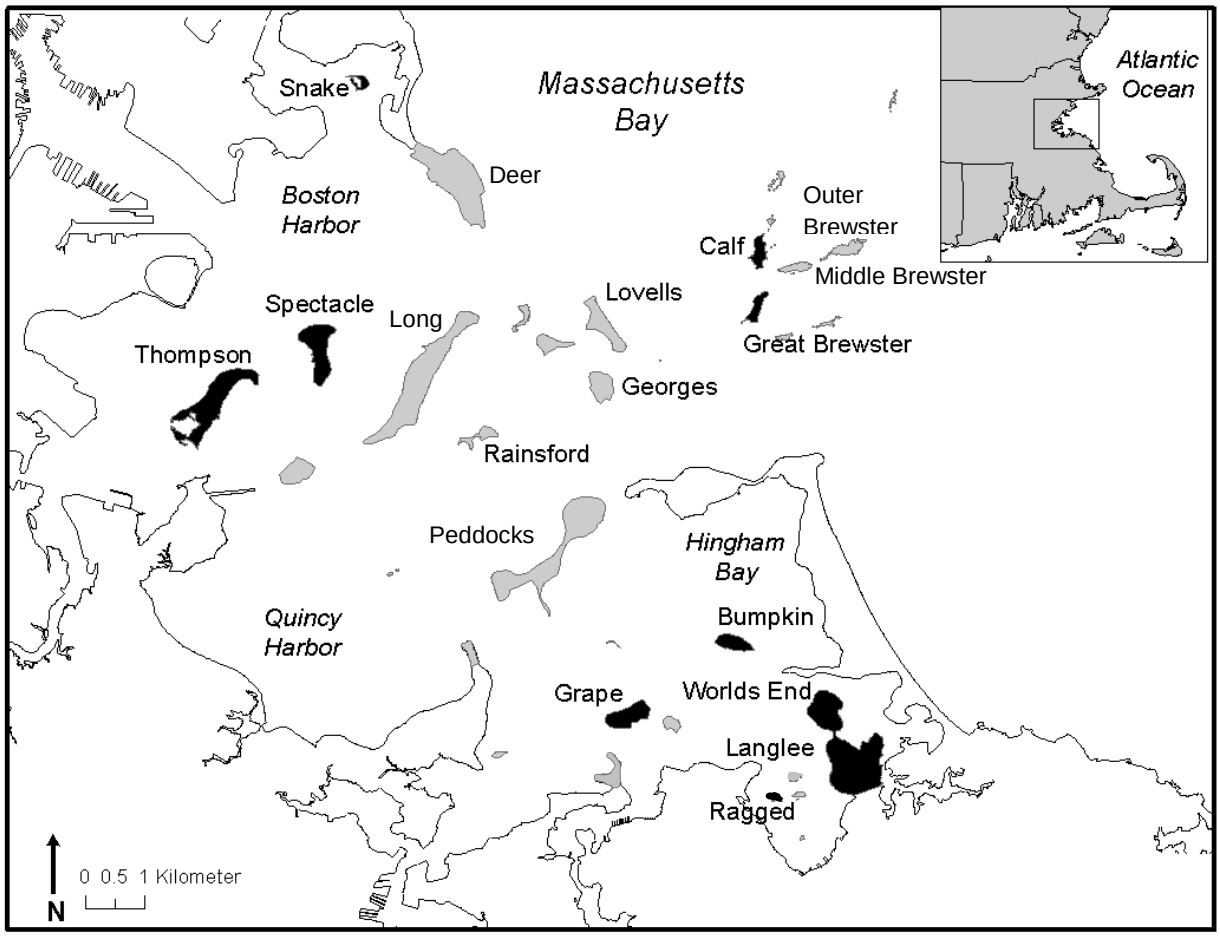


Figure 1. Map of 34 islands and peninsulas (shaded in gray and black) comprising Boston Harbor Islands national park area, Massachusetts, U.S.A. Names are provided only for islands and peninsulas where invertebrates were collected. Islands and peninsulas shaded in black were sampled intensively with a structured sampling protocol.

Study Area

The islands and peninsulas sampled for invertebrates ranged in size from 1.1 to 104.5 ha (Table 1). Nineteen of the islands are drumlins, formed by deposits of glacial till in Boston basin; 11 are bedrock outcrops (National Park Service 2002). While these deposits were connected to the mainland for a time when the glaciers retreated over 12,000 years ago, sea level rise associated with glacial melting flooded the basin and isolated the drumlins as islands (Crosby 1928; Rosen and FitzGerald 2004), and they now lie between 0.3 and 3.3 km from the mainland. Most of the intertidal areas on the islands are mixed coarse substrate such as gravel and cobble, but a few islands have sandy beaches, and some have areas of bedrock shoreline (Bell et al. 2005). Dominant vegetation communities on most islands include forest, woodland, maritime shrub, old field, and beach strand (Elliman 2005). Non-native woody and herbaceous plant species dominate many of the vegetation communities on the islands (44% of all plant species on the islands are introduced), but the dominant shrub on almost all of the islands is native staghorn sumac (*Rhus typhina*). Spectacle Island is a reclaimed landfill that was replanted within the last decade and is currently mostly open habitat. Its north drumlin is the highest point on the islands, at 54 m. Salt marshes and brackish marshes occur on several of the islands, but freshwater is extremely scarce. The mainland surrounding the harbor comprises several towns, ranging from somewhat less developed landscapes in Hingham and Weymouth to the south of the harbor, to heavily urbanized landscapes in Boston and Winthrop, including international port facilities for shipping and air transport.

Over the past several centuries, all of the more accessible and sizeable islands and peninsulas have hosted human activities and structures (Kales 2007). In the present day, almost all of the islands in the park are open to human visitors, but the islands vary greatly in the intensity of human traffic and impacts. Several islands (Bumpkin, Georges, Grape, Lovells, Peddocks, Spectacle, Thompson) are serviced by public ferries between May and October. Portions of these islands and World's End are also actively landscaped (e.g., mowing, clearing brush). Islands with ferry service and World's End receive thousands to tens of thousands of visitors per year (Table 1), with Spectacle and Georges Islands serving as hubs in the ferry system. Thompson Island, an education center with residential programs, also receives very high numbers of visitors. Long Island and Deer Island, both accessible by car, serve as sites for social services programs and a sewage treatment facility, respectively. The remaining islands, which do not have public ferry service, probably receive on the order of hundreds of visitors per year, but records are not available.

Table 1. Area, isolation, human visitation rates, and sampling design for each island sampled in Boston Harbor Island national park area between 2005 and 2008. Islands in bold type were sampled intensively with a structured sampling design, all other islands were sampled sporadically.

Island	Code	Terrestrial area (ha)[4]	Isolation (km)	Human visitation[5]	Year(s) sampled[6]	Sampling effort: # sites (# samples)[7]				
						Pitfall	Litter	Malaise	Light[8]	Bowl
Bumpkin	BM	12.2	0.6	2,824	2006	5(21)	0	3(5)	3(3)	0
Calf	CF	7.5	3.3	NA	2007	5(39)	7(9)	2(6)	1(1)	4(7)
Deer[1]	DI	74.9	0.0	77,940		0	0	0	0	0
Georges	GE	15.8	1.5	76,699		0	0	0	1(1)	0
Grape	GP	21.9	0.5	3,119	2005, 2008	13(55)	12(30)	8(9)	4(6)	19(29)
Great Brewster	GB	7.5	2.3	NA	2006	6(45)	11(15)	3(7)	2(2)	2(2)
Langlee	LN	1.8	0.5	NA	2005	5(25)	5(20)	3(10)	5(20)	5(20)
Long[2]	LI	85.1	0.0	2,100		0	0	0	0	0
Lovells	LV	19.6	2.2	5,576		0	1(1)	0	3(3)	3(3)
Middle Brewster	MB	5.0	3.1	NA		0	0	0	0	0
Outer Brewster	OB	7.7	3.4	NA		0	0	0	0	0
Peddocks	PE	74.6	0.8	1,237		0	0	0	0	0
Rainsford	RF	6.6	2.4	NA		0	0	0	0	0
Ragged	RG	1.1	0.3	NA	2006	5(31)	12(20)	2(6)	1(2)	1(2)
Snake	SN	2.9	0.3	NA	2007	4(20)	4(6)	2(4)	0	0
Spectacle	SP	34.6	1.9	42,019	2007	5(39)	3(12)	4(7)	1(1)	1(1)
Thompson[3]	TH	54.2	0.5	16,156	2005, 2007	31(119)	16(36)	10(27)	8(13)	8(13)
Worlds End[1]	WE	104.5	0.0	51,960	2006	9(63)	13(21)	7(13)	7(8)	7(8)

[1]Peninsula, connected to mainland at all times
[2]Connected to mainland by causeway and bridge
[3]Island connected to mainland at very low tides
[4]Terrestrial area above high tide line from Bell et al. (2002)
[5]Visitor counts for 2009. Counts represent visitors arriving by ferry, charter, and private boat, except counts for WE and LI represent drive-up visitors (National Park Service 2010, unpublished report) NA = no available data (islands without ferry service or ranger).
[6]Years for structured trap sampling, does not include all active collecting events. In 2005, we sampled Aug-Oct only
[7]These sampling data do not include separate projects focused on ants (hand and litter searches only, 2009; Clark et al. 2011) and bees (bowls only, 2010; Rykken and Farrell in prep.).
[8] Includes both mercury vapor light and ultra-violet light trap samples (see Table 2)

Methods

Sampling design and techniques

Islands were sampled with varying intensities and in different years (Table 1). Three islands (Thompson, Grape, and Langlee) were sampled between late August and October, 2005, in a short pilot season to test field sampling methods. A full-season (May through October) structured sampling design was implemented on Grape and Thompson in subsequent years, and also on seven other islands (Table 1). Eight additional islands (Deer, Georges, Long, Lovells, Middle Brewster, Outer Brewster, Peddocks, and Rainsford) were visited sporadically for hand and net-collecting, visual surveys for Lepidoptera and Odonata, and/or bee bowl and light trapping.

On islands with structured sampling, a variety of traps and methods was used to sample different habitats. Sampling was stratified by dominant habitat types: woodland, shrubland, meadow, beach (above the high tide line), salt- or brackish marsh, freshwater marsh or pond edge. Larger islands had more sampling sites than smaller islands, but had fewer samples per unit area overall. Sampling methods included both passive traps (Table 2) and active sampling techniques (see below). Sampling generally occurred every other week throughout the season, on each island: pitfall and malaise traps were open for the full week (pitfall sites were stationary, but malaise traps were moved between habitats on the bigger islands); light traps were run one night in a different location each week; and bee bowl transects were set up and opened for several hours on one sunny day each sampling week. Litter samples were collected from just one island (in rotation) each sampling week because we had only three Berlese funnels in the lab to extract invertebrates.

Active sampling techniques included hand-collecting and the use of sweep nets, aerial nets, aspirators, and beating sheets. The latter technique entails beating or shaking branches of a tree or shrub with a stick and catching any falling invertebrates on a 1 m x 1 m nylon sheet stretched taut on a frame below. Invertebrates are then picked off the sheet by hand or with an aspirator. Active techniques were used in the course of field visits to the islands to tend passive traps, but also by school groups and others during educational and public programs on various islands.

Field data sheets were filled out for each collecting trip (Appendix A), recording the date, weather, time of day, location of traps being opened (including lat/long coordinates provided by a Garmin eTrex GPS receiver), number and condition of traps being shut, and listing all the samples returning to the lab by their unique sample codes. A paper label with this code written in pencil was placed inside EVERY sample container returning to the lab. The code was constructed as follows:

WE-PIT-B 19.07

where WE is the two letter island code (as in Table 1), PIT is the code for collecting method (Table 2), B refers to the exact location of the pitfalls, 19 is the collecting week (the first week of sampling in the year was designated as “1” and successive weeks were numbered accordingly), and 07 is the year 2007. Similarly constructed codes, unique to each sampling event, followed all specimens through processing and into the database (Figure 2).

Table 2. Description of passive traps and protocols used for structured sampling during Boston Harbor Islands ATBI. The three-letter code for trap type in parentheses after the name was used for sample codes (see text).

Trap type (and code)	Description	Protocol	Killing agent/ Preservative	Target taxa
Pitfall (PIT)	A plastic 20 oz. (591 mL) cup; 90 mm diameter at the mouth; 3 holes punched in the bottom for drainage. The cup is dug into the ground so the mouth is flush with the substrate. A 2 oz. (59 mL) plastic cup is nested within the larger cup and filled with preservative. Invertebrates fall in and are unable to crawl out. A plastic plate is supported by 3 nails above the cup to keep out rain and debris.	4-8 permanent sites were set up on each island, depending on island size and habitat diversity. At each site, 3 pitfalls were arranged in a line or a triangle 10 m apart. Traps were left open for approximately 1 week, then sealed with a tight-fitting lid while not in use.	1:1 mix of 95% ethanol (or water) and propylene glycol.	Ground-dwelling invertebrates such as ants, beetles, worm, spiders, snails, millipedes.
Berlese funnel (LTR)	A wire ¼" (6.4 mm) mesh screen 30 cm in diameter fits across the top of an aluminum funnel, which rests inside the rim of a 3.5 gallon (13.2 L) plastic bucket. Leaf litter sample is placed on the mesh and a lid with an attached 25-watt light bulb is closed over the bucket assembly. As heat from the bulb dries out the litter, invertebrates are driven down through the mesh screen into the funnel and are captured at the bottom in a jar containing preservative.	Collecting sites were often associated with pitfall sites, but included other areas as well. 4-8 samples were collected from one island per sampling week. At each site, a one-gallon (3.8 L) sealable plastic bag was filled with leaf litter and this was brought back to the lab and emptied onto the mesh screen of the Berlese funnel. Samples were left to dry for approximately 3 days.	Collecting jars contained 95% ethanol.	Small litter-dwelling invertebrates such as ants, beetles, mites, springtails, spiders.

Table 2. Description of passive traps and protocols used for structured sampling during Boston Harbor Islands ATBI. The three-letter code for trap type in parentheses after the name was used for sample codes (see text).

Trap type (and code)	Description	Protocol	Killing agent/ Preservative	Target taxa
Bee bowl (BB)	A plastic 3.25 oz. (96 mL) cup; 70 mm diameter at the mouth; painted white, yellow, or blue. The colors are intended to mimic flowers and attract pollinators, primarily bees. (for videos on bee bowl techniques, http://www.youtube.com/watch?v=3X3VH-2s-kU)	On each island, 1-3 transects were set in open areas such as fields and along trails, typically where flowers were in bloom, on calm, sunny days. A transect was comprised of 12-15 cups laid out on the ground with 5 m between cups, alternating the 3 colors. Cups were left out for no longer than 24 hours, then collected. Contents of all cups within a transect were combined.	Bee bowls contained water and dish soap (to break the surface tension). Upon collection, contents were strained and transferred to a 4 oz. (118 mL) Whirl-Pak with 95% ethanol.	Bees and other pollinators such as wasps, flies, and beetles.
Malaise (MAL)	A large tent-like structure made of a synthetic mesh that works by intercepting the flight path of insects and directing them up to a peak in the tent where they enter (and cannot escape from) a plastic jar partially filled with preservative.	One trap was used per island and rotated from site to site each sampling week (unless the island was so small that sites were limited). At each site, the trap was erected at a habitat edge, on a large trail, or in another natural flight corridor. The trap was left running for approximately one week then closed until the next event.	1:1 mix of 95% ethanol (or water) and propylene glycol.	Flying insects such as flies, wasps, beetles, bees, some Hemipterans.

Table 2. Description of passive traps and protocols used for structured sampling during Boston Harbor Islands ATBI. The three-letter code for trap type in parentheses after the name was used for sample codes (see text).

Trap type (and code)	Description	Protocol	Killing agent/ Preservative	Target taxa
Mercury vapor light (MV)	A 175-watt mercury vapor bulb (set in a metal electrical housing) hangs above a white bed sheet which is suspended from a nylon line strung between two trees. The bulb is powered by a Honda EU1000i portable generator. Nocturnal insects are attracted to the light and land on the sheet.	Because we had only one mercury vapor light, it was rotated between islands during the season. It was set up at the edge of an open area (e.g., salt marsh or meadow), turned on at dusk, and run for several hours. Insects were picked off the sheet and immediately transferred to killing jars.	Killing jars contain ethyl acetate.	Nocturnal flying insects including most moths, some flies, wasps, and beetles.
Ultra-violet light (UV)	A 3.5 gallon (13.2 L) plastic bucket supports a stainless steel vane with four baffles which radiate from an 18" (45cm) upright black light bulb. Nocturnal flying insects are drawn towards the light and then directed downwards by the baffles to a metal funnel leading into the bucket where they are killed by a fumigant. The bulb is powered by a 12-volt car battery; a photoelectric switch turns the bulb on at dusk and off at dawn.	One trap was used per island and rotated from site to site each sampling week. Traps were located at habitat edges, often in open areas where the light was visible for a distance. Lights were left out overnight and collected the next day.	Vapona® pest strips (DDVP or 2,2- dichlorovinyl dimethyl phosphate)	Nocturnal flying insects including most moths, some flies, wasps, and beetles.

Additional intensive sampling

In June, 2006, we conducted a Coleoptera (beetle) bioblitz on Thompson and Lovells islands. Approximately 30 students, amateurs, and professional entomologists gathered to document as many beetle species as possible in 24 hours. Collecting methods for the bioblitz included pitfall traps, litter samples, and hand-collecting.

In 2009, A. Clark conducted field work for his undergraduate honors thesis on island ant diversity, hand-collecting intensively on Calf, Great Brewster, Langlee, Ragged, Spectacle, and Thompson islands. Each island was visited twice between June and August, and sampled at 6-9 sites (Clark et al. 2011).

In 2010, additional funds were received to conduct a pilot bee monitoring program in the park. For this project, we ran 16 bee bowl transects on nine islands/peninsulas (Bumpkin, Grape, Great Brewster, Peddocks, Ragged, Spectacle, Thompson, Webb, World's End) four times, between late April and mid-October. For these transects, we used the general protocol in Table 2, but we used 30 bowls, and left bowls out for a minimum of 6 hours (Rykken and Farrell in prep.)

Specimen processing, curation, and identification

Figure 2 summarizes the flow of specimens from field collection to data entry. Trap contents from wet traps (pitfall, malaise, and bee bowls) were brought back to the lab and stored in the refrigerator in their field preservative until processing. Any samples that had been waterlogged (e.g., pitfall traps) or showed signs of deteriorating were either processed immediately or transferred to new containers with 95% ethanol. We used 95% ethanol for all temporary and permanent invertebrate storage to better preserve DNA for possible future study. The dry catch from UV lights or net-collecting was stored in killing jars with ethyl acetate and processed quickly or transferred to the freezer.

Trap contents from each wet trap were emptied into a large (143 mm diam.) plastic sorting dish, along with the sample label, for sorting under a dissecting microscope. Specimens were identified to class, order, or family level, and sorted into smaller partitioned petri-dishes (90 x 15 mm). When the primary sorter finished with a sample, the sorting dish was checked by a second person for missed specimens, and the smaller petri dishes were also checked to make sure all specimens were correctly sorted. Once checked, specimens in each taxon were transferred to either 1 dram (3.7 mL) glass shell vials or 20 mL glass scintillation vials containing 95% ethanol, together with the sample code label.

Preparation of various taxa was prioritized on the basis of known taxonomic experts willing to identify specimens, and/or access to regional identification keys in the literature and online. Specimens in these taxa were prepared dry (pinned, point-mounted) or wet (ethanol vials) and given printed locality labels (Fig. 3a). Pinned and wet specimens (e.g., millipedes, spiders) were identified in the lab with available taxonomic keys (Appendix B), or sent out to taxonomists for identification (Appendix C). Upon identification, specimens also received printed determination labels (Fig. 3b). Latin names and authorities for species were taken from ITIS (Integrated Taxonomic Information System http://www.itis.gov/) or the most current literature available.

All specimens, dry and wet, identified and unidentified, were deposited in the permanent collections of the Museum of Comparative Zoology at Harvard University, Cambridge, MA.

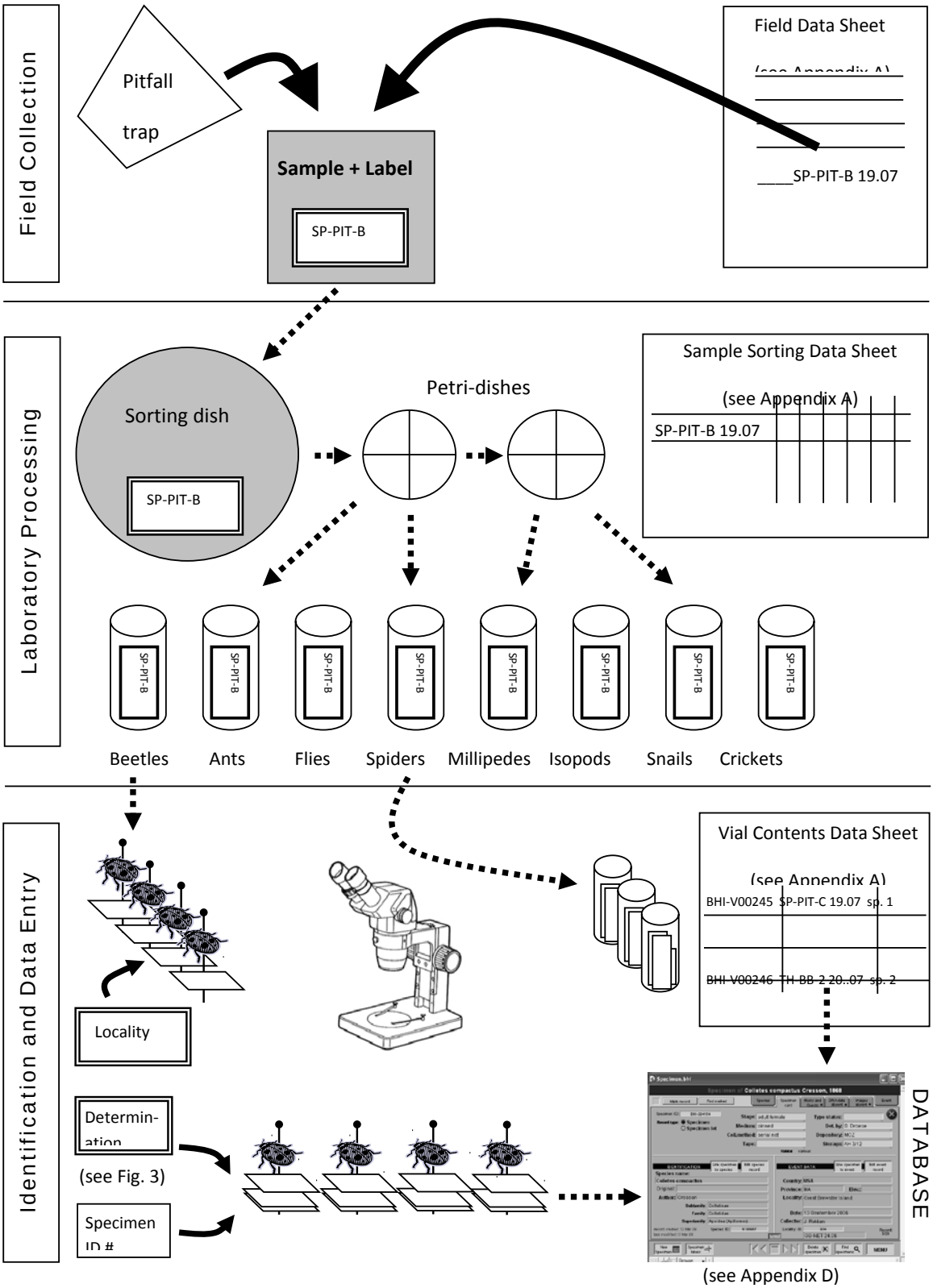


Figure 2 (previous page). The flow of specimens from field collection to data entry for Boston Harbor Islands ATBI. All data sheets shown in the figure are included in Appendix A, specimen labels are shown in larger size in Fig. 3, and Mantis database forms are presented in Appendix D.

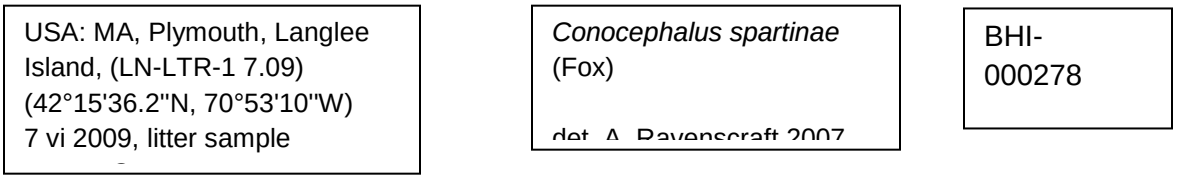


Figure 3. (a) Locality label for specimens, showing sampling location (including sample code), sampling date, method of collection, and name of collector. **(b)** Determination label, showing Latin genus and species name, the name of the authority (original describer of the species), the name of the determiner (the taxonomist who identified the specimen) and the year in which the specimen was identified. **(c)** Specimen ID number for pinned specimen. The locality, determination, and specimen ID labels were printed in 3, 4, and 7 point font, respectively.

Databasing

All invertebrates identified to genus or species level were entered into Mantis, a relational database used for the entomology collections at the MCZ. Mantis is a free and open collections-based biological database manager created with FileMaker software (Naskrecki 2008). In Mantis, every specimen record is linked to a sampling event with locality information, a species page, and higher taxonomic classification. Files are related through common ID fields. See Appendix D for more details on the database forms and all the fields used. Data for identified pinned specimens were entered into Mantis by reading relevant information directly off the locality and determination labels. Information for each vial containing identified specimens was first hand-written on a Vial Contents datasheet (Appendix A), and then later entered from the datasheet into Mantis. Each specimen or "lot" of specimens (i.e., specimens of the same species, sex, and life stage from one sampling event) was assigned a unique specimen ID number upon entry into the database, in the format BHI-###### for pinned specimens, and BHI-V##### for ethanol-preserved specimens. A third specimen label (Figure 3c), indicating the BHI number, was attached to the pin or inserted into the vial of all databased specimens (Figure 2).

Almost all species in the database were represented by high resolution images of one or more specimens. Images were produced using camera equipment and software programs (AutoMontage, Helicon Focus, and Adobe Photoshop) detailed in the E-Type Initiative protocols (http://insects.oeb.harvard.edu/etypes/Protocols.htm) with some recent modifications. Standard images for most insects included several habitus and close-up shots, as well as all labels associated with the specimen (Fig. 4). The database is publicly accessible and searchable on the ATBI project website (http://insects.oeb.harvard.edu/boston_islands/index.htm).

All geo-referenced specimen data (but no images) were ultimately transferred to the NPS biodiversity database, NPSpecies, in January, 2013. This entailed communicating with NPS data managers, matching the relevant fields from both databases, and exporting these data from Mantis into an Excel spreadsheet for transfer. Future updates to the database will be coordinated in a similar manner. All specimens at the MCZ are currently (May 2013) receiving barcodes and will be searchable in MCZbase (http://www.mcz.harvard.edu/collections/searchcollections.html).



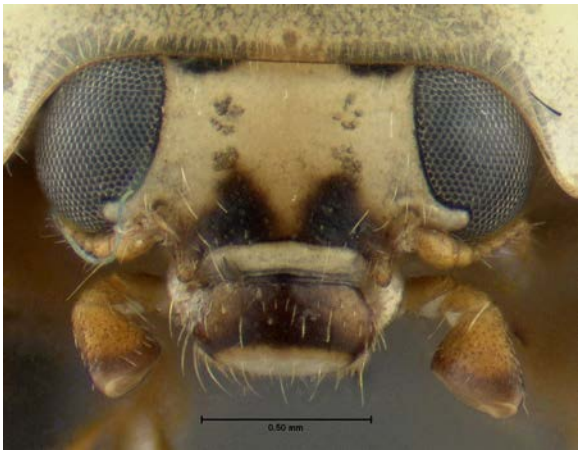
(a)



(b)



(c)



(d)



(e)

Figure 4. Standard images included in the database for all insect species: (a) dorsal habitus; (b) lateral habitus; (c) ventral habitus; (d) head-frontal; (e) labels. Additional images of key diagnostic body parts were included for various taxa. All images © 2012 The President and Fellows of Harvard College.

Quality assurance and control protocols

With tens of thousands of specimens being collected, sorted, curated, and databased by dozens of different people in the lab, consistent oversight and quality control protocols for each step of the process were critical to generating accurate and reliable data.

Sample codes

In order to ensure that locality information stayed with each specimen of a sample until it received a printed locality label, we devised an efficient sample code system (see above in Sampling design and techniques) where each sample was assigned a unique 8 to 10 digit code that was intuitive to create, quick to write, and indicated where, when, and how the specimens from that sample were collected. This code was created for each sample in the field, written on the field data sheet, and hand-written on labels that went inside all sample containers brought back to the lab. After sorting, the sample code labels accompanied specimens into vials and onto pins until they ultimately received printed locality labels (as in Figure 2). This assured that specimens were NEVER orphaned from their locality information. During the data entry process, the sample code was also an efficient means of linking a specimen to its locality information, and for searching samples.

Tracking and checking samples

Each sample brought back to the lab was logged onto a sample sorting data sheet and after sorting, all new vials of specimens generated from that sample were also recorded on this sheet, together with the sorter's initials (Appendix A). As described above, the sorting procedure for any sample included a primary sorter who identified specimens to order or family, and a checker who looked for missed specimens in the sample dish, and for misidentified specimens among the sorted sub-samples before they were transferred into vials.

Species identifications

Species identifications made by taxonomic experts were assumed to be valid, except in cases where the taxonomist expressed some uncertainty about a determination because of the physical condition of the specimen, its sex, or some other discrepancy (e.g., the species did not fit the closest description exactly, and might have been an unknown variant or possibly a new closely-related species). We documented these types of uncertainty in the database by adding "near" or "cf." to the species name if the uncertainty was at the species level, or indicating "?ID" on the specimen page if the uncertainty was at the specimen level. If the species was known to be undescribed, then we used "new sp." for the species epithet. If one or more specimens could only be identified to genus level, we called them "*Genus* sp." If specimens belonging to a genus belonged to more than one species and could be identified to morphospecies, we called them "*Genus* sp.1," "*Genus* sp.2," etc. Students under the guidance of specialists also made identifications (e.g., for Coleoptera: Carabidae; Orthoptera; Formicidae; Dermaptera), and the majority of these were confirmed by their mentors.

Data entry

All specimen data entered into Mantis were double-checked for accuracy by a second person. Data entered from vial contents data sheets (Appendix A) were checked via the unique BHI specimen code, and likewise, the unique BHI number allowed a second person to efficiently double-check data entry of all pinned specimens. Any person entering data into Mantis was required to "tag" each specimen page

with their initials and the date, so that data discrepancies picked up by the checker could be brought to their attention if necessary.

Statistical analyses

We restricted our statistical analyses to subsets of the data to answer questions about the completeness of our inventory, species distributions across islands, and relative proportions and distributions of introduced species. The criteria for selecting focal taxa were: (1) collectively, the taxa represented a diversity of feeding groups and dispersal abilities, (2) each taxon was well-sampled, with comparable sampling efforts across islands; and (3) within each taxon, most or all of the specimens had been identified by an expert.

We selected six focal taxa for all questions pertaining to species richness estimates and species distributions across islands (Table 3).

Table 3. Six focal taxa selected for species richness estimates and analysis of distribution patterns.

Taxon	Common name	Feeding mode	Dispersal mode
Apiformes	Bees	Herbivore (pollen, nectar)	Strong fliers
Carabidae	Ground beetles	Predator (some seed eaters)	Good runners; many can fly
Curculionoidea	Weevils	Herbivore (various plant parts)	All species crawl; some also fly
Diplopoda	Millipedes	Detritivore	All crawl; none fly
Formicidae	Ants	Scavenger (plants, animals, fungi)	All crawl; males and queens fly
Mycetophilidae + Keroplatidae	Fungus gnats	Fungivore (some spp. with predatory larvae)	Weak fliers

To estimate absolute species richness we used EstimateS version 8.2 (Colwell 2005) to calculate the Chao 1 species richness estimator with log-linear 95% confidence intervals (Chao 1984, 1987). The estimate is calculated as:

$$S_{Chao\ 1} = S_{obs} + F_1^2/2F_2$$

where S_{obs} is the total number of species observed in all the samples (including all collecting methods) pooled, and F_i is the number of species that have exactly *i* individuals when all samples are pooled. Therefore, as the number singletons and doubletons increases, the estimate increases.

To compare community similarity (i.e., number of shared species) between all pairs of islands we used Chao's estimator (corrected for unseen shared species) for Chao's Sørensen Abundance-based similarity index (calculated with EstimateS version 8.2; Colwell 2005). This index uses abundance rather than incidence data, and is based on the probability that two randomly chosen individuals, one from each island being compared, both belong to species shared by both samples (but not necessarily to the same species; Chao et al. 2005). The estimator for the index has been shown to reduce the negative bias associated with under-sampling, common in most inventories (for equations see Chao et al. 2005).
We used simple linear regression to examine the relationships between: (a) species richness of focal taxa and the area and isolation of islands; (b) plant species richness and island area; (c) community similarity

of focal taxa and distance between islands; (d) proportion of introduced species from *all* sampled taxa and the area and isolation of islands. We used plant species richness (from Elliman 2005) to represent habitat diversity for (b), in order to determine if island area and habitat diversity were strongly correlated. In conjunction with the analyses for (d), we made comparisons with plant data from the same islands, as Elliman (2005) had documented high proportions of introduced species, and Long et al. (2009) had found strong relationships with island isolation.

Most analyses included 8 islands and one peninsula (World's End), for a sample size $N = 9$. However, Grape Island was dropped from analyses for the focal taxon Mycetophilidae (fungus gnats) because identifications were incomplete, thus for these regressions $N = 8$. Island area measurements encompassed the terrestrial area above the high tide line and were obtained from Bell et al. (2002). Island isolation was measured as the shortest distance between an island and the mainland (0 km for World's End); all island-mainland and island-island distances were measured using GoogleEarth (earth.google.com). To account for the effect of island area when examining the relationship between species richness and island isolation, we followed the methods of Long et al. (2009). After regressing species richness as a function of island area and fitting a linear model, we regressed the residuals as a function of island isolation. Island area was $\log_{10}$-transformed because the largest measurement was two orders of magnitude larger than the smallest. All regressions were performed using Stata 12.0 Statistics/Data Analysis. R^2 values were considered statistically significant at a level of $\alpha = 0.05$.

To compare proportions of introduced species in Boston Harbor relative to the mainland, we focused on six beetle families meeting similar criteria to the taxa selected for other analyses (i.e., various feeding and dispersal modes, well-sampled, and complete identifications; Table 4). We focused on beetles because we were able to make comparisons to a published Coleoptera species checklist from Rhode Island (Sikes 2004; Sikes and Webster 2005), which we surmised would be similar to the fauna occurring in eastern Massachusetts. There is currently no comparable checklist for Massachusetts.

Table 4. Six Coleoptera (beetle) families selected for comparison of mainland and island introduced and native faunas.

Family	Common name	Feeding mode	Dispersal mode
Carabidae	Ground beetles	Predator (some seed eaters)	Good runners; many can fly
Chrysomelidae	Leaf beetles	Herbivore	Most can fly, but stay close to host plants
Curculionidae	Weevils	Herbivore (various plant parts)	Some species can fly
Elateridae	Click beetles	Various (herbivores, predators)	Most species can fly
Scarabaeidae	Scarab beetles	Various (incl. dung, carrion, plants)	Some species can fly
Staphylinidae	Rove beetles	Predator	Most species can fly

Outreach and Education

We took a variety of approaches to engage and educate students, citizen scientists, park visitors, and others about biodiversity in the microwilderness. Many of our ideas built on outreach programs and

products from other ATBIs currently underway, including projects at Great Smoky Mountains National Park (Nichols and Langdon 2007), and in the Dominican Republic (Farrell 2005).

Developing curricula

The education staff at Boston Harbor Islands national park area worked with scientists at the Museum of Comparative Zoology (MCZ) and educators at the Thompson Island Outward Bound Education Center to create curriculum-based field and classroom programs, primarily for middle school students.

Delivering engaging presentations

MCZ scientists made an effort to talk about the ATBI project and insect biodiversity to audiences of all levels and interests, including students, citizen scientists, park visitors, professional scientists, and others. Screen-sized high resolution images and 3-D images of all types of arthropods were used to bring these tiny denizens of the microwilderness up to a scale where they could be better appreciated and understood. Scientists and park rangers also staffed an ATBI booth with information and activities at local science and environmental fairs.

Creating educational products

We created many different products using our high resolution insect images, including posters, field guides, and games. The creation of these products was a collaborative effort between scientists, designers, and National Park Service (NPS) staff. Scientists were responsible for choosing the focal taxa, providing images, and writing content for games and field guides. Graphic designers were essential to making the products eye-catching, well-organized, and fun to use. Resource managers, educational rangers and others NPS staff were critical for defining potential audiences in the design stage, and disseminating the materials after production.

Providing opportunities to participate

Getting students and other members of the public out into the field to observe and collect insects is an effective way to increase their knowledge and appreciation of biodiversity. Teaming professionals with amateurs in collecting events can also bolster the enthusiasm among all participants. We organized a variety of collecting events for students, park visitors, citizen scientists and other interested public to work with scientists and park rangers to document invertebrate biodiversity in the park. We also provided paid and volunteer opportunities for students, interns, and citizen scientists to assist us in our structured sampling.

Because of the overwhelming amount time and effort required to process tens of thousands of invertebrate specimens over the course of an ATBI, we recruited high school and undergraduate students, adult volunteers and interns, park rangers and other staff to work in the lab to process, identify, and database specimens. Almost none of these workers had prior entomological experience. The opportunity to view invertebrates under magnification with a dissecting microscope, and to learn basic taxonomy, curation, and databasing skills was a transformative experience for many people of all ages.

Disseminating information to wider audiences

We relayed information about the ATBI to audiences beyond park boundaries, within and outside of the region, by creating a project website, and authoring and contributing to articles for a variety of professional and popular publications. Additionally, the ATBI was featured on a segment of a nationally broadcast television show.

Results

More than fifty students, interns, volunteers, and one scientist logged approximately 12,000 hours in the lab at the MCZ to process 76,839 specimens (in 20,053 separate lots). This did not include time spent by more than forty taxonomists to identify specimens. There are currently 1732 distinct species in the database (Appendix E), of which1643 have valid species epithets. The remaining 89 species include uncertain determinations ("cf." or "near" a valid species), undescribed (known and unknown) species ("new sp."), and distinct morphospecies (identified to *Genus* "sp. 1" and "sp. 2" etc.). Additionally, there are 83 taxa identified only to genus level (i.e., *Genus* "sp.") in the database, including groups of multiple species, and males or females that could not be reliably matched with identified species. We used 1732 distinct species in our analyses (including all distinct morphospecies within identified genera). The 1732 species were distributed among seven taxonomic classes, 24 orders, and 203 families (Fig. 5).

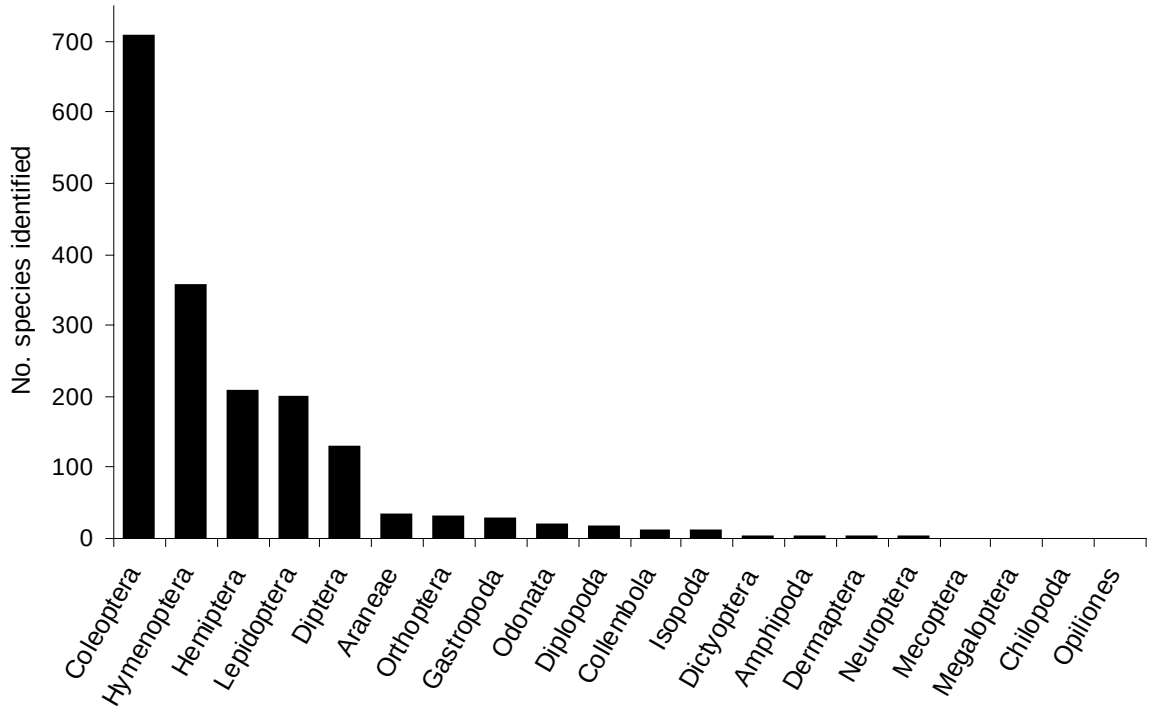


Figure 5. Number of species (including morphospecies) identified across four classes (Gastropoda, Diplopoda, Collembola, Chilopoda) and 16 orders (within three classes: Arachnida, Insecta, and Malacostraca) during the Boston Harbor Islands ATBI. Coleoptera = beetles; Hymenoptera = wasps, ants & bees; Hemiptera = true bugs & hoppers; Lepidoptera = moths & butterflies; Diptera = flies; Araneae = spiders; Orthoptera = crickets, grasshoppers & katydids; Gastropoda = snails & slugs; Odonata = damselflies & dragonflies; Diplopoda = millipedes; Collembola = springtails; Isopoda = sowbugs & pillbugs; Dictyoptera = cockroaches & mantids; Amphipoda = scuds or beach fleas; Dermaptera = earwigs; Neuroptera = lacewings; Mecoptera = scorpionflies; Megaloptera = alderflies, dobsonflies & fishflies; Chilopoda = centipedes; Opiliones = daddy long-legs or harvestmen.

As expected, we documented far more species of beetles (Coleoptera) than of any other order, because Coleoptera are the most diverse order of insects in nature. However, the number of species documented

for each order or class reflects only the specimens that were identified (and the availability of taxonomists to work on particular groups), and does not take into account all the specimens that were collected but remained unidentified (Fig. 6). We estimate that approximately 160,000 specimens were collected over the six years of the ATBI, and of those, more than half (~84,000) remain unidentified. Most of the unidentified specimens are in the orders Hymenoptera (~14,000), Diptera (~61,000), and Araneae (~4000; Fig. 5), and these specimens have not been sorted beyond order level.

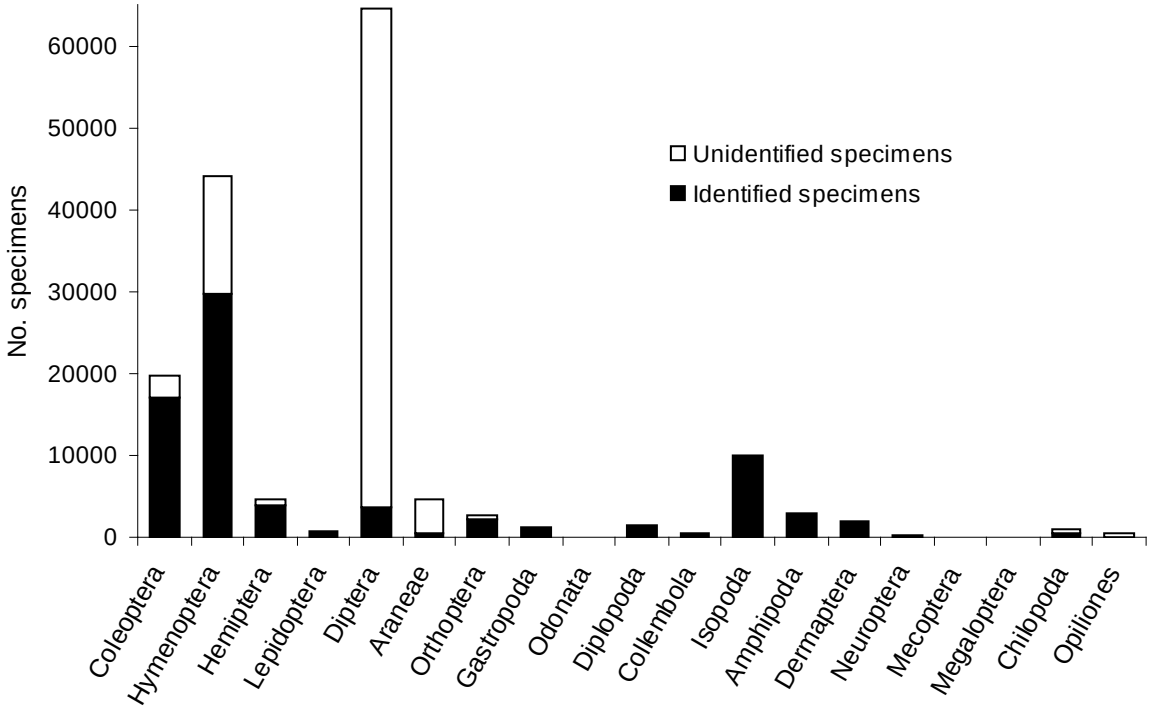


Figure 6. Number of identified specimens and estimated number of unidentified specimens collected in four classes (Gastropoda, Diplopoda, Collembola, Chilopoda) and 16 orders (within three classes: Arachnida, Insecta, and Malacostraca) during the Boston Harbor Islands ATBI. See Fig. 5 for common names of taxa.

Species of special significance

The following species, arranged alphabetically by order (family in parentheses), are of particular interest. For additional species notes on ground beetles (Carabidae) see Davidson et al. 2011. Species with asterisks are suspected to be new North American, U.S. and/or Massachusetts records.

Order Araneae

Dysdera crocata (Dysderidae). This was one of the most commonly collected spiders on the islands, and a spider species we prioritized for identification. It is widespread in eastern North America, and known to specialize on isopods (sowbugs) as prey. As almost all the isopods we collected are introduced, it is no surprise that this important predator is also introduced.

Sphodros niger (Atypidae). While this impressive mygalomorph purseweb spider is not unknown in Massachusetts, it is rarely collected (H. Levi, pers. comm.). There are existing records from Martha's

Vineyard, Cape Cod, and Walden Pond in Concord (Edwards and Edwards 1990). These elusive spiders spin silk tubes that extend from their belowground burrow into the leaf litter, and capture prey—primarily millipedes—that walk over the tube (Edwards and Edwards 1990).

Trochosa ruricola (Lycosidae). This Palearctic wolf spider was first recorded in North American on Cape Cod in 1993 (Edwards 1993). It has since spread into Canada and at least as far as the Midwest (Prentice 2001). Its virtually indistinguishable sister species, *Trochosa terricola*, has a Holarctic distribution. It is suspected that *T. ruricola* may be displacing the native *T. terricola* in some areas (Lalongé et al. 1994). We have not yet sorted all of the specimens of these two species from our collections, but it will be interesting to see which is more abundant and/or widespread on the islands.

Order Coleoptera

**Amara aulica* (Carabidae). Our new state record for this ground beetle represents the southern limit of its known range. The species was introduced to northeast Canada and was known only from New Hampshire and Maine in the U.S. (Davidson et al. 2011).

**Amara bifrons* (Carabidae). The same pattern is evident for this introduced ground beetle as for *A. aulica* (Davidson et al. 2011). We collected over 800 individuals on Spectacle Island, suggesting that this species is actively colonizing the island.

**Apenes lucidulus* (Carabidae). Our new state record for this native ground beetle represents the northeastern limit of its known range (Davidson et al. 2011).

Badister transversus (Carabidae). This wetlands-associated ground beetle is listed as a species of special concern with the Department of Energy and Environmental Conservation in Connecticut (http://www.ct.gov/dep/cwp/browse.asp?A=2702; accessed 10-8-2012), but not in Massachusetts. We collected just one specimen on Spectacle Island.

Bembidion nigropiceum (Carabidae). This ground beetle was first recorded in Massachusetts in 1897 and described as a new species, *B. puritanum* Hayward. It was not collected again in North America. In 1980, while at the MCZ, Erwin and Kavanaugh (1980) looked at the original specimens and synonymized them with a European coastal species, *B. nigropiceum*. They speculated that the species had come over with the shipping trade in the 1800's, but had not persisted, thus explaining why no one had seen the species again in almost a century. Our rediscovery of *B. nigropiceum* on three islands in 2007, after more than 100 years, suggests that the beetle, which is small, flightless, and restricted in habitat, may have been present but overlooked for all that time (Davidson and Rykken 2011).

**Laemostenus terricola terricola* (Carabidae). This large, flightless ground beetle is native to Europe and Asia. It is previously known from both coasts of Canada but not from the U.S. (Davidson et al. 2011).

**Epitrix ?pubescens* (Chrysomelidae). This flea beetle is native and widespread in Europe, but previously unrecorded from North America. It feeds on *Solanum* species. Identification is still awaiting confirmation (E. Riley, pers. comm.).

*_Longitarsus rubiginosus_ (Chrysomelidae). This European flea beetle has been considered as a potential biocontrol agent for the exotic weed, _Convulvulus arvensis_, field bindweed (CPHST 2010). The only known previous North American records of this species are from Canada (E. Riley, pers. comm.),

Neogalerucella calmariensis (Chrysomelidae). The black-margined loosestrife beetle was one of two European beetles intentionally introduced to North America in 1992 to control the invasive wetland plant, purple loosestrife (_Lythrum salicaria_; Malecki et al. 1993). Release sites were in the Northeast, the Northwest, and in Canada. Purple loosestrife is known from ten islands in Boston Harbor (Elliman 2004); we found the beetles on Grape, Lovells, Spectacle, and Thompson Islands.

*_Paria sexnotata_ (Chrysomelidae). The juniper Paria feeds on _Juniperus_ species, and in the park it is associated with the critically imperiled maritime juniper woodland/shrubland natural community on Langlee and Ragged islands, and also on World's End (Elliman 2005). These likely represent the first state records for this species (E. Riley, pers. comm.)

Phyllotreta striolatus (Chrysomelidae). The Palearctic striped flea beetle feeds primarily on plants in the family Brassicaceae and is now a serious agricultural pest in many states. Fifteen preserved specimens were found in an excavated colonial privy site in Boston, dating between 1675 and 1700, confirming a very early introduction of this species to North America (Bain and LeSage 1998). It likely arrived in Boston with ballast, dunnage, or food consumed by ship passengers from Europe (see Discussion section).

*_Agriotes lineatus_ (Elateridae). This click beetle is a pest of many agricultural crops in Europe, and previous North American records are limited to eastern and western Canada, Washington, and Oregon (Douglas 2011). Our collections from the park represent new records for Massachusetts and the eastern U.S.

Ampedus ?new sp. (Elateridae). One specimen of this click beetle, collected in a malaise trap on World's End, may be a new undescribed species, according to Serge LaPlante, from the Canadian National Collection of Insects. He did not recognize it, although it is also possible this is an introduced species with which he was not familiar. The specimen remains at the MCZ.

*_Athous haemorrhoidalis_ (Elateridae). This click beetle is an agricultural pest species from Europe, the only other documented records in North America are from Ontario, Canada (Douglas 2011).

*_Athous ?bicolor_ (Elateridae). This click beetle is also native to Europe, and would represent the first record for North America. DNA barcoding is planned to confirm the identification (H. Douglas, pers.comm).

*_Lordithon obsoletus_ (Staphylinidae). Prior to our discovery of this rove beetle in the park, it was known as a southern/coastal plain species, with Long Island as its northern limit (A. Brunke, pers. comm.).

*_Sepedophilus ?immaculatus_ (Staphylinidae). This rove beetle is native to Europe, and had not previously been recorded in North America. We collected one specimen on Grape Island. Genitalia were not dissected, so further confirmation is necessary (A. Brunke, pers. comm.).

Order Hemiptera

**Hishimonus sellatus* (Cicadellidae). This leafhopper is native to Asia and serves as a vector for a mulberry pathogen in its native range. Our collection on Snake Island is the first documented record for North America.

Order Hymenoptera

Myrmica rubra (Formicidae). The European fire ant, or ruby ant, was first recorded in North America by Wheeler (1908) in the Arnold Arboretum in Boston, MA. He recommended that this "belligerent immigrant be kept under observation" because of its populous colonies, aggressive sting, and preference for cultivated soil such as lawns. Since then, the ant has appeared in five southeastern Canadian provinces, six northeastern states, and Washington state (Wetterer and Radchenko 2011). Most records in the U.S. have been made during the last ten years, and there are increasing reports of large outbreaks of very aggressive ants, including in coastal Maine (Groden et al. 2005). It is thought that perhaps these nuisance ants are from a different genetic strain that was introduced more recently (Wetterer and Radchenko 2011). *Myrmica rubra* was documented on 13 islands in Boston Harbor, making it one of the most widespread species in our survey. To our knowledge, it is not considered a nuisance on the islands, and so these ants may be descended from the original populations introduced in the early 20th century.

**Myrmica scabrinodis* (Formicidae). This ant is native to Europe and our records from World's End and five islands likely represent the first confirmed North American records (Clark et al. 2011).

**Pyramica metazytes* (Formicidae). This tiny (less than 2mm), cryptic ant was described quite recently by Bolton (2000), and was known previously from only southeastern states, including Mississippi, Louisiana, Alabama, and Tennessee. Our new state record for Massachusetts represents a significant northward expansion of this species' known range.

Order Julida

Thalassisobates littoralis (Nemasomatidae). This millipede is native to coastal parts of western Europe down to the Mediterranean and is known in North America only from one site in Virginia and possibly one previous record from Massachusetts (Hoffman 1999). Because *T. littoralis* is a littoral (beach) species and prone to drifting, there is some uncertainty whether it arrived in North America with or without the aid of human transport (Enghoff 1987).

Order Lepidoptera

Cycnia inopinatus (Erebidae). The unexpected Cycnia is listed as Threatened with the Massachusetts Natural Heritage and Endangered Species Program (MNHESP). This implies that the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range, or to be declining or rare as determined by biological research and inventory, and is likely to become Endangered in Massachusetts in the foreseeable future (321 Code of Massachusetts Regulations 10.03). The moth is a specialist on *Asclepias* (milkweed) throughout its range, which extends from the Atlantic coastal plain to the Ohio Valley and upper Midwest (Bess 2005). It is associated with high quality coastal scrub habitat, dry barrens, and native grasslands, and tends to be local and uncommon where it occurs (Bess 2005).

Oligia strigilis (Noctuidae). The marbled minor was introduced to Canada from Europe in the 1980's. The first records for the U.S. were collected by Mello in his Boston Harbor Island surveys in 2001, and

simultaneously by other collectors on Cape Cod (Mello 2005). We collected this species on Great Brewster and Lovells islands, as did Mello, and also on Thompson Island, where Mello did not detect it previously.

Order Symphypleona

Sminthurinus elegans (Katiannidae). According to taxonomist E. Bernard, the 23 specimens of this springtail (Collembola) collected on Thompson Island have noticeably different patterning than the specimens he is familiar with from the interior U.S. He suggests they may be one of a similar-looking group of springtail species from Europe.

Order Stylommatophora

Pupilla muscorum (Pupillidae). Despite its common name, the widespread column is scarce in Massachusetts, previously recorded only in Plymouth County (T. French, pers. comm.). However, the species has a Holarctic distribution. This snail is a known calciphile, dependent on calcium carbonate in the soil (Kerney 1999). We collected it on Grape and Calf islands.

Species richness estimates for focal taxa

Millipedes were the least diverse group of the focal taxa, with 15 species; bees were the most diverse, with 172 species. The observed species richness for millipedes equaled the estimated absolute species richness predicted by the Chao 1 richness estimator, and fungus gnat species richness fell within the 95% confidence interval of the estimate (Fig. 7). The observed species richness for each of the other groups (ants, weevils, ground beetles, and bees) comprised 75-82% of the estimated absolute richness, and fell below the 95% confidence interval (Fig. 7).

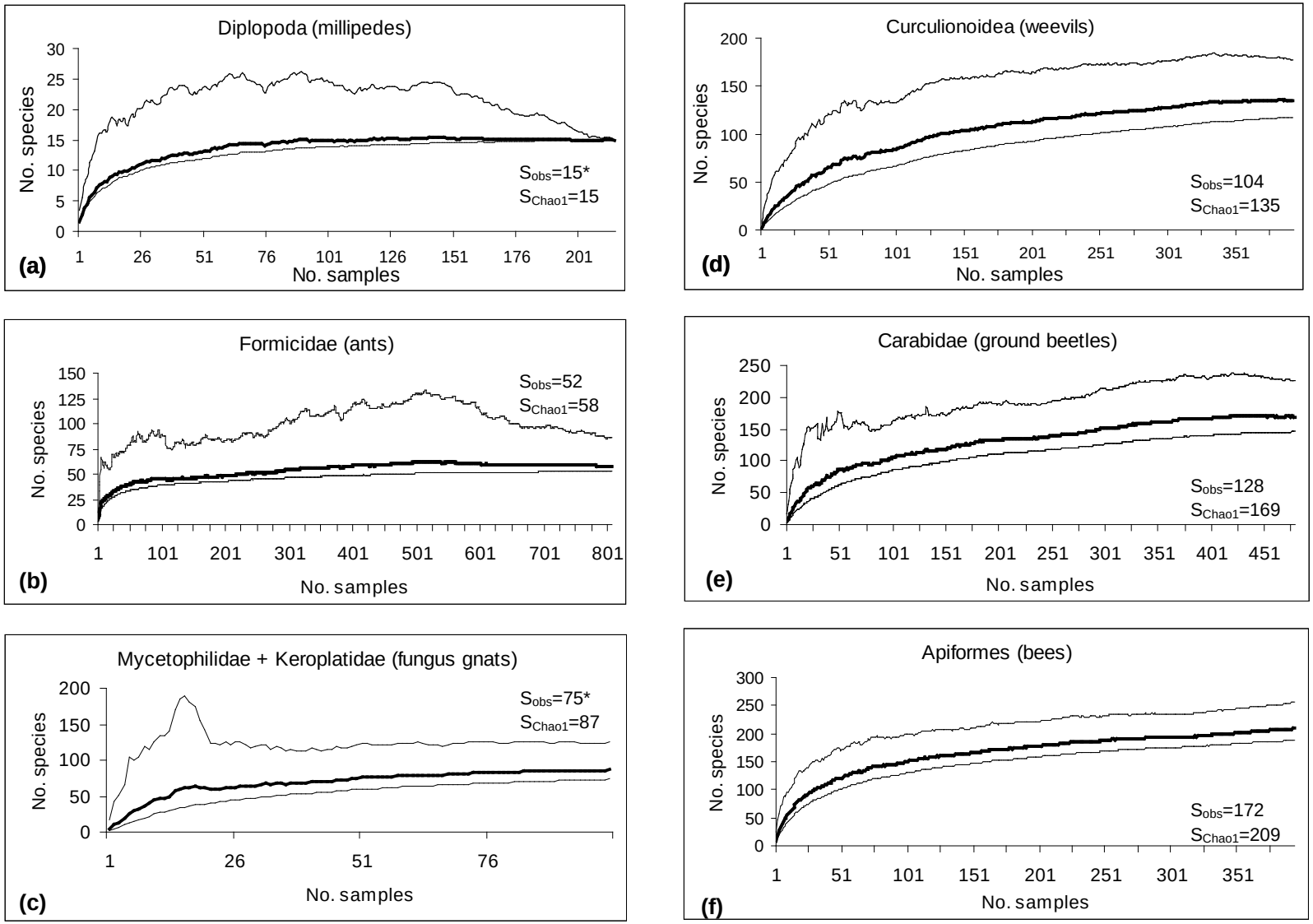


Figure 7. Species richness estimates for six focal taxa using the Chao 1 richness estimator (thick line) with log-linear 95% confidence intervals (thin lines). (a) and (f) use the bias-corrected Chao 1 formula, and (b), (c), (d), (e) use the classic Chao 1 formula. S_{obs}=observed number of species and S_{Chao1}=estimated absolute number of species. (* S_{obs} falls within 95% confidence interval of S_{Chao1})

The effects of island area and isolation on species richness

The species richness of weevils, ground beetles, and bees showed a significant positive correlation with terrestrial island area (Fig. 8). For ants, despite one influential negative outlier (SP) there was also an obvious positive relationship. Plant species richness, representing habitat diversity, was also positively correlated with island area (plot not shown; N = 9 islands, R^2 = 0.627, P = 0.011, S = 95.00 (log(ha)) + 44.23). The species richness of ants and fungus gnats, after adjusting for island area, showed a significant negative relationship with island isolation (distance from the mainland) (Fig. 9).

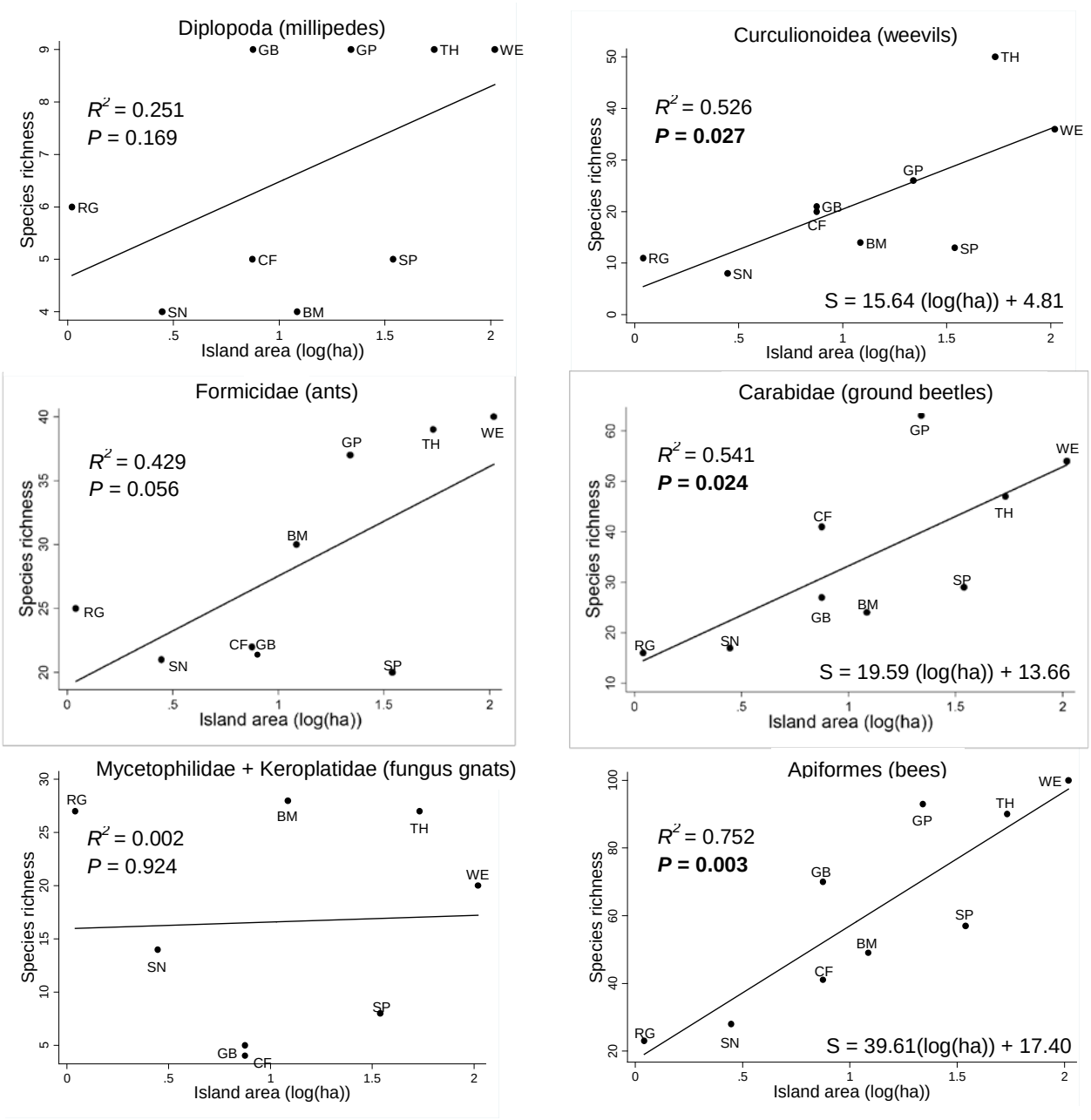


Figure 8. The relationship between species richness and log-transformed area for six focal taxa on eight islands and one peninsula (WE) in Boston Harbor (N = 9 for all taxa except fungus gnats (N = 8)). Fitted simple linear regression lines are shown. P-values < 0.05 are in bold; S = species richness.

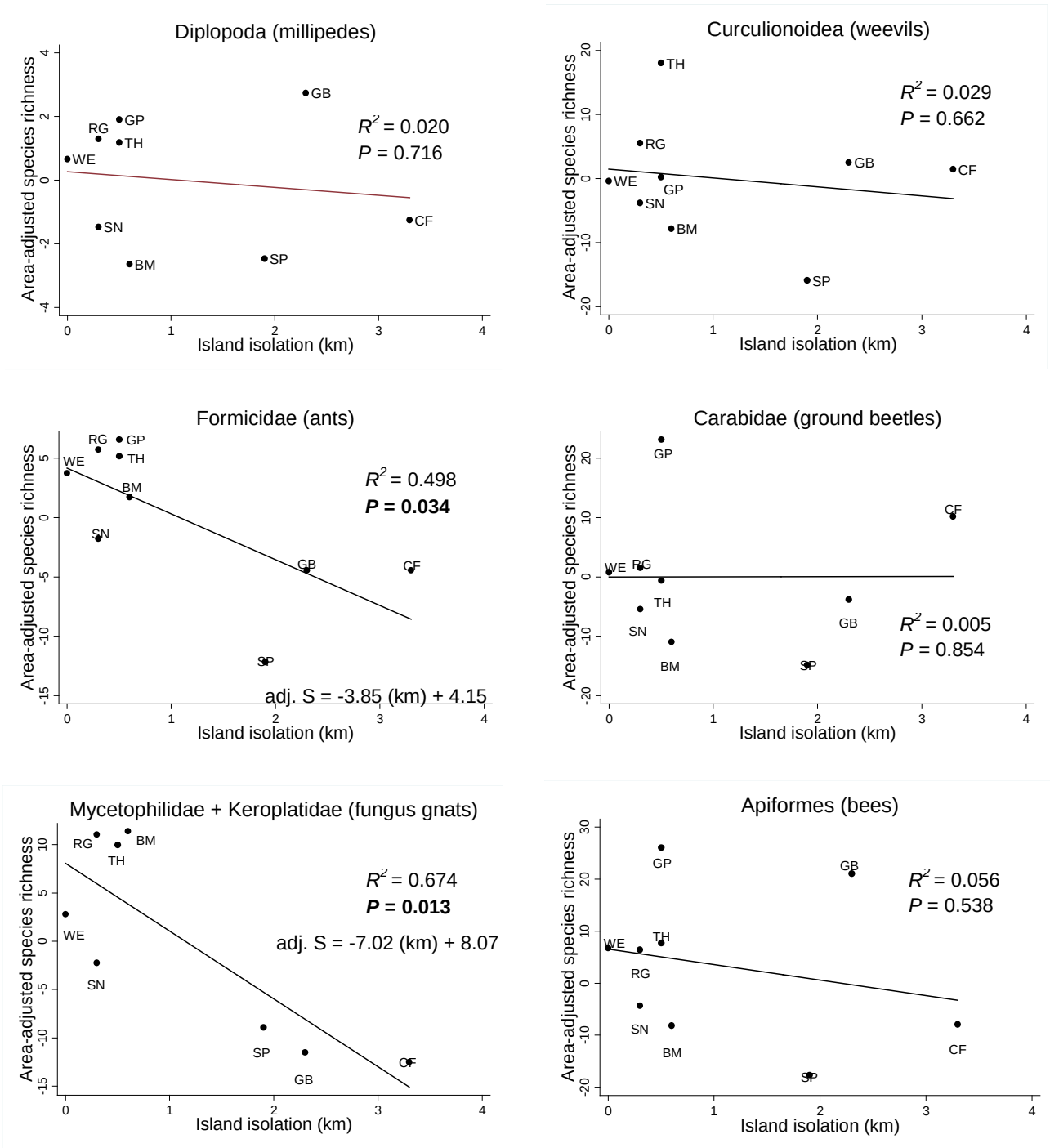


Figure 9. The relationship between area-adjusted species richness (i.e., the residuals from the species richness-island area regressions) and island isolation (distance from the mainland) for six focal taxa on islands and one peninsula (WE) in Boston Harbor (*N* = 9 for all but fungus gnats (*N* = 8)). Fitted simple linear regression lines are shown. *P*-values < 0.05 are in bold; adj. S = area-adjusted species richness.

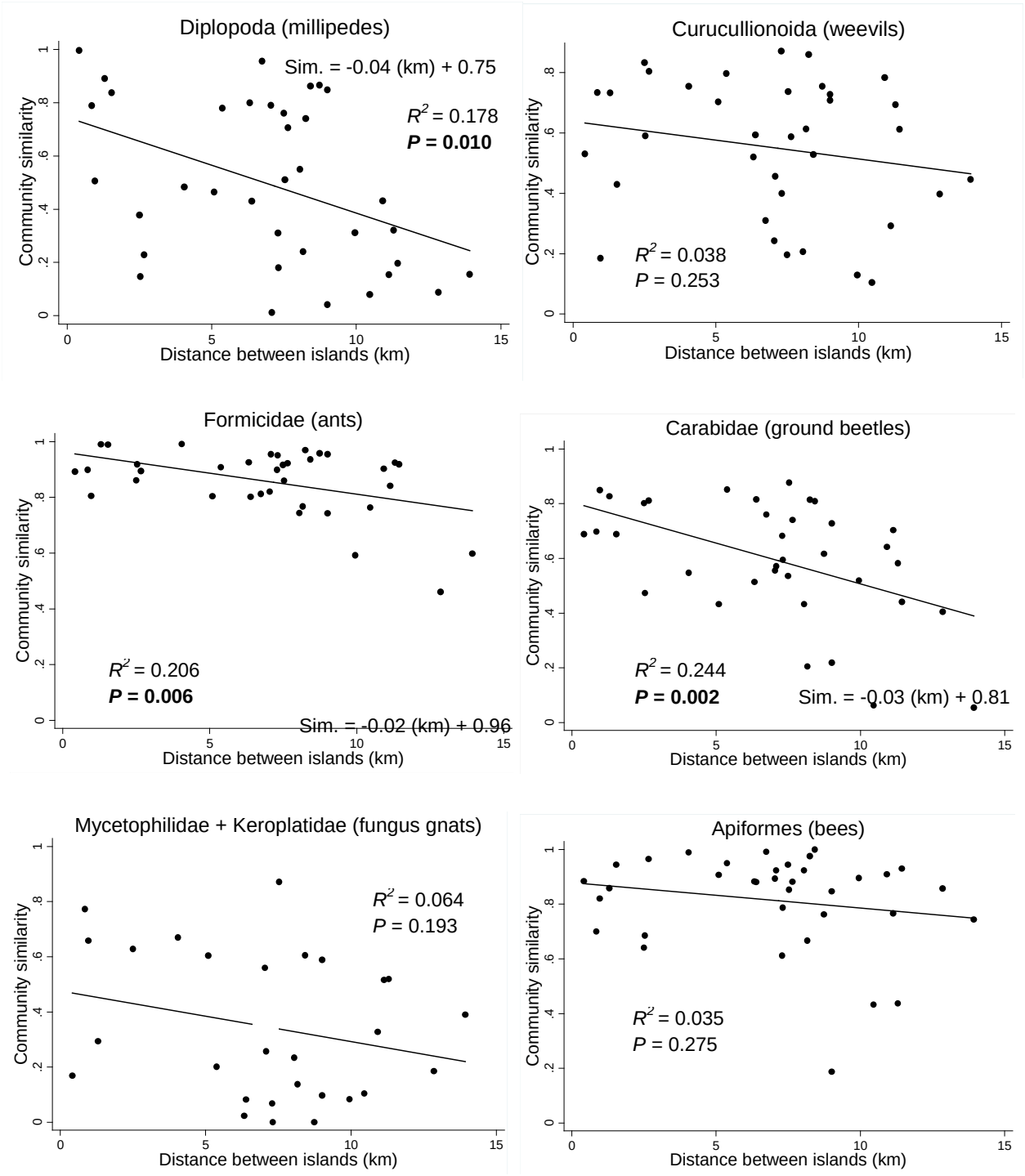


Figure 10. The relationship between community similarity (Chao's estimator for Chao's Sørensen Abundance-based similarity index) and distance between islands (and one peninsula (WE)) for six focal taxa on islands in Boston Harbor (N = 9 islands for all but fungus gnats (N = 8 islands)). Fitted simple linear regression lines are shown. P-values < 0.05 are in bold; Sim. = community similarity

The similarity of focal taxa communities between islands

The similarity in species composition between pairs of islands showed a significant negative correlation with increasing distance between islands for millipedes, ants, and ground beetles (Fig. 10). The mean community similarity between pairs of islands was higher for bees and ants than for any other focal taxa, and fungus gnats were the least similar among islands on average (Fig. 11).

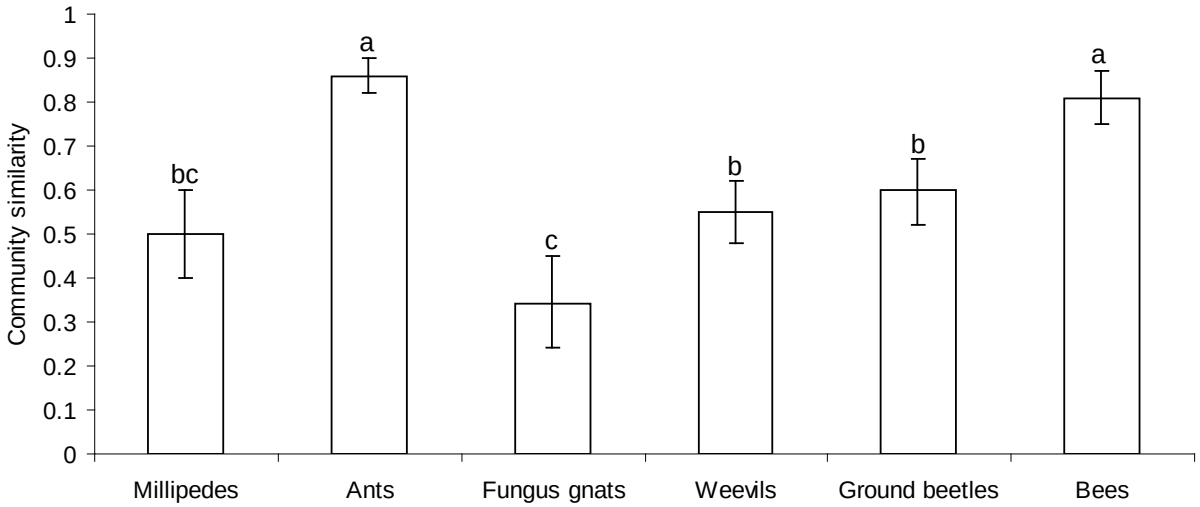


Figure 11. Mean community similarity (± 95% CI) for six focal taxa between pairs of islands in Boston Harbor. *N* = 9 islands, or 36 island-pair comparisons for all taxa except fungus gnats (*N* = 8 islands, 28 island-pair comparisons). Two or more taxa sharing a letter (a,b,c) indicates overlap of 95% CI.

Introduced species

Of a total of 1732 species, 239 species were known or suspected to be non-native to eastern North America (Appendix E), representing 13.8% of the total. Among these were several new U.S. and North American records (see notes about each species in the previous section; ? indicates that confirmation of species determination is still pending): *Laemostenus terricola terricola* (Coleoptera: Carabidae); *Longitarsus rubiginosus* and *Epitrix ?pubescens* (Coleoptera: Chrysomelidae); *Athous haemorrhoidalis* and *Athous ?bicolor* (Coleoptera: Elateridae); *Sepedophilus ?immaculatus* (Coleoptera: Staphylinidae); *Hishimonus sellatus* (Hemiptera: Cicadellidae); *Myrmica scabrinodis* (Hymenoptera: Formicidae).

Taxa with relatively high proportions of introduced species included several of the ground-dwelling non-insect arthropod groups: order Isopoda (sowbugs—6 of 8 species known to be introduced), class Diplopoda (millipedes—13 of 15 species introduced), and class Gastropoda (snails/slugs--10 of 28 species introduced). Two families within the Hemiptera also had many introduced species: Miridae (plant bugs—6 of 15 species introduced) and Cicadellidae (15 of 103 species introduced).

Comparing proportions of introduced beetle species between Boston Harbor Islands npa and the mainland

Not surprisingly, species richness for the six focal Coleoptera families in Boston Harbor Islands npa was lower than that documented for all of Rhode Island, ranging from 26% (Scarabaeidae) to 52% (Elateridae) of the Rhode Island fauna (Table 5). While the order of families with the lowest to the highest proportion of introduced species was almost the same between the two sites, the proportion of introduced species

was much higher in Boston Harbor Islands npa than in Rhode Island for all families, ranging from 1.9 times (Curculionidae) to 3.1 times (Staphylinidae) higher (Table 5). We documented between 1 and 19 introduced species for each family that have not yet been detected in Rhode Island (Table 5).

Table 5. Comparison of proportions of introduced species in six Coleoptera families between Boston Harbor Islands npa and Rhode Island, and number of introduced species found on Boston Harbor Islands that were not recorded for Rhode Island (Rhode Island data compiled from: Sikes 2004; Sikes and Webster 2005).

	Boston Harbor Islands npa			Rhode Island	
Family	Total no. spp.	Proportion introduced spp.	No. unique introduced spp.	Total no. spp.	Proportion introduced spp.
Elateridae	49	0.06	3	94	0.02
Carabidae	128	0.14	6	324	0.06
Chrysomelidae	58	0.22	4	189	0.07
Scarabaeidae	27	0.30	1	103	0.13
Staphylinidae	87	0.31	19	216	0.10
Curculionidae	95	0.40	16	192	0.21

Comparing the distribution of native versus introduced species across islands

The mean number of islands on which introduced species occurred was higher than for native species, across all beetle families except Elateridae (Fig. 12). Introduced scarabaeid beetles were the most widespread group, with each species occurring on an average of five islands. Similarly, the mean abundance for introduced species across islands was higher than for native species across all families except for Elateridae (Fig. 13). A large range of variability in species abundances, especially for Carabidae and Scarabaeidae was indicated by the 95% confidence intervals, suggesting that differences in the means for most of the taxa are inconclusive.

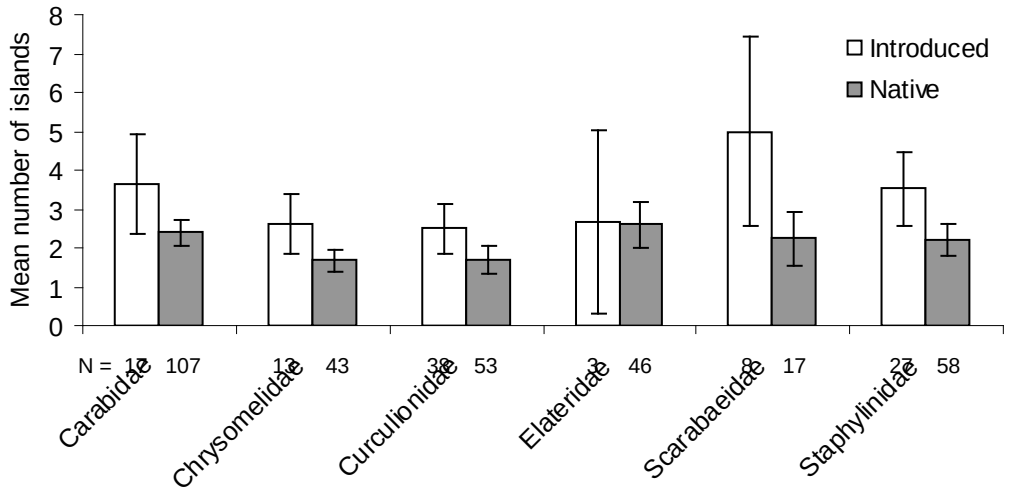


Figure 12. Mean number (± 95% confidence interval) of islands (out of 9, including one peninsula (WE)) on which introduced versus native species occur for six beetle families in Boston Harbor Islands npa. N = number of species in each group used to calculate the mean.

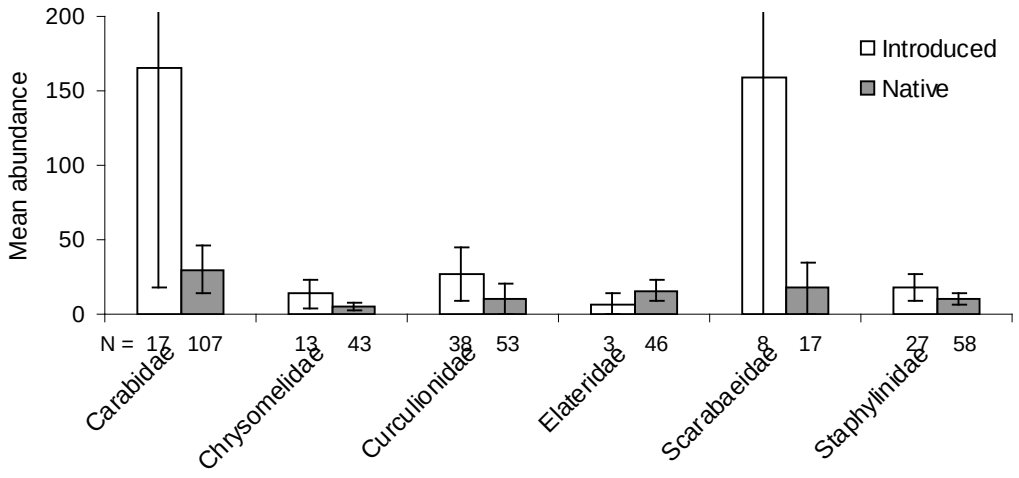


Figure 13. Mean abundance (± 95% confidence interval) of introduced versus native species of six beetle families on eight islands and one peninsula (WE) in Boston Harbor. N = number of species in each group used to calculate the mean. Confidence intervals for introduced Carabidae (± 147.16) and Scarabaeidae (± 231.16) were cut off at the top in order to view data for other families more clearly.

While the proportion of introduced invertebrate species (with *all* taxa combined) showed some positive correlation with island isolation (Fig. 14), it was not as strong as for introduced plants.

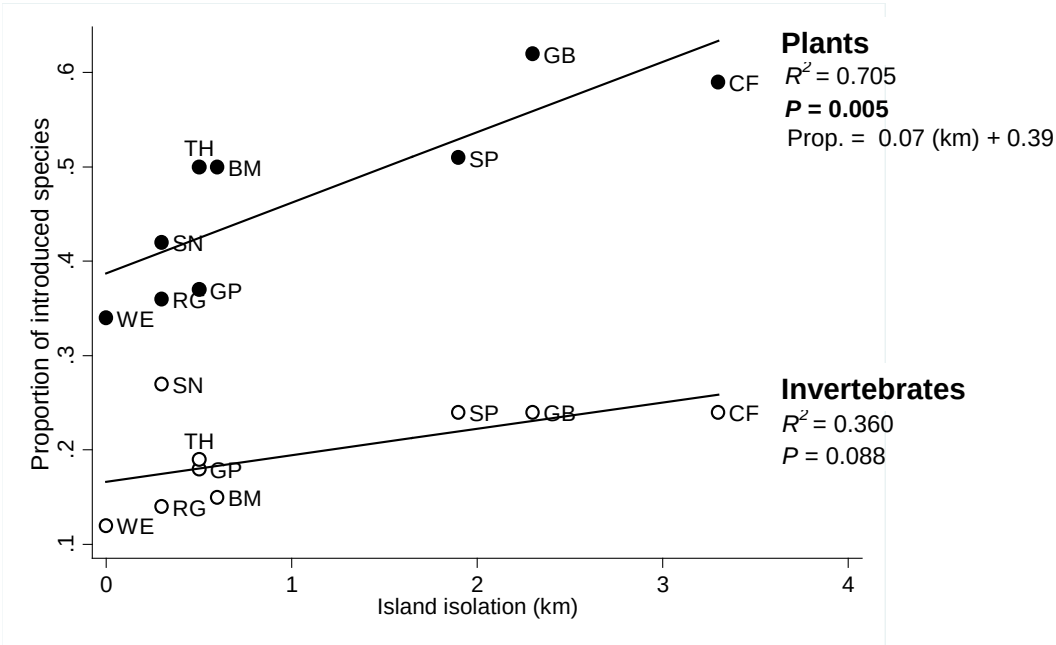


Figure 14. The relationship between the proportion of introduced species on an island or peninsula (WE) and that island's distance from the mainland (isolation) in Boston Harbor. Fitted simple linear regression lines are shown for vascular plants (data from Elliman 2005) and all invertebrate taxa; *N* = 9 for both regressions. *P*-values < 0.05 are in bold; Prop. = proportion of introduced species.

Outreach and Education

Field and classroom curricula

Scientists at the MCZ and educators from Boston Harbor Islands npa collaborated to develop curricula, primarily targeted at middle school students.

Field curriculum

Field activities were facilitated with three "Bug Kits" that classes carried with them to the islands. Each kit was encased in a large, durable suitcase on wheels, making it easily transportable on city sidewalks, the ferries, and along island trails (Appendix F). The kit contained collecting equipment (e.g., nets, beating sheet, vials, aspirators), field guides, data sheets, and sorting/observing tools (e.g., trays, forceps, magnifiers; complete list of contents in Appendix F). Students were typically divided into three groups, with each group working in a different habitat type (meadow, forest, or beach). Time was spent collecting specimens, then sorting through the catch, identifying specimens to order level using simple guides (Appendix F). A data sheet was used to tally specimens and classify them into feeding groups. If time permitted, the three habitat groups came together to compare results. Field "expeditions" were led by NPS education rangers in collaboration with teachers. Students were made aware that they were participating in an ongoing inventory project, and all specimens collected during these activities were contributed to the ATBI. Identified specimens from student collections eventually made it into the ATBI database, and students could later search for them in the online database. Many of the expeditions followed "catch and release" protocols.

Between 2008 and 2011, park rangers led 29 one-day field expeditions for 1,080 Boston Public School students. ATBI field activities were also a core element in environmental programs hosted by Thompson Island Outward Bound Education Center (TIOBEC) that were led by NPS rangers and TIOBEC staff. This included programs for 619 Boston Public School 4,6, and 7th grade students, either as part of overnight expeditions or in summer school programs. Additionally, 1,737 5th and 6th grade students from outlying school districts participated in ATBI field activities as part of multi-day programs.

While NPS rangers were responsible for leading most of the field activities on the islands, in 2006 and 2007, teachers from the Boston area gathered for one day to learn about island insect biodiversity and to become familiar with the Bug Kit so that they could then bring their own classes out. In 2010, a group of environmental educators from Massachusetts also received training in classroom and field ATBI activities.

Classroom curriculum

For many years, NPS rangers have delivered island-themed programs in classrooms in the Boston public school district, and we collaborated to develop a new curriculum focused on island invertebrates and the ATBI. The program included an "Exploring insect life" slide presentation developed by rangers, a role-playing skit that emphasized trophic connections between various organisms and their environment, and an activity in which students could observe and learn about real insect specimens from the islands. Because students could not go out to collect insects in winter and early spring, specimens were brought into the classroom in the form of "bug cubes." These 2" x 1.5" x 1" (5.1 x 3.8 x 2.5 cm) cubes were made of polyester resin and each contained an actual insect specimen collected in the park (only duplicate specimens of cataloged species were used for the cubes; Appendix F). An intern at the MCZ manufactured 160 cubes, and they were boxed in sets of 10 or 20 specimens. In the classroom, each

group of students worked with a set to identify the specimens (many to family level) and assign them to feeding groups, using laminated identification guides designed to accompany the cubes. Additionally, rangers worked one-on-one with teachers to ensure that their lesson plans incorporated explicit skills relevant to meeting curriculum standards. For instance, they developed a tally sheet on which students calculated proportions, percentages, and fractions of specimens assigned to various feeding groups (Appendix F), thus incorporating critical math skills into the lesson plan.

Between 2008 and 2011, NPS rangers made 71 visits to 5th grade classrooms in the Boston Public School system, presenting the ATBI program to a total of 2,061 students.

Presentations, trainings, interactive events and displays

Scientists, park resource managers, and students involved with the ATBI delivered more than 30 oral presentations to audiences ranging from garden clubs to land managers to academic scientists (Appendix G). Additionally, we held 13 trainings for educators, including biology teachers, natural history volunteers, and Outward Bound instructors (Appendix G).

Scientists, park staff, and youth from the Island Ambassadors (an environmental stewardship program associated with the park) hosted informational booths at eight science and environmental fair events, as a way to disseminate information about the ATBI, the park, and local arthropod diversity (Appendix G). Children and adults alike were engaged with activities using real insect specimens, 3D images (Fig. 15), and insect sounds.

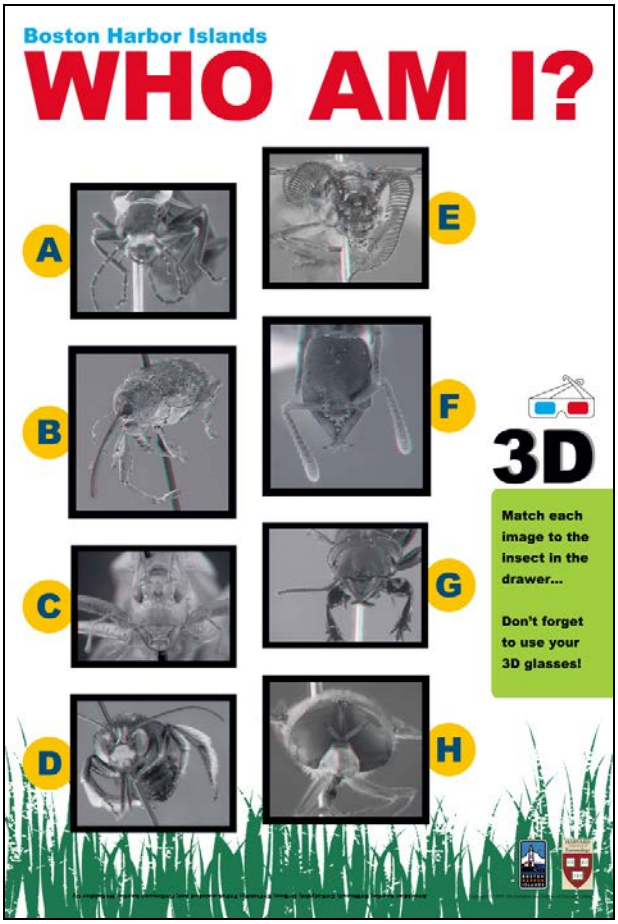
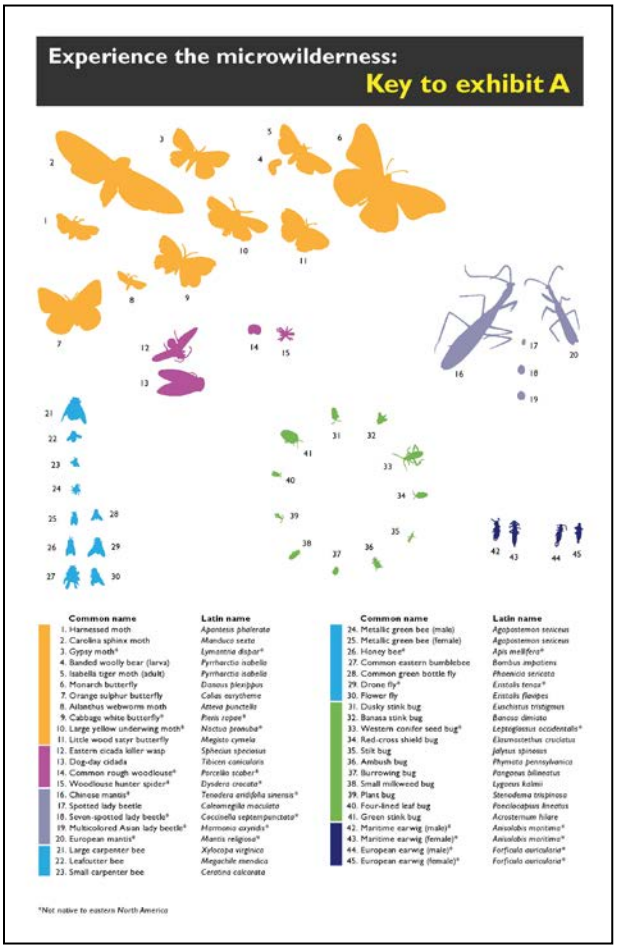




Figure 15. An example of a poster (actual size 24" x 36 ") created using high resolution images of invertebrate specimens collected during the Boston Harbor Islands ATBI. This poster was used as part of an activity to match 3D images with actual pinned specimens. (Additional posters in Appendix H.)

We created a more permanent installation for the park visitor center on Spectacle Island, featuring an informational panel, several ATBI biodiversity posters, complimentary field guides, and a cart with a pinned insect display featuring 100 commonly-encountered species (Fig. 16). The specimens were arranged in groups exploring various biological themes (e.g., Masters of deception, Special diets, What's in a name?, Singing insects, Freshwater origins, Does it sting?) and accompanying guides provided species names (Fig. 16).





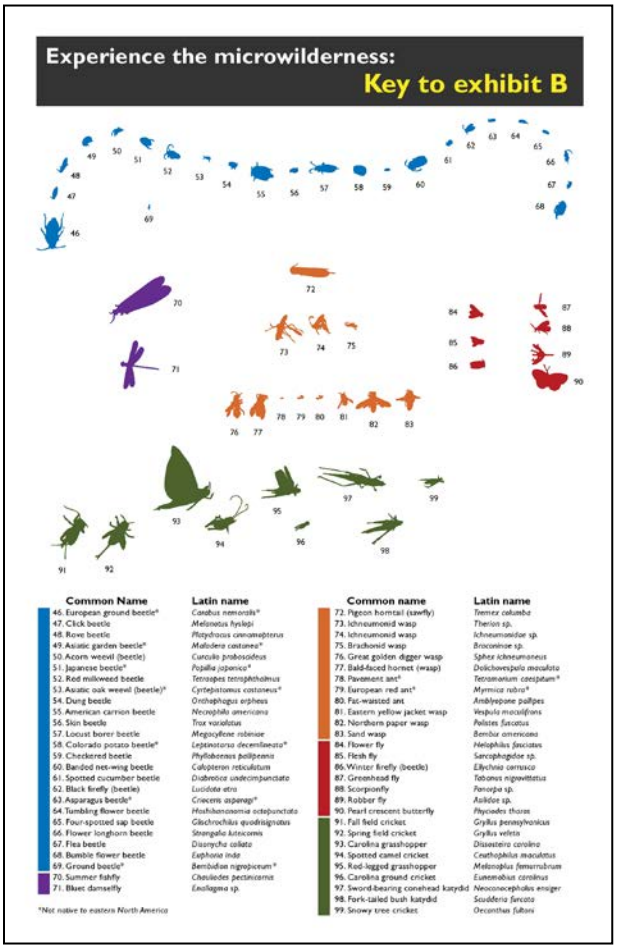


Figure 16. A rolling cart custom built to display insect specimens collected in Boston Harbor Islands npa. The top of the cart is glass, which covers two museum drawers of pinned insects. Specimens were

arranged in thematic groups. The laminated guides silhouetted the arrangement of the pinned specimens and provided common and Latin species names for all specimens.

Posters, games, and field guides

We created 11 posters using high resolution images of insects collected during the Boston Harbor Islands ATBI (Fig. 15; Appendix H). The posters featured: moths, carabid beetles, ants, bees, weevils, leafhoppers, a dragonfly, an assortment of predators, PredatOR Prey (a complement to the card game described below), bee genera (a complement to the bee guide described below), and 3D images. The 3D poster was used for an activity at public events in which participants tried to match pinned specimens with large 3D images of their heads, using magnifying lenses and 3D glasses (Fig. 15). The other posters were distributed to educators for their classrooms, to taxonomists and other scientists for their labs, and to the park for putting on display in visitor centers and ferries. Some posters were for sale through the Boston Harbor Islands Alliance website, several were auctioned off at fundraisers, and many more were given away as gifts to interns, volunteers, and to the public at special events.

A collaborative effort between students in the Island Ambassador program, scientists, park staff, and a graphic designer resulted in the creation of a PredatOR-Prey playing card game (Appendix H). The deck contained 40 cards representing matching pairs of invertebrate predators and their prey, with several playing options. Each card also included some information on the ecological role or natural history of the featured species. Three thousand decks were printed, with the majority going to school-aged children, but many were also distributed to educators, ATBI participants, and scientists. The graphic designer, Hull Creative Group, received an American Graphic Design Award for their work in 2008.

We also used high resolution images to produce two fold-out field guides to insects and other invertebrates of the Boston Harbor Islands (Appendix H). The first guide included images and measurements of 61 commonly-encountered invertebrates, and was intended to be distributed to park visitors, students, and other interested public. The second guide focused on the identification and natural history of 24 bee genera. The bee guide included information on the appearance, and foraging and nesting habits of different bee genera, and was targeted at citizen scientists, rangers, naturalists, gardeners, and other bee enthusiasts.

ATBI participants

Fieldwork in the park

Students, interns, citizen scientists, park staff, and the general public actively assisted scientists collect invertebrates in the park.

Interns and students

We hired one full-time intern (with NPS funds) to assist with field work in 2006, and another in 2007, and these interns also helped with sample processing in the lab (see below). The ATBI provided an easily accessible, real-world field experience for many more high school and college students, who worked as volunteers and/or conducted their own research in conjunction with the ATBI (see below). The proximity of the park to the Harvard University campus, and the opportunity to contribute specimens to an ongoing inventory, also drew several undergraduate biology classes to the islands for one-day field trips.

Citizen scientists

Citizen scientists contributed to the inventory effort in various ways. For the "charismatic megafauna" of the insect world (i.e., butterflies and dragon/damselflies), we recruited skilled amateurs from local butterfly and odonate clubs to conduct surveys for these taxa in the park. We provided the surveyors with data sheets (to ensure data consistency) and free ferry passes, and let them devise their own sampling schedules as time allowed. Some odonate vouchers were collected (and deposited in the MCZ), but in most cases, data came from observations, and some photo vouchers (for butterflies).

Citizen scientists who regularly help with other park stewardship projects (such as invasive plant control or bird monitoring) were recruited to assist with various ATBI field activities, including a bee monitoring project. The bee monitoring entailed setting up transects of "bee bowls" (see methods) to catch bees on warm sunny days, and the relatively simple protocols together with the pleasant conditions, made this an ideal field activity for volunteer citizen scientists.

We recruited youth from the Island Ambassador program to assist us in surveying for the elusive ground beetle, *Bembidion nigropiceum*. After receiving some training in the field on how to identify the appropriate beach microhabitat, aspirate the tiny beetles out of the gravel, and fill out the data sheet, Island Ambassadors and their NPS mentors then surveyed several other islands for the beetle over the course of the summer.

The park and the MCZ collaborated to conduct two "bioblitzes." The first event was held on Lovells Island in June, 2005, and was led by Drs. Brian Farrell and E.O. Wilson from the MCZ. Students from Odyssey High School and youth from the Island Ambassadors program spent a day collecting insects. The second bioblitz was held on June 10-11, 2006, on Lovells and Thompson islands. The event was focused on beetles, with a goal of documenting as many species as possible within 24 hours. Despite unrelenting rain and winds, more than 30 students, amateurs, and professional scientists worked side-by-side, collecting beetles and processing and identifying specimens in the lab. The final tally was approximately 70 identified species.

Park rangers and the general public

On islands where state and national park rangers resided over the summer (e.g., Bumpkin, Grape, and Spectacle islands), we recruited rangers to assist us with tending and emptying various types of insect traps, in order to increase the overall efficiency of our sampling and collecting schedule. Although rangers varied in their levels of interest and available time, this arrangement was also beneficial to ATBI outreach goals because a few rangers learned first-hand about how the traps worked, became more aware and informed about insect biodiversity, and could then pass on this knowledge and enthusiasm to park visitors. Additionally, park rangers on Spectacle Island were provided with one of the ATBI field collecting kits (see Field Curriculum section above), and were encouraged to lead insect observing (and sometimes collecting) activities for interested park visitors.

More structured opportunities for the general public to get involved with the ATBI included an annual (2007-2010) "Family Fun Day" sponsored by the Boston Harbor Islands Partnership, during which families with school-aged children joined the ATBI lead scientist and interns for an afternoon on Spectacle Island to collect and observe invertebrates. As with all insect-collecting activities associated with the ATBI, specimens were deposited at the MCZ to be added to the project database.

Various groups visiting the islands learned about and participated in the ATBI. This included the Boston Boys and Girls Club who joined in on a night collecting trip on Bumpkin Island (2007), and staff from Earthwatch Institute who also collected insects on Bumpkin Island (2006).

Lab work at the Museum of Comparative Zoology

We provided opportunities for more than 50 students, volunteers, and interns to work in the lab at the MCZ. Of these, 35 people worked at least 20 hours each, and 11 people worked more than 200 hours each. Almost no one had previous experience working with invertebrates, and we provided training in coarse-level arthropod taxonomy, specimen curation techniques, and using a biodiversity relational database. Many people also received further training in the taxonomy of particular taxa, and in state-of-the art techniques for imaging insects.

In all, almost 6,000 hours were logged in the lab by non-MCZ staff over six years. Eleven interns (logging 2750 hours) were paid with NPS project funds to work in the lab, and these included recent college graduates, park rangers in the "off season," and mid-career people with diverse backgrounds, looking for part-time work. A further 16 people (logging 1200 hours) were paid for their work through sources outside of the ATBI project, including nine Harvard College students (MCZ Entomology Department funds), six high school students from the Island Ambassadors program, and one high school student participating in a summer program at the Massachusetts Institute of Technology (MIT) with the Research Science Institute. More than 20 volunteers (logging 2000 hours) were also instrumental to lab productivity, and included four high school students (home-schooled or summer volunteers), 13 college students (including 11 Harvard College students, some of whom transitioned to paid work), one graduate student, and one "retired" off-season park ranger who logged an impressive 756 hours over the course of three years.

Student projects

As mentioned above, one of the important benefits of coordinating the ATBI from a university, and of conducting an ATBI in an urban park so close to many other universities, was that a large pool of students had immediate access to a local biodiversity research project, including easily accessible field sites and an established, well-equipped lab (including equipment for high-resolution digital imaging and DNA sequencing). Initially, all interested students assisted with ongoing inventory work, and, if inspired, were then encouraged to develop their own research questions in conjunction with the ATBI. Several high school and college students conducted independent research over the course of the ATBI, many of these projects and honors theses (listed below) won prestigious prizes and one was published in the peer-reviewed literature (Clark et al. 2011).

Sung Won Cho, The Groton School, Groton, MA ('10). *An analysis of effects of habitat structure on the ground beetle (Coleoptera: Carabidae) communities of two sites in eastern Massachusetts, USA.* Intel Science Talent Search 2011 finalist.

Maesen Churchill, Lincoln East High School, Lincoln, NE ('10). *Integrating island biogeography and ecological niches: a study of beetle diversity in Boston Harbor Islands national park area.* MIT Research Science Institute participant.

Adam Clark, Harvard College, Cambridge, MA ('10). *Ant communities of the Boston Harbor Islands National Recreation Area.* Senior honors thesis; winner of the Hoopes Prize.

Stephanie Madden, Harvard College, Cambridge, MA ('08). *Biogeography and molecular ecology of ground beetles on the Boston Harbor Islands.* Senior honors thesis.
Alison Ravenscraft, Harvard College, Cambridge, MA ('09). *Evaluation of the acoustic niche hypothesis: a quantitative analysis and comparison of sound spectrum partitioning in tropical and temperate communities.* Senior honors thesis.

MCZ faculty and staff contributions

While one post-doc/research associate at the MCZ was employed full-time to coordinate the ATBI, considerable in-kind support also came from the project PI (B. Farrell) and several staff members at the MCZ. Faculty assistants designed and maintained the website, and also assisted in the design and production of posters and field guides. The curatorial and lab assistant maintained the database, provided technical support for extracting and exporting data, trained students and interns in techniques for digital imaging and DNA sequencing, and performed the majority of the specimen imaging.

Disseminating information to a wider audience

We created a project website (http://insects.oeb.harvard.edu/boston_islands/) with several objectives: to inform scientists, educators, resource managers, students, park visitors, and others about ATBI objectives, methods, and accomplishments; to provide public access to the ATBI database (including all images); and to acknowledge project participants (including taxonomists). The site also features student projects, and includes a "Bug of the Month" page which profiles some of the commonly- encountered species collected in the park.

ATBI results and activities were featured in a number of publications including professional science journals, regional magazines, and newsletters.

Clark, A.T., J. Rykken, and B.D. Farrell. 2011. The effects of biogeography on ant diversity and activity on the Boston Harbor Islands, Massachusetts, U.S.A. PLoS ONE 6(11): e28045.

Davidson, R.L., and J.J. Rykken. 2011. Rediscovery of *Bembidion (Lymnaeum) nigropiceum* (Marsham) (=*puritanum* Hayward) (Coleoptera: Carabidae: Bembidiini) in Massachusetts, with remarks on biology and habitat. ZooKeys 147: 487-496.

Davidson, R.L., Rykken, J.J., and B.D.Farrell. 2011. Carabid beetle diversity and distribution in Boston Harbor Islands national park area (Coleoptera: Carabidae). ZooKeys 147:497-526.

Kowalski, K.M. 2007. Bio-Blitz! Odyssey Magazine 16:38-39.

Rykken, J.J., and R.L Davidson. 2008. Carabid beetle rediscovered in Massachusetts. Newsletter of the Vermont Entomological Society 61:7-8.

Rykken, J.J. 2011. Discovering the microwilderness of the Boston Harbor Islands. Massachusetts. Wildlife Magazine LXI(1):26-35.

Rykken, J.J., and M. Albert. 2012. Boston Harbors Islands All Taxa Biodiversity Inventory: integrating science, education, and management in an urban island park. Park Science 29:26-28.

Rykken, J.J., and B.D. Farrell. 2013. Discovering the microwilderness in parks and protected areas. Pages 306-322 *in* R.H. Lemelin, editor. The management of insects in recreation and tourism. Cambridge University Press, New York, NY.

Valigra, L. 2008. Boston Harbor insect census: looking to tiny creatures to tell the big story on the environment. Gulf of Maine Times 12:1,12.

The ATBI was also featured in a segment of the PBS children's television program Fetch!, produced by WGBH. The episode (no. 310) premiered in 2008.

Discussion

Diversity and distribution of invertebrates across the park

Meeting inventory objectives

From a scientific perspective, the Boston Harbor Islands ATBI had two main goals: (1) to document as many species as possible in the park, and (2) to describe and compare patterns of species distribution across islands and with the mainland. These two broad goals of biodiversity inventory have been categorized as "strict inventory" and "community characterization" by Longino and Colwell (1997), and while the former typically relies on active sampling by taxonomic experts to generate species lists, the latter uses structured, replicated methods to capture and compare variability over space and time. At a minimum, strict inventory requires the collection and identification of just a single specimen per species; the expert will sample in many different habitats, looking for rare species as well as common ones to build up the list. Structured sampling, on the other hand, typically relies more on passive trapping techniques that can be deployed by non-specialists. In this process, large specimen sample sizes that incorporate species redundancy and spatial/temporal replication are critical for documenting and comparing community patterns. If the only goal is to compare communities, then identifying specimens to morphospecies may be adequate for completing the inventory (Oliver and Beattie 1996). An additional benefit to structured sampling is that trap samples are easily repeatable and can be compared to future samples collected in the same way, while biases associated with active sampling by one or more experts are far more variable, making true replication difficult to achieve.

In the Boston Harbor Islands ATBI, we attempted to combine both "traditional" and "structured" sampling methods to the extent possible, following the model of the Great Smoky Mountains ATBI (Nichols and Langdon 2007). However, luring taxonomists to collect in this small, urban park proved challenging, and so the bulk of the sampling was done by non-specialists (i.e., students, volunteers, and interns), using traps to document species and characterize communities. We sent curated specimens to taxonomists to make identifications, thus valid species names are associated with most of the specimens in the current database. The trade-off for relying on structured trapping versus active sampling by experts is that, for instance, among the more diverse focal taxa (weevils, ground beetles, bees), observed species richness fell short (75-82%) of estimated absolute species richness. For less diverse taxa, such as millipedes, ants, and fungus gnats, structured sampling yielded the same number, or nearly as many species as the statistical estimates for absolute richness. Among non-focal groups, this was likely also the pattern. For instance, we can be fairly certain that most if not all of the species of isopods, amphipods, earwigs, and megalopterans have been documented on the islands we sampled, but more diverse taxa such as rove beetles (Staphylinidae) or many of the diverse wasps and flies are likely under-sampled by our surveys. Additional types of traps or collecting may also have brought in a higher diversity of taxa. For instance, we did not use pheromone or bait traps which target taxa such as bark beetles (Curculionidae: Scolytinae), sap beetles (Nitidulidae), carrion beetles (Silphidae), mosquitoes (Diptera: Culicidae), and ticks (Ixodida) far more efficiently than pitfall or malaise traps. Similarly, a structured branch beating and/or sweep netting protocol may have sampled a higher diversity of leaf feeders such as leaf beetles (Chrysomelidae) and leaf hoppers (Hemiptera: Cicadellidae) than our sporadic active sampling and passive trapping methods. Among spiders, web-spinners (e.g., Araneae: Araneidae) are best collected by hand, while our pitfall traps targeted ground-dwelling species (e.g., Araneae: Salticidae, Lycosidae).

Another bias in the current biodiversity database resulted from the necessity of prioritizing the processing and curation of a subset of specimens from a collection of more than 160,000 based on the availability of taxonomists. This also resulted in a sizeable backlog of specimens that are currently stored in vials of ethanol at the MCZ. Dipterans (flies) represent the largest backlog, and parasitic wasps in the suborder Apocrita are virtually absent in the database. Specialists for these taxonomically challenging groups are few, and often over-burdened by requests for their identification skills. Unfortunately, unidentified and/or uncurated specimen backlogs are the rule rather than the exception in comprehensive invertebrate inventories using structured sampling protocols (Parker and Bernard 2006), and this points both to the need for longer-term funding for ATBIs (especially for processing, curation, and taxonomy), and to the need for more skilled taxonomists. This overall shortage of specialists for the most diverse groups, aptly described as the 'taxonomic impediment' (Taylor 1983), coupled with an ongoing decline in the field of taxonomy as specialists retire and fewer students enter the field (Hopkins and Freckleton 2002), will need to be addressed if ATBIs are truly expected to document "all species."

Drivers of species richness across islands

The classic model of island biogeography (MacArthur and Wilson 1967) predicts that the number of species inhabiting islands is a balance between immigration and extinction. Species richness should be positively correlated with island size, primarily because extinction rates are lower on larger islands with more robust populations; and richness should be negatively correlated with island isolation, because islands further from the mainland receive fewer immigrants. Habitat diversity has also been proposed as an important driver in determining species richness on both oceanic islands and in terrestrial fragments (Báldi 2008; Jonsson et al. 2009). While it is often the case that island area and habitat diversity are positively correlated (Kohn and Walsh 1994), some island studies have found one factor or the other to be of primary importance (Nilsson et al. 1998; Jonsson et al. 2009). On the Boston Harbor Islands, island area was strongly, positively correlated with plant species richness, which we used as a surrogate for habitat diversity. Thus, the effects of the two variables are interchangeable in the following discussion.

As predicted by the theory of island biogeography, island area was strongly correlated to species richness for bees, weevils, ground beetles, and ants. Only fungus gnats and millipedes showed weak or no relationship with area. Most fungus gnats are abundant in forests, where their larvae develop in fungi associated with dead wood or in rodent or bird nests, and adults congregate in dark, moist places (Vockeroth 1981; Økland 1996). Thus, fungus gnats are dependent on a particular type of habitat, not just habitat diversity per se. Their diversity was highest on islands with more forest or woodland cover (Ragged, Bumpkin, and Thompson), and lowest on the outer islands, Calf and Great Brewster, which are dominated by shrubs. Millipedes, the least diverse taxon with only 15 species, 13 of which are introduced, have relied on humans or drift to disperse across islands, and thus are dependent on opportunistic colonization events. The number of species found on any island ranged between 4 and 9, with relatively small islands, such as Great Brewster, able to support as many species as larger islands.

Several islands were positioned as "outliers" in species-area relationships (Fig. 8). For instance, Spectacle Island had far fewer ant species than its size would predict. In fact, Spectacle Island fell below the fitted regression line to a lesser or greater degree for all six taxa. This island is a reclaimed land fill that was replanted only within the last decade, and as such, its habitat diversity is still quite low, and colonization is likely in its initial stages. For ground beetles, Grape Island had far more species than

predicted, and Calf Island also had more. Each of these two islands has a freshwater wetland that we sampled with pitfall traps. Twelve species of hygrophilic ground beetles were collected at the edge of the freshwater marsh on Grape Island and/or from a small, seepy meadow on Calf Island, and nowhere else on the islands. Similarly, Nilsson (1988) found that wet forests were a strong driver for carabid species richness on lake islands in Sweden. Lastly, Thompson Island had a far more diverse weevil fauna than its size predicted. Thompson Island is one of the few islands with stands of mature forest, including the introduced English Oak (*Quercus robur*). These and other oaks provide habitat for five species of acorn weevils (*Curculio*) that were collected only on Thompson and Langlee (a small island also dominated by mature woodland, including oaks). Other oak-associates, such as species of *Conotrachelus* were found only on Thompson and Langlee islands. These outliers suggest that factors such as human disturbance and the occurrence of particular habitat types can strongly influence species richness patterns.

Island isolation was strongly negatively correlated with species richness for just two taxa, fungus gnats and ants. Fungus gnats are generally weak, short-range fliers (Mesler et al. 1980), so it is possible that distances between the mainland and more distant islands present a greater barrier to dispersal. However, it is notable that the islands closer to the mainland (see Fig. 9) were those with stands of mature forest (the habitat preferred by fungus gnats), while the three most isolated islands (Spectacle, Great Brewster, and Calf) have essentially no forest cover. This pattern of decreasing forest cover with increasing isolation is not unique to the Boston Harbor Islands. Ås (1984) documented three zones of vegetation cover across an archipelago in the Baltic Sea, with conifer and deciduous forest decreasing on islands as distance from the mainland increased from 5 to 40 km. In Boston Harbor, trees are scarce and shrubs dominate the outer islands, in part, because they are more exposed to wind and salt spray (Elliman 2005). As discussed previously, Spectacle island has little forest cover because of its cultural history.

Ants also showed a significant decrease in species richness with increased island isolation. The primary mode of dispersal for ants is during nuptial flights by winged (alate) males and females. These typically occur in large swarms as the ants emerge from multiple nests simultaneously and disperse across the landscape. Dispersal distance and timing varies depending on the species (Vepsäläinen and Pisarski 1982) and climatic conditions (Boomsma and Leusink 1981). Goldstein (1975) concluded that isolation was not a barrier to dispersal for ants on the Thimble Islands in Long Island Sound, because he found alate ants of several previously undocumented species on the most remote island 1.6 km from the mainland, as well as dense concentrations (~4 per m^2) of live alate ants floating in the water near another island. Isolation effects were documented for ants on 18 Frisian Islands which ranged from 10-66 km from the mainland, however island area explained more of the variation in species richness across islands (Boomsma et al. 1987). Factors other than island area and isolation, such as habitat suitability for nest building, are likely also important for successful ant colonization (Vepsäläinen and Pisarski 1982; Boomsma et al. 1987). An alternative mode of dispersal for synanthropic ants is the human-assisted transportation of nests in soil, plants, or wood. "Tramp" species can disperse easily in human-disturbed landscapes (Rizali et al. 2010). On the Boston Harbor Islands, for instance, the European pavement ant, *Tetramorium caespitum*, was documented on 12 islands.

The lack of an isolation effect on species richness for the remaining taxa (bees, weevils, millipedes, and ground beetles) is not surprising, given the relatively short distances between islands and the mainland. Nilsson (1988), working on a similarly-scaled system of 17 islands in a Swedish lake (all within 4 km of

the mainland) also found no effects of isolation on plant, snail, and ground beetle diversity. We can surmise that there are three main mechanisms for dispersal to islands among the focal arthropod taxa: winged flight; passive transport via ocean drift or wind; and human-facilitated transport (recent or historical). A fourth mechanism for island colonization exists for relict populations of native species that inhabited the drumlins and rock outcrops 4-5,000 years ago before sea level rose to isolate these features from the mainland (Rosen and FitzGerald 2004).

For bees, which may travel hundreds to thousands of meters between nesting and foraging sites (Zurbuchen et al. 2010), it is reasonable to assume that distances between islands do not present a barrier to dispersal for most species. At the other end of the dispersal spectrum, millipedes must rely on passive transport via water, wind, or humans. Because they live in the soil and leaf litter, it is very likely they have been subject to opportunistic transport with humans, and therefore, as with island area, island isolation has no strong effect on their ability to colonize an island. Rizali et al. (2010), working with ants on small islands in Indonesia, found that the isolation effect was weaker on islands with anthropogenic disturbance than on more natural islands, because humans brought in tramp species (i.e., synanthropic species) and thus homogenized the fauna. As all the islands in Boston Harbor have been disturbed by humans to some degree, and almost all the millipedes are introduced synanthropic species, our results support these findings. The same homogenization may also apply to weevils in the Boston Harbor Island, as 40% of the species in this group are introduced. Some species do disperse by flight, but others do not, and certainly many species have arrived on islands with cultivated plants transported by humans.

Ground beetles are an interesting group to consider in regards to dispersal because species vary in flight capability. Some species are brachypterous, with hind wings absent or reduced, others are macropterous, with fully-formed wings (although this is not always an indication of flight capability, as flight muscles are not always functional), and others species are wing-dimorphic, having both brachypterous and macropterous individuals (Den Boer 1970). In the absence of humans, ground beetles can disperse to islands by flying, or by being carried passively by wind or water. Research on ground beetle dispersal to islands in the Baltic Sea (Kotze 2008), at scales of island size and isolation similar to the Boston Harbor Islands, has yielded interesting results. Ås (1984) found that islands had a higher proportion of brachypterous species than the mainland (40-67% versus18%), and surmised that flight was disadvantageous for island colonists because it was energetically expensive and came at the cost of lower reproductive output. For short distances, drifting was a more cost-effective option, especially in the Baltic Sea where salinity is low. On the Boston Harbor Islands, just 9% of the species were brachypterous, but this was higher than or comparable to the proportions found on large islands in Atlantic Canada: Prince Edward Island (3%), Cape Breton, N.S. (8%), and Newfoundland (7%; Majka et al. 2008). One of the most widespread and abundant ground beetles in the park was the brachypterous species, *Carabus nemoralis*. This introduced tramp species likely had assistance from humans to disperse. However, the remaining 11 brachypterous species (nine native and two uncommon introduced species) were restricted to the World's End peninsula and nearby islands in Hingham Harbor (Langlee, Ragged, Bumpkin, Grape), suggesting that World's End may be a mainland source, and these species are slowly dispersing to nearby islands. The vast majority of ground beetles on the islands are capable of flight, but may also be relying on drift and human transport to disperse, obscuring any effects of island isolation on species richness. They may also be using the islands as "stepping stones" to disperse, as discussed below.

Community similarity between islands

Similarity in species composition between pairs of islands was, on average, highest for bees and ants. As bees are strong fliers it was not surprising that islands are relatively similar in their bee fauna, regardless of inter-island distance. Ants, however, did show a strong negative correlation between community similarity and inter-island distance, suggesting that they may use islands as "stepping stones" to nearby islands in the colonization process (Fattorini 2010). For instance, although there are relatively few ant species on Calf and Brewster, because of their isolation, the two outer islands share many ant species in common because ants from one island can disperse the short distance to the other island more readily. Ground beetles and millipedes also showed a significant negative relationship between community similarity and inter-island distance, although, on average, islands were less similar to each other in species composition. These two taxa may also be using islands as stepping stones for dispersal, either by drifting or flying (by beetles) to nearby islands. Human-assisted transport is less likely to account for these patterns, unless boats are making multiple stops at neighboring islands (e.g., ferries). Fungus gnats showed the least similarity in species composition, on average, between islands, and no relationship between similarity and inter-island distance. This may, again, be due to limited dispersal capabilities, and their preference for forested habitat, which is not present on all islands. Even if there is more forest on islands closer to the mainland, a pair of islands close to the mainland (e.g., Ragged and Snake) can be very distant from each other. Human-assisted transport is also less likely for fungus gnats, as they are not directly associated with plants or soil.

In summary, in addition to the classic predictors for patterns of species richness on islands—area, isolation, and habitat diversity—we found habitat type (e.g., presence of forest or wetland habitats) to be important in determining species richness patterns for some taxa. In addition, humans can have a strong effect on species distributions by assisting in dispersal and disrupting habitats. Lastly, patterns of species distribution varied widely across the six arthropod focal taxa, and this variation related to their feeding habits, modes of dispersal, degree of human-association, and habitat affinities.

Invertebrate colonists in North America and on the Boston Harbor Islands

Historic and recent arrivals

Introductions of invertebrates into Boston Harbor span at least four centuries. Several European beetle species (Staphylinidae: *Creophilus maxillosus*, Scarabaeidae: *Trox scaber*, Nitidulidae: *Omosita colon*, Chrysomelidae: *Phyllotreta striolata*) documented in the ATBI, are known—from archeological excavations—to have been present in Boston as early as 1650 (Bain 1998). Lindroth (1957) introduced the term "cultural steppe" to describe the open landscapes cultivated in northeastern North America by European colonists. Pastures, crop fields, gardens, buildings, and waste places all provided new habitats in a region whose fauna had previously been primarily associated with forests (Spence and Spence 1988; Buckland et al. 1995), although Native Americans had cleared much of the forest with fire prior to European settlement in the vicinity of Boston and on some of the islands (Richburg and Patterson 2005). It is no surprise then, that European invertebrate colonists also took advantage of opportunities in the New World. Ballast, dunnage, as well as feed and dung associated with domestic animals arriving on cargo ships from Europe harbored the early arrivals (Lindroth 1957; Buckland et al. 1995). Lindroth (1957) surveyed the ground-dwelling invertebrate fauna of eight "ballast places" on the southwest coast of England, from where building rubble, rock, soil, and sand were known to have originated for ships bound to Newfoundland and other ports. Among the native fauna he documented there, between 43 and 75% of the species had been carried to North America. On the Boston Harbor Islands, we have documented 26

beetle species, one earwig, three spiders, one harvestman, one centipede, two millipedes, four isopods, and four snails in common with these British ballast places (Appendix E).

Lindroth's 1957 list does not include the ground beetle *Bembidion nigropiceum*, although he documented it on the south coast of England in a later publication (Lindroth 1974). The littoral habitat of this species would make it a good candidate for transport, even though beach sand was a less-preferred component of ballast. Lindroth (1957) argued that successful colonists were not a "random draw" from the local fauna, but rather, were likely to possess at least some of the following characteristics: ground-dwelling; adapted to dry, disturbed habitats; polyphagous; parthenogenic (capable of asexual reproduction); and brachypterous (having no functional wings). The last criterion may seem counter-intuitive, since colonists must be able to disperse distances in order to find suitable habitat, however, Lindroth maintained that brachypterous species would be more likely to stay onboard ship across the Atlantic. Moreover, Spence and Spence (1988) emphatically rejected the idea that flight is necessary for introduced ground beetles to expand their ranges. They argued that in western Canada, a significant mode of dispersal into interior British Columbia was opportunistic, human-assisted transport. Of the 18 introduced ground beetles on the Boston Harbor Islands, all meet the majority of Lindroth's criteria in that they are: ground-dwelling; adapted to dry, open, disturbed habitats in their native ranges; and polyphagous (eight are predators, ten are seed eaters; Bousquet 2010). All but three species (including *B. nigropiceum*) are known to fly (Bousquet 2010), but, as mentioned previously, the brachypterous species, *Carabus nemoralis*, was one of the most widespread ground beetles in the park. According to Lindroth, the only species to fit *all* of his criteria for the ideal colonist, including parthenogenesis, were weevils in the genus *Otiorhynchus*, and, indeed, at least three of the four *Otiorhynchus* species we documented in the ATBI are native to southwestern England (Lindroth 1957).

Four of the species common to Lindroth's "ballast-places" in England and the Boston Harbor Islands are thought to have holarctic distributions, so they are considered native to both places. Often, determining the native range of a species where there are no historical records of its introduction into the New World can be difficult and contentious. For instance, the littoral millipede, *Thalassisobates littoralis*, was previously known only from the Mediterranean, the British Isles, and the Swedish coast, before isolated records were confirmed for Virginia and Massachusetts (Enghoff 1987). Enghoff suspected that the species was, indeed, originally native to Europe, but unlike the many other millipedes that have been introduced to eastern North America from Europe via cargo ships, he surmised that the salt tolerant *T. littoralis* may have crossed the Atlantic ocean in drift, without the aid of humans. We found this species on the beaches of six islands in Boston Harbor, and in great abundance on Calf and Grape islands. Another species whose native range remains under dispute, is the white-lipped snail, *Cepaea hortensis*. This snail occurs only along the northeastern coast in North America, but is found both in coastal and inland in Europe. Lindroth (1957) argued that the pre-Columbian middens in which it had been discovered were unreliably dated, and there was nothing to suggest that it had not come over with Europeans settlers. More recently, the discovery of these and other snails in cave deposits in Quebec, provides strong stratigraphic evidence that *C. hortenis* was present in North America prior to the arrival of Vikings, between 1000 and 7850 years before present (Pearce et al. 2010).

The Boston Harbor Islands continue to receive invertebrate colonists. Global changes in modes of cargo transportation, as well as in the types of cargo (e.g., stored grains, nursery stock) and quarantine restrictions, have influenced more recent faunal introductions. For instance, the islands now have many

adventive species from Asia, including: four established species of scarab beetles (the plant pests *Maladera castanea*, *Anomala orientalis*, *Nipponeserica peregrina*, *Popillia japonica*); the Asiatic oak weevil, *Cyrtepistomus castanaeus*, and the broad-nosed weevil, *Myosides seriehispidus*; the ambrosia beetles, *Ambrosiophilus atratus* and *Euwallacea validus*; the multi-colored Asian lady beetle, *Harmonia axyridis*; the ant, *Nylanderia flavipes*; the giant resin bee, *Megachile sculpturalis*; and the leafhoppers, *Japananus hyalinus*, *Orientus ishidae*, and *Hishimonus sellatus*. The new North American record for *H. sellatus*, a vector for a mulberry pathogen in its native range, points to the value of invertebrate inventories in busy port areas. The ATBI has also led to three new records for European wireworm pests (the larvae of click beetles, Elateridae). *Agriotes lineatus* was previously known only from Oregon and Washington in the U.S.; *Athous haemorrhoidalis* was known only from Ottawa in North America (Douglas 2011); and the as yet unconfirmed *Athous bicolor* would represent a first detection in North America. It is likely that these species occur also on the mainland, but they await survey and detection.

A hotspot of non-native biodiversity

There are many reasons why islands in Boston Harbor might have a high occurrence of introduced species relative to mainland sites or even other coastal islands. Certainly, with hundreds of years of human activity such as burning, building, agriculture, and waste disposal, they present an ideal "cultural steppe" landscape in which species adapted to open, disturbed habitats could thrive, and offer beaches for littoral species. It is probable that ballast was dumped directly onto at least some of the islands as ships came into port in Boston, as was the case in Newfoundland, where discharging ballast directly into the harbor was illegal (Lindroth 1957), likely resulting in multiple re-introductions of species. The harbor has remained an active port, now receiving air traffic as well, with runways at the international airport lying just half a kilometer from Snake Island. Forty-four percent of plant species documented for the islands are introduced, and while some of these have arrived as opportunistically as the invertebrates, many have also been imported intentionally for cultivation, including ornamental plantings, pasture feed, and for soil stabilization (Elliman 2005; Richburg and Patterson 2005). It is not unlikely that herbivorous and/or soil-dwelling invertebrates would accompany these introductions. Soil and fill has also been transported to the islands, and in the case of Spectacle Island, 2.8 million cubic meters of excavated soil, gravel, and clay from the Central Artery/Third Harbor Tunnel Project ("Big Dig") in Boston was transported to the island to cap an existing land fill in the 1990's (Kales 2007). The island was then replanted. We can only surmise that the two soil-dwelling introduced isopods, *Armadillidium nasatum* and *Trachelipus rathkei*, abundant on Spectacle and found nowhere else on the islands (except for two specimens of *T. rathkei* on nearby Thompson Island, and two on World's End peninsula), were recent arrivals with the soil.

While it was not possible to compare the overall proportion of introduced species (13.8%) in this island park with other mainland sites, because up-to-date regional species lists were lacking for most taxa, among the six focal beetle taxa, the proportion of non-native species was two to three times that of the nearby coastal state of Rhode Island. When compared to other coastal islands in Massachusetts, the patterns were similar. For instance, Goldstein and Simmons (2002) recorded 14-15% of the scarabaeid beetle fauna on Martha's Vineyard, Nantucket Island, and Tuckernuck Island as introduced, about half the percentage (30%) documented for the Boston Harbor Islands (but similar to the 13% recorded for Rhode Island; Sikes 2004). For ground beetles, the 6% introduced species on Nantucket was identical to that of Rhode Island (Purrington 1996; Sikes 2004), less than half that on the Boston Harbor Islands (14%). However, on islands in the Canadian Maritimes, percentages of introduced ground beetles were more similar to the Boston Harbor Islands: Prince Edward Island—16% (Majka et al. 2008); insular

Newfoundland—15% (Larson and Langor 1988); Cape Breton Island—12% (Majka et al. 2008), in part, perhaps, due to busier trade with cargo ships from England.

Variation among taxa

Our data suggest that for all the focal beetle taxa except Elateridae, introduced species are, on average, more widespread across islands in the park than native species, perhaps indicative of more frequent dispersal activity, such as drifting, flying, or hitchhiking with humans. Another measure of the influence of introduced species on the islands is their abundance relative to native species (Spence and Spence 1988). Even though introduced species comprised 14-40% of the total species richness for the six focal beetle families, the mean number of individuals captured per species was higher for introduced species than native species in all families except Elateridae. As the three introduced species of elaterid beetles are presumably relatively recent introductions (representing new records for the state, country and continent), it is not surprising that their abundance was low. Among all beetle families, variability in abundance for introduced species was high, and specimen counts of many hundred individuals on some islands for individual species (e.g., 815 *Amara bifrons* and 537 *Harpalus rufipes* ground beetles on Spectacle Island; 760 *Nipponoserica peregrina* scarabaeid beetles in a single ultraviolet light sample on Grape Island) contributed to very large confidence intervals for the means. How these widespread and abundant introduced species affect co-existing native fauna on the Boston Harbor Islands is a topic in need of further exploration, as there are many examples of native arthropod species being displaced or extirpated by introduced fauna, however, this has typically been documented on larger, more isolated islands (Gillespie and Roderick 2002). It would be especially interesting to monitor the fauna of the recently rebuilt and replanted Spectacle Island over time, as this island is likely still in the initial stages of active colonization. Other ground-dwelling taxa on the Boston Harbor Islands were dominated (in species richness and/or abundance) by introduced species, including isopods, millipedes, earwigs, and gastropods.

We documented lower proportions of introduced species among most of the insect taxa not dwelling primarily on the ground (i.e., less likely to have been transported with ballast). For instance, among bees (172 species), stinging wasps (other than bees and ants; 127 species), and moths and butterflies (197 species) the percentage of introduced species was 4-5%. Among moths, we collected seven of the eight introduced species recorded previously by Mello (2005), and added two more to the list: the European corn borer, *Ostrinia nubilalis*, and the leopard moth, *Zeuzera pyrina*. Another hymenopteran group, the ants (Formicidae) typically have their social nests in or near the ground, but winged reproductive males and queens disperse by flying. Of 52 ant species documented on the islands, 10% were introduced, including the ubiquitous pavement ant (*Tetramorium caespitum*), collected on 12 islands, and its much rarer obligate parasite, *Anergates atratulus*, found only on Thompson Island. Equally widespread, we collected the European fire ant, *Myrmica rubra*, from 13 islands (introduced to Boston in 1908; see species note in results). A similar proportion of introduced ants is documented for all of New England, 14 out of 132 total species (Ellison et al. 2012). Among some of the herbivorous hemipterans (true bugs and hoppers), the proportions were higher. Many species of leafhoppers (Cicadellidae; 103 species; 15% introduced) and plant bugs (Miridae; 15 species; 40% introduced) are significant plant pests, and undoubtedly are transported to new places with their cultivated host plants.

Variation among islands

Islands also showed a marked variation in the proportion of introduced to native invertebrate species when all taxa were considered simultaneously. World's End, a peninsula, had the lowest percentage of

introduced species (12%), while Snake Island had the highest with 27%. Long et al. (2009) found that among vascular plants on 25 Boston Harbor Islands, the proportion of introduced species increased significantly with island isolation. The proportion of introduced plants on all islands were more than double that of invertebrates (see Figure 14). Although there appeared to be a similar relationship between invertebrates and island isolation, it was far weaker, primarily due to Snake Island having a much higher proportion of introduced species than its proximity to the mainland would predict, and also perhaps because of the significantly lower sample size of islands used in our analysis. All of the hypotheses proposed by Long et al. (2009) to explain why introduced plants may have an advantage in colonizing more distant islands could also apply to invertebrates, with the most likely being: greater dispersal abilities; higher tolerance to the harsher environments, and better adaptations to early successional habitats, found on the more exposed, outer islands. For arthropods, a greater ability to disperse by flight or drift, rather than via humans, would be necessary to reach the outer islands (e.g., Calf and Great Brewster Islands) as these islands receive relatively few human visitors these days. Historically, however, some of the outer islands may have served as more frequent ballast-dumping locations as cargo ships came into Boston Harbor from Europe.

In addition to isolation, there are characteristics associated with the unique cultural histories of individual islands that may help explain the arrivals of particular species, whether opportunistic or intentional. For instance Snake and Ragged Islands are both relatively small islands (2.9 and 1.1 ha, respectively) and are the same distance (0.3 km) from the mainland, yet Snake has proportionally twice as many introduced species as Ragged. The two islands lie on opposite shores of the harbor, Ragged Island is located in Hingham Harbor, close to World's End, which is managed as a conservation area. Snake Island, on the other hand, lies directly off the runway of an international airport, and near to more developed areas on shore, such as the sewage treatment plant on Deer Island. Differences in the mainland source pools of potential new colonizers in these two areas may influence the species composition of the smaller islands.

An urban park-university model for learning and teaching about local biodiversity

From a biodiversity perspective, a small, urban park in Boston Harbor may seem an unlikely place to conduct an ATBI. While one might argue that there are interesting things to learn about island biogeography and species associated with anthropogenic landscapes, these islands certainly do not represent a significant "hotspot" of biodiversity. However, from an educational perspective, conducting a biodiversity inventory in a park adjacent to New England's largest metropolitan area provided limitless opportunities for public outreach and engagement. Additionally, the synergistic collaboration between park and university in coordinating an ATBI resulted in a variety of innovative educational products and mutually beneficial opportunities for both institutions. For example, the Museum of Comparative Zoology added more than 75,000 identified specimens to its invertebrate collections, representing a local, well-curated fauna that is available for future study by other researchers and students. Fifteen Harvard students, as well as many more students from nearby high schools and other universities, could access nearby field sites using public transportation, and gained hands-on experience with sampling design and methods, arthropod curation and taxonomy, digital imaging, and databasing. Many students went on to conduct research projects of their own in the park. In addition, the park's educational mission and enthusiastic staff gave students and scientists many opportunities to engage with the public, educators and students, interpretive rangers, and resource managers through presentations, field trips, and other public events.

Boston Harbor Islands is a small park with limited resources and staff, and there were many benefits to having a local university coordinate the scientific program of the ATBI. Through this collaboration, the park and project had access to MCZ staff and facilities, including local scientists familiar with coordinating a large-scale inventory; in-kind personnel support for website and database maintenance, imaging, and design of outreach products (e.g., posters, field guides); well-equipped laboratories with dissecting microscopes and state-of-the-art imaging equipment; and a world-renowned collections repository for storing all specimens *and* attracting taxonomists in the greater scientific community to assist in making identifications. This last point is especially important in a small, urban park to which scientists are not easily enticed to come and collect for themselves, given the relatively low overall biodiversity and the lack of lab facilities and accommodations in the park. Universities can also provide a critical work force for lab and field activities, in the form of enthusiastic and intellectually curious undergraduates. At the MCZ, all of the Harvard students started as volunteers, and some were later supported by academic grants or departmental funds.

It is important to note that the MCZ would not have entered into this collaboration with NPS if the museum were not able to accession (i.e, own) the specimens collected in the park and so invest in their collection and curation. Because Boston Harbor Islands national park area is virtually unique among NPS units in that almost no land is owned by the NPS, this arrangement was possible. However, current regulations that require permanent ownership by the NPS of specimens collected on their lands continue to be a significant sticking point for potential collaborations with other major collections at institutions who would otherwise be very enthusiastic to work with national parks. A new type of repository agreement that is being negotiated between the NPS and several institutions (including the Smithsonian Institution and the MCZ) may offer one solution. NPS still retains ownership of specimens, but institutions have more flexibility to curate specimens according to their own standards and protocols.

A common challenge to all parks, regardless of their size or location, is getting the public excited about the denizens of the microwilderness (Ginsberg 1994; Rykken and Farrell 2013). In larger, iconic parks such as Yellowstone or Yosemite, invertebrates must compete with the much beloved and very visible charismatic megafauna (i.e., vertebrates such as bears, elk, and wolves), while in a park with historical attractions, such as Boston Harbor Islands, visitors typically have little expectation to see any kind of wildlife at all. Undoubtedly, the combined and unprecedented efforts and talents of the agencies in the Boston Harbor Islands Partnership and the Museum of Comparative Zoology have gone a long way to educating visitors, students, and nearby residents that “biodiversity” in Boston Harbor is comprised of a vast microwilderness of bizarre and beautiful forms and colors, fascinating life histories, and essential ecological roles, and that there are many discoveries yet to be made.

Management Implications

The National Park Service Organic Act of 1916 tasks resource managers to conserve natural landscapes in their parks, and the “wild life therein.” A first step to management is having a reasonable knowledge about the full range of species living within park boundaries (Ginsberg 1994), and there is no doubt that All Taxa Biodiversity Inventories will contribute a wealth of new information about the flora and fauna. The Boston Harbor Islands ATBI generated more than 1,500 new species records for the park, a modest number when compared to the 7,391 new park records for Great Smoky Mountain National Park (http://www.dlia.org/; accessed 9-15-2012). But beyond generating lists of thousands of species and

associated distribution data, scientists need to work with park managers to develop effective ways to use biodiversity information to inform park management.

Species and habitats of conservation concern

We did not expect that an ATBI in a small, urban, island park in New England would discover hundreds of species new to science, as has been the case in the Great Smoky Mountains National Park (922 species, http://www.dlia.org/ accessed 9-17-2012). Although we documented several as yet undescribed (but not unknown) species, and one elaterid beetle (*Ampedus* sp.) that may be new to science, most of our "new" species were newly recorded exotic introductions from around the world (see below). However, it is also not unlikely that if and when all the micro-Hymenoptera and Diptera collected during the ATBI are sent out to taxonomists, the Boston Harbor Islands could claim the discovery of more than one species new to science. This speculation is, unfortunately, more a comment on the state of invertebrate taxonomy in even relatively depauperate regions of the world, than on the unique diversity of the Boston Harbor Islands fauna.

The Boston Harbor Islands are home to at least three moth species considered rare in Massachusetts. Mello (2005) documented two "species of special concern," the coastal heathland cutworm, *Abagrostis nefascia* (J.B. Smith), and the spartina borer, *Spartiniphaga inops* (Grote) in 2001 and 2002. The ATBI discovered the unexpected tiger moth, *Cycnia inopinatus*, on Great Brewster Island in 2006, a threatened species. Mello (2005) recommended that vegetation management in the park should have as a goal the maintenance of diverse habitats, including successional shrub habitats, grasslands, and particular host plant communities, as well as controlling invasive plant species. He also suggested mowing at multiple year intervals (rather than annually), and avoiding mowing during certain critical developmental stages of species of concern. These guidelines are intended to serve as conservation strategies for at-risk species, and also to promote overall lepidopteran diversity in the park. Additionally, an immediate conservation priority would be to conduct additional surveys for the threatened *Cycnia inopinatus* in areas of its milkweed host plant (see Bess 2005 for a sampling protocol), to get a better understanding of its distribution in the park. This should be done in consultation with the Massachusetts Natural Heritage and Endangered Species Program (MNHESP).

It is worth noting that the invertebrate section of the MNHESP state list currently includes a total of 104 species, covering primarily large, "charismatic" species popular with amateur entomologists, such as moths and butterflies, tiger beetles, dragonflies and damselflies, and a few other invertebrate groups (e.g., snails, mussels, and crustaceans). If the scientific community had a more complete knowledge of the ecology, biology, and distribution of species across *all* insect and invertebrate taxa, then without a doubt the status of many more species would be of conservation concern.

As noted in the previous section, particular habitat types on the islands had a large influence on invertebrate richness. One example is the relatively rare occurrence of fresh water, which attracted a suite of hygrophilic invertebrate species even to very small wetlands. On Grape and Calf islands, pitfall traps in wetland habitats yielded from 15 to 57 more invertebrate species than in any other habitat types. The freshwater marsh on Grape Island is already being managed for native plant diversity, by active removal of invasive plants. However, the small wet meadow on the western shore of Calf Island should also be noted as a significant resource. Several larger wetlands in the park were not directly incorporated into our survey (e.g., the artificial Ice Pond at World's End, where our pitfall traps were repeatedly destroyed by

vertebrates and we were forced to abandon the site), but these would be fruitful areas for additional inventory.

Other habitats of significance in this island park include those associated with the marine littoral zone, including sand and gravel beaches, dunes, salt marsh edges, and the vegetative drift and wrack that accumulate in these areas. As discussed previously, there are numerous invertebrate species closely associated with the littoral zone, and many specialize in one particular microhabitat. We found several of the species Majka and Ogden (2006) referred to as "beach-drift beetles," including the ant-loving beetle, *Brachygluta abdominalis* (Staphylinidae), the clown beetle, *Hypocaccus fraternus* (Histeridae), and the ant-like flower beetle, *Sapintus pusillus* (Anthicidae). Davidson and Rykken (2011) described in detail the microhabitat of the rediscovered ground beetle, *Bembidion nigropiceum*, as a one-meter wide gravel tube or "'nirdle' of gravel pushed up by the seawater at the high-tide line." Majka and Ogden (2006) point out that the beach drift environment is vulnerable to human disturbance, especially through "clean up" to make beaches appealing for recreation. Kluft and Ginsberg (2009), using multiple sampling methods including sand cores, found that increased ORV traffic was associated with a significant decrease in beach wrack-associated invertebrates. Likewise, the restricted habitats of *B. nigropiceum* and other species, suggest that managers consider "beach habitat" from a micro-scale perspective if active management actions are planned, such as beach stabilization. Unfortunately, the only island in the park with extensive sandy beaches and dunes, Lovells, was not included in our structured sampling program (except for the sand dune bee survey described below), but additional sampling in these habitats would likely add new species to the database.

Many insects are closely associated with plant hosts for food or shelter or both, and so vegetation management has a direct affect on invertebrate conservation. Programs to restore native plant communities, to promote diversity by maintaining a mosaic of habitats in all stages of succession, and to protect vulnerable communities from human disturbance, will benefit invertebrates as well. Timing and frequency of mowing, herbicide use, and other active management strategies should also consider potential effects on the associated invertebrate fauna. More targeted conservation efforts may be warranted for particular species or communities of concern. For instance, Elliman (2005) notes that the maritime juniper woodland/shrubland community found in small patches on World's End, Langlee Island, and Ragged Island, is listed as S1 in Massachusetts (critically imperiled with few occurrences and/or little remaining acreage) and has one of the most native plant associations in the park. Associated with this community, we have found the juniper hairstreak, *Callophrys gryneus*, the juniper twig-geometer, *Patalene olyzonaria*, and the juniper Paria (a leaf beetle), *Paria sexnotata*. The latter species is likely a new record for the state (E. Riley, pers. comm.).

Plant-associated insects, such as pollinators, may require different microhabitats for nesting. The majority (~70%) of native bees, for instance, are ground-nesting miners, requiring open patches of soil or sand for building their nests. It is important, therefore, that these bees have access to both forage (flowers) and nesting areas within a few hundred meters of each other (Zurbuchen et al. 2010). Some bees dig their nests into vertical banks of cliffs, and we have seen evidence of this on Thompson Island in the sandy bluffs below the meadows on the southeast part of the island. Other south-facing soft cliffs on the islands likely also provide critical nesting

In sum, managing for native invertebrate diversity on a landscape scale relies on many of the same strategies involved in promoting and maintaining native plant diversity. When managing for particular groups or species, however, micro-scale habitats and the full suite of life history requirements (e.g., foraging, nesting, dispersal) must also be considered.

Keeping track of introduced species

One obvious utility of the ATBI in the Boston Harbor Islands has been to document introduced species. Many of these species are well-established "weedy species" in the region, widespread and abundant, and have likely been on the islands for decades or centuries, such as the seven-spotted ladybeetle (*Coccinella septempunctata*) and the cabbage white butterfly (*Pieris rapae*). The lady beetle and butterfly are representative of the two major concerns regarding introductions: invasive species displacing native fauna, and pest species causing economic damage to cultivated crops. *Coccinella septempunctata* was intentionally introduced (multiple times) to the U.S. as a biocontrol agent for aphids, but once established, began displacing native species in both natural and cultivated landscapes (Wheeler and Hoebeke 1995; Alyokhin and Sewell 2004). *Pieris rapae* was an accidental introduction to Montreal in the 1860's, and is now a ubiquitous pest species on cruciferous plants. Other species were introduced more recently to the region, and park records will be important for documenting range expansions, such as the giant resin bee (*Megachile sculpturalis*) from Asia, and the ambrosia beetle, *Ambrosiophilus atratus*, which is currently being monitored by the USDA (Hack 2006). It is also interesting to note that among the six focal beetle taxa we compared with the Rhode Island fauna, 49 introduced beetle species were found only on the Boston Harbor Islands, and had not yet been detected in Rhode Island.

Among the park's newly discovered first arrivals to the U.S. and North America, two are known to be pests of agricultural crops in their native ranges: *Hishimonus sellatus* is a vector of mulberry dwarf phytoplasmas in Asia (Kawakita et al. 2000), and the wireworm larva of the elaterid beetle, *Athous haemorrhoidalis*, is a below-ground pest on crop plants (Douglas 2011). It is likely that these species also occur on the mainland, and indeed, two photo records of *Hishimonus sellatus* (confirmed by R.A. Hamilton) in eastern Massachusetts have recently been submitted to an online arthropod identification website (http://bugguide.net/node/view/611930; accessed 9-15-2012). At a minimum, these species should be reported to the Animal and Plant Health Inspection Service (APHIS, U.S. Department of Agriculture). The ATBI in the Dominican Republic set a precedent for this sentinel role, when students on a field trip collected two specimens of what would be the first confirmed records of an important citrus pest, the Old World lime swallowtail (*Papilio demoleus* Linnaeus), in the Americas (Guerrero et al. 2004).

Contributing to local and regional databases

In a state and regional context, the more than 1,500 newly documented species in the park (both introduced *and* native) will contribute new "dots on the map" that can fill important knowledge gaps beyond park boundaries. In all, the ATBI documented eight species suspected to be new arrivals to the U.S. or North America, and 11 new records for Massachusetts (including five introduced species) confirmed by taxonomists (Table 6). Undoubtedly, there are many more species representing new state records. For instance, we identified 79 unconfirmed state records for beetles (including 15 introduced species) by searching through existing records in checklists for Maine (Majka et al. 2011), Rhode Island (Sikes 2004, 2005), and the northeast (Downie and Arnett 1996a, 1996b). This highlights the overall

scarcity of published checklists, and even unpublished data, for most Massachusetts invertebrates, with the exception of charismatic taxa such as butterflies and odonates.

Park and state checklists provide valuable local data, but we also intend that the ATBI database will contribute to regional, and even global databases. Online biodiversity databases such as Biodiversity Information Serving Our Nation (BISON; http://bison.usgs.ornl.gov/), Discover Life (www.discoverlife.org), Encyclopedia of Life (EOL; http://eol.org), and Global Biodiversity Information Facility (GBIF; www.gbif.org) provide publicly-accessible portals to ecological, taxonomic, genetic, life history, and geographic information for species found all over the world. The Boston Harbor Islands ATBI database can make significant contributions with geo-referenced specimen data and high resolution images for more than 1,500 species. In return, as these databases gather additional biodiversity data from other parks and conservation lands, natural resource managers will be able to extract spatially explicit data sets that can be used to assess and monitor the effects of some of today's most pressing large-scale environmental threats, such as climate change, within parks and across regions.

Table 6. Species collected during the ATBI that represent new confirmed records for Massachusetts (MA), the United States (US), and North America (NA). ? indicates unconfirmed species determination.

Order	Family	Species	Record	Origin
Coleoptera	Carabidae	*Amara aulica*	MA	Europe
Coleoptera	Carabidae	*Amara bifrons*	MA	Europe
Coleoptera	Carabidae	*Apenes lucidulus*	MA	Native
Coleoptera	Carabidae	*Harpalus rubripes*	MA	Europe
Coleoptera	Carabidae	*Laemostenus terricola terricola*	US	Europe/Asia
Coleoptera	Chrysomelidae	*Epitrix ?pubescens*	NA?	Europe
Coleoptera	Chrysomelidae	*Longitarsus rubiginosus*	US	Europe
Coleoptera	Chrysomelidae	*Paria sexnotata*	MA	Native
Coleoptera	Elateridae	*Agriotes lineatus*	MA	Europe
Coleoptera	Elateridae	*Athous haemorrhoidalis*	US	Europe
Coleoptera	Elateridae	*Athous ?bicolor*	NA?	Europe
Coleoptera	Staphylinidae	*Lordithon obsoletus*	MA	Native
Coleoptera	Staphylinidae	*Sepedophilus ?immaculatus*	NA?	Europe
Hemiptera	Cicadellidae	*Hishimonus sellatus*	NA	Asia
Hymenoptera	Formicidae	*Camponotus caryae*	MA	Native
Hymenoptera	Formicidae	*Anergates atratulus*	MA	Europe
Hymenoptera	Formicidae	*Myrmica scabrinodis*	NA	Europe
Hymenoptera	Formicidae	*Pyramica metazytes*	MA	Native
Hymenoptera	Halictidae	*Lasioglossum lionotum*	MA	Native

Invertebrates as indicator taxa for monitoring

In a visionary workshop hosted by the National Park Service in 1992, Ginsberg and others proposed that a national network of NPS sites be established to monitor invertebrate biodiversity, and that one priority be the development of protocols for selecting suites of species to serve as indicators of ecosystem health (Ginsberg 1992). Several years later, the NPS created and implemented a comprehensive, nationwide Inventory and Monitoring program, spanning 32 regional networks. However, among the "vital signs"

most commonly monitored by the various networks, invertebrates have been noticeably absent, with the exception of aquatic macroinvertebrates and some forest pest species (http://science.nature.nps.gov/im/monitor/index, accessed 9-18-2012).

Worldwide, invertebrate taxa have been used to monitor the health and functioning of various terrestrial and aquatic ecosystems (Kremen 1992; McGeoch 1998; Rainbow et al. 2012). Many insects and other invertebrates possess traits that make them effective indicators of environmental change, such as large population size, high diversity, short generation times, easily sampled, and a range of sensitivities to environmental gradients such as moisture and temperature. These characters also make them ideal candidates for monitoring effects of large scale environmental threats such as global climate change, pollution, habitat fragmentation, and invasive species (Menéndez 2007; Leal et al. 2012). For example, pollinators have been used to monitor effects of climate change because they are tightly linked to their plant hosts, and asynchronous climate-induced shifts in species ranges or phenologies could disrupt plant-pollinator networks (Franzen and Ockinger 2012; Gilman et al. 2012).

As an extension of ATBI efforts, we received NPS Challenge Cost Share Funding (PMIS 159489) in FY2010 to pilot a native bee monitoring project in the park (Rykken and Farrell, in prep.). Globally, bees have been of conservation concern because humans and ecosystems depend on these important pollinators, but populations of many species are declining (Cameron et al. 2011) and their ranges are shifting in response to changing climates (Kuhlman et al.2012). Native bees are an ideal group to monitor on the Boston Harbor Islands, because they are diverse and abundant, easy to sample with a standardized, repeatable protocol, and their taxonomy is relatively well known. Our main objectives were twofold: (1) to develop a scientifically rigorous monitoring program that could detect relatively small changes (3-5%) in native bee abundance and diversity over 5-year intervals; and (2) to involve citizen scientists both in the field, sampling bees, and in the lab, sorting and preparing specimens. We set up 16 bee bowl transects (see Methods section) on nine islands, and sampled four times during the blooming season. These efforts yielded approximately 4,000 bee specimens comprising more than 100 species (analysis in progress). In addition to one paid intern, 10 community volunteers contributed more than 500 hours in the field and lab to sample and process specimens. This project successfully integrated scientific and community involvement goals, and protocols are in place to repeat the sampling in 2015.

There are more possibilities for using invertebrates as indicators in park ecosystems. For instance, there is a vigorous, volunteer-based invasive plant removal program underway on many of the islands. As native plant communities are restored on the islands, it will be important to document if and how associated pollinator and/or other herbivorous insect communities shift in abundance, diversity, and species composition, as this will influence the successful long-term reestablishment of functioning ecosystems.

Boston Harbor Islands as "cultural steppe" *AND* refuge

After explaining the mystery of the long sought-after Massachusetts ground beetle, *Bembidion* "*puritanum*," by unmasking it as a European species, Erwin and Kavanaugh (1980) suggested that, "If *Bembidion nigropiceum* became established and still survives in North America, we suggest it be looked for in natural areas adjacent to harbors that received ships in the 1800's. Unfortunately, such natural areas may now be difficult or impossible to find." More than a century after they had last been observed in Massachusetts, no one can be certain whether the specimens of *B. nigropiceum* collected on Thompson,

Grape, and Rainsford Islands during the ATBI are descendants of that original population from Europe (Davidson and Rykken 2011), but if so, then the Boston Harbor Islands have, indeed, provided the ideal "natural area" for this elusive beetle to thrive for more than 100 years, undetected.

The account illustrates the interesting position, both geographically and culturally, that the Boston Harbor Islands occupy. The islands lie in a thriving, busy port, adjacent to the largest urban center in New England, and have been connected to distant parts of the world since the 1600's. As a result, they have hosted centuries of human activity, including all manner of physical and biological alterations to their post-glacial landscapes, and were almost entirely transitioned to the "cultural steppe" that Lindroth described as the ideal environment into which non-native invertebrates could extend their ranges. This history is reflected in the fauna we catalog in the microwilderness.

From another perspective, however, the islands are part of a growing movement to restore the harbor and many of its landscapes to more natural and native conditions. Water quality and native fish diversity, in what was referred to as "the filthiest harbor in the country" just 30 years ago, have steadily improved after the installation of a state-of-the-art sewage treatment facility on Deer Island. Over the last several decades, islands have become state parks, conservation lands, environmental education centers, and, collectively, a national recreation area, with missions that include the preservation and restoration of native flora, fauna, and functioning ecosystems (National Park Service 2002). Salt marsh hydrology has been restored on Thompson Island and World's End; native plant removal programs are in place on many islands; American oystercatchers, willets, and least terns nest on the beaches of tiny Snake Island, just half a kilometer from an international airport runway. The unexpected tiger moth, uncommon throughout its range, finds the coastal scrub habitat it requires on Great Brewster Island. Increasingly, the islands thus represent a relative wilderness, a refuge, for resident wildlife and human visitors alike. In this setting, the ATBI has given scientists, students, park managers, rangers, and visitors, unique opportunities to explore a remarkably diverse microwilderness, and to document the biodiversity that thrives at the edge of urban and wild.

Conclusions

The inventory of nearly 1,800 species brought many surprises, including new records of species for North America, the United States, the Northeast, or Massachusetts. Surprises also included higher totals than expected for several groups, like ants and bees. Statistical analyses of the totals suggested that the number of species we observed and documented was far from exhaustive for most taxa, and there are many more species yet to discover on the islands. A more complete inventory may have been achieved by recruiting specialists to come to the park to actively collect in multiple habitats, however, logistics and the anthropogenic nature of the park made it challenging to recruit scientists. Structured sampling allowed us to assess patterns of species distribution and composition for a subset of taxa across islands in the park, and lay the groundwork for future resampling. We found that for many taxa, species richness on an island was strongly related to island area and habitat (plant) diversity. Particular habitat types, such as mature forest or freshwater wetlands also influenced species richness. However, most taxa did not respond to island isolation. We surmise that for species with strong dispersal abilities (i.e., flight), distances between the mainland and the most distant islands are too short to present a barrier to dispersal, and for less mobile species, the dominant mode of transport has likely been with humans, and thus colonization has been more opportunistic. Some species may also be using islands as "stepping stones" in the colonization process, dispersing to nearby islands by flying or drifting.

Many taxa, especially those associated with soil and cultivated plants, such as millipedes, isopods, weevils, and leafhoppers, had high proportions of introduced species, and for beetles we know that these proportions were high relative to the nearby mainland. Other groups, including pollinators such as bees and butterflies had very low proportions of introduced species. Species have been arriving on the islands over the past several hundred years in the company of humans, with ballast from cargo ships, stored grains, ornamental plants and associated soil, livestock and feed, etc. The "cultural steppe" character of the islands, with open and early successional habitats predominating after European colonization, was also ideal for supporting invertebrate colonists. Introduced species certainly continue to arrive on the islands, and we have documented several new records for the state, U.S., and North America.

Conducting an ATBI in a small, urban park presented challenges and opportunities. The park has few facilities or natural resources staff, however it has a strong educational mission and many existing programs (e.g., K-12 field and classroom activities, environmental educator trainings, family activities) into which we incorporated ATBI activities. We were also able to take advantage of a large existing park volunteer workforce. Collaborating with a university provided the park access to scientists, students, and excellent facilities for the tremendous amount of work required to conduct the fundamental operations of a successful ATBI. Collaborations between scientists, other MCZ personnel, designers, students, resource managers, and educational staff also resulted in a phenomenal array of outreach and educational products, such as K-12 curricula, biodiversity posters, award-winning games, field guides, and displays.

Recommended management actions and future priorities:

(1) Contact the Massachusetts Natural Heritage and Endangered Species Program(MNHESP) to alert them to our discovery of the state-listed unexpected tiger moth, *Cycnia inopinatus*, on Great Brewster Island. Conduct more surveys of this milkweed-associated species on other islands.

(2) Alert the Animal and Plant Health Inspection Service (APHIS) to our new North American records for introduced species that are known to be pests: Hemiptera: Cicadellidae: *Hishimonus sellatus* (the mulberry leafhopper); Coleoptera: Elateridae: *Athous haemorrhoidalis* (a click beetle). The latter record was published recently (Douglas 2011), so APHIS may already be aware of it.

(3) Locate and delineate the wetland mentioned on Calf Island (and ascertain if it is the same "moist meadow" mentioned by Elliman in his 2004 report).

(4) Coordinate with databases such as BISON, EOL, Discover Life, and GBIF to contribute ATBI biodiversity data.

(5) Make accessible printed and/or online checklists for all major orders of arthropods surveyed in the ATBI.

(6) Plan for a follow up bee monitoring program in 2015, to build on pilot work conducted in 2010.

(7) Prioritize Diptera (flies), Hymenoptera (parasitic wasps), Araneae (spiders), and remaining Coleoptera (beetles) for identification. This will entail preparing/mounting a large backlog of flies and wasps, and finding a taxonomist for each group who can make family level identifications and then can find other specialists as needed to make lower level determinations.

Spreading the Boston Harbor Islands npa model to other parks

The wealth of scientific resources and educational products produced as a result of the ATBI clearly adds value to this national park and results in a higher public profile and greater use by educators. This is made possible by three considerations. First is the educational mission of the park. The rangers and stewards are committed to promoting use of the park by schools. This creates an audience for educational products and scientific resources that can be produced by the second consideration: proximity of the park to a university with natural history collections. However, involvement of a university museum and taxonomists would not have been possible were it not for the permission granted for collecting and accessioning specimens into a non-NPS repository. This third consideration is the key issue for involving taxonomists and collections in a national park, for which agency-wide policy has been to retain ownership of all materials related to collecting specimens in national parks (and often forbidding any collecting outright). A unique exception to this policy is Boston Harbor Islands national park area because the islands are not owned by the NPS. If this restriction were lifted from other national parks (as it is for national forests), enabling taxonomists to inventory their biological diversity and museums to invest in curation of the specimens they would then own, a door would be opened for implementation of programs similar to this one across the national park system.

Nevertheless, this configuration of a university museum with natural history collections and associated taxonomists, and an audience of K-12 students, college students, and their educators is present near a number of national forests, state parks and other protected areas that would benefit from the synergy that resulted from the ATBI. We hope the idea will spread.

Literature Cited

Alyokhin, A., and G. Sewell. 2004. Changes in a lady beetle community following the establishment of three alien species. Biological Invasions 6:463-471.

Ås, S. 1984. To fly or not to fly? Colonization of Baltic islands by winged and wingless carabid beetles. Journal of Biogeography 11:413-426.

Bain, A. 1998. A seventeenth-century beetle fauna from colonial Boston. Historical Archaeology 32:38-48.

Bain, A. and L. LeSage. 1998. A late seventeenth century occurrence of *Phyllotreta striolata* (Coleoptera: Chrysomelidae) in North America. Canadian Entomologist 130:715-719.

Báldi, A. 2008. Habitat heterogeneity overrides the species-area relationship. Journal of Biogeography 35:675-681.

Balsbaugh, E.V. Jr., D.D. Kopp, and C. Scholl. 1979. The wharf borer *Nacerdes melanura* L., (Coleoptera: Oedemeridae) in North Dakota. Coleopterists Bulletin 33:455-456.

Bell, R., M. Chandler, R. Buchsbaum, and C. Roman. 2002. Inventory of intertidal habitats: Boston Harbor Islands, a national park area. Technical Report NPS/NERBOST/NTR-2004/1. National Park Service, Northeast Region, Boston, MA, USA.

Bell, R., M. Chandler, R. Buchsbaum, C. Roman, and M. Chandler. 2005. Inventory of intertidal marine habitats, Boston Harbor Islands national park area. Northeastern Naturalist 12:169-200.

Bess, J. 2005. Conservation assessment for the unexpected tiger moth (*Cycnia inopinatus* (Edwards)). USDA Forest Service, Eastern Region, Milwaukee. 27 pp.

Bolton, B. 2000. The ant tribe Dacetini. Memoirs of the American Entomological Institute 65:1–1028.

Boomsma, J.J., and A. Leusink. 1981. Weather conditions during nuptial flights of four European ant species. Oecologia 50:236-241.

Boomsma, J.J., A.A. Mabelis, M.G.M. Verbeek, and E.C. Los. 1987. Insular biogeography and distribution ecology of ants on the Frisian Islands. Journal of Biogeography 14:21-37.

Bousquet, Y. 2010. Illustrated identification guide to adults and larvae of northeastern North American ground beetles (Coleoptera: Carabidae). Pensoft, Sofia-Moscow. 562 pp.

Buckland, P.C., A.C. Ashworth, and D.W. Schwert. 1995. By-passing Ellis Island: insect immigration to North America. Pages 226-244 *in* R.A. Butlin and N. Roberts, editors. Ecological relations in historical times: human impact and adaptation. Blackwell Publishers Inc., Cambridge, MA.

Cameron, S.A., J.D. Lozier, J.P. Strange, J.B. Koch, N. Cordes, L.F. Solter, and T.L. Griswold. 2011. Patterns of widespread decline in North American bumble bees. Proceedings of the National

Academy of Sciences. Published online before print January 3, 2011, doi: 10.1073/pnas.1014743108. 6pp.

CPHST (Center for Plant Health Science & Technology). 2010. CPHST Biological Control Unit Annual Report, U.S. Department of Agriculture. 52 pp.

Chao, A. 1984. Non-parametric estimation of the number of classes in a population. *Scandinavian Journal of Statistics* 11: 265-270.

Chao, A. 1987. Estimating the population size for capture-recapture data with unequal catchability. *Biometrics* 43: 783-791.

Chao, A., R.L. Chazdon, R.K. Colwell, and T.-J. Shen. 2005. A new statistical approach for assessing compositional similarity based on incidence and abundance data. Ecology Letters 8: 148-159.

Clark, A.T., J. Rykken, and B.D. Farrell. 2011. The effects of biogeography on ant diversity and activity on the Boston Harbor Islands, Massachusetts, U.S.A. PLoS ONE 6(11): e28045.

Clark, A.T. 2011. Ant communities of the Boston Harbor Islands National Recreation Area. Honors Thesis. Harvard College, Cambridge, Massachusetts.

Colwell, R.K. 2011. EstimateS: Statistical estimation of species richness and shared species from samples. Version 8.2. User's Guide and application published at: http://purl.oclc.org/estimates.

Crosby, I.B. 1928. Boston through the ages: the geological story of greater Boston. Marshall Jones Company, Boston, MA. 166pp.

Davidson, R.L., and J.J. Rykken. 2011. Rediscovery of *Bembidion (Lymnaeum) nigropiceum* (Marsham) (=*puritanum* Hayward) (Coleoptera: Carabidae: Bembidiini) in Massachusetts, with remarks on biology and habitat. ZooKeys 147: 487-496.

Davidson, R.L., J. Rykken, and B. Farrell. 2011. Carabid beetle diversity and distribution in Boston Harbor Islands national park area (Coleoptera, Carabidae). ZooKeys 147:497-526.

Den Boer, P.J. 1970. On the significance of dispersal power for populations of carabid-beetles (Coleoptera, Carabidae). Oecologia 4:1-28.

Douglas, H. 2011. New records of European wireworm pests and other click beetles (Coleoptera: Elateridae) in Canada and USA. Journal of the Entomological Society of Ontario 142:11-17.

Downie, N.M., and R.H. Arnett. 1996a. The beetles of northeastern North America, Vol. I. The Sandhill Crane Press, Gainesville, FL. pp.1-880.

Downie, N.M., and R.H. Arnett.1996b. The beetles of northeastern North America, Vol. II. The Sandhill Crane Press, Gainesville, FL. pp.891-1721.

Edwards, R.L., and E.H. Edwards. 1990. Observations on the natural history of a New England population of *Sphodros niger* (Araneae, Atypidae). Journal of Arachnology 18:29-34.

Edwards, R.L. 1993. New records of spiders (Araneae) from Cape Cod, Massachusetts, including two possible European immigrants. Entomological News 104:79-82.

Elliman, T. 2004. Vascular plant survey of the Boston Harbor Islands national park area: final report. For: Island Alliance, Massachusetts Natural Heritage and Endangered Species Program, and National Park Service. 164 pp. + App.A-F.

Elliman, T. 2005. Vascular flora and plant communities of the Boston Harbor Islands. Northeastern Naturalist 12:49-74.

Ellison, A.M., N.J. Gotelli, E.J. Farnsworth, and G.D. Alpert. 2012. A field guide to the ants of New England. Yale University Press, New Haven, CT. 398 pp.

Enghoff, H. 1987. *Thalassisobates littoralis* (Silvestri)--an amphiatlantic millipede (Diplopoda, Julida, Nemasomatidae). Entomologist's Monthly Magazine. 123:205-206.

Erwin, T.L., and D.H. Kavanaugh. 1980. On the identity of *Bembidion puritanum* Hayward (Coleoptera: Carabidae: Bembidiini). The Coleopterists Bulletin 34:241-242.

Fahrig, L. 2003. Effects of habitat fragmentation on biodiversity. Annual Review of Ecology, Evolution, and Systematics 34: 487-515.

Farrell, B.D. 2005. From agronomics to international relations: building an online encyclopedia of life in the Dominican Republic. Revista: Harvard Review of Latin America Fall 2004/Winter 2005: 6-9.

Fattorini, S. 2010. The influence of geographical and ecological factors on island beta diversity patterns. Journal of Biogeography 37:1061-1070.

Franzen, M. and Ockinger, E. 2012. Climate-driven changes in pollinator assemblages during the last 60 years in an Arctic mountain region in Northern Scandinavia. Journal of Insect Conservation 16:227-238.

Gagné, R.J. 1981. A monograph of *Trichonta* with a model for the distribution of Holarctic Mycetophilidae (Diptera). U.S. Department of Agriculture, Technical Bulletin 1638. 64 pp.

Gillespie, R.G., and G.K. Roderick. 2002. Arthropods on islands: colonization, speciation, and conservation. Annual Review of Entomology 47:595-632.

Gilman, R.T., N.S. Fabina, K.C. Abbott, and N.E. Rafferty. 2012. Evolution of plant-pollinator mutualisms in response to climate change. Evolutionary Applications 5:2-16.

Ginsberg, H. 1993. Invertebrate monitoring in the National Park System. Technical Report NPS/NARURI/NRTR-93/02. National Park Service. Narragansett, RI. 17pp.

Ginsberg, H. 1994. Conservation of invertebrates in U.S. National Parks. American Entomologist. Summer: 76-78.

Goldstein, E.L. 1975. Island biogeography of ants. Evolution 29:750-762.

Goldstein, P.S., and T. Simmons. 2002. A checklist and commentary on the scarabaeid fauna of the Massachusetts offshore islands (Coleoptera: Scarabaeidae). Journal of the New York Entomological Society 110:389-401.

Groden, E., F.A. Drummond, J. Garnas, and A. Franceour. 2005. Distribution of an invasive ant, *Myrmica rubra* (Hymenoptera: Formicidae), in Maine. Journal of Economic Entomology 98:1774-1784.

Guerrero K.A., D. Veloz, S. L. Boyce, and B.D. Farrell. 2004. First New World documentation of an Old World citrus pest, the lime swallowtail *Papilio demoleus* (Lepidoptera: Papilionidae), in the Dominican Republic (Hispaniola). American Entomologist Winter 2004.

Hack, R.A. 2006. Exotic bark- and wood-boring Coleoptera in the United States: recent establishments and interceptions. Canadian Journal of Forest Resources 36:269-288.

Hanski, I. 2011. Habitat loss, the dynamics of biodiversity, and a perspective on conservation. Ambio 40: 248-255.

Hoffman, R.L.1999. Checklist of Millipeds of North and Middle America. Virginia Museum of Natural History, Special Publication No 8, 584 pp.

Hopkins, G.W. and R.P. Freckleton. 2002. Declines in the numbers of amateur and professional taxonomists: implications for conservation. Animal Conservation 5:245-249.

Howe, M.A., G.T. Knight, and C. Clee. 2010. The importance of coastal sand dunes for terrestrial invertebrates in Wales and the UK, with particular reference to aculeate Hymenoptera (bees, wasps & ants)

Janzen, D.H. and W. Hallwachs, W. 1994. All Taxa Biodiversity Inventory (ATBI) of terrestrial systems: a generic protocol for preparing wildland biodiversity for non-damaging use. Report of a National Science Foundation Workshop, 16–18 April 1993, Philadelphia, PA, 132 pp.

Jonsson, M., G.W. Yeates, and D.A. Wardle. Patterns of invertebrate density and taxonomic richness across gradients of area, isolation, and vegetation diversity in a lake-island system. Ecography 32:963-972.

Kales, D. 2007. The Boston Harbor Island: a history of an urban wilderness. The History Press, Charleston, SC. 158 pp.

Kawakita, H., T. Saiki, W. Wei, W. Mitsuhashi, K. Watanabe, and M. Sato. 2000. Identification of mulberry dwarf phytoplasmas in the genital organs and eggs of leafhopper *Hishimonoides sellatiformis*. Phytopathology 90:909-914.

Kerney, M. 1999. Atlas of the land and freshwater mollusks of Britain and Ireland. Harley Books, Colchester, England. 264 pp.

Kluft, J. M. and H. S. Ginsberg. 2009. The effect of off-road vehicles on barrier beach invertebrates at Cape Cod and Fire Island National Seashores. Technical Report NPS/NER/NRTR—2009/138. National Park Service. Boston, MA.

Kohn, D.D., and D.M. Walsh. 1994. Plant species richness—the effect of island size and habitat diversity. Journal of Ecology 82:367-377.

Kotze, D.J. 2008. The occurrence and distribution of carabid beetles (Carabidae) on islands in the Baltic Sea: a review. Journal of Insect Conservation 12:265-276.

Kremen, C. 1992. Assessing the indicator properties of species assemblages for natural areas monitoring. Ecological Applications 2:203-217.

Kuhlmann, M., D. Guo, R. Veldtman, and J. Donaldson. 2012. Consequences of warming up a hotspot: species range shifts within a centre of bee diversity. Diversity and Distributions 18:885-897.

Laforge, L. 1932. Geology of the Boston area, Massachusetts. Bulletin 839, U. S. Geological Survey, Washington, D.C.

Lalongé, S., J.H. Redner, and D. Coderre. 1997. First Canadian records of *Trochosa ruricola* (DeGeer), *Ostearius melanopygius* (O. Pickard-Cambridge), and *Dictyna decaprini* Kaston (Araneae: Lycosidae, Linyphiidae, Dictynidae, respectively). Canadian Entomologist 129:371-372.

Larson, D.J., and D.W. Langor. 1988. Carabid beetles of insular Newfoundland (Coleoptera: Carabidae: Cicindellidae)—30 years after Lindroth. Canadian Entomologist 114:591-597.

Leal, I.R., B.K.C. Filgueiras, J.P. Gomes, L. Iannuzzi, and A.N. Andersen. 2012. Effects of habitat fragmentation on ant richness and functional composition in Brazilian Atlantic forest. Biodiversity and Conservation 21:1687-1701.

LeSage, L. 1988. Notes on European *Longitarsus* species introduced in North America (Coleoptera: Chrysomelidae: Alticinae). Canadian Entomologist 120:1133-1145.

Lindroth, C.H. 1957. The faunal connections between Europe and North America. Wiley and Sons, Inc., New York, NY. 344 pp.

Lindroth, C.H. 1974. Coleoptera, Carabidae. Handbook for the identification of British insects 4:1-148.

Long, J.D., G.C. Trussell, and T. Elliman. 2009. Linking invasions and biogeography: isolation differentially affects exotic and native plant diversity. Ecology 90:863-868.

Longino, J.T. and R.K. Colwell. 1997. Biodiversity assessment using structured inventory: capturing the ant fauna of a tropical rain forest. Ecological Applications 7:1263-1277.

MacArthur, R.H. and E.O. Wilson. 1967. The theory of island biogeography. Princeton University Press, Princeton, NJ. 203 pp.

Majka, C.G., Y. Bousquet, C. Noronha, and M.E. Smith. 2008. The distribution, zoogeography, and composition of Prince Edward Island Carabidae (Coleoptera). Canadian Entomologist:128-141.

Majka, C.G., D.S. Chandler, and C.P. Donahue. 2011. Checklist of the beetles of Maine, USA. Empty Mirrors Press, Halifax, NS, Canada. 328 pp.

Majka, C.G., and J. Ogden. 2006. *Brachygluta abdominalis* (Aubé) (Coleoptera: Staphylnidae) newly recorded in Canada, with notes on other beach-drift beetles. Proceedings of the Entomological Society of Washington 108:761-764.

Malecki, R.A., B. Blossey, S.D. Hight, D. Schroeder, L.T. Kok, and J.R. Coulson, 1993. Biological control of purple loosestrife: a case for using insects as control agents, after rigorous screening, and for integrating release strategies with research. BioScience 43: 680-686.

McGeoch, M.A.1998. The selection, testing and application of terrestrial insects as bioindicators. Biological Reviews of the Cambridge Philosophical Society 73:181-201.

Mello, M.J. 2005. Inventory of Macrolepidoptera and other insects in the Boston Harbor Islands national park area. Northeastern Naturalist 12:99-144.

Menéndez, R. 2007. How are insects responding to global warming? Tijdschrift voor Entomologie 150: 355–365.

Mesler, M.R., J.D. Ackerman, and K.L. Lu. 1980. The effectiveness of fungus gnats as pollinators. American Journal of Botany 67:564-567.

MNHESP (Massachusetts Natural Heritage and Endangered Species Program). 2012. Massachusetts list of endangered, threatened and special concern species. 321 CMR 10.90, February 27, 2012.

Naskrecki, P. 2008. Mantis v. 2.0 - A Manager of Taxonomic Information and Specimens. URL: http://insects.oeb.harvard.edu/mantis

National Park Service. 2002. Boston Harbor Islands: a national park area. General Management Plan. Northeast Region. Boston, MA. 97 pp.

Nichols, B.J. and K.R. Langdon. 2007. The Smokies All Taxa Biodiversity Inventory: history and progress. Southeastern Naturalist 6:27-34.

Nilsson, S.G., J. Bengtsson, and S. Ås. 1988. Habitat diversity or area *per se*? Species richness of woody plants, carabid beetles and land snails on islands. Journal of Animal Ecology 57:685-704.

Økland, B. 1996. Unlogged forests: important sites for preserving the diversity of mycetophilids (Diptera: Sciaroidea). Biological Conservation 76:297-310.

Oliver, I. and A. Beattie. 1996. Designing a cost-effective invertebrate survey: a test of methods for rapid assessment of biodiversity. Ecological Applications 6:594-607.

Parker, C. and E. Bernard. 2006. The science approach to the Smokies ATBI. The George Wright Forum 23:26-36.

Paton, P.W.C, R.J. Harris, and C.L. Trocki. 2005. Distribution and abundance of breeding birds in Boston Harbor. The Northeastern Naturalist 12:145-168.

Pearce, T.A., J.C. Olori, and K.W. Kemezis. 2010. Land snails from St. Elzear cave, Gaspé Peninsula, Quebec: antiquity of *Cepaea hortensis* in North America. Annals of Carnegie Museum 79:65-78.

Prentice, T.R. 1993. Distinguishing the females of *Trochosa terricola* and *Trochosa ruricola* (Araneae, Lycosidae) from populations in Illinois, USA. The Journal of Arachnology 29:427-430.

Purrington, F.F. 1996. Ground beetles of Nantucket Island, Massachusetts: 1995 (Coleoptera: Carabidae). Journal of the New York Entomological Society 104:95-103.

Rainbow, P.S., A.G. Hildrew, B.D. Smith, Brian D.; T. Geatches, and S.N. Luoma. 2012. Caddisflies as biomonitors identifying thresholds of toxic metal bioavailability that affect the stream benthos. Environmental Pollution 166:196-207.

Richburg, J.A., W.A. Patterson III. 2005. Historical description of the vegetation of the Boston Harbor Islands: 1600-2000. Northeastern Naturalist 12:13-30.

Rizali, A., D.J. Lohman, D. Buchori, L.B. Prasetyo, H. Triwidodo, M.M. Bos, S. Yamane, and C. H. Schulze. 2010. Ant communities on small tropical islands: effects of island size and isolation are obscured by habitat disturbance and 'tramp' ant species. Journal of Biogeography 37:229-236.

Rosen, P.S., and D. FitzGerald. 2004. Processes and evolution of Boston Harbor Islands: Peddocks and Lovells Islands. Pages 197-210 *in* L. Hansen, editor. Guidebook for field trips in the Eastern Massachusetts Region. New England Intercollegiate Geological Conference, 96th Annual meeting.

Rykken, J.J., and B.D. Farrell. 2013. Discovering the microwilderness in parks and protected areas. Pages 306-322 *in* R.H. Lemelin, editor. The management of insects in recreation and tourism. Cambridge University Press, New York, NY.

Sikes, D.S. 2004. The beetle fauna of Rhode Island, an annotated checklist. The Biota of Rhode Island Vol. 3. The Rhode Island Natural History Survey, Kingston, RI. 296 pp.

Sikes, D.S., and R.P. Webster. 2005. Bioinventory of Rhode Island Coleoptera: 45 new records. The Coleopterists Bulletin 59:311–327.

Taylor,R.W. 1983. Descriptive taxonomy: past, present, and future. Highley, E. and R.W. Taylor, editors. Pages 93-134 *in* Australian systematic entomology: a bicentenary perspective. CSIRO, Melbourne, Australia.

Trocki, C.L., N.W. Talancy, and P.W.C. Paton. 2007. An inventory of amphibians, reptiles, nonvolant mammals, and select bird species on islands in Boston Harbor. Technical Report NPS/NER/NRTR—2007/094. National Park Service. Boston, MA. 43 pp.

Vepsäläinen, K., and B. Pisarski. 1982. Assembly of island ant communities. Annales Zoologici Fennici 19:327-335.

Vockeroth, J.R. 1981. Mycetophilidae. McAlpine, J.F., B.V. Peterson, G.E. Shewell, H.J. Teskey, J.R. Vockeroth, and D.M. Wood, editors. Pages 223-246 *in* Manual of Nearctic Diptera, Volume 1. Research Branch Agriculture Canada, Monograph no. 27. 674 pp.

Wetterer, J.K., and A.G. Radchenko. 2011. Worldwide spread of the ruby ant, *Myrmica rubra* (Hymenoptera: Formicidae). Myrmecological News 14:87-96.

Wheeler A.G. and E.R. Hoebeke. 1995. *Coccinella novemnotata* in northeastern North America: historical occurrence and current status (Coleoptera: Coccinellidae). Proceedings of the Entomological Society of Washington 97: 701–716.

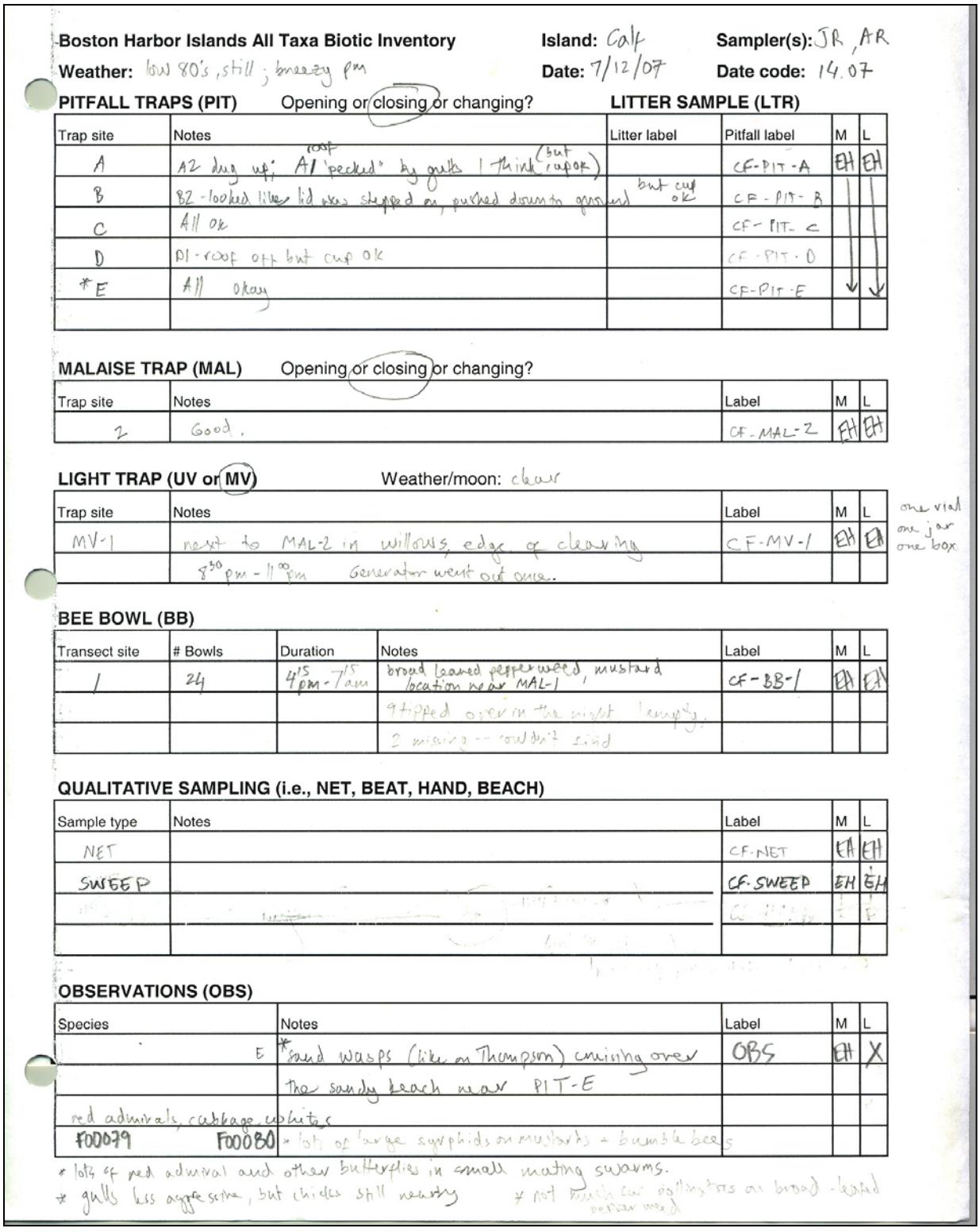
Wheeler, W.M. 1908. A European ant (*Myrmica laevinodis*) introduced into Massachusetts. Journal of Economic Entomology 1:336-339.

White, P. 2007. Forward to The Great Smoky Mountains National Park All Taxa Biodiversity Inventory: a search for species in our own back yard. Southeastern Naturalist 6:1-26.

Zurbuchen, A., L. Landert, J. Klaiber, A. Müller, S. Hein, and S. Dorn. 2010. Maximum foraging ranges in solitary bees: only few individuals have the capability to cover long foraging distances. Biological Conservation 143:669-670.

Appendix A. Field and laboratory data sheets used to track samples and specimens for the Boston Harbor Islands ATBI.

Field data sheet



Boston Harbor Islands All Taxa Biotic Inventory **Island:** Calf **Sampler(s):** JR, AR

Weather: low 80's, still; breezy pm **Date:** 7/12/07 **Date code:** 14.07

PITFALL TRAPS (PIT) Opening or closing or changing? **LITTER SAMPLE (LTR)**

Trap site	Notes	Litter label	Pitfall label	M	L
A	A2 dug up; A1 roof "pecked" by gulls I think (but cup ok)		CF-PIT-A	EH	EH
B	B2 - looked like lid was stepped on, pushed down in ground	but cup ok	CF-PIT-B		
C	All ok		CF-PIT-C		
D	D1 - roof off but cup ok		CF-PIT-D		
*E	All okay		CF-PIT-E		

MALAISE TRAP (MAL) Opening or closing or changing?

Trap site	Notes	Label	M	L
2	Good.	CF-MAL-2	EH	EH

LIGHT TRAP (UV or MV) Weather/moon: clear

Trap site	Notes	Label	M	L
MV-1	next to MAL-2 in willows, edge of clearing	CF-MV-1	EH	EH
	8:30 pm - 11:00 pm Generator went out once.			

one vial one jar one box

BEE BOWL (BB)

Transect site	# Bowls	Duration	Notes	Label	M	L
1	24	4:15 pm - 7:15 am	broad leaved pepperweed, mustard location near MAL-1	CF-BB-1	EH	EH
			9 tipped over in the night, empty.			
			2 missing -- couldn't find			

QUALITATIVE SAMPLING (i.e., NET, BEAT, HAND, BEACH)

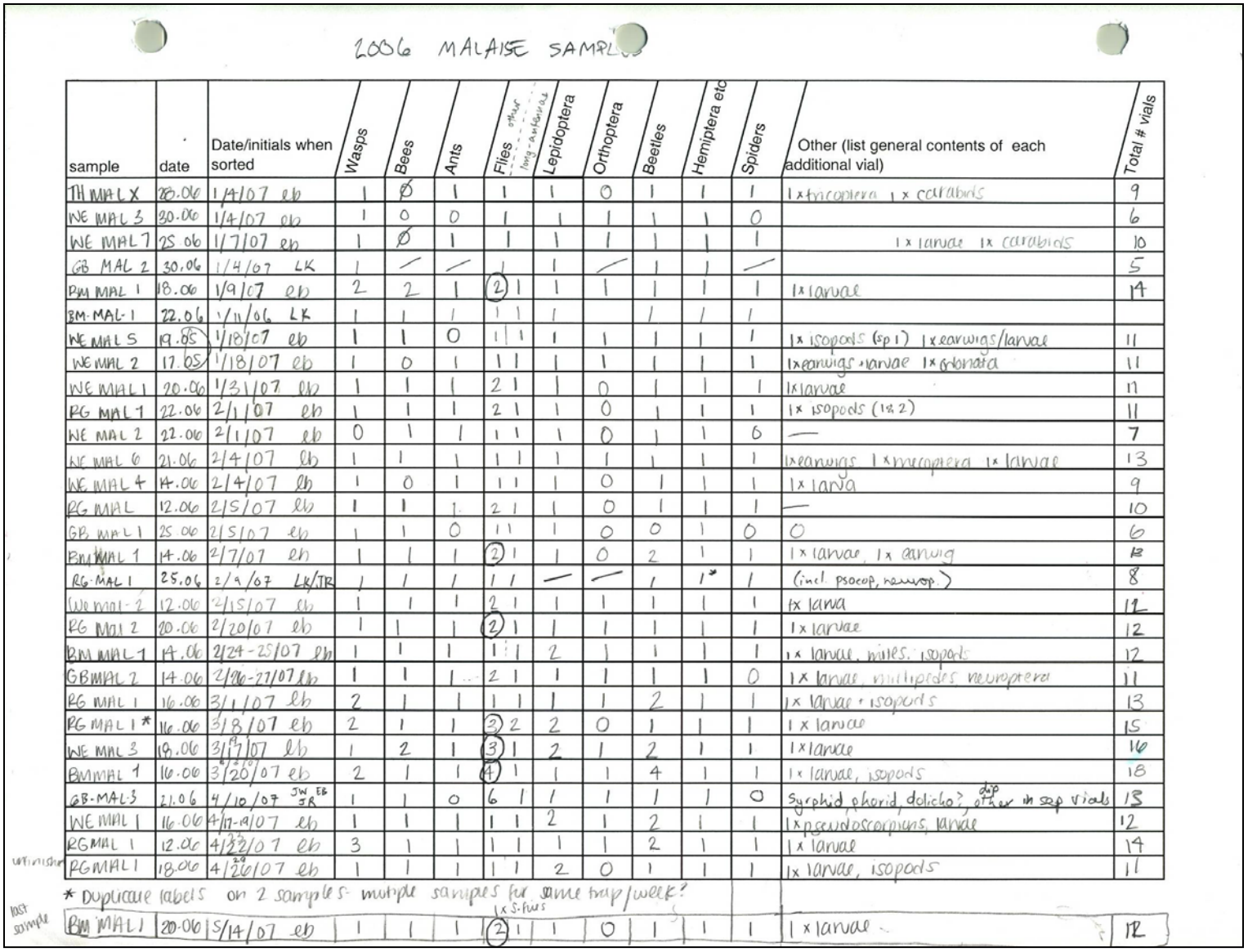
Sample type	Notes	Label	M	L
NET		CF-NET	EH	EH
SWEEP		CF-SWEEP	EH	EH

OBSERVATIONS (OBS)

Species	Notes	Label	M	L
E	*sand wasps (like on Thompson) cruising over	OBS	EH	X
	the sandy beach near PIT-E			
red admirals, cabbage whites				
F00079 F00080	* lots of large syrphids on mustards + bumble bees			

* lots of red admiral and other butterflies in small mating swarms.
* gulls less aggressive, but chicks still nearby * not much cw caterpillars on broad-leaved pepperweed

Lab sample sorting data sheet



2006 MALAISE SAMPLES

sample	date	Date/initials when sorted	Wasps	Bees	Ants	Flies (other / long-antennae)	Lepidoptera	Orthoptera	Beetles	Hemiptera etc	Spiders	Other (list general contents of each additional vial)	Total # vials
TH MAL X	28.06	1/4/07 eb	1	Ø	1	1	1	0	1	1	1	1 x tricoptera 1 x carabids	9
WE MAL 3	30.06	1/4/07 eb	1	0	0	1	1	1	1	1	0		6
WE MAL 7	25 06	1/7/07 eb	1	Ø	1	1	1	1	1	1	1	1 x larvae 1x carabids	10
GB MAL 2	30.06	1/4/07 LK	1	/	/	1	1	/	1	1	/		5
RM MAL 1	18.06	1/9/07 eb	2	2	1	(2) 1	1	1	1	1	1	1x larvae	14
BM MAL 1	22.06	1/11/06 LK	1	1	1	1 1	1		1	1	1		
WE MAL 5	19.05	1/18/07 eb	1	1	0	1 1	1	1	1	1	1	1x isopods (sp 1) 1x earwigs/larvae	11
WE MAL 2	17.05	1/18/07 eb	1	0	1	1 1	1	1	1	1	1	1x earwigs + larvae 1x odonata	11
WE MAL 1	20.06	1/31/07 eb	1	1	1	2 1	1	0	1	1	1	1x larvae	11
RG MAL 1	22.06	2/1/07 eb	1	1	1	2 1	1	0	1	1	1	1x isopods (1 & 2)	11
WE MAL 2	22.06	2/1/07 eb	0	1	1	1 1	1	0	1	1	6	—	7
WE MAL 6	21.06	2/4/07 eb	1	1	1	1 1	1	1	1	1	1	1x earwigs 1x trichoptera 1x larvae	13
WE MAL 4	14.06	2/4/07 eb	1	0	1	1 1	1	0	1	1	1	1x larva	9
RG MAL	12.06	2/5/07 eb	1	1	1	2 1	1	0	1	1	1	—	10
GB MAL 1	25 06	2/5/07 eb	1	1	0	1 1	1	0	0	1	0	0	6
RM MAL 1	14.06	2/7/07 eb	1	1	1	(2) 1	1	0	2	1	1	1 x larvae, 1 x earwig	12
RG MAL 1	25.06	2/9/07 LK/JR	1	1	1	1 1	—	—	1	1*	1	(incl psocop, neurop.)	8
WE MAL 2	12.06	2/15/07 eb	1	1	1	2 1	1	1	1	1	1	1x larva	12
RG MAL 2	20.06	2/20/07 eb	1	1	1	(2) 1	1	1	1	1	1	1 x larvae	12
RM MAL 1	14.06	2/24-25/07 eb	1	1	1	1 1	2	1	1	1	1	1 x larvae, mites, isopods	12
GB MAL 2	14.06	2/26-27/07 eb	1	1	1	2 1	1	1	1	1	0	1 x larvae, millipedes, neuroptera	11
RG MAL 1	16.06	3/1/07 eb	2	1	1	1 1	1	1	2	1	1	1 x larvae + isopods	13
RG MAL 1*	16.06	3/8/07 eb	2	1	1	(3) 2	2	0	1	1	1	1 x larvae	15
WE MAL 3	19.06	3/17/07 eb	1	2	1	(3) 1	2	1	2	1	1	1 x larvae	16
BM MAL 1	16.06	3/20/07 eb	2	1	1	(4) 1	1	1	4	1	1	1 x larvae, isopods	18
GB MAL 3	21.06	4/10/07 JW JR EB	1	1	0	6 1	1	1	1	1	0	syrphid, phorid, dolicho?, dip other in sep vials	13
WE MAL 1	16.06	4/17-9/07 eb	1	1	1	1 1	2	1	2	1	1	1x pseudoscorpions, larvae	12
RG MAL 1	12.06	4/22/07 eb	3	1	1	1 1	1	1	2	1	1	1 x larvae	14
RG MAL 1	18.06	4/26/07 eb	1	1	1	1 1	2	0	1	1	1	1x larvae, isopods	11
	* Duplicate labels on 2 samples- multiple samples for same trap/week?												
LAST SAMPLE	RM MAL 1	20.06	5/14/07 eb	1	1	1	(2) 1 x S. fuus 1	1	0	1	1	1	1 x larvae	12

Vial contents data sheet

Beetles ② ✓JR

Identified specimens stored in vials

BHI #	Locality	Species	Sex	Total	Storage info	Det.	Enter. by
BHI-V02341	CF-PIT-A 14.07	CRYTRI		1	S	JR	ARN
BHI-V02342	↓	STLGEM		1	↓	|	ARN
BHI-V02343	↓	TRXVAR		1	↓	|	ARN
BHI-V02344	CF-PIT-E 16.07	GLSQUA		1	S	|	ARN
BHI-V02345	↓	BLPMOE		2	↓	|	ARN
BHI-V02346	CF-PIT-B 26.07	BRCABD	♂	4	S	|	ARN
BHI-V02347	↓	↓	♀	1	↓	|	ARN
BHI-V02348	↓	TRMPUL		3	↓	|	ARN
BHI-V02349	CF-PIT-F 26.07	GLSFAS		1	0	|	ARN
BHI-V02350	CF-PIT-F 22.07	MLDCAS		2	S	|	ARN
BHI-V02351	CF-PIT-E 17.07	HYPFRA (?)		10	S	|	ARN
BHI-V02352	|	BLPMOE		1	|	|	ARN
BHI-V02353	↓	BLPMET		1	↓	↓	ARN
BHI-V02354	CF-PIT-B 18.07	DSNCOL		1	S	JR	ARN
BHI-V02355	CF-PIT-F 20.07	MLDCAS		5	S	JR	ARN
BHI-V02356	|	OTRSUL		1	|	|	ARN
BHI-V02357	|	GLSFAS		1	|	|	ARN
BHI-V02358	↓	OTROVA		2	↓	↓	ARN
BHI-V02359	CF-PIT-D 20.07	GLSFAS		5	S	JR	ARN
BHI-V02360	SP-PIT-C 22.07	MLDCAS		1	S	JR	ARN
BHI-V02361	|	EPHIND		1	|	|	ARN
BHI-V02362	↓	OTROVA		1	↓	↓	ARN
BHI-V02363	SP-PIT-C 20.07	OTROVA		2	S	JR	ARN
BHI-V02364	SP-PIT-C 12.07	SRCPER		1	S	JR	ARN
BHI-V02365	↓	OTROVA		2	↓	↓	ARN
BHI-V02366	SP-PIT-E 12.07	STLGEM		1	S	JR	ARN
BHI-V02367	SP-PIT-D 12.07	EPHIND		1	S	JR	ARN
BHI-V02368	↓	OTROVA		1	↓	JR	ARN
BHI-V02369	SP-PIT-B 12.07	GLSQUA		1	S	JR	ARN
BHI-V02370	↓	STLGEM		1	↓	JR	ARN
BHI-V02371	SP-PIT-C 16.07	SRCPER		1	S	JR	ARN
BHI-V02372	↓	OTROVA		4	↓	JR	ARN
BHI-V02373	SP-PIT-B 15.07	LPTDEC		1	S	JR	ARN
BHI-V02374	SP-PIT-E 15.07	LPTDEC		1	S	JR	ARN
BHI-V02375	↓	OTROVA		1	↓	↓	ARN
BHI-V02376	SP-PIT-B 30.07	TRXVAR		1	S	JR	ARN
BHI-V02377	SN-PIT-A 15.07	MLDCAS		4	S	JR	ARN
BHI-V02378	SP-MAL 26.07	CCCSEP		1	S	JR	ARN
BHI-V02379	SP-MAL 26.07	PSYVIG		1	↓	↓	ARN

6 12 14 16

Appendix B. Taxonomic references, checklists, and keys used for identification of invertebrates at the MCZ lab.

Arnett, Jr., R.H., N.M. Downie and H.E. Jacques. 1980. How to know the beetles. Wm. C. Brown Company Publishers, Dubuque, IA.

Arnett, Jr., R.H. and M.C. Thomas. 2001. American beetles: Archostemata, Myxophaga, Adephaga, Polyphaga: Staphyliniformia, Vol. 1. CRC Press, Boca Raton, FL. 443 pp.

Arnett, Jr., R.H., M.C. Thomas, P.E. Skelley, and J.H. Frank. 2002. American beetles: Polyphaga: Scarabaeoidea through Curculionoidea, Vol. 2. CRC Press, Boca Raton, FL. 861 pp.

Bell, R.T. 1971. Handbook of the Malacostraca of Vermont and neighboring regions (crayfish, sowbugs and their relatives). University of Vermont, Burlington, VT. 65pp.

Beirne, B.P. 1956. Leafhoppers (Homoptera: Cicadellidae) of Canada and Alaska. The Canadian Entomologist 88 (Suppl. 2): 1-180.

Bland, R.G. 2003. The Orthoptera of Michigan—biology, keys, and descriptions of grasshoppers, katydids, and crickets. Michigan State University Extension Bulletin E-2815. 220 pp.

Blousfield, E.L. 1973. Shallow-water gammaridean Amphipoda of New England. Cornell University Press, Ithaca, NY. 312 pp.

Blower, J.G. 1985. Millipedes : Keys and notes for the identification of the species. Synopses of the British Fauna (New Series) No. 35. E.J. Brill/Dr. W. Backhuys, London, UK. 242 pp.

Borror, D.J. and R.E. White. 1970. A field guide to insects, America north of Mexico. The Peterson Field Guide Series. Houghton Mifflin Company, New York, NY. 404 pp.

Bousquet, Y. (Ed.) 1991. Checklist of beetles of Canada and Alaska. Research Branch, Agriculture Canada, Publ. 1861/E. 430pp.

Bousquet, Y., and A. Larochelle. 1993. Catalogue of the Geadephaga (Coleoptera: Trachypachidae, Rhysodidae, Carabidae including Cicindelini) of America north of Mexico. Memoirs of the Entomological Society of Canada, No. 167. pp.1-397.

Bousquet, Y. 2010. Illustrated identification guide to adults and larvae of northeastern North American ground beetles (Coleoptera: Carabidae). Pensoft, Sofia-Moscow. 562 pp.

Bright, D.E., and P. Bouchard. 2008. The Insects and Arachnids of Canada. Part 25. Coleoptera, Curculionidae, Entiminae: Weevils of Canada and Alaska Volume 2. NRC Research Press, Ottawa, Ontario, Canada. 327pp.

Britton, W.E. 1923. The Hemiptera or sucking insects of Connecticut. Guide to the Insects of Connecticut, Part IV. State Geological and Natural History Survey Bull. No. 34. 807 pp.

Burch, J.B. 1962. How to know the eastern land snails. Wm. C. Brown Company Publishers, Dubuque, IA. 214 pp.

Cameron, R.A.D., B. Eversham and N. Jackson. 1983. A field key to the slugs of the British Isles. Field Studies 5: 807-824.

Capinera, J.L., R.D. Scott and T.J. Walker. 2004. Field guide to grasshoppers, crickets, and katydids of the United States. Comstock Publishing Associates, Ithaca, NY. 249 pp.

Carpenter, V. 1991. Dragonflies & damselflies of Cape Cod. Natural History Series, No. 4. The Cape Cod Museum of Natural History, Brewster, MA. 79 pp.

Chamberlin, R.V., and W. Ivie. 1941. North American Agelenidae of the genera Agelenopsis, Clilena, Ritalena and Tortolena. Annals of the Entomological Society of America 34:585-28.

Cheng, L. (Ed.) 1976. Marine insects. American Elsevier Publishing Company, NY. 581 pp.

Clark, S.M., D.G. LeDoux, T.N. Seeno, E.G. Riley, A.J. Gilbert and J.M. Sullivan. 2004. Host plants of leaf beetle species occurring in the United States and Canada (Coleoptera: Megalopodidae, Orsodacnidae, Chrysomelidae, excluding Bruchinae). Coleopterists Society, Special Publication No. 2. 476 pp.

Coovert, G.A. 2005. The ants of Ohio (Hymenoptera: Formicidae). Bulletin of the Ohio Biological Survey New Series Vol.15, No. 2. Ohio Biological Survey, Inc., Columbus, OH. 196 pp.

Dearborn, R., R. Bradbury and G. Russell. 1983. The forest insect survey of Maine: Order Hymenoptera. Entomology Division, Technical Report, No. 20. Maine Forest Service, Department of Conservation, Augusta, ME. 101 pp.

DeLong, D.M. 1948. The leafhoppers, or Cicadellidae, of Illinois (Eurymelinae-Balcluthinae). Bulletin of the Illinois Natural History Survey 24: 97-376.

Dillon, E.S., and L.S. Dillon. 1961. A manual of common beetles of eastern North America. Row, Peterson and Company, Elmsford, NY. 884 pp.

Dondale, C.D., and J.H. Redner. 1982. The Insects and Arachnids of Canada. Part 9. The sac spiders of Canada and Alaska (Araneae: Clubionidae and Anyphaenidae). Research Branch, Agriculture Canada, Publ. 1724. 194 pp.

Dondale, C.D., and J.H. Redner. 1978. The Insects and Arachnids of Canada. Part 5. The crab spiders of Canada and Alaska (Araneae: Philodromidae and Thomisidae). Research Branch, Canada Department of Agriculture, Publ. 1663. 255 pp.

Dondale, C.D., and J.H. Redner. 1990. The Insects and Arachnids of Canada. Part 17. The wolf spiders, nurseryweb spiders, and lynx spiders of Canada and Alaska (Araneae: Lycosidae, Pisauridae, and Oxyopidae). Research Branch, Agriculture Canada, Publ.1856. 383 pp.

Dondale, C.D., J.H. Redner, P. Paquin, and H.W. Levi. 2003. The Insects and Arachnids of Canada. Part 23. The orb-weaving spiders of Canada and Alaska (Araneae: Uloboridae, Tetragnathidae, Araneidae, Theridiosomatidae). NRC Research Press, Ottawa, Ontario, Canada. 371 pp.

Downie, N.M., and R.H. Arnett. 1996a. The beetles of northeastern North America, Vol. I. The Sandhill Crane Press, Gainesville, FL. pp.1-880.

Downie, N.M., and R.H. Arnett.1996b. The beetles of northeastern North America, Vol. II. The Sandhill Crane Press, Gainesville, FL. pp.891-1721.

Dunkle, S.W. 2000. Dragonflies through binoculars: a field guide to dragonflies of North America. Oxford University Press, New York, NY.266 pp.

Eason, E.H. 1964. Centipedes of the British Isles. Frederick Warne and Co. Ltd., New York, NY. 294 pp.

Edwards, G.B. 2004. Revision of the jumping spider genus Phidippus (Araneae: Salticidae). Occasional Papers of the Florida State Collection of Arthropods, Volume 11. 156pp.

Ellison, A.M., N.J. Gotelli, E.J. Farnsworth, and G.D. Alpert. 2012. A field guide to the ants of New England. Yale University Press, New Haven, CT. 398 pp.

Foottit, R. and W.R. Richards. 1993. The Insects and Arachnids of Canada. Part 22. The genera of the aphids of Canada (Homoptera, Aphidoidea and Phylloxeroidea). Research Branch, Agriculture Canada, Publ. 1885. 766 pp.

Gibbs, J. 2011. Revision of the metallic *Lasioglossum* (*Dialictus*) of eastern North America (Hymenoptera: Halictidae: Halictini). Zootaxa 3073:1-216.

Gibson, G.A.P., J.T. Huber, and J.B. Woolley (Eds.). 1997. Annotated keys to the genera of nearctic Chalcidoidea (Hymenoptera). NRC Research Press, Ottawa, Canada. 794 pp.

Glassberg, J. 1993. Butterflies through binoculars: a field guide to butterflies in the Boston, New York, Washington region. Oxford University Press, New York, NY.

Gordon, R.D. 1985. The Coccinellidae (Coleoptera) of America north of Mexico. Journal of the New York Entomological Society 93: 1-912.

Gregory, S. 2009. Woodlice and waterlice (Isopoda: Oniscidea & Asellota) in Britain and Ireland. FSC Publications, Shrewsbury, U.K. 175 pp.

Hamilton, K.G.A. 1985. Leafhoppers of ornamental and fruit trees in Canada. Communications Branch Agriculture Canada, Publ. 1779/E. 71 pp.

Hamilton, K.G.A. 1982. The Insects and Arachnids of Canada. Part 10. The spittlebugs of Canada (Homoptera: Cercopidae). Research Branch, Agriculture Canada, Publ. 1740. 102 pp.

Harris, H.M. 1928. A monographic study of the hemipterous family Nabidae as it occurs in North America. Entomologica Americana Vol. IX (New Series). 252 pp.

Hillyard, P. D. 2005. Harvestmen : keys and notes for the identification of British species. Synopses of the British Fauna (New Series) No. 4. Field Studies Council, Shrewsbury, UK. 167 pp.

Hopkin, S.P. 1997. Biology of the springtails (Insecta: Collembola). Oxford University Press, New York, NY. 330 pp.

Hubbell, T.H. 1936. A monographic revision of the genus *Ceuthophilus* (Orthoptera, Gryllacrididae, Rhaphiophorinae). University of Florida Publication, Biological Science Series II: 1-551.

Kaston, B.J. 1948, Spiders of Connecticut. State Geological and Natural History Survey, Bulletin no. 70. 874 pp.

Kaston, B.J. 1978. How to know the spiders. WCB/McGraw-Hill, Boston, MA. 272 pp.

Kerney, M.P. and R.A.D. Cameron. 1979. A field guide to the land snails of Britain and north-west Europe. Wm. Collins Sons and Co. Ltd., London, UK. 288 pp.

Kevan, D.K.McE. and G.G.E. Scudder. 1989. Illustrated keys to the families of terrestrial arthropods of Canada 1. Myriapods (millipedes, centipedes, etc.). Biological Survey of Canada Taxonomic Series No. 1. 88pp.

Lafontaine, J.D, and B.C. Schmidt. 2010. Annotated check list of the Noctuoidea (Insecta, Lepidoptera) of North America north of Mexico. ZooKeys 40:1-239.

Lam, E. 2004. Damselflies of the northeast : a guide to the species of eastern Canada & the northeastern United States. Biodiversity Books, Forest Hills, NY. 96 pp.

Larochelle, A. and M.C. Larivière. 2003. A Natural History of the Ground-beetles (Coleoptera: Carabidae) of America North of Mexico. Pensoft Publishers, Sofia-Moscow. 583 pp.

Legg, G. and R.E. Jones. 1988. Pseudoscorpions (Arthropoda, Arachnida) : keys and notes for the identification of the species. Synopses of the British Fauna (New Series) No. 40. E.J. Brill/Dr.W. Backhuys, New York, NY. 159 pp.

Leonard, J.G. and R.T. Bell. 1999. Northeastern tiger beetles: a field guide to tiger beetles of New England and eastern Canada. CRC Press, Boca Raton, FL. 176 pp.

Levi, L.R. and H.W. Levi. 1952. Preliminary list of harvestmen of Wisconsin with a key to genera. Wisconsin Academy of Sciences, Arts and Letters 41: 163-167.

Levi, H.W and L.R. Levi. 1972. The genera of the spider family Theridiidae. Bulletin of the Museum of Comparative Zoology 127: 1-71.

Liljeblad, E. 1945. Monograph of the family Mordellidae (Coleoptera) of North America, north of Mexico. Miscellaneous Publications of the Museum of Zoology, University of Michigan, No. 62. pp. 1-229.

Lindroth, C.H. 1961. The ground-beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska. Part 2. Opuscula Entomologica Supplementum 20: 1-200.

Lindroth, C.H. 1963. The ground-beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska. Part 3. Opuscula Entomologica Supplementum 24: 201-408.

Lindroth, C.H. 1966. The ground-beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska. Part 4. Opuscula Entomologica Supplementum 29: 409-648.

Lindroth, C.H. 1968. The ground-beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska. Part 5. Opuscula Entomologica Supplementum 33: 649-944.

Lindroth, C.H. 1969a. The ground-beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska. Part 6. Opuscula Entomologica Supplementum 34: 945-1192.

Lindroth, C.H. 1969b. The ground-beetles (Carabidae, excl. Cicindelinae) of Canada and Alaska. Part 1. Opuscula Entomologica Supplementum 35: i-xlviii.

Linsley, E.G. and J.A. Chemsak. 1976. Cerambycidae of North America. Part VI, No.2. Taxonomy and classification of the subfamily Lepturinae. University of California Publications in Entomology 80:1-186.

Lisberg, A.E. 2003. Taxonomic changes for fifteen species of North American Mordellidae (Coleoptera). Insecta Mundi 17: 191-194.

Majka, C.G., D.S. Chandler, and C.P. Donahue. 2011. Checklist of the beetles of Maine. Empty Mirrors Press, Halifax, NS, Canada. 328 pp.

Marsh, P.M., S.R. Shaw, and R.A. Wharton. 1987. An identification manual for the North American genera of the family Braconidae (Hymenoptera). Memoirs of the Entomological Society of Washington, 13:1-98.

Marshall, S.A. 2006. Insects—their natural history and diversity : with a photographic guide to insects of eastern North America.. Firefly Books Inc., Buffalo, NY. 718 pp.

Martin, J.E.H. 1977. The insects and arachnids of Canada. Part 1. Collecting, preparing, and preserving insects, mites, and spiders. Research Branch, Canada Department of Agriculture, Publ. 1643. 182 pp.

Maw, H.E.L., R.G. Foottit, K.G.A. Hamilton, and G.G.E. Scudder. 2000. Checklist of the Hemiptera of Canada and Alaska. NRC Research Press, Ottawa, Canada. 220 pp.

McAlpine, J.F., B.V. Peterson, G.E. Shewell, H.J. Teskey, J.R. Vockeroth, and D.M. Wood. 1981. Manual of Nearctic Diptera, Volumes 1 and 2. Research Branch Agriculture Canada, Monograph nos. 27,28. 1332 pp.

McAtee, W.L. 1914. Key to the nearctic genera and species of Geocorinae (Heteroptera: Lygaeidae). Proceedings of the Biological Society of Washington 27: 125-136.

Merritt, R.W. and K.W. Cummins (Eds). 1978. An Introduction to the aquatic insects of North America. Kendall/Hunt Publishing Company, Dubuque, IA. 441 pp.

Michener, C.D., R.J. McGinley, and B.N. Danforth. 1994. The bee genera of North and Central America (Hymenoptera:Apoidea). Smithsonian Institution Press, Washington, DC. 209 pp.

Mitchell, T.B. 1960. Bees of the eastern United States, Volume I. The North Carolina Agricultural Experiment Station, Tech. Bull. No. 141. 538 pp.

Mitchell, T.B. 1962. Bees of the eastern United States, Volume II. The North Carolina Agricultural Experiment Station, Tech. Bull. No. 152. 557 pp.

Moore, I. and E.F. Legner. 1979. An illustrated guide to the genera of the Staphylinidae of America north of Mexico exclusive of the Aleocharinae (Coleoptera). Division of Agricultural Sciences, University of California, No. 4093. 332 pp.

Needham, J.G, A.D. MacGillivray, O.A. Johannsen and K.C. Davis. 1903. Aquatic insects in New York state. New York State Museum Bulletin 68, Entomology 18: 199-517.

Nikula, B., J.L. Loose, and M.R. Burne. 2003. A field guide to dragonflies and damselflies of Massachusetts. Massachusetts division of Fisheries and Wildlife, Natural Heritage and Endangered Species Program, Westborough, MA. 197 pp.

Noonan, G.R. Classification, cladistics, and natural history of native North American Harpalus Latreille (Insecta: Coleoptera: Carabidae: Harpalini), excluding subgenera Glanodes and Pseudophonus. The Thomas Say Foundation Vol. XIII. Entomological Society of America, Lanham, MD. 310 pp.

Oliver, P. and C.J. Meechan. 1993. Woodlice : keys and notes for identification of the species. Synopses of the British Fauna (New Series) No. 49. Field Studies Council, Shrewsbury, UK. 135 pp.

Oman, P. 1949. The nearctic leafhoppers (Homoptera: Cicadellidae) : a generic classification and check list. Memoirs of the Entomological Society of Washington, No. 3. pp. 1-253.

Otte, D. 1981. The North American grasshoppers. Vol. !. Acrididae, Gomphocerinae and Acridinae. Harvard University Press, Cambridge, MA. 275 pp.

Otte, D. 1984. The North American grasshoppers. Vol. 2. Acrididae, Oedipodinae. Harvard University Press, Cambridge, MA. 366 pp.

Paquin, P., and N. Dupérré. 2003. Guide d'identification des araignées (Araneae) du Québec. Fabreries, Supplément 11. 251 pp.

Pechuman, L.L. 1981. The horse flies and deer flies of New York (Diptera, Tabanidae). Search: Agriculture, No. 18. Cornell University Agricultural Experiment Station, Ithaca, NY. 66 pp.

Platnick, N.I., and C.D. Dondale. 1992. The Insects and Arachnids of Canada. Part 19. The ground spiders of Canada and Alaska (Araneae: Gnaphosidae). Research Branch, Agriculture Canada, Publ.1875. 297 pp.

Pollock, L.W. 1998. A practical guide to the marine animals of northeastern North America. Rutgers University Press, New Brunswick, NJ. 394 pp.

Prentice, T.R. 2001. Distinguishing the females of *Trochosa terricola* and *Trochosa ruricola* (Araneae, Lycosidae) from populations in Illinois, USA. The Journal of Arachnology 29:427-430.

Riley, E.G., S.M. Clark and T.N. Seeno. 2003. Catalog of the leaf beetles of America north of Mexico (Coleoptera: Megalopodidae, Orsodacnidae and Chrysomelidae, excluding Bruchinae). Coleopterists Society, Special Publication No. 1. 290 pp.

Sikes, D.S. 2004. The beetle fauna of Rhode Island, an annotated checklist. The Biota of Rhode Island Vol. 3. The Rhode Island Natural History Survey, Kingston, RI. 296 pp.

Sims, R.W. and B.M. Gerard. 1999. Earthworms : notes for the identification of British species. Synopses of the British Fauna No. 31 (Revised). Field Studies Council, Shrewsbury, UK. 169 pp.

Slater, J.A. and R.M. Baranowski. 1978. How to know the true bugs (Hemiptera-Heteroptera). Wm. C. Brown Company Publishers, Dubuque, IA. 256 pp.

Summers, G. 1979. An illustrated key to the Chilopods of the north-central region of the United States. Journal of the Kansas Entomological Society 52:690-700.

Teskey, H. J. 1990. The insects and Arachnids of Canada. Part 16. The horse flies and deer flies of Canada and Alaska (Diptera: Tabanidae). Research Branch, Agriculture Canada, Publ. 1838. 381 pp.

Ubick, D., P. Paquin, P.E. Cushing, and V. Roth (eds.) 2005. Spiders of North America: an identification manual. American Arachnological Society. 377 pp.

Vlasak, J. and K. Vlasakova. 2002. Records of Cerambycidae (Coleoptera) in Massachusetts with notes on larval hosts. Coleopterists Bulletin 56:203-219.

Vockeroth, J.R. 1992. The Insects and Arachnids of Canada. Part 18. The flower flies of the subfamily Syrphinae of Canada, Alaska, and Greenland (Diptera, Syrphidae). Research Branch, Agriculture Canada, Publ. 1867. 456 pp.

Webb, D.W., N.D. Penny, and J.C. Martin. 1975. The Mecoptera, or scorpionflies, of Illinois. Illinois Natural History Survey Bulletin 31:251-316.

Westfall, M.J. and M.L. May. 1996. Damselflies of North America. Scientific Publishers, Gainesville, FL. 649 pp.

White, R.E. 1983. A field guide to the beetles of North America. The Peterson Field Guide Series. Houghton Mifflin Company, New York, NY. 368 pp.

Wilcox, J.A. 1954. Leaf beetles of Ohio (Chrysomelidae: Coleoptera). Ohio Biological Survey, Bull.43, VIII: 353-506.

Yanega, D. 1996. Field guide to northeastern longhorned beetles (Coleoptera:Cerambycidae). Illinois Natural History Survey Manual 6. 184pp.

Appendix C. Taxonomists who donated their time and expertise to identify invertebrates from the Boston Harbor Islands ATBI.

Name	Affiliation	Taxa identified
Anderson, R.	Canadian Museum of Nature, ON	Coleoptera:Curculionioidea
Arduser, M.	Missouri Department of Conservation, MO	Hymenoptera: Apiformes
Ascher, J.	American Mus.Nat. Hist., NY	Hymenoptera: Apiformes
Baldinger, A.	Harvard University, MA	Amphipoda
Bell, R.	University of Vermont, VT	Coleoptera: Carabidae
Bernard, E.	University of Tennessee, Knoxville, TN	Collembola
Brunke, A.	University of Guelph, ON	Coleoptera: Staphylinidae
Chandler, D.	University of New Hampshire, NH	Coleoptera; Hemiptera: Cicadellidae
Clark, A.	Harvard University, MA	Hymenoptera: Formicidae
Cover, S.	Harvard University, MA	Hymenoptera: Apiformes
Dakin, M.	Mississippi Entomological Museuem, MS	Orthoptera
Davidson, R.	Carnegie Mus. Nat. Hist., PA	Coleoptera: Carabidae
Dourson, D.	Copperhead Environmental Consulting, MA	Gastropoda
Droege, S.	USGS, Patuxent, MD	Hymenoptera: Apiformes
Footit, R.	Canadian National Collection of Insects, ON	Hemiptera: Aphididae
French, T.	Mass. Division of Fisheries and Wildlife, MA	Gastropoda
Gibbs, J.	Cornell University, NY	Hymenoptera: Apiformes
Gimmel, M.	Louisiana State Arthropod Museum, LA	Coleoptera: Phalacridae
Giribet, G.	Harvard University, MA	Chilopoda
Gorring, P.	Harvard University, MA	Coleoptera: Cerambycidae
Hamiltion, K.G.A.	Canadian National Collection of Insects, ON	Hemiptera: Cicadellidae
Hoebeke, E.R.	Cornell University, NY	Coleoptera: Scolytinae
Keiper, J.	Virginia Museum of Natural History, VA	Diptera
Kent, S.	Northeastern University, MA	Apiformes
Lago, P.	University of Mississippi, MS	Coleoptera: Scarabaeoidea
Laplante, S.	Canadian National Collection of Insects, ON	Coleoptera: Elateridae: Eucnemidae
Lenihan, J.	Simmons College, MA	Amphipoda
MacDougall, J.	Biodiversity Consulting, LCC, MA	Odonata
Madden, S.	Harvard University, MA	Coleoptera: Carabidae
Mello, M.	Lloyd Center for the Environment, MA	Lepidoptera
Milam, J.	University of Massachusetts, MA	Apiformes
Model, F.	Massachusetts Butterfly Club, MA	Lepidoptera
Naskrecki, P.	Harvard University, MA	Orthoptera
Ravenscraft, A.	Harvard University, MA	Orthoptera
Riley, E.	Texas A and M University, TX	Coleoptera: Chrysomelidae
Rücker, W.	Neuwied, Germany	Coleoptera: Latridiidae
Rulik, B.	Fed. State Coll. of Nat. Hist. Dresden, Germany	Diptera: Sciaroidea
Rykken, J.	Harvard University, MA	Various taxa
Snyder, B.	Kansas State University, KS	Diplopoda
Stubblefield, W.J.	Fresh Pond Research Institute, MA	Hymenoptera: Aculeata
Szlavecz, K.	Johns Hopkins University, MD	Isopoda
Thompson, F.C.	Smithsonian National Mus. of Nat. Hist., DC	Diptera: Syrphidae
Veit, M.	Lawrence Academy, MA	Odonata; Hymenoptera: Apiformes
Vilisics, F.	Szent István University, Budapest, Hungary	Isopoda
Wagner, D.	University of Connecticut, CT	Lepidoptera

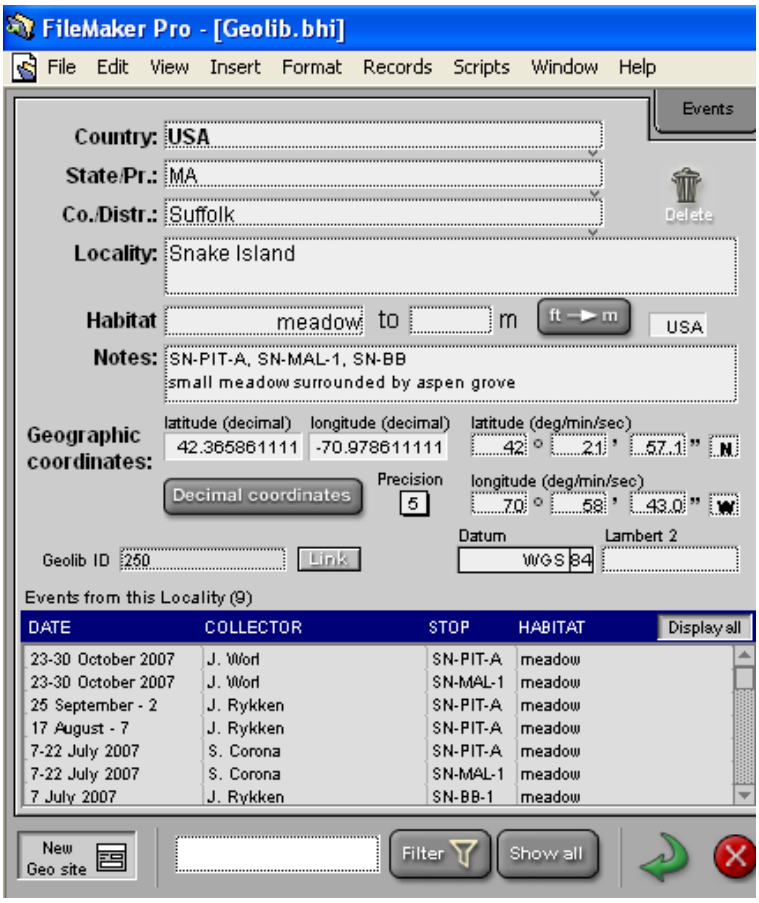
Appendix D. Data fields used in the Mantis database, and examples of forms where data were entered and displayed.

Underlined fields are unique ID's that link tables; *italicized* fields are those that Mantis automatically adds to a table entry form.

Field name	Entry example	Notes
Geolib table		Geographic information for each sampling site
Country	USA	
State/Province	Massachusetts	
County	Suffolk	
Locality	Calf Island	
Site ID	102	Assigned by Mantis
Habitat	Meadow	Broad categories--drop down list
Lat. Deg.	42	
Lat. Min.	18	
Lat. Sec.	55.2	One decimal place accuracy
Lat. S/N	N	
Long. Deg.	71	
Long. Min.	0	
Long. Sec.	42.6	One decimal place accuracy
Long. E/W	W	
Datum	WGS 84	
Locality (Event) table		Information about collecting events
Date start	8/24/2006	Date of collection, or start date for trap
Date end	9/7/2006	Closing date for traps left open for more than one day
Stop	CF-PIT-B 22.06	Field code indicating island, trap, site, and sample date
Collector	J. Rykken	Who collected sample
Notes		
Trap type	pitfall trap	
Locality ID	445	Assigned by Mantis
Higher Taxa (Genus) table		Links all the taxonomic levels above species
Phylum	Arthropoda	Each taxonomic level must be filled in
Class	Insecta	
Subclass	Pterygota	
Order	Coleoptera	
Superfamily	Superfamily 1	Dummy name, where none exists
Family	Carabidae	
Subfamily	Harpalinae	
Genus	Pterostichus	
Species table		
Suborder, Superfamily, Family, Subfamily, Genus		From Higher Taxa table
Species	luctuosus	
Subspecies		
Author	(Dejean)	Who originally described the species
Year	1828	Year species was originally described
Notes		
Species ID	9101071	Assigned by Mantis
Native?	Yes	Native to eastern North America? (yes/no answer)
Species code	ptrluc	Six letter code for each species, to aid in data entry
Common name		If one exists

Field name	Entry example	Notes
Specimen table		
Specimen ID	BHI-V00617	Unique # assoc. with a specimen/lot; assigned by user
Specimen/lot	6	No. individuals in "lot" (assigned the same BHI number)
Stage	adult male	male/female/adult/immature/worker/larva etc.
Medium	in alcohol	pinned, observation, audio recording etc.)
Det. by	J. Rykken	Who identified the specimen
Depository	MCZ	Where the specimen is housed (Mus. Comp. Zool)
Storage	JR 5/19/2007	By whom and when the data were entered
Specimen notes		
Specimen history		Note generated by Mantis if specimen ID has changed
Species name, Author, Species_ID		From Species table
Superfamily, Family, Subfamily		From Higher Taxa table
Country, Province, Locality		From Geolib table
Date, Collector, Stop, Locality_ID		From Locality table

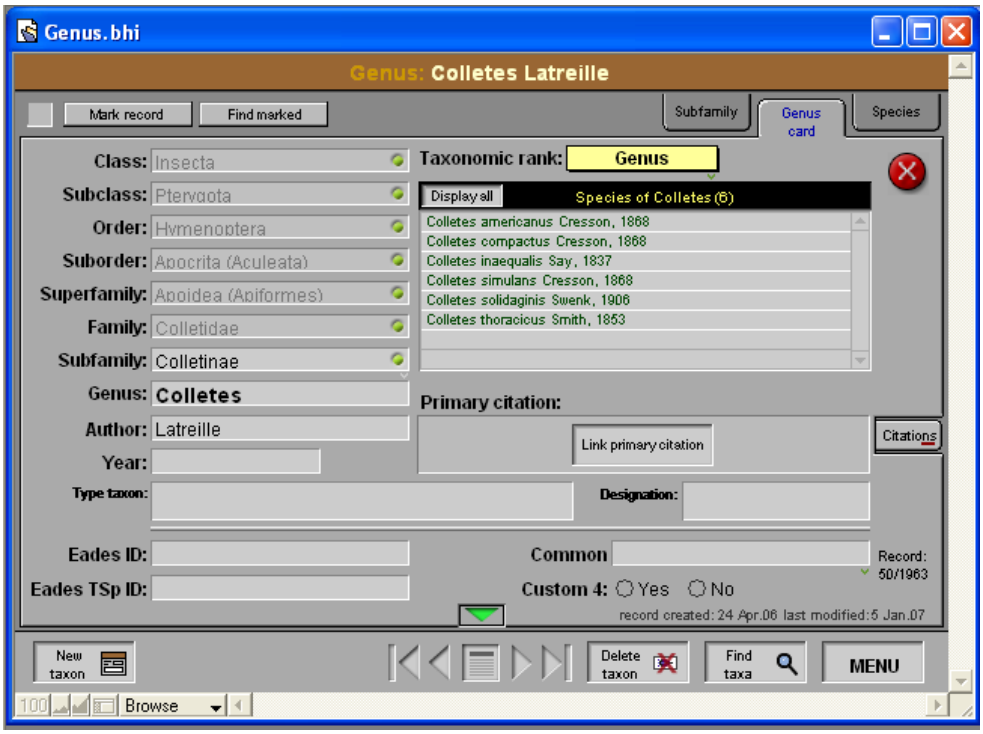
Geolib form for entering geographic location of sampling site, links to Locality (Event) table.



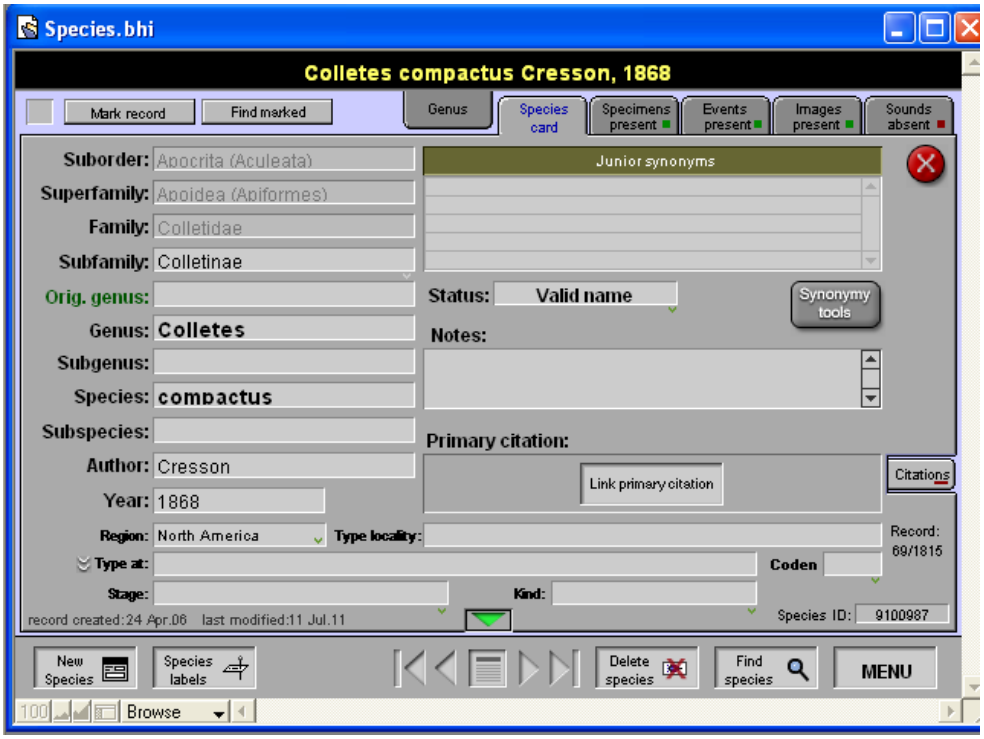
Locality (Event) form



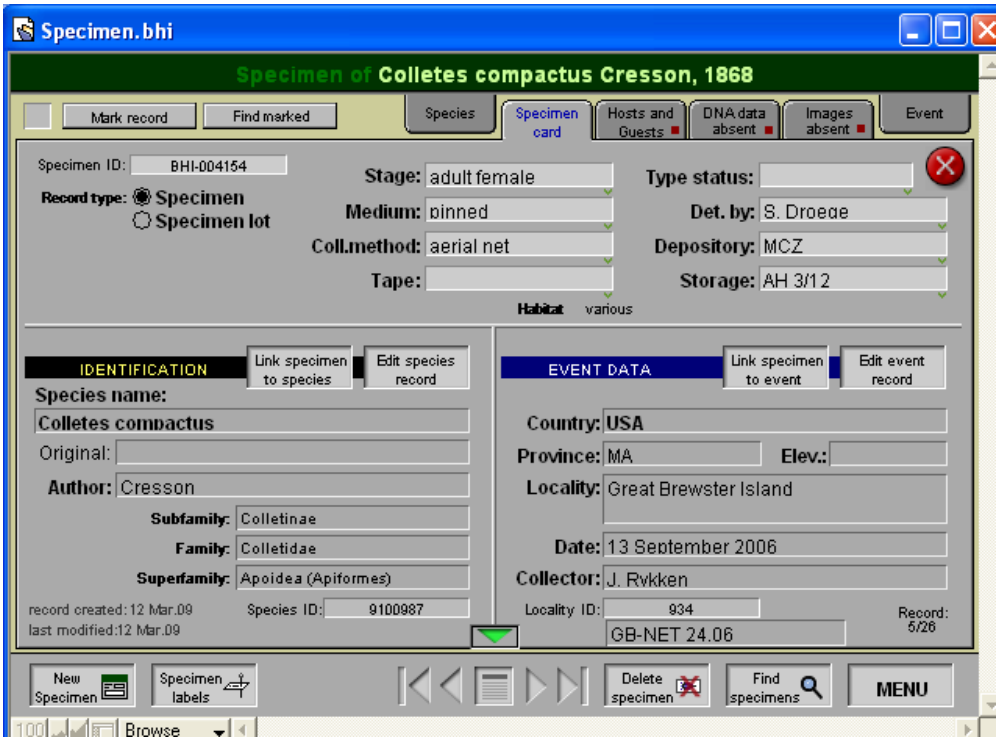
Higher taxa (Genus) form



Species form



Specimen form



Appendix E. Table of 1732 invertebrate species documented during Boston Harbor Islands ATBI, and the total number of specimens collected across 19 islands and peninsulas.

Notes:
Island codes in column headings are defined in Table 1.
* = species of particular interest, see Results section for more information
I = known introduction; I? = uncertainty as to whether species is introduced or has a Holarctic distribution
S = new state record for MA confirmed by taxonomist.
S? = unconfirmed state record; not recorded for MA in Downie and Arnett (1996); Sikes (2004, 2005); or Majka et al. (2011)
US, NA = new record for Unites States or North America. NA? = species determination still needs confirmation.
L = Lindroth (1957) documented this species in coastal "ballast places" of southwestern England.

†Taxonomy for Lepidoptera: Noctuoidea reflects a major revision of the group by Lafontaine and Schmidt (2010; reference in Appendix B).

PHYLUM/Order	**CLASS**/Family	Notes	Islands																				**Total # islands**
			BM	**CF**	**DE**	**GE**	**GP**	**GB**	**LN**	**LI**	**LV**	**MB**	**OB**	**PE**	**RG**	**RN**	**SN**	**SP**	**TH**	**WB**	**WE**	
ARTHROPODA	**ARACHNIDA**																						
Araneae	Agelenidae																						
Agelenopsis potteri	(Blackwall)		0	1	0	0	1	1	9	0	0	0	0	0	0	0	2	2	34	0	0	7
Araneae	Amaurobiidae																						
Amaurobius ferox	(Walckenaer)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Araneae	Araneidae																						
Araneus diadematus	Clerck	I	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Eustala anastera	(Walckenaer)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Neoscona arabesca	(Walckenaer)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Araneae	Atypidae																						
Sphodros niger	(Hentz)	*	0	6	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Araneae	Corinnidae																						
Castianeira cingulata	(C.L. Koch)		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1
Castianeira variata	Gertsch		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
Phrurotimpus alarius	(Hentz)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Phrurotimpus borealis	(Emerton)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Trachelas tranquillus	(Hentz)		0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	2
Araneae	Dysderidae																						
Dysdera crocata	C.L. Koch	*,I,L	38	21	0	0	23	5	2	0	0	0	0	0	11	0	9	1	52	0	26	10
Araneae	Gnaphosidae																						
Drassodes neglectus	(Keyserling)		0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2
Drassyllus rufulus	(Banks)		0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Zelotes fratris	Chamberlin		0	10	0	0	0	3	0	0	0	0	0	0	0	0	1	0	0	0	0	3
Araneae	Linyphiidae																						
Erigone atra	Blackwall		0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Araneae	Lycosidae																						
Allocosa funerea	(Hentz)		4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Pardosa milvina	Milvina		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Pardosa moesta	Banks		0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pardosa saxitilis	(Hentz)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	1

PHYLUM/Order	**CLASS**/Family	Notes	Islands																				Total # islands
			BM	**CF**	**DE**	**GE**	**GP**	**GB**	**LN**	**LI**	**LV**	**MB**	**OB**	**PE**	**RG**	**RN**	**SN**	**SP**	**TH**	**WB**	**WE**	
Pirata minutus	Emerton		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Trochosa ruricola	(De Geer)	*,I,L	4	32	0	0	0	11	0	0	0	0	0	0	0	0	10	1	0	0	0	5
Trochosa terricola	Thorell	L	0	3	0	0	0	0	0	0	0	0	0	0	5	0	0	0	3	0	1	4
Araneae	Miturgidae																					
Cheiracanthium mildei	L. Koch	I	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Araneae	Philodromidae																					
Tibellus oblongus	(Walckenaer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Araneae	Salticidae																					
Pelegrina exigua	(Banks)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Araneae	Segestriidae																					
Ariadna bicolor	(Hentz)		0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Araneae	Tetragnathidae																					
Pachygnatha autumnalis	Marx		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Araneae	Thomisidae																					
Ozyptila praticola	(C.L. Koch)	I	0	7	0	0	0	1	0	0	0	0	0	0	0	0	22	11	9	0	0	5
Xysticus elegans	Keyserling		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	2
Xysticus ferox	(Hentz)		0	2	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	0	12	4
Xysticus fraternus	Banks		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Xysticus gulosus	Keyserling		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Opiliones	Phalangiidae																					
Phalangium opilio	Linnaeus	I,L	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
ARTHROPODA	**CHILOPODA**																					
Lithobiomorpha	Lithobiidae																					
Lithobius forficatus	Linnaeus	I,L	4	9	0	0	50	14	0	0	2	0	0	0	14	0	73	176	65	0	27	10
ARTHROPODA	**COLLEMBOLA**																					
Entomobryomorpha	Entomobryidae																					
Entomobrya multifasciata	(Tullberg)		0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	4	0	0	0	2
Lepidocyrtus paradoxus	Uzel	I	0	0	0	0	0	0	0	0	1	0	0	0	0	0	25	3	0	0	1	4
Orchesella cincta	(Linnaeus)	I	0	0	0	0	161	0	0	0	0	0	0	0	0	0	3	1	7	0	9	5
Orchesella villosa	Linnaeus	I	0	0	0	0	77	0	0	0	0	0	0	0	0	0	0	0	0	0	68	2

PHYLUM/Order	**CLASS**/Family	Notes	Islands																			**Total # islands**
			BM	**CF**	**DE**	**GE**	**GP**	**GB**	**LN**	**LI**	**LV**	**MB**	**OB**	**PE**	**RG**	**RN**	**SN**	**SP**	**TH**	**WB**	**WE**	
Entomobryomorpha	Isotomidae																					
Isotoma viridis	(Bourlet)		0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Isotomiella minor	(Schäffer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Parisotoma notabilis	(Schäffer)		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Entomobryomorpha	Tomoceridae																					
Pogonognathellus sp. 1			0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	16	3
Poduromorpha	Neanuridae																					
Anurida maritima	(Guérin-Méneville)		0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Neanura muscorum	(Templeton)		0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Symphypleona	Katiannidae																					
Sminthurinus elegans	(Fitch)	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0	1
Symphypleona	Sminthuridae																					
Sminthurus sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
ARTHROPODA	**DIPLOPODA**																					
Julida	Blaniulidae																					
Blaniulus guttulatus	(Fabricius)	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Choneiulus palmatus	(Neméc)	I	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	1	5
Nopoiulus kochii	(Gervais)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Proteroiulus fuscus	(Am Stein)	I	0	1	0	0	1	3	6	0	0	0	0	0	3	0	0	0	3	0	0	6
Julida	Julidae																					
Brachyiulus pusillus	(Leach)	I	0	0	0	0	13	1	0	0	0	0	0	0	1	0	0	2	3	0	0	5
Cylindroiulus caeruleocinctus	(Wood)	I	7	52	0	0	50	14	27	0	0	0	0	0	0	0	0	9	41	0	29	8
Cylindroiulus latestriatus	(Curtis)	I	0	1	0	0	22	14	1	0	0	0	0	0	3	0	7	9	2	0	3	9
Cylindroiulus punctatus	(Leach)	I	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	4	2
Ophyiulus pilosus	(Newport)	I	3	0	0	0	0	0	3	0	0	0	0	0	31	0	0	0	0	0	81	4
Julida	Nemasomatidae																					
Thalassisobates littoralis	Silvestri	*	1	104	0	1	255	10	0	0	0	0	0	0	0	0	0	0	9	0	0	6
Polydesmida	Paradoxosomatidae																					
Oxidus gracilis	(Koch)	I	0	0	0	0	276	1	0	0	0	0	0	0	0	0	0	109	0	0	0	3
Polydesmida	Polydesmidae																					

PHYLUM/Order	**CLASS**/Family	Notes	Islands																			**Total # islands**
			BM	**CF**	**DE**	**GE**	**GP**	**GB**	**LN**	**LI**	**LV**	**MB**	**OB**	**PE**	**RG**	**RN**	**SN**	**SP**	**TH**	**WB**	**WE**	
Polydesmus angustus	Latzel	I,L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	1
Polydesmus inconstans	Latzel	I,L	1	0	0	0	50	6	0	0	0	0	0	0	0	0	24	52	13	0	2	7
Polydesmus superus	(Latzel)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Polyxenida	Polyxenidae																					
Polyxenus lagurus	(Linnaeus)		0	0	0	0	1	0	0	0	0	0	0	0	1	0	4	0	11	0	1	5
ARTHROPODA	**INSECTA**																					
Coleoptera	Aderidae																					
Cnopus impressus	(LeConte)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Elonus basalis	(LeConte)		5	0	0	0	1	0	0	0	0	0	0	0	20	0	0	0	0	0	3	4
Zonantes fasciatus	(Melsheimer)		0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	2	0	3	4
Zonantes subfasciatus	(LeConte)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	7	4
Coleoptera	Anobiidae																					
Hadrobregmus notatus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	2
Oligomerus obtusus	LeConte		0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1	0	1	3
Protheca hispida	LeConte	MA?	0	0	0	0	0	0	1	0	0	0	0	0	10	0	0	0	4	0	2	4
Trichodesma gibbosa	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Coleoptera	Anthicidae																					
Amblyderus pallens	(LeConte)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
Anthicus cervinus	LaFerté-Sénectère		0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2
Anthicus flavicans	LeConte		0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Anthicus haldemani	LeConte		0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0	2
Anthicus melancholicus	Laferté-Sénectère		0	1	0	0	25	0	0	0	0	0	0	0	0	0	5	0	2	0	0	4
Anthicus scabriceps	LeConte		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	0	0	1
Malporus formicarius	(LaFerté-Sénectère)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Mecynotarsus candidus	LeConte	MA?	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	24	0	0	2
Notoxus desertus	Casey		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
Notoxus planicornis	LaFerté-Sénectère		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sapintus fulvipes	(Laferté-Sénectère)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sapintus pusillus	(Laferté-Sénectère)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	8	0	3	5

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Coleoptera	Anthribidae																					
Euparius marmoreus	(Olivier)		0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	1	0	1	4
Eusphyrus walshii	LeConte	MA?	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	1
Trigonorhinus sticticus	(Boheman)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Coleoptera	Bostrichidae																					
Lichenophanes sp. 1.			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Coleoptera	Brachypteridae																					
Brachypterolus pulicarius	(Linnaeus)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Coleoptera	Brentidae																					
Apion cf. cyanitinctum	Fall		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	6	0	0	3
Apion frosti	Kissinger		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Apion herculanum	Smith		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Apion idiastes	Kissinger	MA?	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Arrhenodes minutus	(Drury)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Perapion curtirostre	(Germar)	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	**25**	0	0	2
Coleoptera	Buprestidae																					
Acmaeodera tubulus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1
Agrilus bilineatus	(Weber)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2
Dicerca divaricata	(Say)		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Dicerca lurida	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Coleoptera	Byturidae																					
Byturus unicolor	Say		1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	3
Coleoptera	Cantharidae																					
Cantharis carolinus	Fabricius		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Cantharis livida	Linnaeus		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	2
Cantharis rufa	Linnaeus	I,L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Podabrus tricostatus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Rhagonycha sp.1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Coleoptera	Carabidae																					
Acupalpus carus	(LeConte)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

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Acupalpus hydropicus	(LeConte)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2
Acupalpus nanellus	Casey		0	1	0	0	4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
Acupalpus partiarius	(Say)		0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Acupalpus pumilus	Lindroth		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Acupalpus rectangulus	Chaudoir		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Agonum aeruginosum	Dejean		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Agonum decorum	(Say)		0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Agonum ferreum	Haldeman		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Agonum fidele	Casey		0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Agonum gratiosum	(Mannerheim)		0	31	0	0	12	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Agonum melanarium	Dejean		0	57	0	0	187	0	0	0	0	0	0	0	0	0	0	0	0	0	13	3
Agonum muelleri	(Herbst)	I,L	0	4	0	0	0	11	0	0	0	0	0	0	0	0	0	0	2	0	2	4
Agonum palustre	Goulet		0	2	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Agonum punctiforme	(Say)		0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Agonum retractum	LeConte		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Agonum tenue	(LeConte)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Agonum thoreyi	Dejean		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Amara aenea	(DeGeer)	I,L	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Amara angustata	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Amara apricaria	(Paykull)	I	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Amara aulica	(Panzer)	*,I,MA,L	0	1	0	0	6	7	0	0	0	0	0	0	0	0	22	30	29	0	0	6
Amara avida	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	1
Amara bifrons	(Gyllenhal)	*,I,MA	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	815	4	0	0	3
Amara cupreolata	Putzeys		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	2
Amara exarata	Dejean		0	0	0	0	32	1	0	0	0	0	0	0	0	0	0	50	8	0	9	5
Amara familiaris	(Duftschmid)	I,L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Amara littoralis	Mannerheim		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Amara lunicollis	Schiodte	L	4	0	0	0	0	29	0	0	0	0	0	0	0	0	0	3	0	0	3	4
Amara musculis	(Say)		1	3	0	0	21	1	0	0	0	0	0	0	0	0	0	8	57	0	0	6
Amara ovata	(Fabricius)	I,L	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

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Amara quenseli	(Schönherr)		0	1	0	0	22	0	0	0	1	0	0	0	0	0	0	2	57	0	0	5
Amara rubrica	Haldeman		0	0	0	0	35	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2
Amphasia sericea	T.W. Harris		1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	4	0	2	4
Anisodactylus harrisii	LeConte		5	13	0	0	5	6	0	0	0	0	0	0	1	0	1	19	7	0	22	9
Anisodactylus nigerrimus	(Dejean)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Anisodactylus nigrita	Dejean		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Anisodactylus rusticus	(Say)		1	0	0	0	4	0	0	0	1	0	0	0	0	0	0	0	3	0	0	4
Apenes lucidulus	(Dejean)	*MA	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Apristus latens	(LeConte)		0	2	0	30	1	0	0	0	10	0	0	0	0	1	0	2	60	0	0	7
Apristus subsulcatus	(Dejean)		0	0	0	8	33	0	0	0	3	0	0	0	4	2	0	0	247	0	0	6
Asaphidion curtum	(Heyden)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Atranus pubescens	(Dejean)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Axinopalpus biplagiatus	(Dejean)		0	1	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	3
Badister notatus	Haldeman		0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	1	4
Badister transversus	Casey	*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Bembidion americanum	Dejean		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Bembidion constrictum	(LeConte)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	2
Bembidion contractum	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1
Bembidion frontale	(LeConte)		0	1	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	4	3
Bembidion graciliforme	Hayward		0	1	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
Bembidion nigropiceum	(Marsham)	*I	0	0	0	0	1	0	0	0	0	0	0	0	0	9	0	0	72	0	0	3
Brachinus vulcanoides	Erwin		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	1
Bradycellus rupestris	(Say)		0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	3	0	0	0	3
Bradycellus tantillus	(Dejean)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Calathus opaculus	LeConte		0	0	0	0	3	0	0	0	0	0	0	0	0	0	3	6	3	0	0	4
Carabus nemoralis	Müller	I	3	13	0	0	82	174	0	0	0	0	0	0	0	0	14	0	191	0	23	7
Chlaenius emarginatus	Say		2	0	0	0	3	1	0	0	0	0	0	0	0	0	10	0	5	0	7	6
Chlaenius impunctifrons	Say		0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chlaenius pennsylvanicus	Say		0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chlaenius tricolor	Dejean		0	0	0	0	1	0	0	0	0	0	0	0	0	0	3	1	1	0	3	5

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Cicindela sexguttata	Fabricius		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Clivina fossor	(Linné)	I	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Colliuris pensylvanica	(Linné)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cymindis americanus	Dejean		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Cymindis limbatus	Dejean		0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	2	0	3	4
Cymindis neglectus	Haldeman		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cymindis pilosus	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Cymindis platicollis	(Say)		4	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	4	0	5	5
Dicaelus dilatatus	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Dicaelus elongatus	Bonelli		13	0	0	0	7	0	4	0	0	0	0	0	29	0	0	0	0	0	23	5
Dicaelus politus	Dejean		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	2
Diplocheila obtusa	(LeConte)		0	0	0	0	2	3	0	0	0	0	0	0	0	0	1	1	1	0	0	5
Dromius piceus	Dejean		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Dyschirius dejeanii	Putzeys		0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Dyschirius globulosus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	5	0	1	0	4	0	0	3
Dyschirius setosus	LeConte		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Elaphropus incurvus	(Say)		0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	3
Elaphropus vernicatus	(Casey)		0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Elaphropus xanthopus	(Dejean)		0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
Harpalus affinis	(Schrank)	I,L	0	10	0	0	0	1	0	0	0	0	0	0	0	0	3	0	17	0	2	5
Harpalus caliginosus	(Fabricius)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Harpalus compar	LeConte		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Harpalus erythropus	Dejean		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	3
Harpalus opacipennis	(Haldeman)		0	4	0	0	0	1	0	0	0	0	0	0	0	0	0	33	1	0	0	4
Harpalus pensylvanicus	(DeGeer)		43	2	0	0	12	3	0	0	0	0	0	0	2	0	1	0	20	0	6	8
Harpalus rubripes	(Duftschmid)	I,MA,L	0	0	0	0	1	1	0	0	0	0	0	0	0	0	3	1	3	0	1	6
Harpalus rufipes	(DeGeer)	I,L	7	95	0	0	184	82	0	0	0	0	0	0	0	0	38	537	12	0	57	8
Harpalus somnulentus	Dejean		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Laemostenus terricola terricola	(Herbst)	*I,US	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lebia analis	Dejean		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1

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Lebia grandis	Hentz		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Lebia pumila	Dejean		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Lebia solea	Hentz		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
Lebia viridipennis	Dejean		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Lebia viridis	Say		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2
Notiobia terminata	(Say)		0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	2	1	0	2	4
Notiophilus aeneus	(Herbst)		0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	12	2
Ophonus puncticeps	Stephens	I,L	2	0	0	0	1	2	0	0	0	0	0	0	0	0	0	1	44	0	8	6
Oxypselaphus pusillus	(LeConte)		2	0	0	0	19	1	0	0	0	0	0	0	0	0	0	0	0	0	2	4
Patrobus longicornis	(Say)		0	1	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Perigona nigriceps	(Dejean)	I	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1
Platynus decentis	(Say)		0	0	0	0	56	0	0	0	0	0	0	0	3	0	0	0	0	0	1	3
Poecilus chalcites	(Say)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Poecilus lucublandus	(Say)		42	22	0	0	127	19	1	0	1	0	0	0	6	0	0	11	13	0	92	10
Pterostichus caudicalis	(Say)		0	6	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Pterostichus corvinus	(Dejean)		0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pterostichus femoralis	(Kirby)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pterostichus luctuosus	(Dejean)		0	2	0	0	74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Pterostichus melanarius	Illiger	I	0	6	0	0	100	0	10	0	4	0	0	0	0	0	3	61	3	0	0	7
Pterostichus mutus	(Say)		10	2	0	0	216	12	94	0	0	0	0	0	50	0	0	1	328	0	82	9
Pterostichus patruelis	(Dejean)		0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pterostichus pensylvanicus	LeConte		8	0	0	0	11	0	3	0	0	0	0	0	6	0	0	0	7	0	3	6
Pterostichus tristis	(Dejean)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1
Scarites subterraneus	Fabricius		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Selenophorus hylacis	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Selenophorus opalinus	(LeConte)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Sphaeroderus stenostomus	Dejean		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Stenolophus comma	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0	0	2
Stenolophus conjunctus	(Say)		1	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3
Stenolophus lineola	(Fabricius)		0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2

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Stenolophus ochropezus	(Say)		2	6	0	0	9	0	0	0	6	0	0	0	0	0	0	5	15	0	16	7
Stenolophus rotundicollis	(Haldeman)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Syntomus americanus	(Dejean)		1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3
Synuchus impunctatus	(Say)		4	0	0	0	52	7	375	0	0	0	0	0	0	0	0	0	49	0	24	6
Tachyta angulata	Casey		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Trichotichnus autumnalis	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Xestonotus lugubris	(Dejean)		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Coleoptera	Cerambycidae																					
Aegomorphus modestum	(Gyllenhal)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Analeptura lineola	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Anelaphus villosus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	1
Astylopsis sexguttata	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Brachyleptura rubrica	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Cyrtophorus verrucosus	(Olivier)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Ecyrus dasycerus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Elaphidion mucronatum	(Say)		0	0	0	0	1	0	0	0	0	0	0	0	6	0	0	0	10	0	0	3
Enaphalodes rufulus	(Haldeman)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Eupogonius pauper	LeConte		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Hyperplatys aspersa	(Say)		8	10	0	0	2	0	0	0	0	0	0	0	0	0	3	1	0	0	0	5
Hyperplatys maculata	Haldeman		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	2
Lepturges confluens	(Haldeman)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Liopinus alpha	(Say)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3
Megacyllene robiniae	(Forster)		0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	4	0	0	4
Micranoplium unicolor	(Haldeman)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Neoclytus acuminatus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Oberea affinis	Leng & Hamilton		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
Orthosoma brunneum	(Forster)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Parandra brunnea	Fabricius		1	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	3
Prionus laticollis	(Drury)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Psenocerus supernotatus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	3	0	1	3

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Astyleiopus variegatus	(Haldeman)		0	3	0	0	0	0	0	0	0	0	0	0	4	0	0	0	3	0	0	3
Strangalia acuminata	(Olivier)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Strangalia luteicornis	(Fabricius)		11	2	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4
Tetraopes tetrophthalmus	(Forster)		0	0	0	0	0	0	0	0	6	0	0	0	0	1	2	1	2	0	1	6
Typocerus velutinus	(Olivier)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Urgleptes querci	(Fitch)		2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	3
Urgleptes signatus	(LeConte)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Urographis fasciatus	(De Geer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Xylotrechus colonus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Coleoptera	Chrysomelidae																					
Acalymma vittata	(Fabricius)		0	0	0	2	0	2	3	0	0	0	0	0	0	0	0	0	2	0	0	4
Altica foliaceae	(Leconte)	MA?	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Bassareus mammifer	(Newman)		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Calligrapha californica	Brown		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Capraita sexmaculata	(Illiger)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Cassida rubiginosa	Müller	I	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chaetocnema confinis	Crotch		0	5	0	0	0	0	0	0	0	0	0	0	0	0	7	0	10	0	8	4
Chaetocnema denticulata	(Illiger)	MA?	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Chaetocnema minuta	Melsheimer		0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	19	0	16	4
Charidotella sexpunctata	(Fabricius)		0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Chelymorpha cassidea	(Fabricius)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chrysolina quadrigemina	Suffrian	I	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	3	0	0	2
Crepidodera heikertingeri	(Lazorko)		0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Crepidodera sp. 1			0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Crepidodera sp. 2			0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Crioceris asparagi	(Linnaeus)	I	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cryptocephalus mutabilis	Melsheimer		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cryptocephalus tinctus	Leconte		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Deloyala guttata	(Olivier)		1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
Diabrotica undecimpunctata	Barber		0	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	2	0	0	5

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Diachus auratus	(Fabricius)		3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Dibolia borealis	Chevrolat		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	1
Disonycha collata	Fabricius		0	5	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	4	4
Disonycha uniguttata	(Say)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Disonycha xanthomelas	(Dalman)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Distigmoptera impennata	Blake		0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1
Epitrix ?pubescens		*,I,NA?	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2	0	2	0	0	3
Graphops curtipennis	(Melsheimer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Graphops pubescens	(Melsheimer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
Labidomera clivicollis	(Kirby)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Lema daturaphila	Kogan & Goeden		0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	10	1	0	0	4
Leptinotarsa decemlineata	(Say)		0	1	0	0	0	0	0	0	1	2	0	0	0	0	0	20	0	0	0	4
Lexiphanes saponatus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Longitarsus pratensis	(Panzer)	I	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56	0	3	3
Longitarsus rubiginosus	(Foudras)	*,I,US	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	3
Longitarsus turbatus	Horn		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Mantura chrysanthemi	(Koch)	I	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	9	0	0	2
Metachroma laevicolle	Crotch		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	8	2
Neogalerucella calmariensis	(Linnaeus)	*,L	0	0	0	0	3	0	0	0	1	0	0	0	0	0	0	2	5	0	0	4
Odontota dorsalis	(Thunberg)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Ophraella communa	LeSage		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Ophraella cribrata	(Leconte)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Orthaltica copalina	(Fabricius)		6	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	2
Paria fragariae	Wilcox		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
Paria sexnotata	(Say)	*,MA	1	0	0	0	0	0	4	0	0	0	0	0	20	0	0	0	0	0	4	4
Paria thoracica	(Melsheimer)		0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	2
Phaedon laevigatus	(Duftschmid)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Phyllobrotica limbata	(Fabricius)		0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Phyllotreta aeneicollis	(Crotch)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Phyllotreta cruciferae	(Goeze)	I,MA?	3	10	0	0	1	0	0	0	0	0	1	0	0	0	0	0	3	0	0	5

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Phyllotreta striolata	(Fabricius)	*,I	0	4	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3
Plagiodera versicolora	(Laicharting)	I	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3
Plagiometriona clavatus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Psylliodes affinis	(Paykull)	I, MA?	0	0	0	0	4	5	0	0	6	0	0	0	0	0	3	20	8	0	0	6
Psylliodes napi	(Fabricius)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	1
Rhabdopterus picipes	(Olivier)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sumitrosis inaequalis	(Weber)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2
Tymnes tricolor	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	2
Coleoptera	Cleridae																					
Chariessa pilosa	(Forster)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Cregya oculata	(Say)		7	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0	4
Cymatodera bicolor	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	2
Cymatodera inornata	(Say)		0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Enoclerus nigrifrons	(Say)		3	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	4
Enoclerus rosmarus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Isohydnocera tabida	(LeConte)		0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	3
Phyllobaenus pallipennis	(Say)		6	0	0	0	1	0	4	0	0	0	0	0	3	0	0	0	0	0	20	5
Placopterus thoracicus	(Olivier)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Coleoptera	Coccinellidae																					
Anatis labiculata	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Brachiacantha ursina	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Chilocorus stigma	(Say)		0	0	0	0	0	0	3	0	0	0	0	0	6	0	0	0	7	0	1	4
Coccinella septempunctata	Linnaeus	I,L	0	8	0	0	4	9	0	0	5	0	1	0	1	2	0	20	8	0	2	10
Coleomegilla maculata	Timberlake		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13	0	0	2
Cycloneda munda	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	5	3
Harmonia axyridis	(Pallas)	I	17	9	0	6	28	37	34	0	10	1	1	0	7	4	11	44	97	0	11	15
Hippodamia convergens	Guérin-Méneville		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Hippodamia variegata	(Goeze)	I	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	12	1	0	0	4
Hyperaspis binotata	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
Propylaea quatuordecimpunctata (Linnaeus)		I,L	1	2	0	0	2	0	0	0	1	0	0	0	0	0	1	22	8	0	2	8

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Psyllobora vigintimaculata	(Say)		13	4	0	0	1	1	13	0	4	0	0	0	12	0	0	8	28	0	30	10
Coleoptera	Corylophidae																						
Arthrolips sp. 1			0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Coleoptera	Cryptophagidae																						
Atomaria ephippiata	(Zimmermann)		0	44	0	0	0	3	0	0	0	0	0	0	0	0	0	3	19	0	0	4
Anchicera ochracea	(Zimmermann)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Anchicera ovalis	(Casey)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	7	2
Coleoptera	Cupedidae																						
Tenomerga cinerea	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Coleoptera	Curculionidae																						
Acoptus suturalis	LeConte		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Ambrosiophilus atratus	(Eichhoff)	I	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Anisandrus sayi	(Hopkins)	MA?	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Anthonomus lecontei	Burke		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Anthonomus signatus	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Aphrastus taeniatus	Say		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Apteromechus ferratus	(Say)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Barypeithes pellucidus	(Boheman)	I	3	1	0	0	47	18	1	0	0	0	0	0	46	0	1	0	49	0	48	9
Cathormiocerus aristatus	(Gyllenhal)	I	0	13	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Cathormiocerus asperatus	Boheman	I	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2
Ceutorhynchus omissus	(Fall)		0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1
Conotrachelus anaglypticus	(Say)		0	0	0	0	1	0	2	0	2	0	0	0	0	0	0	0	2	0	9	5
Conotrachelus carinatus comp.			0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1
Conotrachelus carinifer	Casey	MA?	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	2
Conotrachelus naso	LeConte		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4	0	0	2
Conotrachelus nenuphar	(Herbst)		57	0	0	0	0	2	3	0	0	0	0	0	5	0	0	1	2	0	2	7
Conotrachelus nr. buchanani	Schoof		8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Conotrachelus posticatus	Boheman		0	1	0	0	1	0	37	0	0	0	0	0	0	0	0	0	8	0	1	5
Conotrachelus pusillus	LeConte	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Corthylus punctatissimus	(Zimmermann)	MA?	0	1	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

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Cosmobaris americana	Casey		0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cryptorhynchus fuscatus	LeConte		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Cryptorhynchus tristis	LeConte	MA?	7	36	0	0	33	0	6	0	0	0	0	0	2	0	0	0	180	0	2	7
Curculio caryae	(Horn)	MA?	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1	0	0	2
Curculio nasicus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Curculio pardalis	(Chittenden)		0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	8	0	0	2
Curculio proboscideus	Fabricius		0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	1	0	0	2
Curculio sulcatulus	(Casey)		0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	3	0	0	2
Cylindrocopturus binotatus	LeConte	MA?	4	2	0	0	0	1	1	0	0	0	0	0	6	0	0	0	5	0	11	7
Cyrtepistomus castaneus	(Roelofs)	I	0	1	0	0	13	0	119	0	0	0	0	0	0	0	0	0	41	0	13	5
Dietzianus pygmaeus	(Dietz)	MA?	0	0	0	0	0	0	1	0	0	0	0	0	8	0	0	0	0	0	1	3
Dorytomus parvicollis	(Casey)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Dryocoetes autographus	(Ratzeburg)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Dryophthorus americanus	Bedel		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Euwallacea validus	(Eichhoff)	I	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Geraeus picumna	(Herbst)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Gymnetron netum	(Germar)	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gymnetron pascuorum	(Gyllenhal)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	2	2
Gymnetron tetrum	(Fabricius)	I	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hypera compta	(Say)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hypera nigrirostris	(Fabricius)	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hypera punctata	(Fabricius)	I	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Isochnus populicola	Silfverberg	I	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Larinus planus	(Fabricius)	I	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lignyodes helvolus	(LeConte)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Listronotus delumbis	(Gyllenhal)		0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Listronotus maculicollis	(Kirby)	I	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lixus concavus	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Madarellus undulatus	(Say)		0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	3
Mecinus pyraster	(Herbst)	I,MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1

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Monarthrum fasciatum	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Monarthrum mali	(Fitch)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Myosides seriehispidus	Roelofs	I	19	43	0	0	60	39	0	0	0	0	0	0	7	0	5	2	14	0	12	9
Myrmex myrmex	(Herbst)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Odontocorynus sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Odontocorynus umbellae	(Fabricius)		0	0	0	0	4	1	0	0	1	0	0	0	0	0	0	0	0	0	2	4
Otiorhynchus ovatus	Linnaeus	I,L	0	2	0	0	3	0	1	0	0	0	0	0	0	0	2	20	5	0	0	6
Otiorhynchus rugostriatus	(Goeze)	I,MA?,L	0	2	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	3
Otiorhynchus singularis	(Linnaeus)	I	0	0	0	0	6	0	3	0	0	0	0	0	3	0	0	0	7	0	1	5
Otiorhynchus sulcatus	(Fabricius)	I,L	0	2	0	0	28	0	1	0	0	0	0	0	0	0	0	0	1	0	1	5
Pachytychius haematocephalus	(Gyllenhal)	I,MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Perigaster liturata	(Dietz)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Phloeophagus minor	Horn	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Phyxelis rigidus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Polydrusus sericeus	(Schaller)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Pseudanthonomus crataegi	(Walsh)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pseudanthonomus helvolus	(Boheman)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Pseudopentarthrum parvicollis	Casey	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Rhinoncus castor	(Fabricius)	I	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2
Rhinoncus pericarpius	(Linnaeus)	I	1	11	0	0	0	12	0	0	0	0	0	0	0	0	0	0	2	0	0	4
Rhyssomatus aequalis	Horn		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sciaphilus asperatus	(Bonsdorff)	I	1	0	0	0	5	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3
Scolytus mali	(Bechstein)	I, MA?	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sitona cylindricollis	(Fahraeus)	I	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	3
Sitona hispidulus	(Fabricius)	I,L	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2
Sitona lepidus	Gyllenhal	I,L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Smicronyx sp. 1			0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Smicronyx sp. 2			0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sphenophorus australis	Chittenden		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Sphenophorus minimus	Hart		0	0	0	0	0	24	0	0	0	0	0	0	0	0	6	2	7	0	0	4

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Sphenophorus parvulus	Gyllenhal		1	0	0	0	0	6	0	0	0	0	0	0	0	0	1	1	1	0	0	5
Sphenophorus venatus	(Say)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Stenoscelis brevis	(Boheman)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Strophosoma melanogrammus	(Forster)	I	5	1	0	0	3	4	6	0	0	0	0	0	2	0	0	0	0	0	2	7
Trachyphloeus angustisetulus	Hansen	I	0	2	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	0	0	4
Trachyphloeus bifoveolatus	(Beck)	I, MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Tychius meliloti	Stephens	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Tychius picirostris	(Fabricius)	I,L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	1	3
Tychius stephensi	Schönherr	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Tyloderma foveolatum	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
Xyleborinus saxeseni	(Ratzeburg)	I	0	0	0	0	181	0	0	0	0	0	0	0	0	0	1	0	18	0	0	3
Xyleborus californicus	Wood	I	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2
Xyleborus ferrugineus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Xylosandrus germanus	(Blandford)	I	1	0	0	0	96	0	1	0	0	0	0	0	1	0	0	0	3	0	1	6
Xyloterinus politus	(Say)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Coleoptera	Dermestidae																					
Dermestes frischii	Kugelann	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Dermestes talpinus	Mannerheim	MA?	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	2
Coleoptera	Elateridae																					
Aeolus mellillus	(Say)	MA?	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	21	2
Agriotes lineatus	(Linnaeus)	*,I,MA,L	0	1	0	0	0	3	0	0	0	0	0	0	0	0	2	7	1	0	0	5
Agriotes mancus	(Say)		0	0	0	0	0	17	0	0	0	0	0	0	0	0	4	0	0	0	11	3
Agriotes oblongicollis	(Melsheimer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Ampedus areolatus	(Say)		0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	2	0	8	3
Ampedus collaris	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Ampedus fuscatus	(Melsheimer)		1	0	0	0	7	0	4	0	0	0	0	0	3	0	0	0	0	0	4	5
Ampedus melanotoides	W.J. Brown	MA?	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	2
Ampedus melsheimeri	(Leng)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Ampedus protervus	(LeConte)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Ampedus pusio	Germar		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	0	1	3

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Ampedus ?new sp.		*,N?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Athous ?bicolor	(Goeze)	*,I,NA?	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Athous brightwelli	(Kirby)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	5	2
Athous cucullatus	(Say)		8	0	0	0	1	0	0	0	0	0	0	0	16	0	0	0	4	0	14	5
Athous haemorrhoidalis	(Fabricius)	*,I,US	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	2
Athous neacanthus	Becker		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Athous orvus	Becker		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Cardiophorus convexulus	LeConte		0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	7	2
Cardiophorus convexus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	5	2
Cardiophorus gagates	Erichson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Conoderus auritus	(Herbst)		0	0	0	0	11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Conoderus bellus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Ctenicera cylindriformis	(Herbst)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Ctenicera pyrrhos	(Herbst)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	2
Dalopius vagus	Brown		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1
Dipropus sp. prob. soleatus	(Say)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hadromorphus inflatus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Hemicrepidius bilobatus	(Say)		4	1	0	0	7	0	1	0	0	0	0	0	10	0	0	0	1	0	15	7
Hemicrepidius brevicollis	(Candèze)	MA?	5	1	0	0	3	2	0	0	0	0	0	0	2	0	0	0	0	0	0	5
Hemicrepidius memnonius	(Herbst)		12	0	0	0	1	1	0	0	0	0	0	0	4	0	4	0	5	0	3	7
Limonius basilaris	(Say)		2	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	2	0	95	4
Limonius griseus	(Beauvois)		1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	5	0	0	3
Limonius plebejus	(Say)		8	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	17	0	4	4
Melanotus americanus	(Herbst)		25	0	0	0	5	0	0	0	0	0	0	0	18	0	0	0	2	0	26	5
Melanotus communis	(Gyllenhal)		0	1	0	0	0	1	2	0	0	0	0	0	4	0	0	0	5	0	3	6
Melanotus depressus	(Melsheimer)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Melanotus hyslopi	Van Zwaluwenburg		16	0	0	0	5	0	0	0	0	0	0	0	20	0	0	0	2	0	11	5
Melanotus ignobilis	Melsheimer	MA?	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Melanotus leonardi	(LeConte)		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1

PHYLUM/Order	**CLASS**/Family	Notes	Islands																				Total # islands
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Melanotus miscellus	Quate	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Melanotus morosus	Candèze		2	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	6	0	10	5
Melanotus pertinax	(Say)		9	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	3
Melanotus sagittarius	(LeConte)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Melanotus similis	(Kirby)		1	21	0	0	8	10	1	0	2	0	0	0	1	0	3	8	23	0	7	11
Melanotus testaceus	Melsheimer	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Melanotus trapezoideus	(LeConte)		1	0	0	0	10	0	0	0	0	0	0	0	3	0	0	0	2	0	10	5
Pseudanostirus hieroglyphicus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Sylvanelater cylindriformis	(Herbst)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Coleoptera	Endomychidae																					
Aphorista vittata	(Fabricius)		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Lycoperdina ferruginea	LeConte		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Stenotarsus hispidus	(Herbst)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2
Coleoptera	Erotylidae																					
Tritoma biguttata	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Tritoma humeralis	Fabricius		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Coleoptera	Eucinetidae																					
Eucinetus haemorrhoidalis	(Germar)	I?	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Coleoptera	Eucnemidae																					
Dirrhagofarsus lewisi	Fleutiaux	I, MA?	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Entomophthalmus rufiolus	(LeConte)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Hylis terminalis	(LeConte)		2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	3
Isorhipis obliqua	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Microrhagus triangularis	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	1	0	1	3
Onichodon downiei	Muona		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Coleoptera	Geotrupidae																					
Geotrupes splendidus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Odonteus liebecki	Wallis		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Coleoptera	Histeridae																					
Euspilotus assimilis	(Paykull)		0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	3

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Hypocaccus fraternus	(Say)	MA?	0	75	0	0	0	0	0	0	2	0	0	0	0	0	0	2	8	0	0	4
Coleoptera	Hydrophilidae																						
Cercyon praetextatus	(Say)	MA?	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	3
Tectosternum naviculare	Zimmermann	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Coleoptera	Laemophloeidae																						
Charaphloeus sp. 1		MA?	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Laemophloeus biguttatus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Laemophloeus fasciatus	Melsheimer		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Placonotus zimmermanni	(LeConte)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Coleoptera	Lampyridae																						
Ellychnia corrusca	(Linnaeus)		0	0	0	0	1	0	1	0	0	0	0	0	2	0	0	0	6	0	7	5
Lucidota atra	(Olivier)	MA?	18	5	0	0	10	1	0	0	3	0	0	0	10	0	0	0	2	0	10	8
Photuris pennsylvanicus	(De Geer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Coleoptera	Languriidae																						
Cryptophilus seriatus	Casey		2	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	4
Languria mozardi	Latreille		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Toramus pulchellus	(LeConte)		0	3	0	0	4	3	0	0	0	0	0	0	1	0	1	0	64	0	13	7
Coleoptera	Latridiidae																						
Cartodere nodifer	(Westwood)	I, MA?	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Corticarina cavicollis	(Mannerheim)		0	3	0	0	5	5	2	0	0	0	0	0	0	0	0	0	41	0	19	6
Corticarina longipennis	(LeConte)		0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	23	0	4	4
Cortinicara gibbosa	(Herbst)	I, L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Melanophthalma inermis	Motschulsky		0	2	0	0	1	4	6	0	0	0	0	0	10	0	0	6	25	0	17	8
Melanophthalma picta	(LeConte)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Melanophthalma pumila	(LeConte)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Melanophthalma villosa	Zimmerman		0	0	0	0	4	1	0	0	0	0	0	0	0	0	1	0	10	0	5	5
Coleoptera	Leiodidae																						
Anisotoma discolor	(Melsheimer)		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2
Leiodes assimilis	(LeConte)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1
Leiodes sp. 1			0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1

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Prionochaeta opaca	(Say)		0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Sciodrepoides watsoni	(Blanchard)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Coleoptera	Lycidae																					
Calopteron reticulatum	(Fabricius)		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Coleoptera	Melandryidae																					
Dircaea liturata	LeConte	MA?	3	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	3	0	2	6
Microscapha clavicornis	LeConte	MA?	1	0	0	0	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	4
Microtonus sericans	LeConte		3	0	0	0	1	0	0	0	1	0	0	0	4	0	0	0	2	0	3	6
Orchesia castanea	Melsheimer		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	4	2
Orchesia ovata	Laliberté		2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	6	3
Phloeotrya vaudoueri	Mulsant	I,MA?	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Coleoptera	Meloidae																					
Epicauta pennsylvanica	De Geer		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Meloe impressus	Kirby		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Coleoptera	Melyridae																					
Attalus scincetus	(Say)		1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Collops nigriceps	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	2
Collops quadrimaculatus	(Fabricius)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	2
Collops tricolor	(Say)		0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1
Collops vittatus	(Say)	MA?	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2	0	11	4
Coleoptera	Monotomidae																					
Monotoma longicollis	(Gyllenhal)	I	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Monotoma producta	LeConte		0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	3
Coleoptera	Mordellidae																					
Conalia helva	(LeConte)		0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Falsomordellistena bihamata	(Melsheimer)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	34	0	0	0	0	0	3	2
Falsomordellistena pubescens	(Fabricius)		68	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	3	0	1	4
Hoshihananomia octopunctata	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40	1
Mordella atrata	Melsheimer	MA?	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2	1	0	5	5
Mordella marginata	Melsheimer		9	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	27	4

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Mordellaria serval	(Say)		2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Mordellina ancilla	(LeConte)	MA?	108	0	0	0	1	1	1	0	0	0	0	0	21	0	0	10	1	0	2	8
Mordellina infima	(LeConte)		0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	4
Mordellistena arida	LeConte		2	0	0	0	0	0	1	0	0	0	0	0	6	0	0	0	2	0	4	5
Mordellistena fuscipennis	(Melsheimer)		20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mordellistena liturata	(Melsheimer)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Mordellistena masoni	Liljeblad	MA?	26	0	0	0	0	0	2	0	0	0	0	0	19	0	0	0	2	0	7	5
Mordellistena ornata	(Melsheimer)		12	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	2
Mordellistena picilabris	Helmuth		0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	16	1	0	0	4
Mordellistena pubescens	(Fabricius)		5	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4	0	3	4
Mordellistena pustulata	(Melsheimer)		2	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	3
Mordellistena syntaenia	Liljeblad		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mordellistena trifasciata	(Say)		21	0	0	0	0	1	4	0	0	0	0	0	46	0	0	0	3	0	3	6
Mordellochroa scapularis	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Tomoxia undulata	(Melsheimer)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Yakuhananomia bidentata	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Coleoptera	Mycetophagidae																					
Litargus balteatus	LeConte	I	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2
Litargus didesmus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4	0	0	2
Litargus tetraspilotus	LeConte		6	0	0	0	2	1	2	0	0	0	0	0	6	0	0	0	21	0	2	7
Typhaea stercorea	(Linnaeus)	I	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	1	2	0	0	4
Coleoptera	Nitidulidae																					
Carpophilus sp.1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Conotelus obscurus	Erichson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
Cryptarcha ampla	Erichson		0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	3	0	0	3	4
Glischrochilus fasciatus	(Olivier)		0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Glischrochilus quadrisignatus	(Say)		0	19	0	0	3	0	0	0	0	0	0	0	0	0	0	2	3	0	0	4
Glischrochilus siepmanni	Brown		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lobiopa undulata	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Meligethes nigrescens	Stephens	I?	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	10	0	2	4

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Omosita colon	(Linnaeus)	I	1	6	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	5
Pallodes pallidus	(Beauvois)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	15	2
Phenolia grossa	(Fabricius)	MA?	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Stelidota geminata	(Say)		4	5	0	0	43	1	3	0	0	0	0	0	4	0	1	3	14	0	8	10
Stelidota octomaculata	(Say)		2	4	0	0	44	1	40	0	0	0	0	0	7	0	3	1	115	0	20	10
Coleoptera	Oedemeridae																					
Asclera ruficollis	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Nacerdes melanura	(Linnaeus)	I	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	2
Coleoptera	Passandridae																					
Catogenus rufus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Coleoptera	Phalacridae																					
Acylomus ergoti	Casey		1	0	0	0	0	2	0	0	1	0	0	0	0	0	6	1	10	0	2	7
Acylomus new sp.			0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Acylomus pugetanus	Casey		0	0	0	0	0	9	0	0	4	0	0	0	0	0	0	0	8	0	3	4
Stilbus apicalis	(Melsheimer)		0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0	3	3
Stilbus nitidus	(Melsheimer)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	24	0	6	4
Coleoptera	Ptilodactylidae																					
Ptilodactyla carinata	Johnson & Freytag		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Coleoptera	Pyrochroidae																					
Dendroides canadensis	Latreille		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Coleoptera	Scarabaeidae																					
Amphimallon majale	(Razoumowski)	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Anomala orientalis	(Waterhouse)	I	1	2	0	0	3	0	0	0	1	0	0	0	0	1	2	13	16	0	3	9
Aphodius pseudolividus	Balthasar	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Aphodius rusicola	Melsheimer		0	3	0	0	4	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
Ataenius fattigi	Cartwright		4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Ataenius imbricatus	(Melsheimer)		5	0	0	0	1	0	2	0	0	0	0	0	9	0	0	0	0	0	0	4
Ataenius spretulus	(Haldeman)		0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	1	2	0	1	5
Copris minutus	(Drury)		0	0	0	0	0	0	14	0	0	0	0	0	2	0	0	0	0	0	0	2
Diplotaxis atlantis	Fall		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

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Euphoria inda	(Linnaeus)		0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	8	2	0	0	3
Maladera castanea	(Arrow)	I	11	7	0	3	5	5	6	0	1	0	0	0	15	0	44	67	75	0	3	12
Nipponoserica peregrina	(Chapin)	I	20	3	0	0	786	7	2	0	3	0	0	0	20	0	10	8	74	0	33	11
Onthophagus hecate	(Panzer)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Onthophagus nuchicornis	(Linnaeus)	I	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Onthophagus orpheus	(Fabricius)		54	2	0	0	18	0	1	0	0	0	0	0	1	0	0	0	1	0	46	7
Onthophagus striatulus	(Beauvois)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95	0	7	3
Onthophagus taurus	Schreber	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Phyllophaga anxia	(LeConte)		0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2
Phyllophaga tristis	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Popillia japonica	Newman	I	1	1	0	0	0	7	0	0	0	0	0	0	1	0	6	2	3	0	5	8
Serica georgiana	Dawson		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Serica mystaca	Dawson	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Serica sericea	(Illiger)		0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0	0	2
Strigoderma arboricola	(Fabricius)		0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	1
Tomarus gibbosus	DeGeer		0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	1
Tomarus relictus	(Say)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Trichiotinus affinis	Gory & Percheron		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Coleoptera	Scirtidae																					
Cyphon modestus	(LeConte)		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	9	0	4	3
Cyphon variabilis	(Thunberg)	I	1	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	4	0	16	5
Flavohelodes pulchella	(Guérin-Méneville)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	2	3
Flavohelodes thoracica	(Guérin-Méneville)	MA?	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	3	3
Prionocyphon discoideus	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Scirtes tibialis	Guérin-Meneville		0	1	0	0	0	3	0	0	0	0	0	0	1	0	0	4	1	0	0	5
Coleoptera	Scraptiidae																					
Anaspis rufa	Say	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Canifa pallipes	(Melsheimer)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	1
Canifa plagiata	(Melsheimer)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Coleoptera	Scydmaenidae																					

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Stenichnus sp. 1			0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Coleoptera	Silphidae																					
Necrophila americana	(Linnaeus)		2	0	0	0	25	0	0	0	0	0	0	0	14	0	0	0	2	0	9	5
Nicrophorus orbicollis	Say		2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	3	3
Nicrophorus tomentosus	Weber		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Coleoptera	Silvanidae																					
Telephanus velox	Haldeman	MA?	0	1	0	0	0	2	0	0	1	0	0	0	1	0	0	0	0	0	1	5
Coleoptera	Sphindidae																					
Sphindus americanus	LeConte		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	28	3
Coleoptera	Staphylinidae																					
Achenomorphus corticinus	(Gravenhorst)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Acidota subcarinata	Erichson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Anotylus insecatus	(Gravenhorst)	I, MA?	0	1	0	0	0	21	0	0	0	0	0	0	2	0	0	0	0	0	0	3
Anotylus sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Anotylus tetracarinatus	(Block)	I,MA?	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Astenus discopunctatus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Astenus sp. 1			0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Baeocera sp. 1			1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Bisnius blandus	(Gravenhorst)		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	2	3
Brachygluta abdominalis	(Aubé)		0	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Bryoporus rufescens	LeConte		3	0	0	0	13	0	23	0	0	0	0	0	12	0	0	0	0	0	15	5
Bryoporus testaceus	Leconte		3	0	0	0	0	1	19	0	0	0	0	0	23	0	0	0	30	0	14	6
Cafius aguayoi	Bierig		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	2
Cafius bistriatus	(Erichson)		0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1
Carphacis effrenatus	Herman		0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	1	2	0	0	3
Coproporus ventriculus	(Say)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Creophilus maxillosus	(Gravenhorst)	I	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Erichsonius brachycephalus	Frank		0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	4
Eupsenius glaber	LeConte	I	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gyrohypnus angustatus	(Stephens)	I,MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1

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Habrocerus capillaricornis	(Gravenhorst)	I	0	4	0	0	0	0	0	0	0	0	0	0	3	0	3	0	3	0	1	5
Homaeotarsus cribratus	(LeConte)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Ischnosoma virginicum	(Bernhauer)		1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Lathrobium sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Lithocharis tricolor	(Fabricius)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1
Lithocharodes longicollis	(LeConte)		0	0	0	0	2	0	16	0	0	0	0	0	5	0	0	0	0	0	6	4
Lordithon anticus	(Horn)		0	0	0	0	0	0	11	0	0	0	0	0	1	0	32	0	26	0	3	5
Lordithon cinctus	(Gravenhorst)		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	10	2
Lordithon facilis	(Casey)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	3	2
Lordithon obsoletus	(Say)	*,MA	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lordithon sp. 1			0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Medon fusculus	(Mannerheim)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Medon sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Melba parvula	(LeConte)	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21	0	0	1
Mycetoporus triangulatus	Campbell		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Neobisnius jucundus	(Horn)		0	13	0	0	10	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3
Neobisnius sobrinus	(Erichson)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Neohypnus obscurus	(Erichson)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	1
Ochthephilum fracticorne	(Paykull)	I?	0	4	0	0	1	1	0	0	0	0	0	0	0	0	1	1	1	0	0	6
Ocypus brunnipes	(Fabiricius)	I	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ocypus nitens	(Schrank)	I, MA?	0	1	0	0	10	2	1	0	0	0	0	0	5	0	1	3	17	0	13	9
Oligota sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	1
Omalium repandum	Erichson		0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Oxybleptes kiteleyi	Smetana		1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	3
Phanerota sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Philonthus caeruleipennis	(Mannerheim)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2	3
Philonthus carbonarius	(Gravenhorst)	I	1	1	0	0	0	5	0	0	0	0	0	0	0	0	0	4	1	0	0	5
Philonthus cognatus	Stephens	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Philonthus flumineus	Casey		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Philonthus hepaticus	Erichson	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	2

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Philonthus lomatus group	Erichson		0	5	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	1	5
Philonthus rufulus	Horn		2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	4
Philonthus sericans	(Gravenhorst)		0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	3	4
Platydracus cinnamopterus	(Gravenhorst)		9	0	0	0	0	13	0	0	0	0	0	0	8	0	1	3	3	0	10	7
Platydracus fossator	(Gravenhorst)		0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	7	2
Platydracus maculosus	(Gravenhorst)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Platydracus praelongus	(Mannerheim)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Platydracus viridanus	(Horn)		1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	4	4
Platydracus zonatus	Gravenhorst		3	0	0	0	11	2	1	0	0	0	0	0	4	0	10	3	11	0	6	9
Pselaphus bellax	Casey		0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Quedius curtipennis	Bernhauer	I,MA?,L	1	3	0	0	2	18	0	0	0	0	0	0	0	0	2	0	2	0	0	6
Reichenbachia divergens	(LeConte)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Rugilus orbiculatus	(Paykull)	I	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Rugilus rufipes	Germar	I	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Rugilus sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Scopaeus exiguus	Erichson	MA?	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sepedophilus crassus	(Gravenhorst)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Sepedophilus ?immaculatus	(Stephens)	*, I, NA?	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Sepedophilus occultus	(Casey)		2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2	4
Sepedophilus testaceus	Fabricius	I	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	3	0	0	3
Sepedophilus velocipes	(Casey)		1	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	3
Stenus clavicornis	(Scopoli)	I,L	0	3	0	0	1	11	0	0	0	0	0	0	0	0	2	0	3	0	0	5
Stenus flavicornis	Erichson		0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Stenus juno	Fabricius	L	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Stenus sp. 1			0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Tachinus corticinus	Gravenhorst	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	29	3	0	0	3
Tachinus fimbriatus	Gravenhorst		1	0	0	0	3	0	29	0	0	0	0	0	1	0	0	1	14	0	4	7
Tachinus limbatus	Melsheimer		0	0	0	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Tachyporus dispar	(Paykull)	I	0	1	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Tachyporus jocosus	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1

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Tachyporus nitidulus	(Fabricius)	I,L	0	2	0	0	23	6	0	0	0	0	0	0	0	0	3	0	2	0	9	6
Tachyporus transversalis	Gravenhorst	I	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Tasgius ater	(Gravenhorst)	I,L	0	3	0	0	13	10	0	0	0	0	0	0	1	0	1	6	8	0	0	7
Tasgius melanarius	(Heer)	I	1	0	0	0	28	35	8	0	0	0	0	0	13	0	6	1	21	0	8	9
Tasgius winkleri	(Bernhauer)	I	0	1	0	0	3	12	1	0	1	0	0	0	1	0	1	3	2	0	1	10
Toxidium gammaroides	LeConte	MA?	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Xantholinus linearis	(Olivier)	I	0	0	0	0	5	4	0	0	0	0	0	0	1	0	0	7	1	0	0	5
Coleoptera	Synchroidae																					
Synchroa punctata	Newman	MA?	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Coleoptera	Tenebrionidae																					
Alobates pennsylvanica	(DeGeer)		0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	3
Anaedus brunneus	(Ziegler)		2	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Blapstinus metallicus	(Fabricius)		0	14	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3
Blapstinus moestus	Melsheimer		0	26	0	0	17	0	0	0	1	0	0	0	0	0	15	0	2	0	0	5
Capnochroa fuliginosa	(Melsheimer)		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1
Centronopus calcaratus	(Fabricius)		2	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
Haplandrus fulvipes	(Herbst)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Hymenorus curticollis	Casey	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hymenorus humeralis	LeConte	MA?	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Hymenorus niger	(Melsheimer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Isomira pulla	(Melsheimer)		1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	5	3
Isomira quadristriata	Couper		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Isomira sericea	(Say)		3	0	0	0	2	3	0	0	0	0	0	0	3	0	0	1	6	0	6	7
Neomida bicornis	(Fabricius)		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Opatrinus minimus	(Beauvois)	MA?	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Phaleria testacea	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Platydema picilabrum	Melsheimer		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Platydema teleops	Triplehorn		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	2
Statira gagatina	Melsheimer		1	0	0	0	0	1	0	0	0	0	0	0	0	0	2	17	1	0	5	6
Tarpela micans	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

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			BM	**CF**	**DE**	**GE**	**GP**	**GB**	**LN**	**LI**	**LV**	**MB**	**OB**	**PE**	**RG**	**RN**	**SN**	**SP**	**TH**	**WB**	**WE**	
Xylopinus saperdioides	(Olivier)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Coleoptera	Tetratomidae																						
Hallomenus scapularis	Melsheimer	MA?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Coleoptera	Trogidae																						
Trox scaber	(Linnaeus)	I?	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Trox variolatus	Melsheimer		0	12	0	0	11	1	15	0	0	0	0	0	0	0	0	1	14	0	2	7
Coleoptera	Trogossitidae																						
Tenebroides bimaculatus	Melsheimer		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Tenebroides nanus	(Melsheimer)	MA?	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Thymalus marginicollis	Chevrolat	MA?	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Dermaptera	Carcinophoridae																						
Anisolabis maritima	Bonelli	I	41	539	0	2	259	130	2	0	19	0	0	3	27	0	0	70	597	0	7	12
Dermaptera	Forficulidae																						
Forficula auricularia	Linnaeus	I,L	10	41	0	0	25	97	0	0	3	0	0	0	0	0	0	9	75	0	40	8
Dictyoptera	Blattellidae																						
Ectobius pallidus	(Olivier)	I	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	6	3
Parcoblatta uhleriana	(Saussure)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Dictyoptera	Mantidae																						
Mantis religiosa	(Linnaeus)	I	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	2	0	0	3
Tenodera aridifolia	Saussure	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1
Diptera	Asilidae																						
Albibarbefferia albibarbis	(Macquart)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Proctacanthus sp. 1			0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Diptera	Calliphoridae																						
Bufolucilia silvarum	(Meigen)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Calliphora vomitoria	(Linnaeus)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cynomya cadaverina	Robineau-Desvoidy		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Phaenicia sericata	(Meigen)		0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Phormia regina	(Meigen)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Diptera	Dolichopodidae																						

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Condylostylus sp. 1			0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Diptera	Keroplatidae																						
Asindulum nigrum	Latreille	I	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Macrocera cf. *pusilla*	Meigen	I?	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Neoplatyura sp. 1			0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Neoplatyura sp. 2			2	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	2
Neoplatyura near *pellita*			0	1	0	0	0	0	7	0	0	0	0	0	5	0	1	0	0	0	1	5
Orfelia cf. *nemoralis*	(Meigen)	I?	1	3	0	0	0	7	0	0	0	0	0	0	4	0	41	0	0	0	0	5
Orfelia near *diluta*			0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Orfelia near *subterminalis*			0	2	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	2	3
Diptera	Mycetophilidae																						
Acnemia amoena	Winnertz	I	0	0	0	0	0	0	1	0	0	0	0	0	4	0	0	0	2	0	1	4
Acnemia comata	Zaitzev		0	0	0	0	0	0	0	0	0	0	0	0	11	0	1	0	0	0	0	2
Acnemia psylla	Loew		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	16	2
Allodiopsis sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Boletina cf. *tricincta*	Loew		2	0	0	0	0	0	1	0	0	0	0	0	97	0	0	0	0	0	5	4
Brachypeza cf. *dentica*	(Guthrie)		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Brevicornu cf. *rosmellitum*	Chandler		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2
Cordyla cf. *recens*	Johannsen		0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	20	2
Cordyla cf. *volucris*	Johannsen		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Cordyla near *pusilla*			1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Exechia cf. *attrita*	Johannsen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Exechia cf. *bellula*	Johannsen		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Exechia cf. *nugatoria*	Johannsen		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2
Exechia cf. *quadrata*	Johannsen		0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1
Exechia cincinnata	Johannsen		0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	9	0	0	2
Exechia repanda	Johannsen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2
Exechiopsis aviculata	(Shaw)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	1
Leia cf. *hyalina*	Coquillett		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Leia cf. *striata*	Williston		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1

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Leia sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	6	0	2	3
Macrobrachius cf. *producta*	(Johannsen)		3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Monoclona rufilatera	(Walker)		16	0	0	0	0	0	118	0	0	0	0	0	38	0	0	0	4	0	0	4
Mycetophila alea	Laffoon		2	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	2	0	0	4
Mycetophila cf. *shawi*	(Laffoon)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Mycetophila cf. *signatoides*	Dziedzicki	I?	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	4
Mycetophila cf. *strigatoides*	Landrock	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
Mycetophila cf. *thioptera*	Shaw		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Mycetophila concinna	(Laffoon)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Mycetophila discors	(Laffoon)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mycetophila edura	Johannsen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Mycetophila falcata	Johannsen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	2
Mycetophila fisherae	(Laffoon)		4	0	0	0	4	8	24	0	0	0	0	0	14	0	25	6	107	0	2	9
Mycetophila ichneumonea	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Mycetophila illudens	(Laffoon)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	0	0	3
Mycetophila luctuosa	Meigen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Mycetophila mitis	(Johannsen)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Mycetophila ocellus	Walker		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Mycetophila pinguis	Loew		2	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	0	3	6
Mycetophila sigmoides	Loew		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2
Mycetophila unipunctata	Meigen		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Mycomya marginata-group			0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mycomya obliqua	(Say)		3	0	0	0	0	0	14	0	0	0	0	0	18	0	0	0	0	0	12	4
Mycomya pulchella imitans	Johannsen		5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mycomya pura	Väisänen		0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	3	3
Neoempheria indulgens	Johannsen		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Phronia conformis	(Walker)		2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Phronia gagnei	Chandler		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Phronia nigricornis	(Zetterstedt)		2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Phronia similis	Johannsen		1	0	0	0	0	0	1	0	0	0	0	0	0	0	4	0	1	0	0	4

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Platurocypta testata	Edwards		10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Rondaniella dimidiata	(Meigen)		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	2
Rondaniella ?new sp.			0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Sceptonia cf. *autumnalis*	Garrett		0	0	0	0	0	0	2	0	0	0	0	0	15	0	0	0	1	0	0	3
Sceptonia cf. *nigra*	(Meigen)		2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Sciophila arizonensis	Zaitzev		4	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	9	0	0	4
Sciophila lutea	Macquart	I	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	1
Sciophila mississippiensis	Khalaf		1	0	0	0	0	5	0	0	0	0	0	0	0	0	5	1	3	0	0	5
Synapha cf. *bicolor*	Shaw & Fisher		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Synapha sp. 1			1	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	1	3
Tetragoneura sp. 1			0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Tetragoneura sp. 2			0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Trichonta foeda	Loew		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Trichonta lucida	Gagné		0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	2
Trichonta vitta	(Meigen)		0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	1
Zygomyia cf. *ornata*	Loew		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Zygomyia interrupta	Malloch		6	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Zygomyia ?new sp.			1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Diptera	Stratiomyidae																					
Odontomyia cincta	Olivier		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Diptera	Syrphidae																					
Allograpta obliqua	(Say)		0	4	0	0	4	0	0	0	1	0	0	0	0	0	0	4	1	0	0	5
Copestylum vesicularium	(Curran)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Epistrophe emarginata	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Epistrophe grossulariae	(Meigen)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Epistrophe xanthostoma	(Williston)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Eristalinus aeneus	(Scopoli)	I	0	6	0	0	0	0	0	0	1	0	0	0	1	0	1	2	0	0	1	6
Eristalis arbustorum	(Linnaeus)	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Eristalis dimidiata	Zetterstedt		0	1	0	0	0	2	0	0	1	1	0	0	0	0	1	0	8	0	0	6
Eristalis flavipes	Walker		0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	3

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Eristalis tenax	(Linnaeus)	I	0	6	0	0	0	0	0	0	0	2	2	0	0	0	1	1	8	0	0	6
Eristalis transversa	(Wiedemann)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2
Eupeodes americanus	(Wiedemann)		0	6	0	0	6	4	0	0	0	0	0	0	6	0	3	1	8	0	3	8
Ferdinandea buccata	(Loew)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Helophilus fasciatus	Walker		0	1	0	0	3	0	1	0	0	0	0	0	0	0	0	0	45	0	3	5
Heringia calcarata	Loew		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Lejops curvipes	(Wiedemann)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2
Mallota bautias	(Walker)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Mallota posticata	(Fabricius)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Melanostoma mellinum	(Linneaus)		1	3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	4	5
Pipiza femoralis	Loew		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Platycheirus hyperboreus	(Staeger)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
Platycheirus obscurus	(Say)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Platycheirus perpallidus	Verrall		0	0	0	0	0	2	0	0	0	0	0	0	0	0	5	0	2	0	0	3
Platycheirus quadratus	(Say)		0	0	0	0	1	15	0	0	0	0	0	0	0	0	4	1	18	0	5	6
Sericomyia chrysotoxoides	Macquart		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2
Somula decora	Macquart		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sphaerophoria asymmetrica	Knutson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	1
Sphaerophoria contiqua	Macquart		0	1	0	0	5	7	0	0	0	0	0	0	0	0	7	34	12	0	1	7
Sphaerophoria philanthus	Meigen		0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	4	21	0	0	4
Sphaerophoria scripta group			0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Spilomyia longicornis	Loew		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Syritta pipiens	Linnaeus	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Syrphus rectus	Osten Sacken		0	3	0	0	1	1	0	0	0	0	0	0	4	0	0	0	1	0	3	6
Syrphus ribesii	Linneaus		0	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	4
Syrphus torvus	Osten Sacken		0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	3	0	0	3
Syrphus vitripennis	Meigen		0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Temnostoma balyras	(Walker)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Toxomerus geminatus	(Say)		31	6	0	0	26	43	2	0	1	1	1	0	1	0	19	15	44	0	131	13
Toxomerus marginatus	(Say)		4	111	0	0	123	636	0	0	10	7	4	0	9	0	92	170	138	0	70	12

PHYLUM/Order	**CLASS**/Family	Notes	Islands																				Total # islands
			BM	**CF**	**DE**	**GE**	**GP**	**GB**	**LN**	**LI**	**LV**	**MB**	**OB**	**PE**	**RG**	**RN**	**SN**	**SP**	**TH**	**WB**	**WE**	
Toxomerus politus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	2
Tropidia quadrata	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
Xylota quadrimaculata	Loew		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Diptera	Tabanidae																					
Tabanus nigrovittatus	Macquart		2	2	0	0	1	0	0	0	0	0	0	0	0	0	3	0	0	0	1	5
Tabanus novaescotiae	Macquart		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Hemiptera	Acanthosomatidae																					
Elasmostethus cruciatus	(Say)		0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hemiptera	Achilidae																					
Catonia cinctifrons	(Fitch)		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	9	2
Hemiptera	Alydidae																					
Alydus eurinus	(Say)		0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
Alydus pilosulus	Herrich-Schäffer		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Hemiptera	Anthocoridae																					
Orius insidiosus	(Say)		0	1	0	0	1	1	0	0	0	0	0	0	0	0	3	9	2	0	0	6
Orius tristicolor	(White)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	2
Hemiptera	Berytidae																					
Jalysus spinosus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Neoneides muticus	(Say)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hemiptera	Blissidae																					
Ischnodemus falicus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hemiptera	Cercopidae																					
Aphrophora quadrinotata	Say		10	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3
Aphrophora salicis	(De Geer)	I	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	1	0	0	0	3
Clastoptera arborina	Ball		0	0	0	0	2	0	0	0	0	0	0	0	9	0	0	0	0	0	2	3
Philaenus spumarius	(Linnaeus)	I	1	3	0	0	1	3	0	0	2	0	0	0	0	0	0	7	5	0	2	8
Prosapia ignipectus	(Fitch)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Hemiptera	Cicadellidae																					
Agallia constricta	(Van Duzee)		0	0	0	0	1	4	0	0	0	0	0	0	0	0	1	1	38	0	1	6
Agallia deleta	(Van Duzee)		3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3

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Agallia quadripunctata	(Provancher)		0	1	0	0	5	0	0	0	0	0	0	0	0	0	1	1	3	0	2	6
Agalliopsis peneoculata	(Oman)		0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	2	3
Allygus atomarius	(Fabricius)	I	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	9	0	10	3
Amblysellus curtisii	(Fitch)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Anoscopus serratulae	(Fabricius)	I	27	47	0	0	11	214	0	0	0	0	0	0	0	0	67	14	119	0	46	8
Aphrodes bicinctus	(Schrank)	I	1	0	0	0	0	13	0	0	0	0	0	0	0	0	0	3	0	0	3	4
Arboridia fumida	(Gillette)		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Athysanus argentarius	Metcalf	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Balcanocerus provancheri	(Van Duzee)		0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Balclutha impicta	(Van Duzee)		0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0	2
Bandara johnsoni	(Van Duzee)		3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Ceratagallia agricola	Hamilton		0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Chlorotettix galbanatus	(Van Duzee)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Chlorotettix unicolor	(Fitch)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Chlorotettix viridius	(Van Duzee)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	7	0	0	2
Coelidia olitoria	(Say)		1	0	0	3	8	0	1	0	5	0	0	0	7	0	0	0	35	0	5	8
Colladonus clitellarius	(Say)		0	0	0	0	2	0	1	0	0	0	0	0	1	0	0	5	6	0	0	5
Deltocephalus flavocostatus	Van Duzee		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Deltocephalus inimicus	(Say)		1	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	6	0	0	4
Deltocephalus littoralis	(Ball)		0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Deltocephalus pulicaris	(Fallén)	I	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	38	0	0	3
Destria bisignata	(Sanders & DeLong)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Dikraneura abnormis	(Walsh)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	1
Dikraneura mali	(Provancher)		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Diplocolenus configuratus	(Uhler)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	0	0	1
Doratura stylata	(Boheman)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	7	3
Draeculacephala antica	(Walker)		0	0	0	0	0	5	0	0	1	0	0	0	0	0	1	0	17	0	3	5
Draeculacephala zeae	Hamilton		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	4	3
Elymana sulphurella	(Zetterstedt)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Empoasca copula	DeLong		0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1

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Eratoneura spinifera	(Beamer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1
Erythroneura comes	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Erythroneura ziczac	Walsh		0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Eupteryx flavoscuta	Gillette		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Euscelis sordida	(Zetterstedt)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Extrusanus extrusus	(Van Duzee)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Flexamia clayi	Young & Beirne		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Graminella nigrifrons	(Forbes)		0	2	0	0	0	1	0	0	0	0	0	0	0	0	1	0	7	0	0	4
Graphocephala coccinea	(Forster)		0	1	0	0	12	4	9	0	20	0	0	0	0	0	1	1	21	0	1	9
Graphocephala fennahi	Young		1	0	0	0	0	1	0	0	3	0	0	0	1	0	0	0	0	0	1	5
Graphocephala picta	(Walker)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gyponana cacumina	DeLong		3	0	0	0	3	0	2	0	1	0	0	0	1	0	0	1	0	0	2	7
Gyponana extenda	DeLong		0	0	0	0	1	0	5	0	0	0	0	0	1	0	0	0	0	0	0	3
Gyponana octolineata	(Say)		0	0	0	0	1	0	4	0	1	0	0	0	0	0	0	0	4	0	0	4
Gyponana querci	(DeLong)		0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	1
Gyponana serpenta	DeLong		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Gyponana tubera	DeLong		1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	3	2	0	0	4
Helochara communis	Fitch		0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Hishimonus sellatus	(Uhler)	*,I,NA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1
Idiocerus formosus	Ball		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Idiocerus gillettei	Hamilton		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Idiocerus pallidus	Fitch		0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Idiocerus stigmaticalis	Lewis	I	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Idiocerus suturalis	Fitch		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Idiocerus venosus	Hamilton		0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Illinigina illinoiensis	(Gillette)		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Japananus hyalinus	(Osborn)	I	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Latalus ocellaris	(Fallén)	I	0	0	0	0	40	19	0	0	0	0	0	0	0	0	29	78	89	0	12	6
Latalus sayii	(Fitch)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Macropsis notata	Prohaska	I	0	16	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	4	4

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Macropsis ocellata	(Provancher)	I	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Macrosteles fascifrons	(Stål)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Macrosteles quadrilineatus	(Forbes)		0	5	0	0	26	0	0	0	1	0	0	0	0	0	1	0	6	0	1	6
Macrosteles variatus	(Fallén)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	6	0	0	0	2
Menosoma cincta	(Osborn & Ball)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Neohecalus lineatus	(Uhler)		0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Neokolla hieroglyphica	(Say)		0	0	0	0	1	0	4	0	0	0	0	0	0	0	0	0	1	0	2	4
Oncopsis sobria	(Walker)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2
Orientus ishidae	(Matsumura)	I	13	0	0	13	9	0	0	0	0	0	0	0	3	0	0	0	7	0	5	6
Osbornellus auronitens	(Provancher)		0	0	0	3	0	0	9	0	0	0	0	0	6	0	0	0	17	0	1	5
Osbornellus limosus	DeLong		17	0	0	0	1	1	2	0	0	0	0	0	15	0	2	0	5	0	0	7
Osbornellus unicolor	Osborn		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Paraphlepsius carolinus	(Lathrop)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	3	3
Paraphlepsius irroratus	(Say)		1	0	0	0	11	0	0	0	0	0	0	0	0	0	1	1	41	0	0	5
Paraphlepsius tennessus	(DeLong)		1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
Paraulacizes irrorata	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Pendarus punctiscriptus	(Van Duzee)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Pendarus stipatus	(DeLong)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	1
Ponana quadralaba	DeLong		0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	2
Ponana rubida	DeLong		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Prescottia lobata	(Van Duzee)		31	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	6	0	4	5
Psammotettix lividellus	(Zetterstedt)		1	0	0	0	5	0	0	0	0	0	0	0	0	0	1	1	4	0	1	6
Scaphoideus camurus	DeLong & Mohr		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Scaphoideus carinatus	Osborn		0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	0	0	2
Scaphoideus cyprius	Ball		1	0	0	0	2	2	0	0	0	0	0	0	40	0	0	0	2	0	39	6
Scaphoideus immistus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1
Scaphoideus incisus	Osborn		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Scaphoideus intricatus	Uhler		3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	2
Scaphoideus merus	DeLong & Beery		0	0	0	0	4	0	0	0	1	0	0	0	6	0	0	0	0	0	0	3
Scaphoideus minor	Osborn		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	1

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Scaphoideus ochraceus	Osborn		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Scaphoideus tergatus	DeLong		0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	3	0	7	4
Scaphoideus veterator	DeLong & Beery		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Scaphytopius acutus	(Say)		1	0	0	0	9	1	1	0	8	0	0	0	0	0	2	8	4	0	2	9
Scaphytopius frontalis	(Van Duzee)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Scaphytopius fulvus	(Osborn)		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Scaphytopius vaccinium	DeLong		0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Sorhoanus pascuellus	(Fallén)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	7	0	7	0	7	4
Texananus longipennis	Crowder		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Xestocephalus similis	Peters		1	0	0	0	1	40	1	0	0	0	0	0	0	0	2	0	18	0	0	6
Xestocephalus superbus	(Provancher)		3	5	0	0	7	47	1	0	0	0	0	0	0	0	8	0	13	0	0	7
Hemiptera	Cicadidae																					
Tibicen canicularis	(Harris)		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hemiptera	Coreidae																					
Leptoglossus occidentalis	Heidemann	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Hemiptera	Cydnidae																					
Amnestus pallidus	Zimmer		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Amnestus pusillus	Uhler		4	1	0	0	16	1	0	0	0	0	0	0	0	0	12	0	0	0	0	5
Melanaethus robustus	Uhler		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Microporus obliquus	Uhler		3	4	0	0	3	0	0	0	0	0	0	0	0	0	0	28	5	0	1	6
Pangaeus bilineatus	(Say)		1	0	0	0	2	11	3	0	0	0	0	0	10	0	0	6	4	0	0	7
Hemiptera	Flatidae																					
Anormenis chloris	(Melichar)		5	0	0	0	13	0	10	0	0	0	0	0	2	0	0	0	31	0	4	6
Metcalfa pruinosa	(Say)		12	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	3	0	10	5
Hemiptera	Fulgoridae																					
Scolops sulcipes	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Hemiptera	Geocoridae																					
Geocoris uliginosus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	2	2
Hemiptera	Hebridae																					
Hebrus sp.1			0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

PHYLUM/Order	**CLASS**/Family	Notes	Islands																			**Total # islands**
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Hemiptera	Issidae																					
Acanalonia bivittata	(Say)		0	0	0	0	1	0	0	0	8	0	0	0	0	0	1	2	2	0	1	6
Acanalonia conica	(Say)		2	0	0	0	1	0	3	0	0	0	0	0	7	0	0	0	6	0	4	6
Hemiptera	Lygaeidae																					
Lygaeus kalmii	Parshley		0	1	0	0	0	0	0	0	2	0	1	0	0	0	4	2	2	0	1	7
Oncopeltus fasciatus	(Dallas)		0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
Hemiptera	Membracidae																					
Campylenchia latipes	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
Ceresa alta	Walker		0	2	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3
Microcentrus caryae	(Fitch)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Telamona westcotti	Goding		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
Thelia bimaculata	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	2
Hemiptera	Mesoveliidae																					
Mesovelia mulsanti	White		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hemiptera	Miridae																					
Adelphocoris lineolatus	(Geoze)	I	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	10	1	0	0	4
Capsus ater	(Linnaeus)	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	7	0	0	0	3
Fulvius slateri	Wheeler		128	104	0	0	182	90	16	0	0	0	0	0	62	0	0	0	130	0	89	8
Halticus bractatus	(Say)		1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	13	0	0	5
Heterotoma merioptera	(Scopoli)	I	0	1	0	0	0	2	0	0	3	0	0	0	0	0	0	1	0	0	0	4
Leptopterna dolabrata	(Linnaeus)	I	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	3	3
Megaloceroea recticornis	(Geoffrey)	I	0	1	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	4
Neurocolpus nubilus	(Say)		12	4	0	0	0	5	0	0	3	0	0	0	1	0	0	0	0	0	2	6
Paraxenetus guttulatus	(Uhler)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Poecilocapsus lineatus	(Fabricius)		2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	4
Polymerus basalis	(Reuter)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	1
Prepops insitivus	(Say)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Stenodema trispinosa	Reuter		1	2	0	0	0	1	0	0	0	0	0	0	0	0	22	8	4	0	6	7
Stenotus binotatus	(Fabricius)	I	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	6	0	0	1	3
Trigonotylus caelestialium	(Kirkaldy)		0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	3

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Hemiptera	Nabidae																					
Lasiomerus annulatus	(Reuter)		3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
Nabis americoferus	Carayon		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	14	0	0	3
Nabis roseipennis	Reuter		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Pagasa fusca	(Stein)		0	2	0	0	10	0	0	0	0	0	0	0	0	0	2	2	4	0	0	5
Hemiptera	Pachygronthidae																					
Oedancala dorsalis	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Phlegyas abbreviatus	(Uhler)		0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	0	0	0	1	4
Hemiptera	Pentatomidae																					
Acrosternum hilare	(Say)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	4	0	2	3
Amaurochrous brevitylus	Barber & Sailer		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0	2
Banasa calva	(Say)		0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Banasa dimidiata	(Say)		4	0	0	0	2	0	2	0	0	0	0	0	1	0	0	0	0	0	0	4
Cosmopepla bimaculata	(Thomas)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Euschistus servus	(Say)		1	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	0	0	0	3
Euschistus tristigmus	(Say)		2	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	1	0	1	5
Euschistus variolarius	(Palisot)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Holcostethus limbolarius	(Stål)		0	1	0	0	0	1	0	0	1	0	0	0	2	0	0	0	1	0	0	5
Oebalus pugnax	(Fabricius)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Parabrochymena arborea	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Perillus bioculatus	(Fabricius)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Podisus maculiventris	(Say)		0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	2	0	0	3	4
Podisus placidus	Uhler		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Thyanta custator	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Trichopepla semivittata	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Hemiptera	Reduviidae																					
Barce uhleri	Banks		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Fitchia aptera	Stål		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Phymata pennsylvanica	Handlirsch		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	2	0	4	4
Hemiptera	Rhopalidae																					

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Harmostes reflexulus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Hemiptera	Rhyparochromidae																					
Antillocoris minutus	(Bergroth)		0	0	0	0	34	0	2	0	0	0	0	0	0	0	2	0	0	0	0	3
Cryphula trimaculata	(Distant)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Drymus unus	(Say)		0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Eremocoris ferus	(Say)		0	0	0	0	6	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Heraeus plebejus	Stål		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2
Myodocha serripes	Olivier		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	2	3
Neopamera albocincta	(Barber)		0	18	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	3
Ozophora picturata	Uhler		1	0	0	0	15	0	21	0	0	0	0	0	5	0	0	0	0	0	15	5
Peritrechus fraternus	Uhler		0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Scolopostethus diffidens	Horváth		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Scolopostethus thomsoni	Reuter		0	0	0	0	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Stygnocoris sabulosus	(Schilling)	I	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	4	0	1	3
Hemiptera	Saldidae																					
Micracanthia humilis	(Say)		0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pentacora sphacelata	(Uhler)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Saldula pallipes	(Fabricius)		0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hemiptera	Thyreocoridae																					
Corimelaena lateralis	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	1
Corimelaena pulicaria	(Germar)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2
Hemiptera	Tingidae																					
Corythucha arcuata	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Hymenoptera	Andrenidae																					
Andrena asteris	Robertson		0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	2	0	1	5
Andrena bradleyi	Viereck		0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Andrena brevipalpis	Cockerell		1	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Andrena carlini	Cockerell		0	0	0	0	5	1	1	0	0	0	0	2	0	0	0	1	8	0	23	7
Andrena commoda	Smith		0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	4	0	1	4
Andrena crataegi	Robertson		0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	3

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Andrena cressonii	Robertson		0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	2	0	30	3
Andrena distans	Provancher		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Andrena dunningi	Cockerell		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Andrena forbesii	Robertson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Andrena frigida	Smith		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Andrena hippotes	Robertson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Andrena hirticincta	Provancher		0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	0	4	5
Andrena imitatrix	Cresson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Andrena milwaukeensis	Graenicher		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Andrena miserabilis	Cresson		1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	12	0	0	3
Andrena morrisonella	Viereck		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Andrena nasonii	Robertson		4	0	0	0	2	1	2	0	0	0	0	6	0	0	0	0	108	0	30	7
Andrena nubecula	Smith		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Andrena perplexa	Smith		1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	0	1	4
Andrena robertsonii	Dalla Torre		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Andrena spiraeana	Robertson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Andrena thaspii	Graenicher		2	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	3
Andrena tridens	Robertson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Andrena vicina	Smith		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
Andrena wheeleri	Graenicher		2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Andrena wilkella	(Kirby)	I	0	0	0	0	2	5	0	2	0	0	0	0	0	0	1	6	1	0	0	6
Calliopsis andreniformis	Smith		0	0	0	0	1	0	0	0	0	0	0	3	0	0	0	3	7	0	28	5
Hymenoptera	Apidae																					
Anthophora terminalis	Cresson		0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	5	3
Apis mellifera	Linnaeus	I	1	0	0	0	11	2	1	0	0	0	0	0	4	2	0	16	10	3	9	10
Bombus bimaculatus	Cresson		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	3
Bombus citrinus	(Smith)		3	0	0	0	3	1	0	0	0	0	0	0	5	0	0	0	3	0	6	6
Bombus fervidus	(Fabricius)		0	9	0	1	8	0	0	0	1	0	0	0	0	0	0	10	0	0	6	6
Bombus griseocollis	(DeGeer)		1	0	0	0	1	1	1	0	7	0	0	0	1	0	6	3	1	0	2	10
Bombus impatiens	Cresson		1	3	0	0	46	5	3	0	3	0	0	1	2	0	9	22	20	3	8	13

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Bombus perplexus	Cresson		0	0	0	0	1	0	0	0	1	0	0	0	1	0	1	0	1	0	1	6
Bombus vagans	Smith		2	3	0	0	21	2	0	0	1	0	0	0	0	0	0	7	4	0	0	7
Ceratina calcarata	Robertson		157	1	0	1	321	565	41	0	47	0	0	64	3	0	6	48	145	3	44	14
Ceratina dupla	Say		73	2	0	0	162	58	2	0	3	0	0	11	0	0	3	17	7	4	23	12
Ceratina strenua	Smith		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Epeolus autumnalis	Robertson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2
Epeolus pusillus	Cresson		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Epeolus scutellaris	Say		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Melissodes agilis	Cresson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Melissodes bimaculata	Lepeletier		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	16	0	2	3
Melissodes desponsa	Smith		0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Melissodes druriella	(Kirby)		0	3	0	2	3	180	0	0	0	0	0	1	0	0	0	0	1	0	0	6
Melissodes illata	Lovell & Cockerell		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1
Melissodes subillata	LaBerge		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Nomada articulata	Smith		0	0	0	0	4	4	0	0	0	0	0	1	0	0	0	3	32	0	8	6
Nomada bethunei	Cockerell		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Nomada bidentate 1			0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Nomada bidentate 2			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Nomada bidentate 3			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Nomada bidentate A			0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Nomada composita	Mitchell		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Nomada cressonii	Robertson		0	0	0	0	5	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Nomada denticulata	Robertson		2	0	0	0	6	0	0	0	0	0	0	2	0	0	0	0	0	0	1	4
Nomada imbricata	Smith		0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	1	3	0	11	5
Nomada luteoloides	Robertson		0	0	0	0	6	1	0	0	0	0	0	1	0	0	0	0	0	0	9	4
Nomada maculata	Cresson		1	0	0	0	1	2	4	0	0	0	0	0	1	0	0	0	2	0	19	7
Nomada pygmaea	Cresson		2	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	6	4
Nomada vicina	Cresson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Nomada wt spine 1			0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Nomada wt spine 2			0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

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			BM	**CF**	**DE**	**GE**	**GP**	**GB**	**LN**	**LI**	**LV**	**MB**	**OB**	**PE**	**RG**	**RN**	**SN**	**SP**	**TH**	**WB**	**WE**	
Nomada wt spine 3			0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Nomada wt spine A			0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Nomada wt spine B			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Nomada wt spine C			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Xylocopa virginica	(Linnaeus)		2	1	0	0	7	1	0	0	3	0	0	0	0	1	7	7	13	0	0	9
Hymenoptera	Bethylidae																					
Anisepyris columbianus	(Ashmead)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Cephalonomia sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Epyris spissus	Evans		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Epyris vierecki	Krombein		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Goniozus cellularis	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
Goniozus hortorum	Brues		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Pristocera armifera	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Pseudisobrachium ashmeadi	Evans		1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Hymenoptera	Chrysididae																					
Caenochrysis doriae	(Gribodo)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Chrysis cembricola	Krombein		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chrysis derivata	du Buysson		0	0	0	0	1	0	0	0	0	0	0	0	5	0	0	0	0	0	1	3
Chrysis nitidula	Fabricius		0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	3	3
Chrysura kyrae	Krombein		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Cleptes semiauratus	(Linnaeus)	I	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Elampus marginatus	Patton		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hedychridium dimidiatum	(Say)		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Omalus aeneus	Fabricius		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Omalus iridescens	(Norton)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hymenoptera	Colletidae																					
Colletes americanus	Cresson		0	0	0	0	0	0	0	0	4	0	0	3	0	0	0	0	2	0	0	3
Colletes compactus	Cresson		0	0	0	0	0	1	0	0	0	0	0	0	0	0	10	0	15	0	0	3
Colletes inaequalis	Say		0	0	0	0	3	0	0	0	0	0	0	0	0	0	1	6	4	0	0	4
Colletes simulans	Cresson		0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	3

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Colletes solidaginis	Swenk		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Colletes thoracicus	Smith		0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Hylaeus affinis	(Smith)		0	0	0	0	0	8	0	0	2	0	0	0	0	0	0	7	3	0	4	5
Hylaeus illinoisensis	(Robertson)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hylaeus mesillae	(Cockerell)		0	1	0	0	25	2	0	0	10	0	0	4	0	0	1	16	10	0	4	9
Hylaeus modestus	Say		4	1	0	0	1	10	0	0	0	0	0	0	1	0	0	0	9	0	16	7
Hylaeus schwarzii	Cockerell		0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hylaeus sp. A			1	10	0	0	3	7	0	0	7	0	0	0	0	0	1	1	8	0	16	9
Hylaeus verticalis	(Cresson)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hymenoptera	Crabronidae																					
Bembix americana	Lepeletier		0	3	0	0	0	0	0	0	4	0	0	0	0	0	0	7	5	0	1	5
Bicyrtes quadrifasciatus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	1	0	0	2
Cerceris atramontensis	Banks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Cerceris fumipennis	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Cerceris halone	Banks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Clytemnestra bipunctata	(Say)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Crabro cribrellifer	(Packard)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Crossocerus impressifrons	(Smith)		0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Crossocerus lentus	(W. Fox)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Crossocerus minimus	(Packard)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Didineis latimana	Malloch & Rower		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
Ectemnius cephalotes	(Olivier)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Ectemnius continuus	(Fabricius)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	4
Ectemnius dives	(Lepeletier & Brullé)		2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Ectemnius maculosus	(Gmelin)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Ectemnius stirpicola	(Packard)		2	3	0	1	0	6	0	0	1	0	0	0	1	0	0	1	1	0	0	8
Gorytes atricornis	Packard		0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Gorytes simillimus	Smith		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Hoplisoides placidus	(Handlirsch)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Lestica confluenta	(Say)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3

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Lyroda subita	(Say)		0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	4	0	0	2
Microbembex monodonta	(Say)		0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1
Mimumesa sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Nysson plagiatus	Cresson		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Oxybelus emarginatus	Say		0	1	0	0	0	0	0	0	0	0	0	0	0	0	8	9	13	0	0	4
Passaloecus cuspidatus	Smith		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Passaloecus monilicornis	Dahlbom		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Passaloecus singularis	Dahlbom		2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	0	0	3
Pemphredon inornata	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Pemphredon lethifer	(Shuckard)		0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	3
Pemphredon rugifer	(Dahlbom)	I	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Philanthus gibbosus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1
Philanthus lepidus	Cresson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Psenulus pallipes	(Pate)		2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Psenulus trisulcus	(W. Fox)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Rhopalum clavipes	(Linnaeus)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Rhopalum rufigaster	Packard		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Solierella peckhami	(Ashmead)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sphecius speciosus	(Drury)		0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Tachysphex antennatus	Fox		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Tachysphex similis	Rohwer		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Tachysphex tarsatus	(Say)		0	0	0	0	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	2
Tachysphex terminatus	(F. Smith)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	0	0	2
Tachytes aurulentus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	1
Tachytes distinctus	(F. Smith)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Trypoxylon attenuatum	Smith	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	2
Trypoxylon collinum	(Packard)		1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Trypoxylon frigidum	Smith		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	2
Trypoxylon johnsoni	Fox		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Hymenoptera	Dryinidae																					

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Gonatopus sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Hymenoptera	Formicidae																					
Amblyopone pallipes	(Haldeman)		1	2	0	0	3	3	5	0	0	0	0	0	1	0	0	0	23	0	2	8
Anergates atratulus	(Schenk)	I, MA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Aphaenogaster fulva	Roger		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Aphaenogaster rudis complex			50	232	0	1	172	49	361	0	7	0	0	0	173	0	0	0	544	0	297	10
Brachymyrmex depilis	Emery		3	0	0	0	6	13	58	0	0	0	0	0	1	0	0	1	0	0	2	7
Camponotus americanus	Mayr		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2
Camponotus caryae	(Fitch)	MA	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	6	4
Camponotus nearcticus	Emery		4	2	0	0	1	0	5	0	1	0	0	0	17	0	0	0	4	0	5	8
Camponotus novaeboracensis	(Fitch)		0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Camponotus pennsylvanicus	(De Geer)		12	0	0	0	57	0	34	0	8	0	0	0	254	0	0	5	136	0	132	8
Crematogaster cerasi	Fitch		0	2	0	0	13	31	28	0	29	0	0	0	209	0	5	5	31	0	62	10
Crematogaster lineolata	(Say)		25	1	0	0	1	34	39	0	1	0	0	0	82	0	18	21	119	0	6	11
Formica dolosa	Buren		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Formica incerta	Buren		0	1	0	0	23	0	8	0	1	0	0	0	2	1	30	10	28	0	13	10
Formica lasioides	Emery		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Formica neogagates	Viereck		1	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	13	3
Formica subsericea	Say		32	0	0	2	18	0	10	0	0	0	0	0	147	0	0	0	37	0	97	7
Lasius alienus	(Förster)		20	1	0	0	265	20	5	0	2	0	0	0	1	0	24	120	143	0	13	11
Lasius claviger	(Roger)		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3
Lasius interjectus	(Mayr)		2	0	0	0	3	1	0	0	1	0	0	0	0	0	0	0	2	0	0	5
Lasius latipes	(Walsh)		0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Lasius nearcticus	Wheeler		0	0	0	0	0	453	5	0	0	0	0	0	2	0	0	0	1	0	7	5
Lasius neoniger	Emery		50	1	0	0	33	138	3	0	16	0	0	0	0	0	112	58	237	0	8	10
Lasius pallitarsis	(Provancher)		0	40	0	0	156	59	0	0	0	0	0	0	0	0	1	2	14	0	5	7
Lasius subglaber	Emery		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Lasius umbratus	(Nylander)		1	0	0	0	3	0	2	0	0	0	0	0	0	0	0	0	8	0	25	5
Monomorium emarginatum	DuBois		0	0	0	0	0	0	0	0	0	0	0	0	0	0	129	30	3	0	0	3
Myrmecina americana	Emery		1	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	2	0	0	3

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Myrmica americana	Weber		1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0	2	4
Myrmica emeryana	Cole		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Myrmica fracticornis	Forel		9	0	0	0	634	0	0	0	0	0	0	0	0	0	9	21	3	0	0	5
Myrmica pinetorum	Wheeler		0	0	0	0	5	0	3	0	0	0	0	0	0	0	0	0	1	0	2	4
Myrmica punctiventris	Roger		31	0	0	0	90	13	6	0	0	0	0	0	79	0	0	0	71	0	57	7
Myrmica rubra	Linnaeus	*,I	142	1863	0	0	28	402	6	0	64	1	2	0	3	0	538	23	228	0	29	13
Myrmica scabrinodis	Nylander	*,I,NA	0	0	0	0	6	0	9	0	0	0	0	0	0	0	1	28	9	0	2	6
Myrmica new sp. *"sculptilis"*			3	1	0	0	99	0	2	0	0	0	0	0	0	0	0	0	0	0	117	5
Myrmica new sp. *"smithana"*			10	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	34	4
Nylanderia flavipes	(F. Smith)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	259	0	0	1
Ponera pennsylvanica	Buckley		6	32	0	0	20	13	12	0	0	0	0	0	27	0	66	5	313	0	17	10
Prenolepis imparis	(Say)		6	6	0	0	179	7	60	0	16	0	0	0	7	0	70	1	296	0	52	11
Protomognathus americanus	(Emery)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pyramica metazytes	Bolton	*, MA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Solenopsis molesta	(Say)		102	0	0	0	123	44	3	0	0	0	0	0	42	0	14	0	134	0	2	8
Stenamma brevicorne	(Mayr)		1	29	0	0	36	129	2	0	0	0	0	0	3	0	37	2	40	0	20	10
Stenamma impar	Forel		2	6	0	0	42	0	11	0	0	0	0	0	11	0	22	0	21	0	5	8
Stenamma schmitti	Wheeler		1	1	0	0	17	0	4	0	0	0	0	0	5	0	0	0	3	0	3	7
Tapinoma sessile	(Say)		37	6	0	0	96	109	22	0	5	0	0	0	15	0	37	38	17	0	78	11
Temnothorax ambiguus	(Emery)		1	25	0	0	34	86	0	0	0	0	1	0	3	0	36	29	11	0	5	10
Temnothorax curvispinosus	(Mayr)		6	22	0	0	217	1	16	0	1	0	0	0	10	0	411	4	128	0	14	11
Temnothorax longispinosus	(Roger)		0	0	0	0	5	13	22	0	0	0	0	0	58	0	3	2	30	0	10	8
Temnothorax schaumii	Roger		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Tetramorium caespitum	(Linnaeus)	I	26	295	0	0	1294	415	14	0	24	2	0	0	100	0	255	1151	363	0	10	12
Hymenoptera	Gasteruptiidae																					
Gasteruption assectator	(Linnaeus)		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1
Hymenoptera	Halictidae																					
Agapostemon sericeus	(Forster)		0	2	0	0	3	7	0	0	1	0	0	0	0	0	0	2	48	0	3	7
Agapostemon texanus	Cresson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	1	2
Agapostemon virescens	(Fabricius)		5	5	0	0	39	94	0	0	3	0	2	9	0	0	1	42	195	18	118	12

PHYLUM/Order	**CLASS**/Family	Notes	Islands																				Total # islands
			BM	**CF**	**DE**	**GE**	**GP**	**GB**	**LN**	**LI**	**LV**	**MB**	**OB**	**PE**	**RG**	**RN**	**SN**	**SP**	**TH**	**WB**	**WE**	
Augochlora pura	Say		3	0	0	0	36	1	6	0	11	0	0	0	8	0	0	0	7	0	34	8
Augochlorella aurata	(Smith)		29	0	0	0	168	107	18	0	17	0	0	9	185	0	2	6	89	7	268	12
Augochloropsis metallica	Fabricius		3	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	13	3
Halictus confusus	Smith		3	22	0	0	45	9	0	0	6	0	0	10	0	0	1	2	17	0	7	10
Halictus ligatus	Say		6	0	0	0	10	11	0	0	2	0	0	2	0	0	0	13	74	0	27	8
Halictus rubicundus	(Christ)		0	0	0	0	0	3	0	0	0	0	0	0	0	0	1	1	4	0	2	5
Lasioglossum bruneri	(Crawford)		0	0	0	0	2	1	1	0	1	0	0	3	0	0	0	0	3	0	3	7
Lasioglossum rozeni	Gibbs		3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lasioglossum cinctipes	(Provancher)		0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	2
Lasioglossum coeruleum	(Robertson)		0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	3
Lasioglossum coriaceum	(Smith)		3	7	0	0	7	5	4	0	1	0	0	1	0	0	0	2	13	0	27	10
Lasioglossum cressonii	(Robertson)		16	6	0	0	73	39	2	0	7	1	3	2	3	0	2	1	21	0	74	14
Lasioglossum divergens	(Lovell)		32	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
Lasioglossum ellisiae	(Sandhouse)		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lasioglossum ephialtum	Gibbs		0	0	0	0	24	42	4	0	0	0	0	14	0	0	0	26	15	0	1	7
Lasioglossum foxii	(Robertson)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lasioglossum imitatum	(Smith)		3	0	0	0	74	1	0	0	1	0	0	3	0	0	0	0	46	1	0	7
Lasioglossum JG3			0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Lasioglossum leucocomum	(Lovell)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2	7	0	1	4
Lasioglossum leucozonium	(Schrank)	I	1	0	0	0	10	4	0	0	0	0	0	7	0	0	1	17	19	3	3	9
Lasioglossum lineatulum	(Crawford)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Lasioglossum lionotum	(Sandhouse)	MA	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	18	0	0	2
Lasioglossum macoupinense	(Robertson)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	2
Lasioglossum marinum	(Crawford)		0	2	0	0	0	0	0	0	53	0	0	0	8	0	0	0	0	0	0	3
Lasioglossum nigroviride	(Graenicher)		0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	1	2
Lasioglossum nymphaearum	(Robertson)		3	0	0	0	2	0	1	1	2	0	0	0	0	0	0	0	27	0	4	7
Lasioglossum oblongum	(Lovell)		0	0	0	0	3	2	3	0	74	0	0	7	2	0	0	0	21	0	2	8
Lasioglossum oceanicum	(Cockerell)		2	0	0	0	1	1	1	0	0	0	0	1	0	0	0	0	19	0	2	7
Lasioglossum pectorale	(Smith)		0	15	0	0	1	1	0	0	0	0	0	0	0	0	0	6	65	1	6	7
Lasioglossum perpunctatum	(Ellis)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1

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Lasioglossum perspicuum	(Knerer & Atwood)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1
Lasioglossum pilosum	(Smith)		1	20	0	0	4	194	0	0	31	0	2	1	0	0	0	7	32	0	0	9
Lasioglossum planatum	(Lovell)		0	22	0	0	44	6	0	0	2	0	4	0	7	0	25	12	6	0	40	10
Lasioglossum quebecense	(Crawford)		3	0	0	0	7	0	4	0	0	0	0	0	0	0	0	0	0	0	2	4
Lasioglossum rohweri	(Ellis)		10	2	0	0	46	5	0	0	1	1	1	0	13	0	2	6	53	0	62	12
Lasioglossum sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	2
Lasioglossum subviridatum	(Cockerell)		0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
Lasioglossum tegulare	(Robertson)		15	1	0	0	16	2	2	0	14	0	0	31	0	0	0	21	52	6	21	11
Lasioglossum versans	(Lovell)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	1
Lasioglossum versatum	(Robertson)		47	0	0	0	78	1	0	0	0	0	0	5	0	0	0	1	2	4	17	8
Lasioglossum viridatum group	(Lovell)		0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2
Lasioglossum zephyrum	(Smith)		0	2	0	0	2	28	0	0	183	0	0	0	0	1	0	3	54	0	1	8
Lasioglossum smilacinae	(Robertson)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sphecodes atlantis	Mitchell		0	0	0	0	2	0	0	0	2	0	0	2	0	0	0	2	5	0	0	5
Sphecodes coronus	Mitchell		0	2	0	0	0	20	0	0	0	0	0	1	0	0	0	0	1	0	4	5
Sphecodes cressonii	(Robertson)		0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	0	2
Sphecodes davisii	Robertson		0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	56	0	0	3
Sphecodes dichrous	Smith		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sphecodes galerus	Lovell & Cockerell		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Sphecodes heraclei	Robertson		0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2
Sphecodes illinoensis	(Robertson)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sphecodes johnsonii	Lovell		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sphecodes levis	Lovell & Cockerell		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Sphecodes mandibularis	Cresson		0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	0	9	0	0	3
Sphecodes minor	Robertson		0	1	0	0	1	9	0	0	0	0	0	0	0	0	1	0	0	0	1	5
Sphecodes pimpinellae	Robertson		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Sphecodes ranunculi	Robertson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hymenoptera	Ichneumonidae																					
Enicospilus sp. 1			0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ichneumon annulatorius	Fabricius		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1

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Therion sp.1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hymenoptera	Megachilidae																						
Anthidium manicatum	(Linnaeus)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	1
Anthidium oblongatum	(Illiger)	I	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Coelioxys rufitarsis	Smith		0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	5	0	0	0	3
Coelioxys sayi	Robertson		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	3
Heriades carinatus	Cresson		0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	3
Hoplitis pilosifrons	(Cresson)		0	1	0	0	0	2	0	0	0	0	0	1	0	0	0	2	0	0	2	5
Hoplitis producta	(Cresson)		8	1	0	0	14	12	0	0	0	0	1	9	0	0	0	3	7	0	1	9
Hoplitis spoliata	(Provancher)		2	5	0	0	5	19	0	0	2	0	0	2	1	0	0	0	4	0	5	9
Megachile brevis	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	1	3
Megachile campanulae	(Robertson)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Megachile centuncularis	(Linnaeus)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Megachile gemula	Cresson		1	3	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	4
Megachile inimica	Cresson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Megachile latimanus	Say		1	1	0	0	1	0	0	1	0	0	0	0	0	0	1	9	0	0	1	7
Megachile mendica	Cresson		1	5	0	0	3	21	0	0	3	0	0	0	0	0	0	8	4	0	4	8
Megachile montivaga	Cresson		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	2
Megachile pugnata	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Megachile relativa	Cresson		1	2	0	0	1	1	0	0	1	0	0	0	0	0	0	2	0	0	3	7
Megachile rotundata	(Fabricius)	I	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	3	0	0	0	3
Megachile sculpturalis	Smith	I	0	1	0	0	0	2	0	0	2	0	0	0	0	1	1	0	1	0	1	7
Osmia albiventris	Cresson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Osmia atriventris	Cresson		2	0	0	0	7	1	0	0	0	0	0	3	0	0	0	2	2	1	8	8
Osmia bucephala	Cresson		0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	5	4
Osmia collinsiae	Robertson		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Osmia inspergens	Lovell & Cockerell		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Osmia lignaria	Say		2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	3
Osmia pumila	Cresson		18	0	0	0	21	17	2	0	0	0	0	2	0	0	0	2	13	2	37	9
Osmia simillima	Smith		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	1	3

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Stelis lateralis	Cresson		0	0	0	0	1	3	0	0	0	0	0	1	0	0	1	1	0	0	0	5
Hymenoptera	Mutillidae																					
Dasymutilla gibbosa	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
Dasymutilla nigripes	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Myrmosa unicolor	Say		1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Pseudomethoca frigida	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	9	0	1	4
Timulla vagans	Fabricius		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	2
Hymenoptera	Pompilidae																					
Ageniella mintaka	Brimley		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Anoplius aethiops	(Cresson)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Anoplius cleora	(Banks)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Anoplius hispidulus	Dreisbach		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Anoplius marginatus	(Say)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Anoplius ventralis	(Banks)		1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	1	4
Anoplius virginiensis	(Cresson)		0	0	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	1	3
Aporinellus completus	Banks		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Aporus niger	(Cresson)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Arachnospila apicatus	(Provancher)		1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
Caliadurgus fasciatellus	(Spinola)		0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	3
Dipogon papago	Dreisbach		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Dipogon pulchripennis	(Cresson)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Dipogon sayi	Banks		0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	2
Episyron biguttatus	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Evagetes padrinus	(Banks)		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Priocnemis cornica	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Priocnemis minorata	Banks		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Priocnessus nebulosus	(Dahlbom)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Tachypompilus ferrugineus	(Banks)		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hymenoptera	Sierolomorphidae																					
Sierolomorpha canadensis	(Provancher)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2

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Hymenoptera	Siricidae																						
Tremex columba	(Linnaeus)		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	2	
Hymenoptera	Sphecidae																						
Ammophila nigricans	Dahlbom		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	1	3	
Ammophila pictipennis	(Walsh)		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	3	1	0	1	4	
Chalybion californicum	(Saussure)		0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	
Eremnophila aureonotata	(Cameron)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Isodontia mexicana	(Saussure)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	3	3	
Prionyx parkeri	Bohart & Menke		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	3	
Sceliphron caementarium	(Drury)		0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	1	0	0	3	
Sphex ichneumoneus	(Linneaus)		0	0	0	0	1	2	0	0	0	0	0	0	0	0	1	0	0	0	1	4	
Sphex pensylvanicus	Linnaeus		0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Hymenoptera	Tiphiidae																						
Tiphia inaequalis	Malloch		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0	0	1	
Tiphia letalis	Roberts		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Hymenoptera	Vespidae																						
Ancistrocerus catskill	(Saussure)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Ancistrocerus adiabatus	(Saussure)		4	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	8	4	
Ancistrocerus campestris	(Saussure)		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	2	
Ancistrocerus gazella	(Panzer)	I	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	4	0	0	2	
Dolichovespula arctica	(Rohwer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Dolichovespula arenaria	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	0	6	3	
Dolichovespula maculata	(Linnaeus)		1	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	13	0	2	5	
Eumenes fraternus	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	2	
Eumenes verticalis	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	
Euodynerus foraminatus	(Saussure)		1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	4	5	
Euodynerus hidalgo	(Saussure)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	
Monobia quadridens	(Linnaeus)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	3	
Parancistrocerus bicornis	(Robertson)		0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	
Parancistrocerus pedestris	(Saussure)		1	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	1	0	3	5	

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Parancistrocerus pensylanica	(Saussure)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	2	3
Parancistrocerus perennis	(Saussure)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	2
Polistes dominula	(Christ)	I	0	0	0	0	0	2	0	0	0	0	0	3	0	0	2	3	11	0	2	6
Polistes fuscatus	(Fabricius)		0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	1	8	0	5	4
Stenodynerus ammonia	Saussure		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Stenodynerus krombeini	Bohart		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Vespula maculifrons	(Buysson)		0	0	0	0	6	0	6	0	0	0	0	0	6	0	1	0	14	0	1	6
Vespula vidua	(Saussure)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lepidoptera	Acrolophidae																					
Acrolophus popeanella	(Clemens)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4	2	0	0	3
Lepidoptera	Cossidae																					
Zeuzera pyrina	(Linnaeus)	I	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Lepidoptera	Crambidae																					
Achyra rantalis	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Anania funebris	(Walker)		2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Apogeshna stenialis	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Blepharomastix ranalis	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Crambus agitatellus	Clemens		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Desmia funeralis	(Hübner)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Desmia maculalis	Westwood		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	3	3
Diastictis ventralis	(Grote & Robinson)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Eustixia pupula	Hübner		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Evergestis pallidata	(Hufnagel)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1
Lygropia rivulalis	Hampson		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Nomophila nearctica	Munroe		0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	3	3
Ostrinia nubilalis	(Hübner)	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pediasia trisecta	(Walker)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Saucrobotys futilalis	(Lederer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sclerocona acutellus	(Eversmann)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Spoladea recurvalis	(Fabricius)		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	2

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Udea rubigalis	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Urola nivalis	(Drury)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Lepidoptera	Drepanidae																					
Oreta rosea	(Walker)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lepidoptera	Erebidae†																					
Apantesis phalerata	(Harris)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4	0	0	2
Bleptina caradrinalis	Guenée		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Caenurgina crassiuscula	(Haworth)		0	0	0	0	0	7	0	0	2	0	0	0	1	0	0	1	6	0	2	6
Caenurgina erechtea	(Cramer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	1
Catocala andromedae	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Catocala antinympha	(Hübner)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Catocala flebilis	Grote		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Catocala ilia	(Cramer)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Catocala piatrix	Grote		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Catocala relicta	Walker		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Chytolita morbidalis	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Chytolita petrealis	Grote		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cisseps fulvicollis	(Hübner)		0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2	2	0	0	3
Cisthene packardii	(Grote)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Cycnia inopinatus	(H. Edwards)	*	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Euchaetes egle	(Drury)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Halysidota tessellaris	(J. E. Smith)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Hypena scabra	(Fabricius)		0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	4	3
Hyphantria cunea	(Drury)		0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Idia aemula	Hübner		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Idia americalis	(Guenée)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Idia lubricalis	(Geyer)		1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Lascoria ambigualis	Walker		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Lymantria dispar	(Linnaeus)	I	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	3	0	0	2	3
Metalectra discalis	(Grote)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1

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Palthis angulalis	(Hübner)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Pangrapta decoralis	(Hübner)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Panopoda rufimargo	(Hübner)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Phalaenostola larentioides	Grote		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Pyrrharctia isabella	(J. E. Smith)		2	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	5	4
Spilosoma virginica	(Fabricius)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Virbia opella	(Grote)		0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Zale lunata	(Drury)		0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	3
Zale minerea	(Guenée)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Zanclognatha cruralis	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Zanclognatha jacchusalis	(Walker)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Lepidoptera	Euteliidae†																					
Marathyssa inficita	(Walker)		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Paectes oculatrix	(Guenée)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lepidoptera	Geometridae																					
Campaea perlata	(Guenée)		0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	2	0	0	3
Chlorochlamys chloroleucaria	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Chloroclystis rectangulata	(Linnaeus)	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	3
Digrammia continuata	(Walker)		0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	1
Ectropis crepuscularia	(Denis & Schiffermüller)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Ennomos magnaria	Guenée		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Eulithis diversilineata	(Hübner)		0	0	0	0	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	3
Eusarca confusaria	Hübner		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Haematopis grataria	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hypagyrtis unipunctata	(Haworth)		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	5	3
Macaria bisignata	Walker		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Macaria fissinotata	(Walker)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Macaria minorata	Packard		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Metarranthis hypochraria	(Herrich-Schäffer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Nacophora quernaria	(Smith)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1

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Orthonama obstipata	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Patalene olyzonaria	(Walker)		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	2
Pero morrisonaria	(Edwards)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Prochoerodes lineola	(Drury)		1	0	0	0	6	0	3	0	1	0	0	0	0	0	0	0	0	0	6	5
Rheumaptera prunivorata	Ferguson		0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1
Scopula limboundata	(Haworth)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1
Tetracis crocallata	Guenée		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Lepidoptera	Hesperiidae																					
Ancyloxypha numitor	(Fabricius)		0	1	1	0	0	8	0	0	0	1	0	0	0	0	0	0	1	0	0	5
Atrytonopsis hianna	(Scudder)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Erynnis horatius	(Scudder & Burgess)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Erynnis juvenalis	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Poanes viator	(Edwards)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	2
Polites mystic	(Edwards)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Polites peckius	(Kirby)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
Polites themistocles	(Latreille)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Thymelicus lineola	(Ochsenheimer)	I	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Lepidoptera	Lasiocampidae																					
Malacosoma americanum	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Lepidoptera	Limacodidae																					
Isa textula	(Herrich-Schäffer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Prolimacodes badia	(Hübner)		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1
Lepidoptera	Lycaenidae																					
Callophrys gryneus	(Hübner)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Celastrina ladon	(Cramer)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2
Celastrina serotina	Pavulaan & Wright		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Everes comyntas	Godart		0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	1	0	0	1	4
Lycaena phlaeas	(Linnaeus)		0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0	2
Lepidoptera	Mimallonidae																					
Lacosoma chiridota	Grote		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

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Lepidoptera	Noctuidae†																						
Abagrotis alternata	(Grote)		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	
Acronicta hasta	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Agnorisma badinodis	(Grote)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	
Agrotis ipsilon	(Hufnagel)		0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	4	
Agrotis venerabilis	Walker		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Agrotis volubilis	Harvey		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	
Amphipyra pyramidoides	Guenee		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Anagrapha falcifera	(Kirby)		0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	12	0	1	5	
Apamea amputatrix	(Fitch)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Apamea devastator	(Brace)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	
Apamea lignicolora	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Apamea ophiogramma	(Esper)	I	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Apamea sordens	(Hufnagel)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	
Apamea verbascoides	(Guenée)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Athetis tarda	(Guenée)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	
Autographa precationis	(Guenée)		1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	4	
Balsa malana	(Fitch)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Balsa tristrigella	(Walker)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Calophasia lunula	(Hufnagel)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	
Chrysodeixis includens	(Walker)		0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	
Chytonix palliatricula	(Guenée)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	
Elaphria versicolor	(Grote)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	
Eudryas unio	(Hübner)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	
Feltia geniculata	(Grote & Robinson)		0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	
Feltia herilis	(Grote)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Feltia jaculifera	(Guenée)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	33	0	0	2	
Helicoverpa zea	(Boddie)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	
Homorthodes furfurata	(Grote)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Lacinipolia renigera	(Stephens)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2	

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Leucania commoides	Guenée		0	0	0	0	0	2	0	0	1	0	0	0	0	0	1	1	0	0	0	4
Leucania inermis	(Forbes)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Leucania insueta	Guenée		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Leucania lapidaria	(Grote)		0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	3
Leucania phragmitidicola	Guenée		0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	2
Leucania pseudargyria	Guenée		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Leucania ursula	(Forbes)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	1	3
Magusa divaricata	(Walker)		0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Maliattha synochitis	(Grote & Robinson)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Megalographa biloba	(Stephens)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Metaxaglaea semitaria	Franclemont		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mythimna oxygala	(Grote)		0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mythimna unipuncta	(Haworth)		2	3	0	0	0	2	8	0	6	0	0	0	0	0	0	1	4	0	1	8
Nephelodes minians	Guenee		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	1
Noctua pronuba	(Linnaeus)	I	4	0	0	0	1	8	10	0	0	0	0	0	0	0	0	0	12	0	26	6
Ochropleura implecta	Lafontaine		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Oligia modica	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Oligia strigilis	(Linnaeus)	*,I	0	0	0	0	0	1	0	0	2	0	0	0	0	0	0	0	1	0	0	3
Panthea furcilla	(Packard)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Papaipema inquaesita	(Grote & Robinson)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Phosphila turbulenta	Hübner		0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	1
Protodeltote muscosula	(Guenée)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Proxenus miranda	(Grote)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Pseudeustrotia carneola	(Guenée)		0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	3
Pseudohermonassa bicarnea	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Raphia frater	(Grote)		0	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	2
Simyra insularis	(Herrich-Schäffer)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sunira bicolorago	(Guenee)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Tricholita signata	(Walker)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Trichoplusia ni	(Hübner)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1

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Xanthia tatago	Lafontaine & Mikkola		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Xestia c-nigrum complex	(Linnaeus)		0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	2	0	0	3
Xestia dolosa	Franclemont		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3
Xestia smithii	(Snellen)		0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	3
Lepidoptera	Notodontidae†																					
Gluphisia septentrionis	Walker		0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	2
Heterocampa guttivitta	(Walker)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Heterocampa umbrata	Walker		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Nadata gibbosa	(J.E. Smith)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Peridea angulosa	(J.E. Smith)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Pheosia rimosa	Packard		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Schizura unicornis	(J.E. Smith)		0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	4
Lepidoptera	Nymphalidae																					
Cercyonis pegala	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Coenonympha tullia	(Müller)		0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	5	4
Danaus plexippus	(Linnaeus)		0	2	0	0	0	9	0	0	1	1	1	0	0	2	2	2	2	0	9	10
Junonia coenia	Hübner		0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Megisto cymela	(Cramer)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	6	3
Nymphalis antiopa	(Linnaeus)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2
Phyciodes tharos	(Drury)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	1
Polygonia interrogationis	(Fabricius)		0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	4
Vanessa atalanta	(Linneaus)		0	4	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	4
Vanessa cardui	(Linnaeus)		0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	4
Vanessa virginiensis	(Drury)		0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	7	3
Lepidoptera	Papilionidae																					
Papilio polyxenes	Fabricius		0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
Papilio troilus	Linnaeus		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Lepidoptera	Pieridae																					
Colias eurytheme	Boisduval		0	1	3	0	0	2	0	0	1	0	0	1	0	0	0	0	1	0	3	7
Colias philodice	Godart		0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	7	3

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Pieris rapae	(Linnaeus)	I	3	5	4	0	2	12	1	0	1	2	1	1	1	1	1	3	10	0	42	16
Lepidoptera	Pyralidae																						
Dolichomia olinalis	(Guenée)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Hypsopygia costalis	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sciota basilaris	Zeller		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Lepidoptera	Sphingidae																						
Amphion floridensis	B.P. Clark		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Hemaris diffinis	(Boisduval)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2
Manduca sexta	(Linnaeus)		0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	3
Paonias myops	(J.E. Smith)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Lepidoptera	Tortricidae																						
Choristoneura conflictana	(Walker)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Sparganothis directana	(Walker)		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Lepidoptera	Yponomeutidae																						
Atteva punctella	(Cramer)		3	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	5	0	0	4
Yponomeuta multipunctella	Clemens		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Mecoptera	Panorpidae																						
Panorpa rufescens	Rambur		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Megaloptera	Corydalidae																						
Chauliodes pectinicornis	(Linnaeus)		1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Neuroptera	Chrysopidae																						
Chrysopa oculata	Say		1	0	0	0	1	2	5	0	0	0	0	0	0	0	1	6	9	0	1	8
Chrysopa quadripunctata	Burmeister		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Odonata	Aeshnidae																						
Anax junius	(Drury)		0	0	0	0	0	0	0	1	0	0	0	5	0	0	0	1	1	0	5	5
Odonata	Coenagrionidae																						
Argia apicalis	(Say)		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Enallagma civile	(Hagen)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
Ischnura posita	(Hagen)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Nehalennia irene	(Hagen)		0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	2

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Odonata	Corduliidae																					
Epitheca cynosura	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Somatochlora linearis	(Hagen)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Odonata	Lestidae																					
Lestes rectangularis	Say		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Odonata	Libellulidae																					
Celithemis elisa	(Hagen)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Libellula pulchella	Drury		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Pachydiplax longipennis	(Burmeister)		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	0	0	2
Pantala flavescens	(Fabricius)		0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	4	0	0	3
Pantala hymenaea	(Say)		0	0	0	0	1	0	0	0	0	0	0	3	0	1	0	0	0	0	0	3
Plathemis lydia	(Drury)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Sympetrum internum	Montgomery		0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	6	3
Sympetrum rubicundulum	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Sympetrum vicinum	(Hagen)		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	3
Tramea carolina	(Linnaeus)		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Tramea lacerata	Hagen		0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	6	0	1	4
Orthoptera	Acrididae																					
Arphia sulphurea	(Fabricius)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	1
Chorthippus curtipennis	(Harris)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Chortophaga viridifasciata	(DeGeer)		1	0	0	0	3	0	0	0	0	0	0	0	0	0	1	0	27	0	0	4
Dissosteira carolina	(Linnaeus)		1	7	0	0	2	7	1	0	2	0	0	0	0	0	0	2	17	0	3	9
Melanoplus bivittatus	(Say)		0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	3
Melanoplus differentialis	(Thomas)		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
Melanoplus femurrubrum	(DeGeer)		0	7	0	0	2	6	0	0	1	0	0	0	0	0	0	1	18	0	7	7
Psinidia fenestralis	(Serville)		0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1
Spharagemon sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Orthoptera	Gryllidae																					
Allonemobius allardi	(Alexander & Thomas)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	45	0	2	4
Allonemobius fasciatus	(DeGeer)		1	43	0	0	3	0	0	0	1	0	0	0	0	0	2	3	77	0	2	8

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Eunemobius carolinus	(Scudder) 1877		16	20	0	0	180	49	0	0	1	0	0	0	0	0	11	0	65	0	38	8
Gryllus pennsylvanicus	Burmeister		0	11	0	0	79	25	8	0	16	0	0	0	13	0	32	24	103	0	65	10
Gryllus veletis	(Alexander & Bigelow)		2	0	0	0	9	101	0	0	0	0	0	0	15	0	0	1	11	0	5	7
Neoxabea bipunctata	(DeGeer)		1	0	0	0	2	0	3	0	3	0	0	0	0	0	0	0	7	0	3	6
Oecanthus exclamationis	Davis		0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
Oecanthus fultoni	T.J. Walker		0	0	0	0	12	0	1	0	8	0	0	0	0	0	0	3	4	0	0	5
Oecanthus nigricornis	F. Walker		0	1	0	0	7	1	0	0	7	0	0	0	0	0	0	2	3	0	0	6
Oecanthus niveus	(DeGeer)		0	0	0	0	1	0	3	0	1	0	0	0	0	0	0	0	0	0	2	4
Oecanthus quadripunctatus	Beutenmüller		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	6	0	0	2
Orthoptera	Rhaphidophoridae																					
Ceuthophilus guttulosus	F. Walker		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	7	2
Ceuthophilus maculatus	(Harris)		10	0	0	0	26	0	62	0	0	0	0	0	117	0	0	0	2	0	20	6
Orthoptera	Tetrigidae																					
Tetrix ornata	(Say)		0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Orthoptera	Tettigoniidae																					
Conocephalus fasciatus	(DeGeer)		0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	7	10	0	0	4
Conocephalus spartinae	(Fox)		0	6	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3
Meconema thalassinum	(DeGeer)	I	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	1	0	2	4
Metrioptera roeselii	(Hagenbach)	I	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	6	0	0	3
Neoconocephalus ensiger	(Harris)		0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	3	7	0	0	3
Orchelimum vulgare	Harris		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Scudderia furcata	Brunner		1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	3
ARTHROPODA	**MALACOSTRACA**																					
Amphipoda	Hyalidae																					
Ptilohyale plumulosus	(Stimpson)		0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Amphipoda	Talitridae																					
Orchestia grillus	(Bosc)		3	0	0	0	3	8	0	0	0	0	0	0	1	0	2	0	246	0	344	7
Platorchestia platensis	(Krøyer)		28	450	0	0	1191	178	0	0	2	0	0	0	104	0	1	4	180	0	80	10
Isopoda	Armadillidiidae																					
Armadillidium nasatum	Budde-Lund	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	232	0	0	0	1

PHYLUM/Order	**CLASS**/Family	Notes	Islands																			**Total # islands**
			BM	**CF**	**DE**	**GE**	**GP**	**GB**	**LN**	**LI**	**LV**	**MB**	**OB**	**PE**	**RG**	**RN**	**SN**	**SP**	**TH**	**WB**	**WE**	
Armadillidium vulgare	(Latreille)	I,L	18	0	0	0	1121	0	36	0	0	1	0	0	120	0	98	78	200	0	28	9
Isopoda	Oniscidae																					
Oniscus asellus	Linnaeus	I,L	0	0	0	0	0	53	0	0	0	0	0	0	0	0	0	0	10	0	46	3
Isopoda	Philosciidae																					
Philoscia muscorum	(Scopoli)	I,L	47	8	0	0	883	113	152	0	9	1	0	0	130	0	133	32	673	0	495	12
Isopoda	Porcellionidae																					
Porcellio scaber	Latreille	I,L	41	458	0	0	3384	378	22	0	68	1	0	0	93	0	0	73	413	0	270	11
Isopoda	Scyphacidae																					
Armadilloniscus sp. 1			0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Isopoda	Trachelipodidae																					
Trachelipus rathkei	(Brandt)	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	105	2	0	2	3
Isopoda	Trichoniscidae																					
Hyloniscus sp. 1			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1
MOLLUSCA	**GASTROPODA**																					
Stylommatophora	Arionidae																					
Arion fasciatus	(Nilsson)	I	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Arion hortensis	Ferussac	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	65	1
Arion subfuscus	(Draparnaud)	I	40	1	0	0	2	12	0	0	0	0	0	0	47	0	0	5	4	0	121	8
Stylommatophora	Cochlicopidae																					
Cochlicopa lubrica	(Müller)	L	2	0	0	1	5	9	2	0	0	0	0	1	8	0	7	7	9	0	16	11
Stylommatophora	Discidae																					
Discus catskillensis	(Pilsbry)		0	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	6	3
Discus rotundatus	(Müller)	I,L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	125	2
Stylommatophora	Helicidae																					
Cepaea hortensis	(Müller)	I	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2
Cepaea nemoralis	(Linnaeus)	I	6	0	0	1	5	0	0	0	5	0	0	1	0	0	11	0	1	0	0	7
Stylommatophora	Limacidae																					
Deroceras laeve	(Müller)	I	0	0	0	0	0	1	0	0	0	0	0	1	3	0	0	0	3	0	8	5
Deroceras reticulatum	(Müller)	I	0	5	0	0	10	2	0	0	3	0	0	0	13	0	22	15	54	0	66	9
Stylommatophora	Punctidae																					

PHYLUM/Order	**CLASS**/Family	Notes	Islands																			**Total # islands**
			BM	**CF**	**DE**	**GE**	**GP**	**GB**	**LN**	**LI**	**LV**	**MB**	**OB**	**PE**	**RG**	**RN**	**SN**	**SP**	**TH**	**WB**	**WE**	
Punctum minutissimum	(I. Lea)		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Stylommatophora	Pupillidae																					
Gastrocopta pentodon	(Say)		0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Pupilla muscorum	(Linnaeus)	*	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Stylommatophora	Strobilopsidae																					
Strobilops labyrinthicus	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
Stylommatophora	Succineidae																					
Novisuccinea ovalis	(Say)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1
Stylommatophora	Valloniidae																					
Vallonia costata	(Müller)		2	0	0	0	7	0	0	0	0	0	0	0	1	0	0	0	0	0	0	3
Vallonia excentrica	Sterki		0	0	0	0	0	8	0	0	0	0	0	1	0	0	0	1	6	0	0	4
Vallonia pulchella	(Müller)		0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Stylommatophora	Vertiginidae																					
Vertigo cristata	Sterki		0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	0	2
Vertigo ovata	Say		0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Stylommatophora	Zonitidae																					
Glyphyalinia indentata	(Say)		0	0	0	0	2	0	6	0	0	0	0	0	3	0	0	0	0	0	0	3
Nesovitrea binneyana	(E.S. Morse)		0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2
Nesovitrea electrina	(Gould)		0	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	1	0	1	3
Oxychilus cellarius	(Müller)	I,L	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Oxychilus draparnaudi	(Beck)	I,L	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Striatura milium	(E.S. Morse)		0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1
Zonitoides arboreus	(Say)		1	0	0	0	4	0	1	0	0	0	0	1	2	0	0	0	5	0	0	6
Zonitoides nitidus	(Müller)		1	1	0	0	33	56	0	0	0	0	0	1	4	0	1	0	1	0	0	8
Total # species recorded on each island:			370	343	7	26	570	379	246	7	194	27	21	66	338	20	248	332	762	13	780	

Appendix F. Curriculum materials developed for field- and classroom-based ATBI programs focusing on invertebrates.

Bug kit used for field activities.



Bug Kit Contents (# items x 3 Ranger bags)

Insect Collecting Materials
Insect nets (2x3)
Beating sheets (1x3)
Aspirators (2x3)
Straws (12x3)
White-cap vials (10x3)
Blue-cap vials (1x3)
Hygienic wipes (10x3)
Erasable markers (2x3)

Insect Sorting Materials
Hand lenses (8x3)
Forceps (4x3)
Plastic droppers (4x3)
White tray (1x3)
Plastic bottle containing ethanol (1 per kit)

Items in Binder (1 per kit)
Instructions for Teachers: collecting and sorting activity
Extensions: talking points
Habitat Comparison Data Sheet
Restock List
Kit Contents

Items on Clipboard
Group Data Sheet (1x3)
Guide to Common Invertebrates (1x3)
How to Identify Common Invertebrate Groups (1x3)

Books
Golden Guide to Insects (1x3)
Golden Guide to Spiders and Their Kin (1x3)

Squirt bottle (1x3)
Funnels (1x3)
Paper labels and pencils (1 bag x 3)
Data sheet used for field activities.

Group Data Sheet

 **Date:** _____  **Island:** _____

 **Weather:**_____  **Collector(s):**_____

Habitat:

Meadow Forest Beach Other:_____

Collecting method(s):

Hand collecting Net Beating sheet Pitfall trap Other:_____

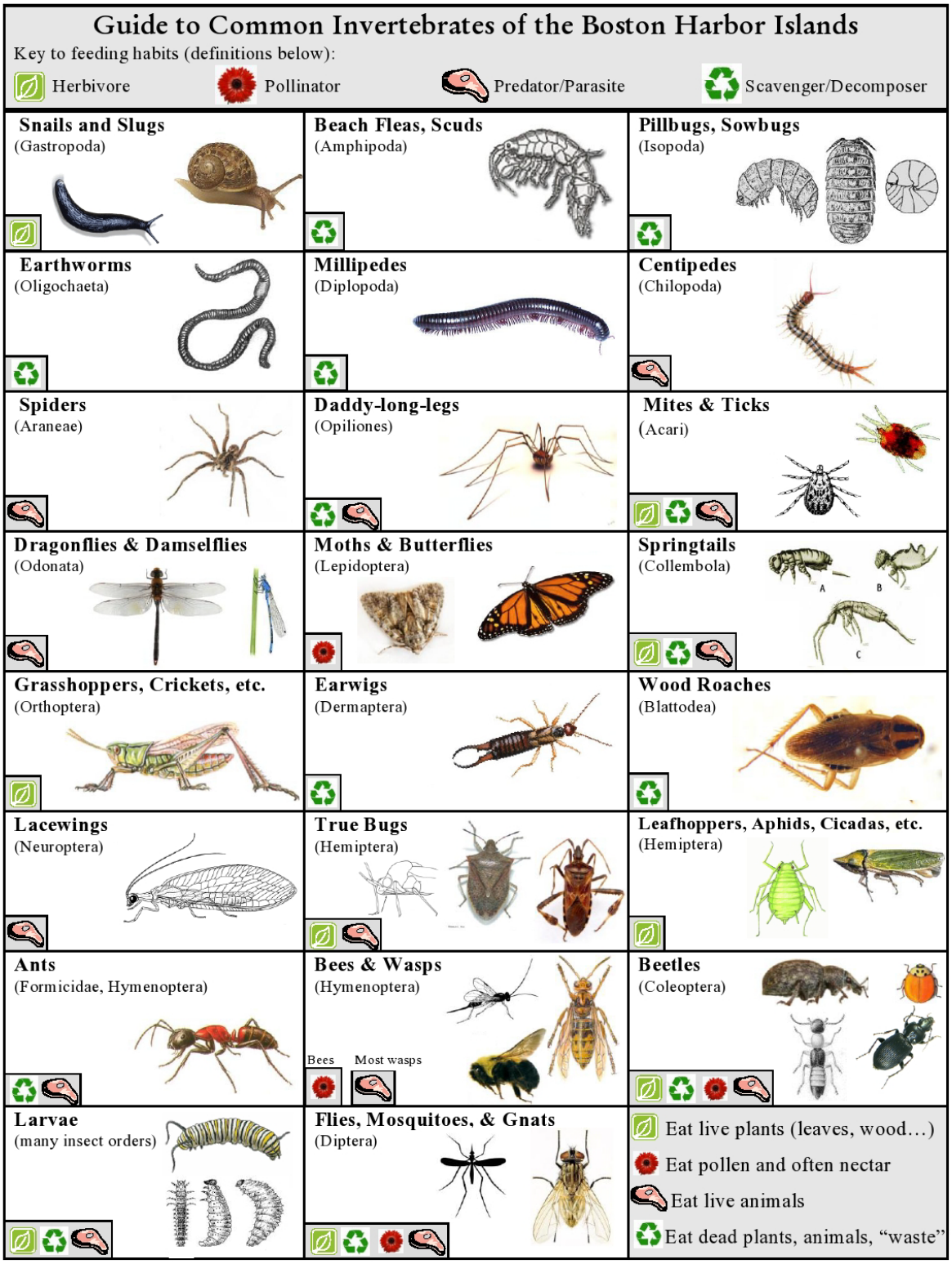
Number of invertebrates captured and observed = _____

Number of invertebrate groups (e.g., flies, beetles, snails) = _____

Number of "species" (things that look different) = _____

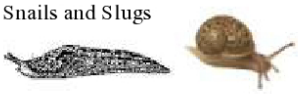
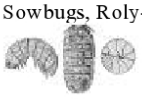
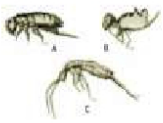
Feeding Group	 **Herbivore**	 **Pollinator**	 **Predator**	 **Decomposer/ Scavenger**	**?? Unsure**
Color	**Brown/Black**	**Yellow/Red/Orange**	**Green**	**Blue**	**White**
Number of Legs	**0**	**6**	**8**	**9-30**	**More than 30**
Movement	**Flying**	**Hopping**	**Crawling (legs)**	**Slithering(no legs)**	**Other_____**
Other _____					

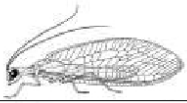
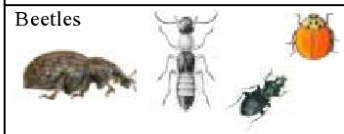
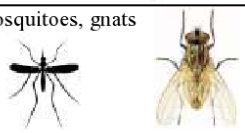
Laminated field guide for identifying invertebrates in the field and in the classroom.



Key diagnostic hints for identifying invertebrates (accompanies field guide above; two pages)

How to Identify Common Invertebrate Groups ("Orders")

Common name	Order	How to identify
Snails and Slugs 	Gastropoda ("Class")	have a **spiral shell** (except for slugs) and **a soft body without segments** or exoskeleton; may have tooth-like projections over the mouth of the shell to keep out predators; a millimeter long to as long as your finger
Beach Fleas, Scuds 	Amphipoda	are **shrimp-like** in appearance, with an arched and laterally flattened pinkish or grayish body; usually near the shore, **some hop**; most amphipods are aquatic but a few are terrestrial
Pillbugs, Sowbugs, Roly-Polies 	Isopoda	look like short, oblong millipedes, but only **seven pairs of legs**; have antennae; may have feelers at the end of the abdomen; **some can roll into a ball**, some cannot; live in moist places in the leaf litter or under objects
Earthworms 	Oligochaeta	have **no legs and lack an obvious head and tail**, but note the wide fleshy band called the clitellum located near the front of the animal; obvious body segments; most earthworms are not native to North America
Millipedes 	Diplopoda ("Class")	are long, worm-like animals with **15 or more body segments** and **two pairs of legs on most segments**; none have as many as a thousand legs; the body is either flattened or sausage-shaped; important decomposers in the soil
Centipedes 	Chilopoda ("Class")	are long, worm-like animals with **15 or more body segments** and only **one pair of legs on each segment**; usually have long antennae and enormous jaws; harmless in the US; they are major predators (can bite finger)
Insect larvae 	Many insect orders	have 0 to 3 pairs of true legs (caterpillars and some wasp larvae have extra pairs of "prolegs"); some look worm-like, some are C-shaped, some are active crawlers; unlike worms, **all have distinct heads** (fly larvae may have very small heads); a larva is the immature stage of any insect that undergoes complete metamorphosis
Spiders 	Araneae	have **eight legs and two body segments** joined at a thin waist; abdomen does not have segments; most have eight eyes; most use silk to catch food, for shelter, or to protect their eggs
Daddy-long-legs, Harvestmen 	Opiliones	most have **eight long, jointed legs** and appear to have a **single round or oval body part**; they are NOT venomous; they do not spin webs and are not found in webs; most are found on trees, walls, the ground, or in leaf litter
Mites and Ticks 	Acari	have **eight short legs** (some parasitic forms have lost some or all of their legs); heads are small but sucking mouthparts can be obvious; **small to microscopic**; they maybe parasites or free-living; some are orange or red
Springtails 	Collembola	are **tiny, jumping, wingless** insects that live in soil, decaying logs, and leaf mold (they jump by releasing a forked structure on their abdomen); color varies from white to red to mottled; very abundant but hard to see because of small size; various feeding habits

Dragonflies and Damselflies 	Odonata	have **large wings** and are strong, rapid fliers (just try to catch one!); they are visual predators with **huge eyes**; dragonflies are typically larger, with wings out-stretched horizontally at rest, while damselflies are smaller with narrower wings which they hold up above them when perching (except for spreadwings); some dragonflies migrate long distances
Moths and Butterflies 	Lepidoptera	have **four wings, covered with scales that form often colorful patterns** and come off like dust when handled; mouthparts form a coiled tube, used to extract nectar; butterflies have club-tipped antennae; moths may have feathery antennae
Grasshoppers, crickets, katydids 	Orthoptera	front wing is thin and narrow; broad hind wings fold fan-like under front wings (young have only wing buds); color varies; chewing mouthparts; **large hind legs for jumping**
Earwigs 	Dermaptera	have long, slender bodies with **pincer-like structures**, called cerci, on the end of their abdomen; adults usually have four wings (some have none); when at rest, the membranous hind wings fold under the short and leathery front wings
Woodroaches 	Dictyoptera	have an **oval, flattened body** and **long, hair-like antennae**; have slender front and hind legs and are often fast runners; some have wings, but others are wingless; in some species the hind wings fold under leathery front wings
Lacewings 	Neuroptera	are soft-bodied green or brown insects with **four membranous wings that have many veins**; wings are held roof-like over the body when at rest; **antennae are usually long** and have many segments; adults are often weak fliers
True bugs 	Hemiptera	body is broad or long and narrow; front wings are half leathery and half membranous and expose a **triangle** where they fold across the back of abdomen, forming a V or Y on the back; have **long, narrow piercing-sucking mouthparts**
Leafhoppers, Aphids, Cicadas (and others) 	Hemiptera	are closely related to the True Bugs, with similar mouth-parts; many have four wings, although some, such as some aphids, don't have wings; wings at rest are held roof-like over the body; **antennae are often short** and bristle-like
Bees/Wasps 	Hymenoptera	have **four clear wings** (unlike flies, see below); abdomen usually is narrowly attached to thorax by a **thin "waist"**; often have a stinger (or egg laying tube) at the tip of the abdomen; bees are typically hairy for carrying pollen
Ants 	Hymenoptera ("Family" Formicidae)	is one commonly-seen family within the Hymenoptera; **waist has one or two "bumps" (petioles) on it**; ants are social insects in which the **majority are wingless**, sterile workers (females); reproductive males and females have wings
Beetles 	Coleoptera	hind wings fold beneath **hardened front wings**; front wings make a line straight down their back where they meet, forming the letter T on their backs (wings may or may not cover entire abdomen); have chewing mouthparts; antennae come in a variety of shapes
Flies, mosquitoes, gnats 	Diptera	are usually small and soft-bodied; **have only one pair of large, clear wings** (hind wings are reduced to two tiny knobbed structures called halteres that help flies keep their balance while flying); most have **very large eyes**, taking up most of the head; some have coloration mimicking bees

Science in the Park

Insects and Other Invertebrates

A NATIONAL PARK AREA
BOSTON HARBOR ISLANDS

Common Name	Feeding Group	Identification	Description
Small ant			• Small, yellow or brown body • Long legs • Antennae are bent in the middle
Carpenter Ant			• Large black body • Antennae are bent in the middle
Beach Flea			• Curved shrimp-like body • Lots of legs
Carrion Beetle			• Flattened, round, black body • Thorax has yellow or orange on it
Flesh Fly			• Hairy • One pair of wings • Black and gray stripes on thorax
Earwig			• Large pincers on end of abdomen • Female pincers are narrower
Wood Roach			• Flat, brown body • Long hair-like antennae • Transparent wings
Burying Beetle			• Flat, brown body • Long hair-like antennae • Transparent wings
Skin Beetle			• Dark body, looks like ball of dirt • Ridges on back
Earthworm			• Tube-shaped, long, and slender body • No legs
Millipede			• Thin, tube-shaped body with many pairs of short legs • Dark color
Pill Bug			• Grayish, oval body • Seven pairs of short legs

Common Name	Feeding Group	Identification	Description
Click Beetle			• Narrow, torpedo-shaped body • Pointed corners on thorax
Woolly Bear Caterpillar			• Short, furry body • Usually with black and orange pattern
Dusky Slug			• Brown/gray color • Soft, short, and fat body • No legs
Snail			• Hard spiral shell protects soft body
Ground Cricket			• Small, fat body • Feelers at end of abdomen • Long hind legs
Field Cricket			• Large, fat body • Feelers at end of abdomen • Long hind legs
June Beetle			• Shiny, brown, roundish body • Short antennae
Acorn Weevil			• Long snout for boring holes
Leafhopper			• Triangle-shaped, pointy head • Wings have veins
Stink Bug			• Broad, shield-shaped body • Triangle shape on back

Laminated identification guide for invertebrates preserved in polyester resin cubes (two pages).

Science in the Park

Insects and Other Invertebrates

Common Name	Feeding Group	Identification	Description
Robber Fly			• Large eyes • Hairy "beak" pointing forward from head • One pair of wingst
Woodlouse Spider			• Two body segments • Eight orange-ish legs
Daddy long legs			• Single round body part • Eight long, jointed legs
Damselfly			• Long, thin body and wings • Large eyes
Lacewing			• Transparent wings with veins covering body • Long antennae
Firefly beetle			• Looks like sunflower seed • Yellow thorax • Soft wings, not hard, not shell-like
Ladybird beetle			• Orange or red body with black spots
Yellowjacket wasp			• Yellow and black body, thin waist • Stinger at end of abdomen • Have medium-length antennae • Only females have stingers
Ground beetle			• Brown or black body • Smaller size
Snail-eating ground beetle			• Dark, shiny, purplish body • Long legs and antennae • Large brown or black body with soft wings
Rove beetle			• Long, thin black or brown body • Short wings don't cover whole body
Centipede			• Flattened brown body • Many legs • Long antennae

Common Name	Feeding Group	Identification	Description
Moth			• Cape-like wings, often brown • Antennae feathery or thin • Fat furry body
Butterfly			• Upright wings, often colorful • Antennae are thin with knobby tips
Bumblebee			• Hairy, yellow, and black • Large body
Mosquito			• Small body with one pair wings • Tube-like mouth-part on female • Females require a blood meal to produce eggs
Striped "ich" wasp			• Black and yellow • Thin waist and slender body • Long stinger at end of abdomen • Only females have stingers • Larvae feed on meat
Brown "ich" wasp			• Very skinny "waist" • Two pairs of wings • Antennae longer than body • Only females have stingers • Larvae feed on meat
Long-horned beetle			• Thin yellow body with black patches • Long yellow antennae • Larvae are herbivores and feed on wood
Sweat bee			• Shiny, green body • Two pairs of wings • Only females have stingers
Flower fly			• Black and yellow body, like a bee • Large eyes • One pair of wings • Very short antennae
Crane fly			• One pair narrow wings • Very long, delicate legs

Polyester resin cubes (“bug cubes”)containing preserved invertebrate specimens. Each cube is 2” x 1.5” x 1” (5.1 x 3.8 x 2.5 cm). An intern manufactured 8 sets of 20 cubes.



An example of a filled-in tally sheet that incorporates math skills into the bug cube sorting activity.

INSECT TALLY

Team: Deanna, Michelle, Destinee, Arista

Symbol	Feeder Group	Number in this Group	Fraction	Decimal	Percent
	Decomposers	2	$\frac{2}{10}$	0.2	20%
	Herbivores	2	$\frac{2}{10}$	0.2	20%
	Pollinators	3	$\frac{3}{10}$	0.3	30%
	Predators	2	$\frac{2}{10}$	0.2	20%
	Scavengers	1	$\frac{1}{10}$	0.1	10%
	TOTAL NUMBER of Insects:	10	$\frac{10}{10}/1$	0.10	100%

Appendix G. Presentations, trainings, and interactive events focused on the Boston Harbor Islands ATBI, 2006-2011.

Presentations targeted to professional scientists and natural resource managers

Boston Harbor Islands Science Symposium, Boston, MA (2011) J. Rykken, D. Tesorero, A. Clark, A. Ravenscraft
George Wright Society Conference, New Orleans, LA (2011) J. Rykken, D. Tesorero
Université du Québec à Montréal, Montreal, Canada (2010) J. Rykken
BellFest Symposium, University of Vermont, Burlington, VT (2010) J. Rykken
The Evergreen State College, Research Ambassador Program, Olympia, WA (2010) J. Rykken
George Wright Society Conference, Portland, OR (2009) J. Rykken
Nantucket Biodiversity Initiative Conference, Nantucket, MA (2009) J. Rykken, A. Clark
Discover Life in America/ATBI Conference, Gatlinburg, TN (2005, 2008, 2009) J. Rykken
Boston Harbor Islands Science Symposium, Boston, MA (2008) J. Rykken, B. Farrell, S. Kent
Olympic National Park, Port Angeles, WA (2008) J. Rykken
NPS Regional Natural Resource Managers Workshop, Shepherdstown, WV (2008) Poster, S. Colwell
Staatliches Museum für Tierkunde, Dresden, Germany (2008). Poster on fungus gnats, B. Rulik
George Wright Society Conference, St. Paul, MN (2007) J. Rykken

Presentations targeted to naturalists, students, and the general public

Mass Audubon, Ipswich River Sanctuary, Topsfield, MA (2011) M. Albert
Cambridge Entomological Club, Cambridge, MA (2005, 2011) J. Rykken
Acadia National Park Hymenoptera Bioblitz, ME (2010) M. Albert
Graham and Parks School, 2nd grade at MCZ, Cambridge, MA (2006, 2008, 2009, 2010)
The Trustees of Reservations, Crane Estate, Ipswich, MA (2010) J. Rykken
Yellowstone National Park Bioblitz, WY (2009) J. Rykken
Hull Garden Club, Hull, MA (2009) J. Rykken
Mystic River Mural Project for high school students, Medford, MA (2008) J. Rykken
Nantucket Consortium of Naturalists, Nantucket, MA (2006) J. Rykken
Northeast Natural History Conference, NY State Museum, Albany, NY (2006) J. Rykken

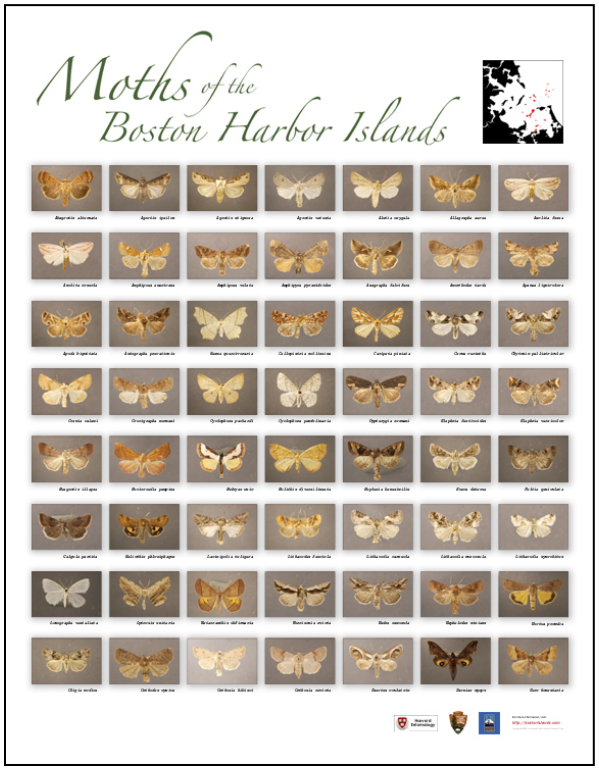
Workshops and trainings for educators

Harvard Life Sci. Program for High School Biology Teachers, Cambridge, MA (2010) J. Rykken
Massachusetts Environmental Educators Conference, Boston, MA (2010) D. Tesorero and TIOBEC staff
Harvard Museum of Natural History, training for museum volunteers (2007, 2010) J. Rykken
Thompson Island Outward Bound instructor training (2006, 2007, 2009) J. Rykken
Massachusetts Marine Educators Boston Harbor Teacher Workshop (2008) J. Rykken
National Science Teachers Association Conference (2008) J. Rykken
Charting a Course to the Boston Harbor Islands Institute for Teachers (2006, 2007) J. Rykken
Boston Harbor Islands Partnership state and national park rangers (2006, 2007)
Harvard Museum of Natural History, workshop for high sch. science teachers (2006) J. Rykken

Interactive displays at public events and places

Harvard Museum of Natural History, Cambridge, MA. Event booth (2009, 2011)
Boston Harbor Islands Visitor Center, Spectacle Island, Boston, MA. Public exhibit (2007-2010)
Cambridge Science Festival, Cambridge, MA. Event booth (2007, 2008, 2009, 2010)
EarthFest, Esplanade, Boston, MA. Event booth (2009)
Earth Night, Convention Center, Boston, MA. Event booth (2006)

Appendix H. Posters, playing cards, and field guides created for the Boston Harbor Islands ATBI.



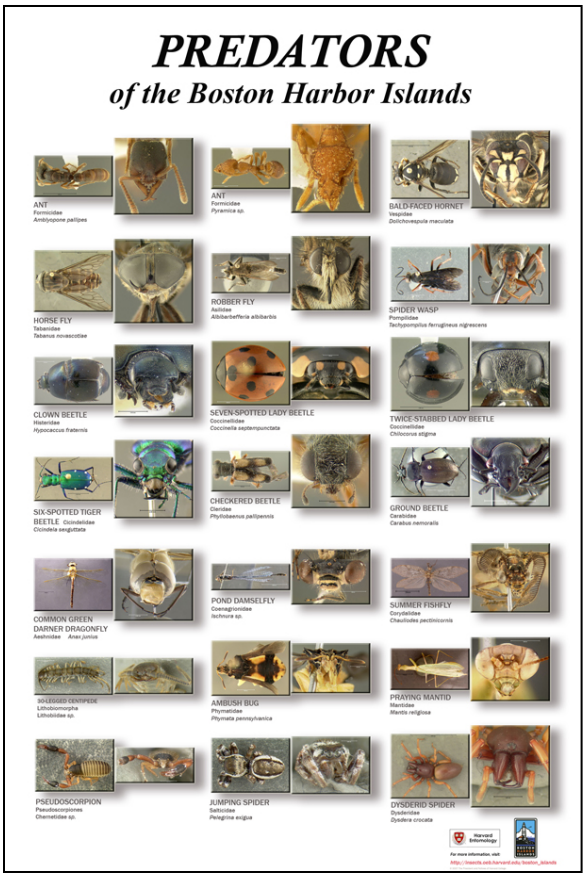







Boston Harbor Islands
Weevils
of the MicroWilderness
bostonharborislands.org/biodiversity


Boston Harbor Islands
Leafhoppers
of the Microwilderness
Leafhoppers suck!
bostonharborislands.org

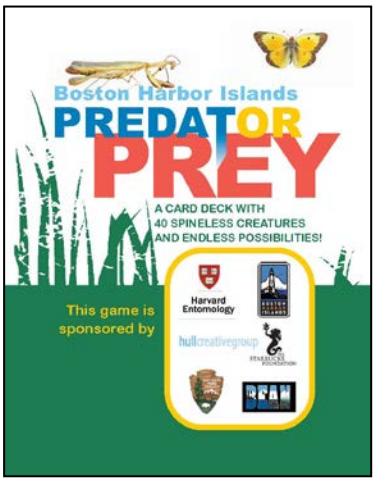

PREDATORS
of the Boston Harbor Islands
ANT
HORSE FLY
CLOWN BEETLE
SIX-SPOTTED TIGER BEETLE
COMMON GREEN DARNER DRAGONFLY
PSEUDOSCORPION
ANT
ROBBER FLY
SEVEN-SPOTTED LADY BEETLE
CHECKERED BEETLE
POND DAMSELFLY
AMBUSH BUG
JUMPING SPIDER
BALD-FACED HORNET
SPIDER WASP
TWICE-STABBED LADY BEETLE
GROUND BEETLE
SUMMER FISHFLY
PRAYING MANTID
DYSDERID SPIDER





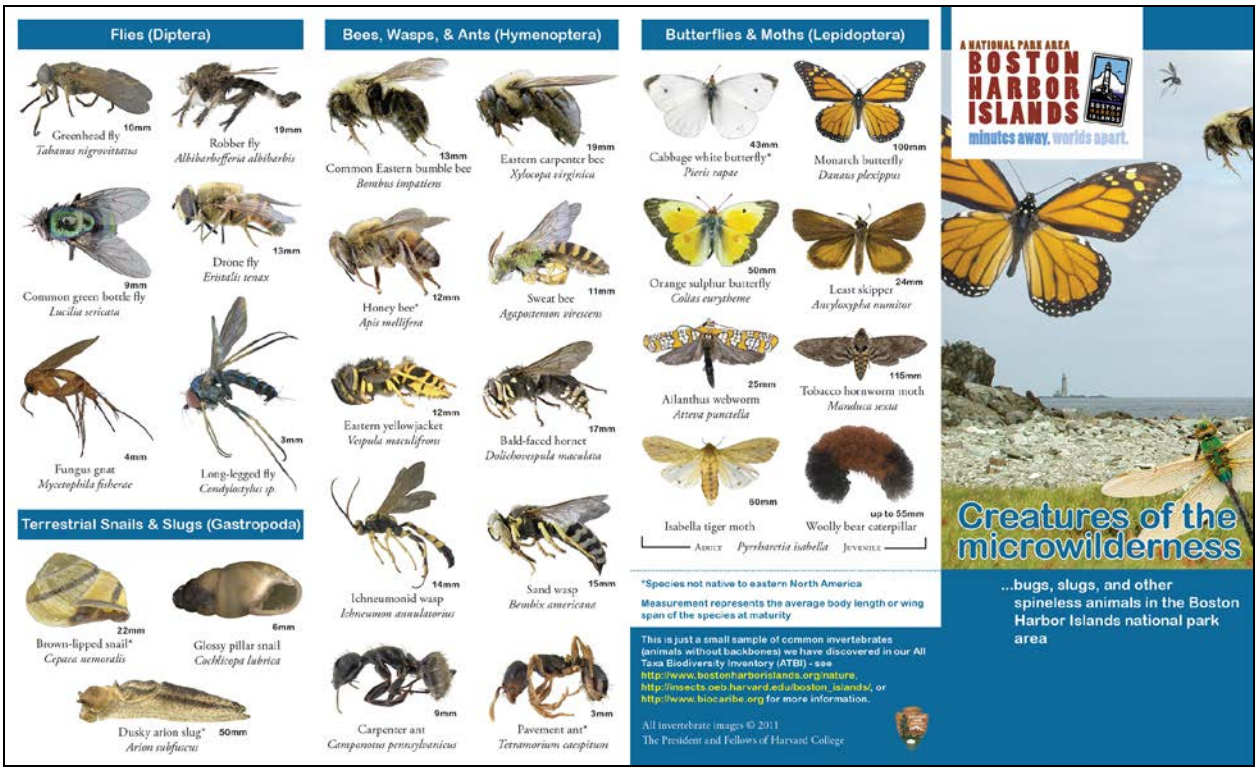


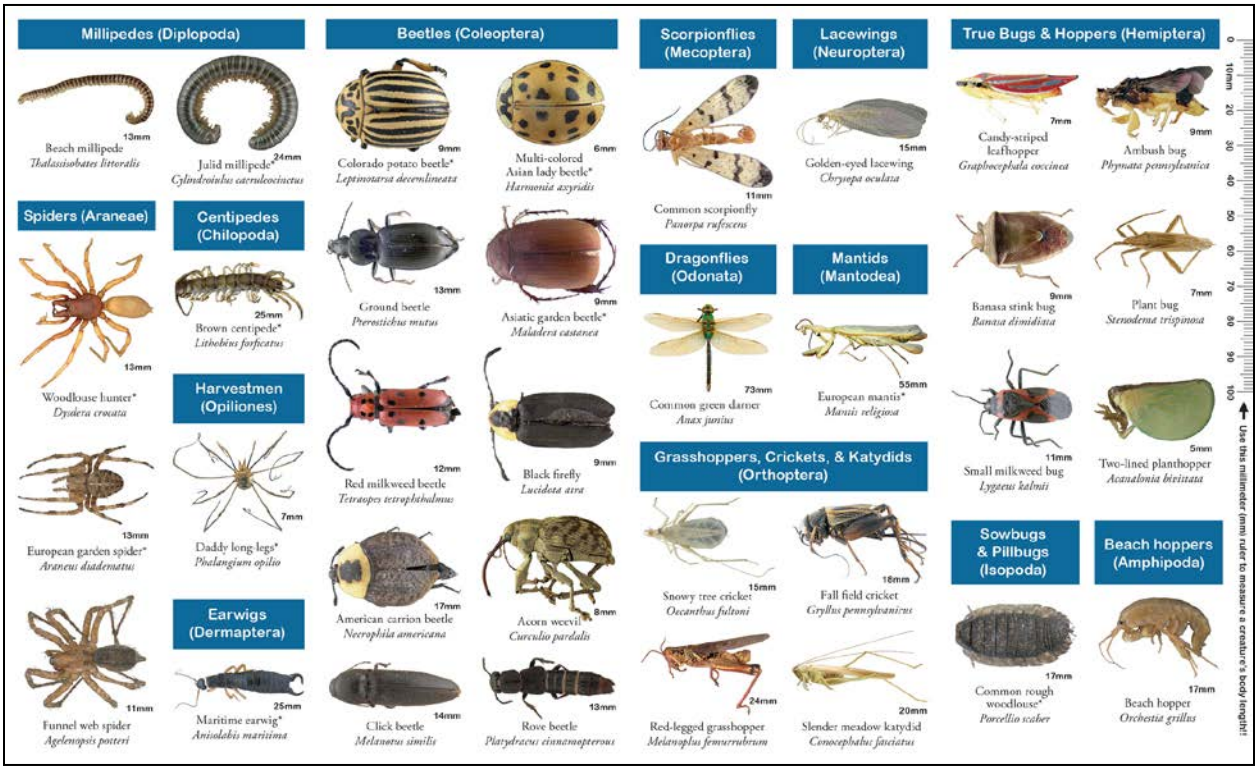
The ten images above are posters, approximate size for each is 24 x 36 inches (except weevil poster, 18 x 24 inches). The three images below are sample playing cards from the PredatOR-Prey card game, approximate size is 2.5 x 3.5 inches.



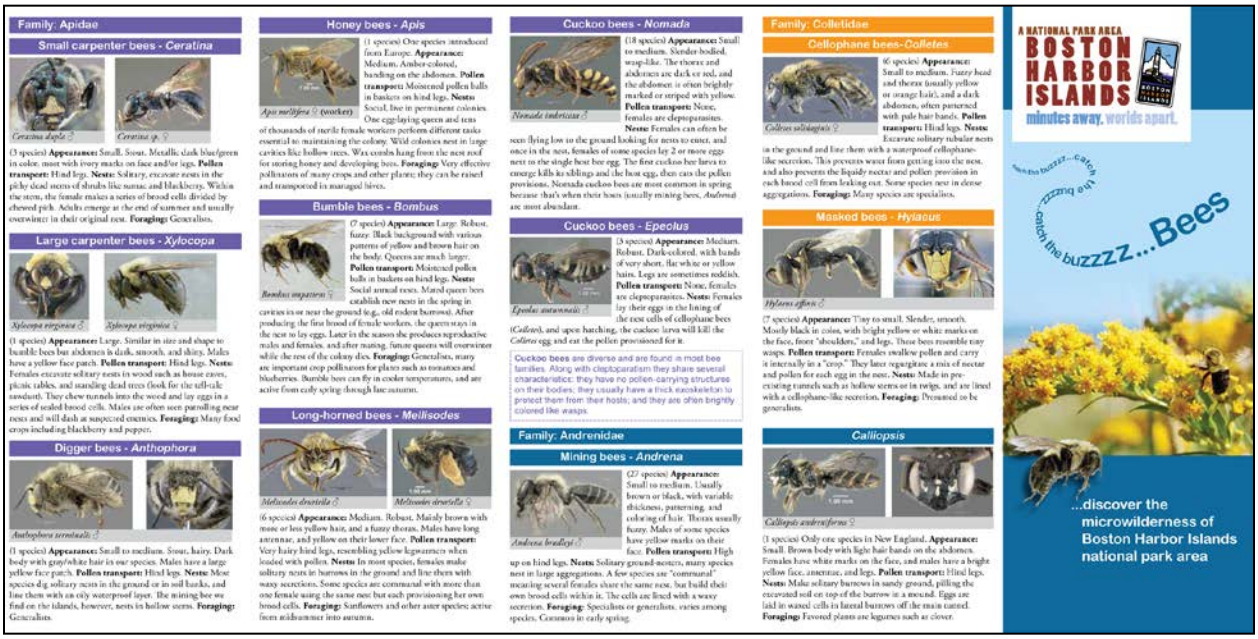


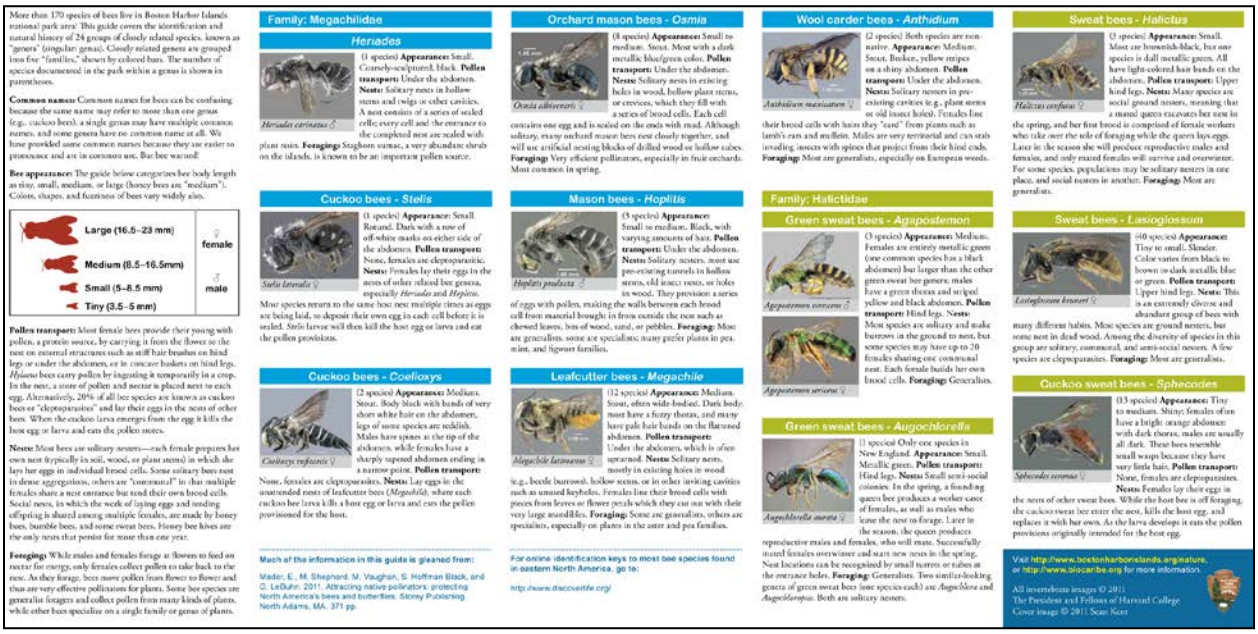



Flies (Diptera)
Greenhead fly 10mm
Tabanus nigrovittatus
Robber fly 19mm
Alhibarbofferia albibarbis
Common green bottle fly 9mm
Lucilia sericata
Drone fly 13mm
Eristalis tenax
Fungus gnat 4mm
Mycetophila fisherae
Long-legged fly 3mm
Condylostylus sp.
Terrestrial Snails & Slugs (Gastropoda)
Brown-lipped snail* 22mm
Cepaea nemoralis
Glossy pillar snail 6mm
Cochlicopa lubrica
Dusky arion slug* 50mm
Arion subfuscus
Bees, Wasps, & Ants (Hymenoptera)
Common Eastern bumble bee 13mm
Bombus impatiens
Eastern carpenter bee 19mm
Xylocopa virginica
Honey bee* 12mm
Apis mellifera
Sweat bee 11mm
Agapostemon virescens
Eastern yellowjacket 12mm
Vespula maculifrons
Bald-faced hornet 17mm
Dolichovespula maculata
Ichneumonid wasp 14mm
Ichneumon annulatorius
Sand wasp 15mm
Bembix americana
Carpenter ant 9mm
Camponotus pennsylvanicus
Pavement ant* 3mm
Tetramorium caespitum
Butterflies & Moths (Lepidoptera)
Cabbage white butterfly* 43mm
Pieris rapae
Monarch butterfly 100mm
Danaus plexippus
Orange sulphur butterfly 50mm
Colias eurytheme
Least skipper 24mm
Ancyloxypha numitor
Ailanthus webworm 25mm
Atteva punctella
Tobacco hornworm moth 115mm
Manduca sexta
Isabella tiger moth 50mm
Pyrrharctia isabella
Adult
Juvenile
Woolly bear caterpillar up to 55mm
*Species not native to eastern North America
Measurement represents the average body length or wing span of the species at maturity
This is just a small sample of common invertebrates (animals without backbones) we have discovered in our All Taxa Biodiversity Inventory (ATBI) - see http://www.bostonharborislands.org/nature, http://insects.oeb.harvard.edu/boston_islands/, or http://www.biocaribe.org for more information.
All invertebrate images © 2011 The President and Fellows of Harvard College
A NATIONAL PARK AREA
BOSTON HARBOR ISLANDS
minutes away. worlds apart.
Creatures of the microwilderness
...bugs, slugs, and other spineless animals in the Boston Harbor Islands national park area


Millipedes (Diplopoda)
Beach millipede 13mm
Thalassisobates littoralis
Julid millipede* 24mm
Cylindroiulus caeruleocinctus
Spiders (Araneae)
Woodhouse hunter* 13mm
Dysdera crocata
European garden spider* 13mm
Araneus diadematus
Funnel web spider 11mm
Agelenopsis potteri
Centipedes (Chilopoda)
Brown centipede* 25mm
Lithobius forficatus
Harvestmen (Opiliones)
Daddy long-legs* 7mm
Phalangium opilio
Earwigs (Dermaptera)
Maritime earwig* 25mm
Anisolabis maritima
Beetles (Coleoptera)
Colorado potato beetle* 9mm
Leptinotarsa decemlineata
Multi-colored Asian lady beetle* 6mm
Harmonia axyridis
Ground beetle 13mm
Pterostichus mutus
Asiatic garden beetle* 9mm
Maladera castanea
Red milkweed beetle 12mm
Tetraopes tetrophthalmus
Black firefly 9mm
Lucidota atra
American carrion beetle 17mm
Necrophila americana
Acorn weevil 8mm
Curculio pardalis
Click beetle 14mm
Melanotus similis
Rove beetle 13mm
Platydracus cinnamopterous
Scorpionflies (Mecoptera)
Common scorpionfly 11mm
Panorpa rufescens
Dragonflies (Odonata)
Common green darner 73mm
Anax junius
Grasshoppers, Crickets, & Katydids (Orthoptera)
Snowy tree cricket 15mm
Oecanthus fultoni
Red-legged grasshopper 24mm
Melanoplus femurrubrum
Lacewings (Neuroptera)
Golden-eyed lacewing 15mm
Chrysopa oculata
Mantids (Mantodea)
European mantis* 55mm
Mantis religiosa
Slender meadow katydid 20mm
Conocephalus fasciatus
Fall field cricket 18mm
Gryllus pennsylvanicus
True Bugs & Hoppers (Hemiptera)
Candy-striped leafhopper 7mm
Graphocephala coccinea
Ambush bug 9mm
Phymata pennsylvanica
Banasa stink bug 9mm
Banasa dimidiata
Plant bug 7mm
Stenodema trispinosa
Small milkweed bug 11mm
Lygaeus kalmii
Two-lined planthopper 5mm
Acanalonia bivittata
Sowbugs & Pillbugs (Isopoda)
Common rough woodlouse* 17mm
Porcellio scaber
Beach hoppers (Amphipoda)
Beach hopper 17mm
Orchestia grillus
Use this millimeter (mm) ruler to measure a creature's body length!
0 10mm 20 30 40 50 60 70 80 90 100

Two sides of a four-panel fold-out field guide to “Creatures of the Microwilderness,” a guide to 61 commonly-encountered invertebrates on the Boston Harbor Islands. Approximate dimensions when unfolded are 14 x 8.5 inches, and when folded, 3.5 x 8.5 inches.





Two sides of a five-panel fold-out field guide to “Catch the buzz…bees”, a guide to the identification and natural history of 24 bee genera found on the Boston Harbor Islands. Approximate dimensions when unfolded are 17 x 8.5 inches, and when folded, 3.5 x 8.5 inches.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 035/120867, May 2013

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

www.nature.nps.gov