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A Comparison of Macroinvertebrate Communities and Their Freshwater Habitats in the Cayman Islands

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ABSTRACT
A survey of macroinvertebrates inhabiting freshwater habitats of Grand Cayman, Cayman Brac, and Little Cayman was conducted between 1997 and 2008. Freshwater habitats in these islands include natural ponds, ornamental ponds, temporary pools, and natural wells. A total of 72 species was collected from the three islands with most of these being reported for the first time from the Caymans. Generally, the freshwater macroinvertebrate fauna in the Cayman Islands is sparse, most likely due to their oceanic origin, their small sizes, limited freshwater habitats, natural and human disturbances, and challenges colonizing such habitats.

Key words: Freshwater invertebrates, Cayman Islands, West Indies.

INTRODUCTION

The Cayman Islands are composed of Grand Cayman, Cayman Brac, and Little Cayman. These three small islands are located in the northwestern Caribbean Sea. The islands were formed by calcareous marine deposits uplifted from the ocean floor along the northern margin of the Cayman Trough, emerging approximately 10-30 million years ago. Maximum elevations for these low-lying islands reach approximately 17 m, 13 m, and 43 m on Grand Cayman, Little Cayman, and Cayman Brac, respectively. Grand Cayman has the largest surface area of 197 km^2 while Cayman Brac has only 38 km^2 and Little Cayman covers only 28 km^2 (Davies and Brunt 1994).

A limited amount of information regarding the freshwater invertebrates of small Caribbean islands is available (Davies and Brunt 1994). Biodiversity surveys of aquatic macroinvertebrates and related ecological studies have been conducted on some islands including Barbados (Bass 2003a), St. Vincent (Harrison and Rankin 1975, 1976), St. Lucia (McKillop and Harrison 1980), Dominica (Flint 1968, 1970; Chace and Hobbs 1969; Stone 1969; Donnelly 1970; Baumgardner *et al*. 2003; Bass 2004a, 2007), Antigua (Bass 2005), Grenada (Flint and Sykora 1993; Baumgardner *et al*. 2003; Bass 2004b), Guanaja (Bass 1993), St. Kitts (Bass 2006), Nevis (Bass 2000, 2006), Montserrat (Baumgardner *et al*. 2003), Saba (Cobben 1960; Bass 2008), Tobago (Hart 1980; Nieser and Alkins-Koo 1991; Botosaneanu and Alkins-Koo 1993; Flint 1996; Baumgardner *et al*. 2003; Bass 2003b), and Trinidad (Hynes 1971; Alkins *et al*. 1981; Alkins-Koo 1990; Nieser and Alkins-Koo 1991; Botosaneanu and Alkins-Koo 1993; Flint 1996; Turner *et al*. 2008).

The objectives of this investigation include to: 1) describe the freshwater habitats existing on the Cayman Islands; 2) determine the species of aquatic macroinvertebrates inhabiting freshwaters of the Cayman Islands; 3) note the microhabitat preferences of each species; 4) determine the relative abundance of each species; 5) compare the macroinvertebrate fauna between Grand Cayman, Cayman Brac, and Little Cayman; and 6) compare the Caymanian freshwater macroinvertebrate fauna to other such fauna on other small Caribbean islands.

MATERIALS AND METHODS

Sixty-eight collections were made from various freshwater habitats across the Cayman Islands between 1997 and 2008 (Figure 1). Forty of these collections were taken on Grand Cayman, eight came from Cayman Brac, and the remaining 20 were collected from Little Cayman. Water temperature was usually recorded from each site at the time of collection.

Several methods of collecting were employed to ensure as many species as possible were captured. Submerged debris, such as stones, leaves, and wood, were carefully examined and inhabitants were picked from the substrate using forceps. A dip net (mesh = 0.1mm) was swept through aquatic vegetation and the water column to capture macroinvertebrates occupying those microhabitats. The microhabitat from which each specimen was collected was noted. Collecting efforts continued at each site until no additional species were encountered. These collecting methods were similar to those used on other islands (Bass 1993, 2003a, 2003b, 2003c, 2004b, 2005, 2006, 2007, 2008) so comparisons of the results could be made.

Specimens were preserved in 70% ethanol and returned to the laboratory for further identification. Taxa that could not be identified to the species level were separated into morphospecies for subsequent analysis. Sorenson's index of similarity (1948) was used to compare these collections in the three Cayman Islands with each other and with similar endeavors on other small Caribbean islands.

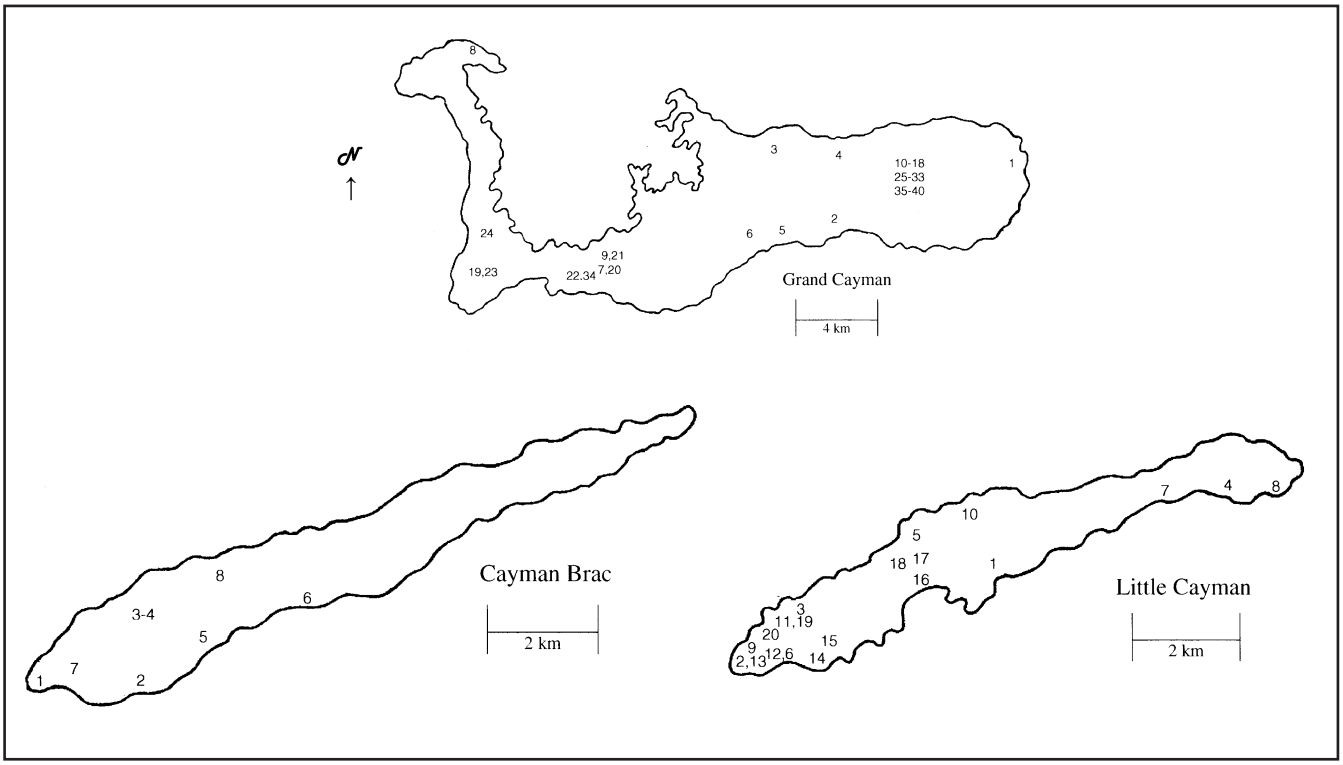

Fig. 1. Map indicating location of collecting sites in the Cayman Islands. Collection number, location, and collection date are listed in legend of Table 1.

RESULTS AND DISCUSSION

Freshwater Habitats

Very few natural freshwater habitats exist across the Cayman Islands. These habitats include natural ponds, sinkholes, and ornamental ponds. Water temperatures ranged from 26-42° C in these habitats. Due to the porosity of the substrate, there are no streams or rivers on these islands.

Permanent bodies of standing water may be found in low-lying areas across the Cayman Islands. These vary in size, but most are relatively shallow, rarely exceeding a few meters in depth. Salinity of these habitats varies, but usually coastal ponds have higher salinities than those found further inland. In the ponds where salinity was measured, values ranged from 0-44 parts per thousand. It should be noted that this research focused on freshwater invertebrates so the majority of biological samples were collected from habitats having little or no salinity. The bottom substrate of these ponds is primarily silt and mud.

Temporary pools may result following heavy rainfall, particularly in forested areas during the rainy season of May through November. The most persistent of these habitats are located in the Queen Elizabeth II Botanical Park. Most of these are small, usually having a surface area of less than 3 m^2 and a depth of no more than 0.8 m. The basin of these pools is generally composed of limestone with a small amount of decomposing leaves and sediment on the bottom.

Sinkholes are very common throughout the Cayman Islands. Some of these have been explored by divers and they have found channels that lead to the open sea, but whether this occurs with the majority of sinkholes is unknown. Because ocean salt is carried inland by the wind, these bodies of water contain various amounts of salt. Subsequent rains wash the salt to the greater depths of the sinkhole, resulting in a freshwater habitat at the surface. However, some sinkholes have become plugged with sediments so the salt remains suspended in the surface water and that environment becomes saline, potentially supporting a different invertebrate community.

Small ornamental ponds began to be constructed on Grand Cayman during the 1990's and these are especially common within the Queen Elizabeth II Botanical Park. These artificial habitats are usually composed of rock and often contain imported aquatic vascular plants. Most of these ponds have surface areas of less than 25 m^2 and depths of no more than 1 m. It is likely that some freshwater invertebrates associated with the imported plants were introduced to Grand Cayman inadvertently.

Aquatic invertebrate communities inhabiting water-filled bracts of *Heliconia* (wild plantain) inflorescences have been reported from several other small Caribbean islands, including Puerto Rico (Richardson and Hull 2000) and Saba (Bass and Bass 2008). *Heliconia* has been introduced into several locations within the Queen Elizabeth II Botanical Park and water may be held in the bracts for

Table 1. List of freshwater macroinvertebrates, including collecting sites, life cycle stages present, relative occurrence, and microhabitats in Cayman Islands (Grand Cayman = GC, Cayman Brac = CB, Little Cayman = LC) during June 1997 through May 2008. Life cycle: A, adult; J, juvenile; L, larva; N, nymph. Occurrence: *** abundant, ** common, * rare.

Taxa / Collection Site	Collections	Life Cycle	Occurrence	Microhabitat	Trophic Relationship[1]
Oligochaeta					
Pristina sp.	GC23	A	*	Detritus	Detritivore
Gastropoda					
Biophalaria schrammi	GC10, GC12, GC13, GC14, GC15, GC16, GC18, GC25, GC26, GC28, GC30, GC36, GC40	J, A	***	Detritus	Detritivore
Bithynia tentaculata	GC10, GC11, GC19, GC20, GC32, GC33, GC34, GC37, CB4, CB7	J, A	***	Detritus	Detritivore
Cerithdea costata	LC13, LC14	A	*	Detritus	Detritivore
Melanoides tuberculata	GC10, GC19, GC22, GC23, GC24, GC27, GC34, GC35	J, A	***	Detritus	Herbivore
Physella cubensis	GC10, GC12, GC40	J, A	*	Detritus	Detritivore
Pyrgophorus parvulus	LC13, LC14, LC16	A	*	Detritus	Detritivore
Bivalvia					
Eupera cubensis	GC29	A	*	Detritus	Collector
Ostracoda					
Unidentified Ostracoda	GC10, GC18, GC26	A	**	Detritus	Detritivore
Amphipoda					
Hyalella azteca	GC10, GC14, GC18, GC26, GC31, GC33, GC36, GC40	J, A	***	Detritus	Detritivore
Decapoda					
Barbouria cubensis	CB6	A	*	Under Rocks	Detritivore
Hydrachnida					
Unidentified Hydrachnida	GC2, GC9				
Ephemeroptera					
Callibaetis sp.	GC26, LC11, LC16, LC20	N	**	Detritus	Collector
Odonata					
Anax junius	GC9, GC14, GC19, GC29	N	**	Detritus	Predator
Brachymesia furcata	GC23, GC34, CB4, CB7, LC15	N	**	Detritus	Predator
Dythemis rufinervis	GC19	N	*	Detritus	Predator
Enallagma sp.	GC2, GC5, GC9, GC14, GC18, GC19, LC4	N	***	Detritus	Predator
Erythemis vesiculosa	GC10	N	*	Detritus	Predator
Erythrodiplax sp.	GC2, GC4, GC5, GC8, GC10, CB2, LC2, LC6, LC9, LC11	N	***	Detritus	Predator
Ischnura ramburi	GC21, GC23, GC28, GC33, GC34, GC40	N	***	Detritus	Predator
Orthemis ferruginea	GC37	N	*	Detritus	Predator
Pachydiplax longipennis	GC14, GC18	N	*	Detritus	Predator
Pantella flavescens	GC34	N	*	Detritus	Predator
Somatochlora sp.	GC34	N	*	Detritus	Predator

Taxa / Collection Site	Collections	Life Cycle	Occurrence	Microhabitat	Trophic Relationship[1]
Hemiptera					
Belostoma minor	GC1, GC3, GC5, GC14, GC19, GC20, GC21, GC22, GC23, GC26, GC31, GC32, GC34, GC37, GC38, CB3, LC7, LC20	N, A	***	Detritus	Predator
Buenoa sp.	GC17, GC28, GC36, GC40, LC16, LC18	N, A	***	Neuston	Predator
Hydrometra sp.	GC14	N	*	Aquatic Plants	Predator
Limnogonus sp.	GC26, GC36	N, A	*	Neuston	Predator
Merragata sp.	GC22	A	*	Neuston	Predator
Mesovelia sp.	GC14, GC16, GC18, GC22, GC26, GC27, GC28, GC38, GC40	N, A	***	Neuston	Predator
Microvelia sp.	GC17, CB5, CB6, LC11, LC16, LC17, LC18, LC19, LC20	A	***	Neuston	Predator
Notonecta sp.	GC27	A	*	Neuston	Predator
Paraplea sp.	GC28	A	*	Detritus	Predator
Rheumabates sp.	CB4, CB6	N	*	Neuston	Predator
Trepobates sp.	GC23	N	*	Neuston	Predator
Trichocorixa verticalis	GC1, GC6, GC7, GC8, GC21, CB1, LC3, LC5, LC6, LC8, LC9, LC10, LC12, LC14	A	***	Detritus	Predator
Trichoptera					
Chimarra sp.	GC18	L	*	Detritus	Collector
Lepidoptera					
Ancentria sp.	GC3	L	*	Detritus	Collector
Coleoptera	GC3, GC8, GC11, GC20, GC21, GC29, CB1, LC5, LC6, LC7	A	***	Detritus	Collector
Berosus sp.					
Celina sp.	GC18, GC19	A	*	Detritus	Predator
Copelatus sp.	GC37, CB7	A	*	Detritus	Predator
Cybister sp.	GC18, GC40	A	*	Detritus	Predator
Cymbiodyta sp.	GC37	L, A	*	Detritus	Collector
Derallus sp.	GC20, GC31	A	*	Detritus	Collector
Dytiscus sp.	GC12	L	*	Detritus	Predator
Hydacticus sp.	GC28, GC29, GC32, GC36	L, A	**	Detritus	Predator
Hydrochus sp.	GC30, GC31, GC32, GC40	A	**	Detritus	Shredder
Hydrobiomorpha phallica	GC16	A	*	Detritus	Collector
Hydrophilus insularis	GC12, GC14, GC18, GC35, GC38, GC39, GC40, LC16	A	***	Detritus	Collector
Laccobius sp.	GC29, GC34, GC37	A	*	Detritus	Piercer
Laccophilus sp.	GC18, LC10	A	*	Detritus	Predator
Paracymus confusus	GC10, GC18	A	*	Detritus	Collector
Pelonomus sp.	GC20	A	*	Detritus	Collector
Peltodytes sp.	GC40	A	*	Detritus	
Rhanthus sp.	CB5, CB7	A	*	Detritus	

Taxa / Collection Site	Collections	Life Cycle	Occurrence	Microhabitat	Trophic Relationship[1]
Thermonectus basillaris	GC13, GC14, GC17, GC18, GC37, GC39, GC40, LC15, LC16	A	***	Detritus	Predator
Tropisternus lateralis	GC1, GC8, GC9, GC14, GC15, GC18, GC20, GC28, GC36, GC38, CB1, LC1, LC2, LC3, LC6, LC9	L, A	***	Detritus	Collector
Diptera Chironomidae					
Ablabesmyia sp.	GC4, GC5, GC9	L	*	Detritus	Predator
C*hironomus* sp.	GC2, GC4, GC5, GC8, GC10, GC15, CB3, CB4, CB7	L	***	Detritus	Collector
Dicrotendipes sp.	GC6	L	*	Detritus	Collector
Goeldochironomus sp.	GC26, LC11	L	*	Detritus	Collector
Labrundinia pilosela	GC9	L	*	Detritus	Predator
Orthocladiinae	GC29	L	*	Detritus	Collector
Tanypodinae	GC4, GC22, GC37	L	*	Detritus	Predator
Tanytarsus sp.	GC2	L	*	Detritus	Predator
Other Diptera					
Aedes sp.	GC21	L	*	Plankton	Collector
Culex sp.	LC3, LC6, LC10	L	*	Planktonic	Collector
Culicoides sp.	GC1, GC3, GC4, GC5, GC7, GC9, GC37, CB2, LC9	L	***	Detritus	Predator
Dolichopodidae	GC3	L	*	Detritus	Predator
Odontomyia sp.	GC9, LC9	L	*	Detritus	Collector
Probezzia sp.	GC9	L	*	Detritus	Predator
Stratiomys sp.	GC19, GC23	L	*	Detritus	Collector

Trophic relationship[1] – Trophic relationships of insects based on Merritt, Cummins and Berg (2008) and non-insects on Thorp and Covich (2001).

Collections: GC1) Collier's Pond, GC, 11 June 1997*; **GC2)** Betty Bay Pond, GC, 11 June 1997*; **GC3)** Point Pond, GC, 11 June 1997*; **GC4)** Malaportas Pond, GC, 11 June 1997*; **GC5)** Meagre Bay Pond, GC, 12 June 1997*; **GC6)** Pease Bay Pond, GC, 12 June 1997*; **GC7)** Governor's Pond, GC, 12 June 1997*; **GC8)** Palmetto Pond, GC, 13 June 1997*; **GC9)** Least Grebe Pond, GC*, 18 June 1997; **GC10)** Fountain Pond, Queen Elizabeth II Botanic Park, GC, 15 May 2003; **GC11)** Wetlands Lake, Queen Elizabeth II Botanic Park, GC, 15 May 2003; **GC12)** Gazebo Pond, Queen Elizabeth II Botanic Park, GC, 15 May 2003; **GC13)** Buttonwood Swamp, Queen Elizabeth II Botanic Park, GC, 15 May 2003; **GC14)** Kary's Pond, Queen Elizabeth II Botanic Park, GC, 15 May 2003; **GC15)** Crocodile Hole, Queen Elizabeth II Botanic Park, GC, 15 May 2003; **GC16)** High Spring Pond, Queen Elizabeth II Botanic Park, GC, 15 May 2003; **GC17)** Natural Well, Queen Elizabeth II Botanic Park, GC, 15 May 2003; **GC18)** Monument Pond, Queen Elizabeth II Botanic Park, GC, 15 May 2003; **GC19)** Halfway Pond, Georgetown, GC, 16 May 2003; **GC20)** Governor's Pond, GC, 21 May 2007; **GC21)** Least Grebe Pond, GC, 21 May 2007; **GC22)** Prospect Pond, GC, 21 May 2007; **GC23)** Halfway Pond, GC, 21 May 2007; **GC24)** Sherwood Drive Pond, GC, 21 May 2007; **GC25)** Fountain Pond, Queen Elizabeth II Botanic Park, GC, 25 May 2007; **GC26)** Colour Garden Pond, GC, 25 May 2007; **GC27)** Wetlands Lake, Queen Elizabeth II Botanic Park, GC, 25 May 2007; **GC28)** Gazebo Pond, Queen Elizabeth II Botanic Park, GC, 25 May 2007; **GC29)** Ground Dove Walk Temporary Ponds, GC, 25 May 2007; **GC30)** Kary's Pond, Queen Elizabeth II Botanic Park, GC, 25 May 2007; **GC31)** Crocodile Hole, Queen Elizabeth II Botanic Park, GC, 25 May 2007; **GC32)** High Spring Pond, Queen Elizabeth II Botanic Park, GC, 25 May 2007; **GC33)** Monument Pond, Queen Elizabeth II Botanic Park, GC, 25 May 2007; **GC34)** Prospect Primary Pond, GC, 19 May 2008; **GC35)** Fountain Pond, Queen Elizabeth II Botanic Park, GC, 27 May 2008; **GC36)** Colour Garden Pond, Queen Elizabeth II Botanic Park, GC, 27 May 2008; **GC37)** Buttonwood Swamp, Queen Elizabeth II Botanic Park, GC, 27 May 2008; **GC38)** High Spring Pond, Queen Elizabeth II Botanic Park, GC, 27 May 2008; **GC39)** Natural Well, Queen Elizabeth II Botanic Park, GC, 27 May 2008; **GC40)** Gazebo Pond, Queen Elizabeth II Botanic Park, GC, 28 May 2008; **CB1)** Mangrove Wreck Pond, CB, 7 June 1997*; **CB2)** Salt Pond, CB, 8 June 1997*; **CB3)** The Splits, CB, 9 June 1997*; **CB4)** The Splits, CB, 20 May 2008; **CB5)** Hayman's Pond, CB, 20 May 2008; **CB6)** Black

Shrimp Hole, CB, 20 May 2008; **CB7)** Turtle Crawl Pond, CB, 20 May 2008; **CB8)** Wallace's Well, CB, 20 May 2008; **LC1)** Tarpon Lake, LC, 3 June 1997*; **LC2)** Bittern Pond (West End Pond), LC, 3 June 1997*; **LC3)** McCoy's Pond, LC, 4 June 1997*; **LC4)** Pond 14B, LC, 4 June 1997*; **LC5)** Jackson Pond, LC, 4 June 1997*; **LC6)** Bulldozer Pond, LC, 4 June 1997*; **LC7)** Pond 14A, LC, 5 June 1997*; **LC8)** Sandy Point Pond, LC, 5 June 1997*; **LC9)** Lighthouse Pond, LC, 5 June 1997*; **LC10)** Grape Tree Pond, LC, 5 June 1997*; **LC11)** Salt Rock Well, LC, 6 June 1997*; **LC12)** Roadside Ditch, LC, 26 May 1998; **LC13)** West End Pond, LC, 29 May 1998; **LC14)** Pirates Point Pond, LC, 29 May 1998; **LC15)** Airstrip Well, LC, 29 May 1998; **LC16)** Power Plant Well, LC, 30 May 1998; **LC17)** Evelyn's Well, LC, 30 May 1998; **LC18)** Sonny's Well, LC, 30 May 1998; **LC19)** Salt Rocks Well, LC, 30 May 1998; **LC20)** Pirates Well, LC, 31 May 1998.
* indicates collection by Richard Heard during June 1997.

about 60-90 days. Their bracts were examined in 2007 and 2008, but no aquatic invertebrates were observed living in these ephemeral microhabitats. However, it is possible they may be colonized by invertebrates in the future.

Freshwater Macroinvertebrates

A total of at least 72 species representing 14 major groups was collected from the freshwater habitats of the Cayman Islands. Grand Cayman supported the highest number of species, 66, while Cayman Brac and Little Cayman contained 14 and 18 species, respectively (Table 1).

Oligochaeta

Only one species of freshwater oligochaete, *Pristina* sp., was collected and this was found in the sediment of a large pond on Grand Cayman (Table 1). *Pristina breviseta* has been reported from a similar habitat in Barbados (Bass 2003a), but the species of the Cayman specimen is undetermined.

Gastropoda

Six species of snail were collected from a variety of standing waters (Table 1) and several interesting distributions were observed. *Biophalaria schrammi* was the most frequently encountered snail, occurring in many aquatic habitats on Grand Cayman. *Bithynia tentaculata* was the only gastropod found on more than one of the Caymans, occurring on both Grand Cayman and Cayman Brac. The eurytolerant pond snail, *Physella*, is widespread in ponds throughout the Caribbean basin, but *P. cubensis* appears to have a limited distribution in the Caymans, occurring in only two ornamental ponds in the Queen Elizabeth II Botanical Park. The introduced snail, *Melanoides tuberculata*, was also found only on Grand Cayman. *Cerithdea costata* and *Pyrgophorus parvulus* existed only on Little Cayman, although empty shells of *C. costata* were observed on all three islands.

Bivalvia

Eupera cubensis was the only bivalve collected and it was found in a temporary pool on Grand Cayman (Table 1). This species has been previously reported from temporary ponds on other small Caribbean islands (Bass 2005) and is common in southeastern North America (Thorp and Covich 2001). Because this clam is tolerant of only low salinity, it is probably transported in damp feathers of migrating waterfowl.

Ostracoda

A single species of ostracod was collected from three artificial ponds in the Queen Elizabeth II Botanical Park (Table 1). Specimens were found in different years indicating this species is thriving on Grand Cayman.

Amphipoda

The amphipod, *Hyalella azteca*, was found in abundance at numerous sites and during different times across Grand Cayman (Table 1). Although this species is widespread throughout the Caribbean basin (Bass 2003c), it was not encountered on Cayman Brac or Little Cayman. These amphipods commonly live among the plant detritus upon which they feed.

Decapoda

Barbouria cubensis, commonly known as the Cuban cave shrimp or black shrimp, was observed in a sinkhole on Cayman Brac (Table 1). Because this species is listed as critically endangered (IUCN 2008) and has been collected from the Caymans previously, no specimens were taken. Cuban cave shrimp are restricted to anchialine caves and pools in the Bahamas, Bermuda, Caicos Islands, Cayman Islands, Cuba, and Jamaica (Iliffe 2007).

Hydrachnida

Unidentified hydrachnids were collected from two sites on Grand Cayman: a permanent coastal pond and an inland temporary freshwater pond (Table 1). Because these habitats are so different from each other, it is likely specimens from these ponds actually represent different species.

Ephemeroptera

Only one mayfly, *Callibaetis*, was found in collections from the Cayman Islands (Table 1). This taxon was collected from submerged detritus on both Grand Cayman and Little Cayman. *Callibaetis* has been previously reported

on the eastern Caribbean islands of Antigua (Bass 2005), Nevis (Bass 2006), and St. Kitts (Bass 2006).

Odonata

Eleven species of odonates, two damselflies and nine dragonflies, were collected from permanent aquatic habitats (Table 1). All 11 taxa occurred on Grand Cayman while only two were found on Cayman Brac and three were collected from Little Cayman. Two dragonflies, *Brachymesia furcata* and *Erythrodiplax*, were collected on all three islands. Odonates act as predators, probably feeding mostly on other small insects. Nymphs were found crawling among living aquatic vascular plants and decomposing plant debris. All have been reported from several Lesser Antillean islands (Needham and Westfall 1955; Donnelly 1970; Harrison and Rankin 1976; Bass 2003a, 2003b, 2004b, 2005, 2006, 2007, 2008). Adult odonates are strong fliers and most likely colonized the Caymans from the nearby Greater Antillean islands, Central America, and South America.

Hemiptera

Twelve taxa of hemipterans were found in a variety of aquatic habitats across the Cayman Islands (Table 1). All are considered predators (Merritt, Cummins and Berg 2008). Eleven of these taxa occurred on Grand Cayman while four taxa were collected from each of Cayman Brac and Little Cayman. Only three taxa, *Belostoma minor*, *Microvelia* sp., and *Trichocorixa verticalis*, were found on all three Cayman islands. Some of the taxa collected, such as *Microvelia*, included wingless adults, an adaptation to island habitats (Roff 1990) commonly observed on small Caribbean islands (Bass 2003c).

Trichoptera

Only one caddisfly, *Chimarra*, was encountered in a single collection from an ornamental pond on Grand Cayman. Although uncommon in the Cayman Islands, numerous taxa of caddisflies, including *Chimarra*, are common on many of the more mountainous islands, especially in the Lesser Antilles (Flint 1968, 1970, 1996; Flint and Sykora 1993).

Lepidoptera

Ancentria was the only lepidopteran to be taken during these collections (Table 1). A single specimen was collected from leaf detritus in a natural pond on Grand Cayman.

Coleoptera

Nineteen species of beetle were collected from a variety of aquatic habitats on the Cayman Islands (Table 1). Grand Cayman composed 17 taxa, Cayman Brac held four taxa, and Little Cayman yielded five taxa. Twelve coleopteran taxa were limited to Grand Cayman and all of these have been reported elsewhere in the Caribbean basin. Only *Tropisternus lateralis* and *Berosus* were collected on all three Cayman islands. *T. lateralis* is one of the most widespread aquatic beetles in the Caribbean basin, being reported from Barbados (Bass 2003), Antigua (Bass 2005), Saba (Bass 2008), St. Kitts (Bass 2006), and Nevis (Bass 2006). Several collections yielded both larvae and adults of the same taxon, indicating those species are probably persisting and reproducing in the Caymans.

Diptera

Fifteen dipteran taxa were collected from a variety of freshwater habitats in the Caymans (Table 1) with 14 of these being found on Grand Cayman. The biting midge, *Culicoides*, was the only taxon collected from all three Cayman islands. Eight of the dipterans reported are midges belonging to the family Chironomidae. The abundant and eurytolerant midge, *Chironomus*, has a widespread distribution throughout the Holarctic region (Wiederholm 1983), and was collected from Grand Cayman and Cayman Brac.

Results of the similarity analysis (Sorenson 1948) of faunas among the Cayman Islands may be explained largely by proximity of the islands to each other (Tables 2-4). The two islands nearest each other, Little Cayman and Cayman Brac, had the highest similarity value of 0.50 and the two islands separated by the greatest distance, Grand Cayman and Cayman Brac, held the lowest value of 0.28.

However, when similarity values of island pairs are compared among other small Caribbean islands, the results are less clear (Table 2-4). Because only standing water is present on the Caymans, it is reasonable that they share the highest faunal similarity values to Antigua, Barbados, Nevis, St. Kitts, and Saba as the fauna of all of these islands is largely composed of lentic species. It appears that certain species with the capacity to colonize standing bodies of freshwater on small oceanic islands have been successful throughout the Caribbean basin (Bass 2003c). In addition, the relatively low number of species present in Antigua, Barbados, Nevis, St. Kitts, and Saba allow for only a few taxa in common between islands to raise the similarity values.

Island biogeography theory (MacArthur and Wilson 1967) predicts the number of species present on an island will increase as island size increases. This holds true when comparing the total number of freshwater macroinvertebrate taxa among the three Cayman islands. The largest of these, Grand Cayman, contains many more species than the two smaller sister islands. Both Cayman Brac (38 km^2) and Little Cayman (28 km^2) are considerably smaller than

Grand Cayman (197 km^2) and therefore, have less suitable habitat available for freshwater invertebrates. Not only do smaller islands have fewer suitable habitats, but they are also smaller targets for colonizers to locate.

Table 2. Sorensen's index of similarity values comparing the freshwater macroinvertebrate fauna of Grand Cayman to that of other small Caribbean islands, including approximate distances to those islands from Grand Cayman and approximate island sizes. Range of values: 0.00 = 0% common taxa and 1.00 = 100% common taxa.

Island	Approximate Distance (km)	Approximate Size (km^2)	Similarity Value
Little Cayman	128	28	0.36
Cayman Brac	161	38	0.28
Guanaja	589	69	0.12
Saba	1,925	13	0.26
Nevis	1,957	94	0.36
St. Kitts	1,967	177	0.34
Montserrat	2,036	83	0.21
Antigua	2,046	280	0.44
Dominica	2,159	751	0.20
St. Lucia	2,240	616	0.24
Grenada	2,243	346	0.17
Tobago	2,360	300	0.12
Barbados	2,417	430	0.36

The numbers and diversity of most freshwater insects occurring on Grand Cayman were reduced during the 2007 collecting period. Much of this island was flooded by the storm surge of Hurricane Ivan in 2004, (Cayman Department of Environment, pers. comm.), probably exterminating many freshwater populations. In addition, this flooding resulted in the creation of many additional microhabitats for mosquitoes, and insecticides were applied to combat the increased populations. Because insecticides are non-selective, many populations of non-target species were likely inadvertently destroyed. Seven of nine ponds on Grand Cayman showed a loss of species between the 2003 and 2007 collections. The application of these insecticides was curtailed in late 2007 and it appears most populations rebounded the following year, with seven of the nine ponds having increased numbers of species in the 2008 samples.

CONCLUSIONS

A total of 72 taxa are reported from the Cayman Islands. This includes 66 species from Grand Cayman, 18 species from Little Cayman, and 14 species from Cayman Brac. These numbers follow the prediction by McArthur and Wilson's island biogeography theory that a larger island will support more species than a smaller one. Because this is the first published report describing the biodiversity of freshwater invertebrates from the Caymans, most of these taxa are being reported from these islands for the first time.

Generally the freshwater macroinvertebrate fauna in the Cayman Islands is sparse, most likely due to the oceanic origin of the islands, their small sizes, a limited amount of freshwater habitats, natural and human disturbances, and challenges colonizing such habitats. Freshwater habitats in the Caymans are composed exclusively of standing waters, both natural and man-made. Therefore, any species inhabiting these lentic bodies of water must be capable of colonizing distant islands and be adapted to such environments. Large tropical storms and hurricanes periodically inundate freshwater habitats with large amounts of salt, and this may stress the invertebrate communities. In recent years, filling of land for road and housing developments has destroyed once productive freshwater habitats, such as Least Grebe Pond on Grand Cayman. Care should be exercised to prevent non-native species from being accidently introduced with imported aquatic plants in ornamental ponds. In addition, efforts to control mosquito populations through the application of pesticides has resulted in the loss of non-target aquatic insect populations, as observed in my 2007 collections. These freshwater invertebrate communities of the Cayman Islands require further study and continued monitoring, as well as protection, in order to insure that a healthy biodiversity will exist in the future.

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Table 3. Sorensen's index of similarity values comparing the freshwater macroinvertebrate fauna of Little Cayman to that of other small Caribbean islands, including approximate distances to those islands from Little Cayman and approximate island sizes. Range of values: 0.00 = 0% common taxa and 1.00 = 100% common taxa.

Island	Approximate Distance (km)	Approximate Size (km^2)	Similarity Value
Cayman Brac	7	38	0.50
Grand Cayman	128	197	0.36
Guanaja	711	69	0.06
Saba	1,804	13	0.11
St. Kitts	1,840	177	0.29
Nevis	1,871	94	0.23
Montserrat	1,930	83	0.14
Antigua	1,936	280	0.41
Dominica	2,056	751	0.13
St. Lucia	2,143	616	0.22
Grenada	2,153	346	0.12
Tobago	2,276	300	0.03
Barbados	2,320	430	0.20

Table 4. Sorensen's index of similarity values comparing the freshwater macroinvertebrate fauna of Cayman Brac to that of other small Caribbean islands, including approximate distances to those islands from Cayman Brac and approximate island sizes. Range of values: 0.00 = 0% common taxa and 1.00 = 100% common taxa.

Island	Approximate Distance (km)	Approximate Size (km^2)	Similarity Value
Little Cayman	7	28	0.50
Grand Cayman	161	197	0.28
Guanaja	733	69	0.06
Saba	1,772	13	0.19
St. Kitts	1,827	177	0.17
Nevis	1,837	94	0.16
Montserrat	1,898	83	0.21
Antigua	1,904	280	0.25
Dominica	2,024	751	0.11
St. Lucia	2,111	616	0.19
Grenada	2,121	346	0.08
Tobago	2,244	300	0.03
Barbados	2,288	430	0.16

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