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Ground Beetles (Coleoptera: Carabidae) from Quantico Marine Corps Base, Virginia

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Ground beetles (carabids) comprise a dominant element in the terrestrial insect fauna in many parts of the world. Diverse in species, abundant in individual numbers, and adapted to a wide variety of biotopes, these beetles provide a valuable resource for studies in ecology, distribution, and evolutionary processes.

With approximately 453 species of carabids now recorded (Davidson, 1995), this family holds first place in a numerical ranking of Virginia's beetle groups. A large number of the species are, however, known from only one or two localities, and existing information on both geographic and seasonal occurrence is strikingly deficient.

A study of the terrestrial animals of the Marine Corps Combat Development Command, Quantico, Virginia was conducted by the second author during the fall of 1990 and spring of 1991. Although intended to survey the local fauna of amphibians and reptiles, the pitfall sampling techniques employed obtained large numbers of epigaean arthropods, including just over 3000 carabids. Drift fence/pitfall installations have proven to be effective methods for sampling terrestrial animals (Gibbons & Semlitsch, 1981; Mitchell et al., 1993). Such studies, even when conducted for relatively short periods of time can yield considerable information on the composition and structure of ground beetle communities. Comparison of the carabid faunas in other locations and habitats in Virginia might be best made by using such collecting technique, granting their apparent limitation in capturing arboreal and streamside species. Quantitative analyses of these samples, with reference to the three different biotopes surveyed are currently being prepared for publication. The present paper provides a baseline checklist of the 78 species of ground beetles collected, with emphasis on overall and local distribution.

Since no locality in the Commonwealth has yet been thoroughly inventoried with respect to carabids, it is difficult to relate the Quantico fauna to that in other parts of the state. Two studies have been conducted during predatory insect inventories in crop fields (soy beans, alfalfa), one of them in Rockbridge County (Los & Allen, 1983), the other in Westmoreland County (Ferguson & McPherson, 1985). Although both investigations utilized a pitfall (can trap) technique, they sampled the beetles of a biotope which, if not atypical for carabids, is not directly comparable to the chiefly woodland habitats surveyed at Quantico.

Another useful reference point, virtually in Virginia, is Plummers Island in the Potomac River, just upstream from Washington, DC, and about 50 km north of Quantico and in a comparable physiographic position. Although technically in Montgomery Co., Maryland, Plummers Island is only 100 m across the river from the Langley area of Fairfax Co., Virginia. A detailed analysis of the Plummers Island carabids examined that fauna from numerous faunistic, historical, and ecological perspectives, and provided a basis for comparison with that at Quantico. Although 214 species of ground beetles have been found on Plummers Island, it must be emphasized that this figure (three times the Quantico total) was achieved over an 80-year period by skilled beetle collectors examining every available microhabitat throughout the year. Furthermore, many of the species

were found only once (suggesting random flight dispersal or downstream transport by high water), and during the last decade included in Erwin's survey (1970-79), only 101 species were taken. The majority of the Plummer's Island fauna not found at Quantico are small riparian and/or edaphobic obligates unlikely to be taken in pitfalls. Despite the deficiency resulting from this bias, the Quantico total of 78 carabids does not suffer from comparison with the 101 found in recent years at Plummers Island, when the relatively short sampling period is taken into account. Because of its geographic proximity to Quantico, and physiographic Coastal Plain, and 82 km to the southeast similarity (both localities straddle the Fall Line), we selected the fauna of Plummers Island as a primary basis for comparison, rather than the nearest Virginia site mentioned above (Westmoreland County, strictly).

Description of the Area and Biotopes

Occupying a substantial part of Stafford and a relatively small part of Prince William counties, Quantico Marine Corps base is astride the "Fall Line," with the easternmost extent along the Potomac River estuary and therefore in the Coastal Plain physiographic province. The majority of the reservation (west of US I-95) is located in the Piedmont. Sampling was conducted in three primary habitat types (each replicated with two sites): floodplain hardwoods (sites 1 and 5), upland hardwoods (site 4 and 6), and old fields (sites 2 and 3), the sites located along a roughly east-west transect in the Chopawamsic Creek drainage (Fig. 1). Site 1 was located in Prince William County just east of US I-95, sites 2-6 west of this highway in Stafford County.

Floodplain hardwoods were characterized by seasonally saturated soil, canopy trees dominated by tulip poplar (*Liriodendron tulipifera*), sweet gum (*Liquidambar styraciflua*), and red maple (*Acer rubrum*), and an understory of American holly (*Ilex opaca*) and red maple. Upland hardwoods were located on dry soils and consisted of red oak (*Quercus rubra*), white oak (*Quercus alba*), and tulip poplar, with an understory of dogwood (*Cornus florida*) and American holly. Old field soils were dry and supported mostly herbaceous plants dominated by a mixture of grasses and shrubs (e.g., *Lespedeza*, *Vaccinium*) and planted loblolly pine (*Pinus taeda*). Old field sites, of course, lacked a canopy.

Sampling was conducted with drift fence/pitfall arrays during two six-week periods (30 August - 11 October 1990 and 17 April - 29 May 1991). Each array consisted of three separate arms of aluminum flashing (0.66 x 7.5 m) and six 19-l plastic buckets for pitfalls. One array was constructed in each study site. Captures were removed from the arrays weekly during each of the sampling periods.

Annotated List of Species

We have followed the systematic sequence and nomenclature employed in the recent and comprehensive list of North American carabids by Bousquet & Larochelle (1993), which summarizes by state the known distribution of each species. Our statements about overall species ranges are drawn from this and other literature sources; references to in-state range are based largely on material in the VMNH collection.

One departure from the Bousquet-Larochelle list is the decision to disregard subspecific categories where they have been introduced prior to modern generic revision and often more varietal than geographic in basis.

A number of species credited to "VA" in the 1993 list are based on so-far unpublished records in VMNH. Some of these have recently been documented by Davidson (1995); several others are now substantiated from material taken at Quantico and elsewhere in the state.

Users of the present list are alerted to several changes of name affecting common and well-known local species: thus Carabus limbatus Say has become Carabus goryi Dejean, and Stenolophus carbonarius Say renamed Stenolophus carbo Bousquet (Bousquet & Larochelle, 1993).

Family Carabidae

Tribe Notiophilini

1. Notiophilus aeneus Herbst. Eight specimens were collected in spring in upland hardwoods (site 6) only. This beetle is widespread in northeastern United States, apparently reaching its southern limit in Georgia. It occurs in most parts of Virginia at low to moderate elevations, and Erwin (1981: 131) recorded several specimens from moist sites on Plummers Island.

2. *Notiophilus semistriatus* Say. Eight specimens were collected during the spring period only, from old field (2, 3), upland hardwoods (4) and floodplain hardwoods

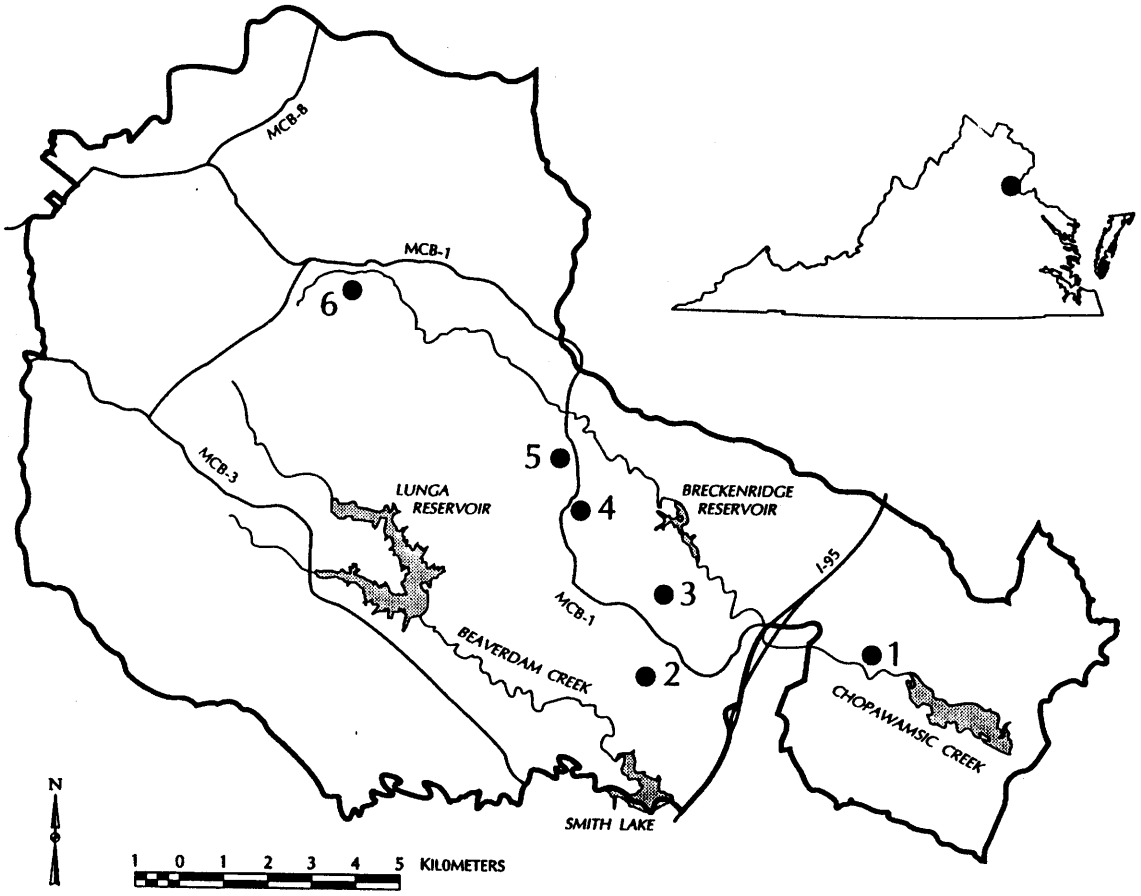

Figure 1. Location of the six drift fence/pitfall sampling sites on Quantico Marine Corps Base, Virginia.

(5) sites. The range of this species is similar to that of the preceding, although *N. semistriatus* extends further north and west. Only one specimen was found on Plummers Island (Erwin 1981: 132), and *semistriatus* is the least represented of the three Virginia notiophilids in the VMNH collection.

Tribe Cicindelini (formerly Cicindelidae)

3. *Cicindela sexguttata* Fabricius. We examined 62 specimens collected in the spring only, from all sites except 5, which is in floodplain hardwoods. Over half of the total came from old field site 3. This is typically a forest-dwelling species which invades open clearings, widespread over most of the United States and adjacent Canada. It is statewide in Virginia, and one of the most common tiger beetles in the region. Erwin (1981: 138) considered *sexguttata* to be common on Plummers Island throughout the 76 year period of his survey, and, consonant with our findings, recorded adults only in March, April, and May.

4. *Cicindela unipunctata* Fabricius. Two specimens were collected during the spring sampling period, from upland hardwoods at site 4. C. *unipunctata* occurs throughout most of the eastern United States, and is widespread in Virginia. A species of upland woods, it extends only slightly into the Coastal Plain along its western edge. It has not been collected on Plummers Island.

Tribe Carabini

5. *Calosoma wilcoxi* LeConte. Three specimens were taken during the spring period, in upland hardwoods at site 6 only. The species occurs in most of the United

States and in Quebec. Most Virginia records are in the Coastal Plain and Piedmont provinces, but a few records exists for several mountain counties. It was not recorded by Erwin (1981) for Plummers Island.

6. *Carabus goryi* Dejean. A total of 66 specimens was captured, the great majority (59) of them in upland hardwoods at site 6, and all but two of them during the spring sampling period. The species occurs almost everywhere east of the Mississippi River, and is one of the most abundant carabids in Virginia, where it is statewide. Under the earlier name *limbatus*, Erwin (1981: 133) noted that "many examples" were collected at Plummers Island between 1905 and 1920, but none since the latter date.

7. *Carabus vinctus* Weber. The majority of the 170 specimens from Quantico were trapped in floodplain hardwoods at sites 1 and 5, and about two-thirds of them during the spring period. Although the species is essentially statewide in Virginia, most of the records are for the Coastal Plain province, reflecting a generally southern range over eastern United States. Despite the abundance of this species at Quantico, Erwin (1981: 134) found only a few records for Plummers Island, none of them since 1914.

8. *Carabus serratus* Say. Three specimens of this very distinctive species were collected in spring from upland hardwoods (sites 4 and 6). C. *serratus* is manifestly a boreal species, extending across northern North America, and southward through the Appalachians to South Carolina. Previous Virginia records have been on and west of the Blue Ridge at elevations above 300 m, except for several old specimens in the USNM collection labeled "Alexandria" and "Glencarlyn." Erwin (1981: 134) cited single captures for Plummers Island in 1923 and the "Virginia shore" in 1912, both of which could represent specimens rafted down the Potomac during high water from some upland origin. But the Quantico material implies an existing disjunct population in northern Virginia, some 35 mi/60 km east of the nearest populations on the Blue Ridge.

9. *Carabus sylvosus* Say. Of the 28 specimens of this species captured at Quantico, 27 were trapped during the spring period at sites 4, 5, and 6. The single exception was collected at the old field site 3 in fall. C. *sylvosus* occurs over most of eastern North America, as far west as Texas and Kansas. Most Virginia records are for the Coastal Plain and Piedmont, with a few disjunct finds for the Blue Ridge (at 1000 m) and westward. Erwin (1981: 134) noted the capture of but a single beetle on Plummers Island, in 1922, although a few were taken on the Virginia side of the Potomac in 1905, 1920, and 1921, all September-November in contrast to the situation at Quantico.

Tribe Cychrini

10. *Sphaeroderus stenostomus* (Weber). Only nine specimens of this generally very abundant beetle were taken at Quantico, all during the spring period at sites 1, 2, 5, and 6. Specimens were taken from March through October at Plummers Island, and pitfall trapping elsewhere in Virginia by VMNH staff suggests that *stenostomus* is active throughout the year. The species (in the broad sense) occurs in Canada west to Saskatchewan and most of the eastern half of the United States. It is statewide in Virginia, where represented by several distinctive geographic races. Pending a revision of the genus by Prof. T. C. Barr, we decline to adopt existing trinomials (although it seems likely that the form in eastern Virginia will become the nominate subspecies).

11. *Scaphinotus elevatus* (Fabricius). A single specimen was captured at upland hardwoods site 6 during the spring period. S. *elevatus* appears to be scarce in Virginia, and Erwin (1981) cited no records for Plummers Island. This snail-eating beetle occupies a chiefly lowland range from Maine to Louisiana. Toward the south, the species does extend up into the Appalachians, and a few specimens have been taken west of the Blue Ridge in Virginia, at 650 m in Montgomery Co. Otherwise existing Virginia localities are all in the Piedmont and Coastal Plain.

12. *Scaphinotus unicolor* (Fabricius). This striking big species is among the most abundant ground beetles found at Quantico, where 66 specimens were taken (59 of them during the spring period) at all sites except floodplain hardwoods site 1. In an inclusive sense (ignoring the several dubious "subspecies" names), *unicolor* has a chiefly southern range, with most Virginia records confined to the Coastal Plain and Piedmont. Erwin cited "many specimens" taken on Plummers Island between 1902 and 1943, and it is difficult to imagine such a conspicuous beetle being overlooked during the following three decades by skillful carabid collectors.

Tribe Scaritini

13. *Scarites subterraneus* Fabricius. The 14 specimens from Quantico were all captured during the spring sampling period, at sites 1, 2, 3, and 6. The species seems to prefer dry habitats, and is common in urbanized areas around Virginia. Erwin (1981: 139) recorded captures at Plummers Island between 1902 and 1962. The lack of more recent collections is inexplicable, considering the usual abundance of this species over both a continent-wide range and statewide occurrence in Virginia.

14. *Clivina bipustulata* (Fabricius). All four specimens obtained during this study were taken during the spring: one from floodplain hardwoods (site 1), and three from old field (site 2). The latter seems atypical for this species, which is usually found closely associated with water. The range of the species includes most of eastern United States and Ontario; in Virginia existing locality records are restricted to the Coastal Plain and lower Piedmont. Erwin (1981: 141) mentioned "several specimens" from Plummers Island, from April through September.

Tribe Patrobini

15. *Patrobus longicornis* (Say). Only one specimen was trapped at the Quantico reservation, from the old field site 2 during the fall period. *P. longicornis* is frequently found associated with water, although it is not truly hygrophilous. On Plummers Island, "several specimens" have been taken by numerous collectors from April to November. The species is widely distributed across most of North America, and Virginia localities -although not numerous - are dispersed over most of the state.

Tribe Loxandrini

16. *Loxandrus brevicollis* (LeConte) Two specimens of this iridescent beetle were collected during the spring period from floodplain hardwoods (site 1) only. Like most members of the genus, *brevicollis* is partial to low wet situations, and its range is largely confined to the Coastal Plain from eastern Pennsylvania to Oklahoma. These specimens (kindly identified for us by R. L. Davidson). constitute a new state record for the species, which was not listed for Virginia by Bousquet & Larochelle (1993: 161), nor recorded from Plummers Island by Erwin (1981).

17. *Loxandrus inferus* Allen. Three specimens (R. L. Davidson, det.) of this recently described species were taken during the spring at floodplain hardwoods site 1. Previously known from Maryland (although not from Plummers Island), District of Columbia, Virginia, Georgia, Alabama, and Louisiana, *inferus* is represented in the VMNH collection from Greensville and Middlesex counties in the Coastal Plain, the City of Richmond on the Fall Line, and Halifax County in the southcentral Piedmont.

18. *Loxandrus* sp. indet. Twenty specimens of what appears to be a third member of the genus at Quantico were taken at site 1 during the spring period. The near impossibility of identifying females in this genus, as well as the difficulty of examining the internal aedeagal sac of formalin-preserved males, will require the collection of fresh material before an identification can be made.

Tribe Pterostichini

19. *Poecilus lucublandus* (Say). This generally abundant species is represented by 152 specimens taken during both the fall and spring intervals. The great majority (145) came from floodplain hardwoods sites 1 and 5; the other seven were trapped at old field site 2 and upland hardwoods site 6. *P. lucublandus* occurs in a variety of habitats including cultivated fields; Erwin (1981: 161) indicated that most of the captures on Plummers Island were from floodplain habitats. The species is continentwide in the United States and southern Canada, and statewide in Virginia.

20. *Lophoglossus* sp. indet. (possibly *substrenuus* LeConte). Five specimens were collected during the spring period in both floodplain (sites 1, 5) and upland hardwoods (site 6). In the current, unrevised condition of this genus, both the identities and ranges of the various species cannot be stated with any degree of certainty.

Several "morphospecies" occur in the Coastal Plain of Virginia; Erwin (1981) did not record the capture of any lophoglossid at Plummers Island.

21. *Myas coracinus* Say). Often very abundant locally, M. coracinus is represented in the Quantico material by 160 specimens taken in both the fall and spring intervals. They appeared in all sites, but half of the total number came from upland hardwoods site 6. Erwin (1981: 162) cites "many examples" taken on Plummers Island

between 1906 and 1919, with none found after the latter date (compare the similar case of *Scaphinotus unicolor*, above). The species is widespread in southern Canada, the Great Lakes region, and southward through the Atlantic coast states. In Virginia it is virtually statewide, but in the Coastal Plain only north of Richmond, and with Piedmont localities more toward its western perimeter.

22. *Pterostichus commutabilis* (Motschulsky). A single specimen of this scarce pterostichine was taken at site 1 during the spring season. The species occupies a farflung distribution across most of North America, but details about the southeastern part of the range are imprecise. The few existing records suggest a Coastal Plain extension as far as South Carolina; whether this segment is disjunct from the main part of the range in the northern interior is not clear.

The species was not cited for Virginia by Bousquet & Larochelle (1993: 168). The Quantico specimen and one in the VMNH collection from the Dismal Swamp, near Suffolk (19 May 1963, M. K. Klimkiewicz), provide the first known records for the state.

23. *Pterostichus coracinus* (Newman). Probably the most abundant carabid at Quantico, this species is represented by no fewer than 183 specimens, all but one of them taken in floodplain hardwoods sites 1 and 5. The one exception is from upland hardwoods at site 6. Most specimens were taken during the fall sampling period. The species occurs chiefly in northeastern North America, extending southward through the Appalachians, and is widespread in Virginia except for the Coastal Plain. Erwin (1981: 162) stated that *coracinus* was not found on Plummers Island (or the adjacent Virginia side of the Potomac) after 1919, although several specimens were collected prior to that date (see the analogous cases of *Scaphinotus unicolor* and *Myas coracinus*, mentioned above).

24. *Pterostichus caudicalis* (Say). One specimen from site 5, floodplain hardwoods, was taken in the fall sampling period. Several specimens were taken on Plummers Island and adjacent Maryland from 1908 through 1978 (Erwin, 1981: 163), and material is in the USNM collection from Langley, "Fairfax Co.", and "Alexandria". The species is known from most of Canada and northeastern United States, extending south through the Appalachians to North Carolina. Virginia records are very scanty and the Quantico individual is the only one in the VMNH collection.

25. *Pterostichus moestus* (Say). One specimen was taken in the spring period from floodplain hardwoods site 1. The range of this species embraces much of northeastern United States, west to Indiana and south to north Georgia. Most Virginia records are from the Blue Ridge and westward, although early records exist for Fredricksburg and the vicinity of Washington, DC. Erwin (1981: 163) cited specimens collected on Plummers Island prior to 1933. In North Carolina, *moestus* occurs only in the southern Blue Ridge.

26. *Pterostichus tristis* (Dejean). Nine specimens were collected at Quantico during the fall period, eight of them at upland hardwoods site 6, only one from floodplain hardwoods site 1. This species is primarily boreal, from Wisconsin, Ontario, and Nova Scotia south through the Appalachians to north Georgia. In Virginia, virtually all of the records are from the mountains and westernmost Piedmont, although VMNH has a series taken at Turkey Run Park, Fairfax County, just across the Potomac from Plummers Island. Erwin (1981: 161) recorded *tristis* from that site; these several records plus the Quantico material confirm the presence of this species in wooded sites well east of the Blue Ridge.

27. *Cyclotrachelus spoliatus* (Newman). With a total capture of 324 specimens, this species is the second most abundant carabid at Quantico. The great majority (86%) of this number were from old field site 3 (n=105) and from upland hardwoods site 4 (n=174). Most specimens were taken during the fall sampling period. The species ranges from the District of Columbia to Georgia, and in Virginia occurs exclusively on and east of the Fall Line. It is also very abundant in the nearby Prince William Forest Park (VMNH material), making its absence from Plummers Island the more remarkable. Apparently *spoliatus* prefers well-drained habitats despite its virtual restriction to the Coastal Plain.

28. *Cyclotrachelus furtivus* (LeConte). Four specimens (det. R. L. Davidson) were trapped at Quantico, all during the spring period, from site 1 (floodplain hardwoods) and site 4 (upland pine/hardwoods). The species occupies a curious range, from western Pennsylvania to New Jersey, and southward as far as the James River in Virginia (Freitag, 1969, Fig. 133). It has been collected in the District of Columbia as well as the

adjoining counties of Fairfax, Virginia, and Montgomery, Marvland, so its absence from Plummers Island is noteworthy.

29. *Cyclotrachelus sigillatus* (Say). We examined 62 specimens of *C. sigillatus*, taken in all Quantico sites except old field site 2. About two-thirds of the total were taken in the spring period. The species ranges from southern New York south and west to Alabama and the Florida panhandle (Freitag, 1969, Fig. 131). It is apparently statewide in Virginia.

Tribe Zabrini

30. *Amara pennsylvanica* Hayward. Five specimens were collecting in the fall from floodplain hardwoods (site 1) and old field (site 2) habitats. The species occurs in eastern Canada (to Nova Scotia) and southward through much of eastern United States except the coastal plain, the few records for Virginia (VMNH) and North Carolina (Brimley, 1938) are in the Piedmont and mountains, and those for South Carolina (Kirk, 1969) in the extreme westernmost corner. Erwin (1981) had no records for Plummers Island.

31. *Amara cupreolata* Putzeys. Six specimens of this species were taken in spring from old field sites (2 and 3) only, suggesting a dry (or disturbed) habitat preference. *A. cupreolata* is widespread over much of North America east of the Rockies but it seems to be spotty in occurrence (collector bias?). VMNH has a few localities across Virginia except for the far southwestern counties. Erwin (1981) had no records for Plummers Island.

32. *Amara impuncticollis* (Say). Seven specimens were captured at Quantico in floodplain hardwoods (site 1) and old field (site 2) habitats. The species is known from most of eastern United States and Canada. Most VMNH specimens are from the Coastal Plain, with a few from localities in the Piedmont and Ridge & Valley provinces. Erwin (1981) did not record it for Plummers Island.

33. *Amara angustata* (Say). Only one specimen was found at Quantico, from floodplain hardwoods during the fall period. Despite a wide range over much of North America east of the Rockies, *angustata* does not seem to be frequently collected. Erwin (1981: 166) recorded only three specimens from Plummers Island for the period 1907 to 1920, and the VMNH had no material from Virginia.

Tribe Oodini

34. *Oodes brevis* Lindroth. We examined 35 specimens of *brevis* from Quantico, all captured, as might be expected, at floodplain hardwoods site 1, most of them during the spring period. This hygrophilous species occurs in eastern United States north to Ontario; Virginia records are mostly from the Coastal Plain with a few on the eastern Piedmont. It was not recorded by Erwin (1981) for Plummers Island despite the availability of suitable habitats. The type locality is in Fairfax County.

35. *Anatrichis minuta* (Dejean). One specimen was collected at site 1 during the spring sampling period. The species occurs chiefly in the Atlantic and Gulf coastal plains from Massachusetts to Kansas. Erwin did not report it from Plummers Island.

Inclusion of Virginia in the state list for *minuta* by Bousquet & Larochelle (1993: 202) was based on an unpublished record of a specimen (VMNH) taken in Fontaine Swamp, Greensville Co., Virginia, 31 August 1979 (R. L. Hoffman, UV light). This specimen and that here reported from Quantico are the first to be documented in print for Virginia.

Tribe Chlaenini

36. *Chlaenius tomentosus* (Say). We examined 22 specimens of *tomentosus* collected in Quantico, all of them caught during the spring period in the old field sites 2 and 3. This widespread species occurs over most of the United States and southern Canada (Arizona to Quebec) except for peninsular Florida. Most Virginia localities are in the Coastal Plain and Piedmont. Erwin (1981: 166) reported that only two specimens of *tomentosus* were collected on Plummers Island, both of them prior to 1920.

37. *Chlaenius emarginatus* Say. This common species is represented by 90 specimens taken in all of the Quantico sites except upland hardwood site 4. About three-fourths were collected during the spring period. It is widespread over eastern North America: Nova Scotia and Michigan south to Kansas and Florida. The VMNH collection has material from across the state, but the majority of specimens are from Coastal Plain localities. Erwin (1981: 167) recorded "several" specimens from Plummers Island, "in moist areas in the forest above the secondary floodplain."

38. *Chlaenius aestivus* Say. One hundred fifty-nine specimens of this beetle were taken, in all sites except old field site 3, and nearly all during the spring period. The species occurs over most of eastern United States, north to Indiana and Massachusetts; it may be absent from southern Florida. Erwin (1981: 167) mentioned "many examples" taken on Plummers Island between 1902 and 1978, during both spring and late summer periods. The majority of Virginia specimens in VMNH are from the Coastal Plain and Piedmont; several counties west of the Blue Ridge are represented, however, by low-elevation localities in the Shenandoah and Roanoke valleys and from the far southwestern corner of the state. Bell (1960: 120) saw material chiefly from lowland localities, and noted the absence of records for "the higher Appalachians" which our data seem to confirm. A record for *aestivus* in the North Carolina mountains at Burnsville (Brimley, 1938: 126) may be based on an aeolian vagrant or mislabeled specimen.

39. *Chlaenius impunctifrons* Say. Only four specimens were taken, all of them during the spring period at floodplain hardwoods site 1. This possible prediliction for low marshy habitat is confirmed by the statement of Erwin (1981: 168) that specimens at Plummers Island were "Found under stones on primary floodplain...." *C. impunctifrons* occurs over much of North America east of the Rockies, including southern Canada, and appears to be statewide in Virginia although nowhere abundant and not extending above 590 m. VMNH had no material from pitfall traps, perhaps because of the problems with installing them in the appropriate habitat. The VMNH specimens with collection data were taken, by hand, adjacent to streams, ponds, and boggy areas.

40. *Chlaenius tricolor* Dejean. Most of the 17 specimens of *tricolor* were collected in spring and all were from floodplain hardwoods (sites 1 and 5). The species' range covers North America from Newfoundland to Alberta, and south to Texas and Georgia. It appears to be statewide in Virginia, from sealevel to 1000 m in Tazewell and Grayson counties. Erwin (1981: 168) referred to "many specimens" taken on Plummers Island in floodplain habitats, March through October.

Tribe Licinini

41. *Dicaelus ambiguus* LaFerté-Sénectère. The 15 specimens taken at Quantico were from floodplain hardwoods (sites 1 and 5), old field (site 2 only), and upland hardwoods (site 4), most are from the spring sampling period. The species' range includes most of southeastern United States, from Pennsylvania to Iowa, south to Texas and northern Florida. In Virginia, *ambiguus* is common in the central and eastern lowlands, with a few disjunct localities in the southwestern mountains.

No material of this species from Virginia was seen by Ball (1959) for his revision of the Licinini, nor was it recorded for the state by Bousquet & Larochelle (1993). Erwin (1981: 170) reported that several specimens were collected from Plummers Island and its "adjacent shores", one of which is near Langley, Fairfax County, Virginia, but it is easy to understand how such an obscure reference could be overlooked. In any event, the VMNH material from Quantico and elsewhere now constitute formal documentation of *ambiguus* as a member of the Virginia biota.

42. *Dicaelus dilatatus dilatatus* Say. Four specimens were collected during the spring at Quantico, in floodplain hardwoods (site 5) and old field (site 2) habitats. The species in its broad sense ranges from New Hampshire to northern Florida, west to Iowa and Texas; the nominate subspecies is northern and eastern, from New England to Virginia. Erwin (1981: 171) stated that it was not found on Plummers Island after 1925, although abundant prior to that year. In Virginia, *D. d. dilatatus* is essentially statewide except for the far southwestern counties, where it is replaced by the subspecies *d. sinuatus* Ball.

43. *Dicaelus elongatus* Bonelli. Sixty-one specimens of this abundant member of the genus were taken mostly during the spring period at Quantico, from old field sites 2 and 3, but a few were from floodplain hardwoods (site 5 only), and upland hardwoods sites 4 and 6. The species ranges from southern Quebec to Iowa, and south to the Gulf; in Virginia it is essentially statewide but most material is from the Coastal Plain and Piedmont provinces, where pitfall sampling yields long series. Erwin (1981) stated that the only specimen found on Plummers Island was collected in 1901, suggesting that the occurrence was fortuitous.

44. *Dicaelus furvus* Dejean. All of the 29 specimens of

this species were taken during the spring period. 28 of them from upland hardwoods (site 6) and only one from old field (site 2) habitats. The range of *furvus* in its broad sense is basically southern (excluding peninsular Florida), extending northward to Pennsylvania in the east and Nebraska in the interior. Ball (1959: 122) restricted the range of the nominate subspecies to eastern Pennsylvania, Maryland, Virginia, and West Virginia; it remains to be ascertained whether the range of *D. f. carinatus* Dejean extends northward along the Coastal Plain to Virginia.

45. *Dicaelus politus* Dejean. All but one of the 39 specimens collected at Quantico during the spring period came from upland hardwoods site 6, suggesting a pronounced habitat preference. The single exception, taken at upland hardwoods site 4, was probably caught during random dispersal activity. The species is widespread over northeastern North America from Quebec and Iowa south through the Appalachians to Georgia and Alabama. It is nearly statewide in Virginia, but with only a few Coastal Plain localities. According to Erwin (1981: 170) *politus* is abundant on Plummers Island, under stones in mixed forest away from the floodplain.

46. *Dicaelus p. purpuratus* Bonelli. Thirteen specimens of this large and colorful carabid were collected at Quantico during both spring and fall seasons, in old field (site 3), floodplain hardwoods (site 5), and upland hardwoods (sites 4 and 6), suggesting adaptation to a variety of habitats. In its broad sense, the species occurs from Ontario and Minnesota south to Arizona and Florida. Within this area, Ball (1959: 148) recognized four subspecies, of which the nominate occupies most of the species' range, the other three occurring at the southern and western periphery. In Virginia, *purpuratus* is statewide, but with only sporadic occurrence in the mountains; by far most specimens in VMNH are from the Coastal Plain. Erwin (1981: 171) stated that it was abundant at Plummers Island (and adjacent shores) between 1902 and 1919, with none captured after that date.

47. *Badister notatus* Haldeman. A single specimen was collected at floodplain hardwoods site 5, during the spring period. Species of this genus are rarely taken by pitfall, and most are relatively scarce in collections. *B. notatus* is widespread over the United States east of the Mississippi, and north into Ontario. Most of the VMNH specimens are from the Virginia Coastal Plain, with a very few disjunct records for the Piedmont and Ridge & Valley provinces (at low elevations). Erwin (1981: 172) cited specimens from Plummers Island, in low damp places on secondary floodplain.

Tribe Harpalini

48. *Notiobia terminata* (Say). We examined 15 specimens of this carabid from the old field sites 2 and 3; most of them captured during the fall. The species has a wide range, from Newfoundland to North Dakota, south to Texas and Florida. In Virginia it is presumably statewide, although we have no records to date for the far southwestern counties. Erwin (1981: 178) reported that the only specimens found on Plummers Island were two taken in 1902, suggesting only incidental occurrence at that site.

49. *Anisodactylus agricola* (Say). Only one specimen was collected at Quantico, from floodplain hardwoods site 1 in the spring period. The species is widespread in much of eastern North America, but seems not to be frequently collected: VMNH has, for instance, only one specimen from each of the five physiographic provinces. Erwin (1981: 179) cited the species for Plummers Island, in several floodplain habitats.

50. *Anisodactylus nigerrimus* (Dejean). Of the 46 specimens captured at Quantico, the majority were found at old field sites 2 and 3, although sites 1, 5, and 6 also produced a few. All were taken during the spring period. The species' range is extensive, from Newfoundland to North Dakota and southward. It is statewide and common in Virginia, the VMNH material coming from all five regions of the state. But only three were captured at Plummers Island from 1902 through 1923 (Erwin (1981: 179).

51. *Anisodactylus ovularis* (Casey). Ten specimens were taken during the spring period at Quantico, from old field site 2 only. The range of *ovularis* includes most of United States east of the Great Plains, except for the southeastern states between Virginia and Texas. VMNH material was only from west of the Blue Ridge (Augusta, Montgomery, Roanoke counties), suggesting a disjunct status for the Quantico population, the more so as *ovularis* has not been found at Plummers Island.

52. *Anisodactylus rusticus* (Say). Of the 148 specimens of this species taken at Quantico, all but one were trapped

at the old field sites 2 and 3 during the spring period. The sole exception came from site 5 (floodplain hardwoods), presumably a dispersing migrant. The species ranges over much of the continent, as far west as Wyoming and Arizona, and is statewide in Virginia. In contrast to its abundance at Quantico, only one specimen, found in 1908, was reported by Erwin (1981: 179) for Plummers Island, suggesting only transient status.

53. *Amphasia interstitialis* (Say). Nineteen specimens of this species were collected at Quantico, at all sites except 2 and 4, all but one during the spring collecting period. The species occurs in northeastern North America from Quebec south and west to Arkansas, and it is statewide in Virginia. Erwin (1981: 180) reported "numerous specimens" being collected on Plummers Island "and adjacent shores."

54. *Stenolophus carbo* Bousquet. A single specimen of this species was captured at old field site 3 during the spring period. S. carbo (formerly known as carbonarius Say) occurs over much of eastern United States, east of the Great Plains, north to Ontario, but apparently missing from the southeastern States. However, it was not recorded for Virginia by Bousquet & Larochelle (1993), nor for Plummers Island by Erwin (1981). It was listed for North Carolina by Brimley (1938) but not for South Carolina (Kirk, 1969, 1970). The VMNH collection, however, has a specimen taken at Dam Neck Navy Base in the City of Virginia Beach (26 June 1991, Kurt A. Buhlmann). These two specimens therefore establish the occurrence of this species in Virginia.

55. *Stenolophus rotundatus* LeConte. One was collected from old field site 3 during the spring period. The species is widespread in eastern North America, from the Gulf Coast states to Ontario. Erwin (1981) did not record it from Plummers Island, and VMNH had only a single specimen from Russell County in the far southwestern part of Virginia.

56. *Harpalus erythropus* Dejean. Three specimens of this beetle were collected in both spring and fall at old field site 2 and upland hardwoods site 4. The species is widespread over North America east of the Rockies, including southern Canada. It is statewide in Virginia, and was found on Plummers Island until 1932, the last year of collection there.

57. *Harpalus faunus* Say. Most of the 68 Quantico specimens of this species were collected in the fall from old field site 2, the two exceptions having been captured in floodplain hardwoods site 1. *H. faunus* occurs in most of North America, from Quebec to Manitoba and southward to Arizona and the Gulf Coast states. The few VMNH specimens were taken in the Piedmont and Ridge & Valley provinces, but the species is doubtless statewide in range. Erwin (1981: 173) recorded several specimens from Plummers Island, 1902-1978, where it is obviously not common.

58. *Harpalus pensylvanicus* (DeGeer). This, the most abundant carabid at Quantico and probably in Virginia generally, is represented by 397 specimens trapped during the fall period. Although all sites yielded specimens, the vast majority (328) came from old field site 2. The species occurs over most of North America, and is statewide in Virginia, especially in areas of early succession. Curiously, it seems not to have been collected on Plummers Island after 1932 (Erwin 1981: 173).

59. *Harpalus caliginosus* (Fabricius). Only two specimens of this generally abundant beetle were taken at Quantico, one in spring, one in fall, at old field site 2 only. The species ranges over most of the contiguous states and southern Canada from Manitoba eastward. It is apparently statewide in Virginia, although there are no records for the far southwestern counties. Erwin (1981: 174) was able to record only a single specimen for Plummers Island, and that dating from 1905.

60. *Harpalus fulgens* Csiki. Two specimens from Quantico were taken in spring at old field sites 2 and 3. H. fulgens is one of the few Nearctic species of Harpalus with a chiefly southern range: peninsular Florida to Texas, and northward at low elevations to Iowa, western Pennsylvania, and Rhode Island. It is widespread in Virginia, with most VMNH specimens from the Coastal Plain and Piedmont regions. One specimen from 1400 m in Bath County is perhaps an aeolian vagrant. Erwin (1981: 175) considered the species to be common on Plummers Island as far back as 1903.

61. *Harpalus plenalis* Casey. Six specimens of this species were taken from old field sites 2 and 3, all of them during the spring period. As mapped by Noonan (1991, fig. 292), *plenalis* ranges entirely across Canada and extends southward along the major mountain systems

to Arizona, New Mexico, and North Carolina (with questionable localities in Arkansas and Texas). Noonan examined, but did not map, material from Thornton Gap, Page County, Virginia, as well as from the Black and Balsam mountains in western North Carolina. VMNH has a small series from Shenandoah Mountain in western Augusta County, Virginia, consonant with the foregoing range summary. The presence of *plenalis* at Quantico is therefore somewhat unexpected for this obviously boreal animal, and may represent an instance of climatic reliction.

62. *Harpalus herbivagus* Say. All of the 14 specimens from Quantico were collected at old field site 2, most of them during the spring period. This very widespread species occurs over most of the "lower 48" states and southern Canada, except for southern Texas and peninsular Florida. In Virginia it is probably statewide, although VMNH lacks material from the Coastal Plain. Erwin (1981: 175) noted that *herbivagus* has not been found on Plummers Island since 1905.

63. *Selenophorus gagatinus* Dejean. Six specimens were collected at Quantico, during both spring and fall periods, in old field sites 2 and 3. This species occupies a dominantly northeastern range from New Brunswick to Virginia, with disjunct areas in Arkansas-Texas and Georgia-Florida-Alabama. VMNH had material only from two localities - both above 1300 m - in western Virginia, suggesting that *gagatinus* should occur in western North Carolina although so far unrecorded from that state. The only Plummers Island record is for a single specimen found in 1915 (Erwin 1981: 176).

64. *Selenophorus opalinus* (LeConte). This species was found during both spring and fall periods at Quantico, most of the 33 specimens coming from old field sites 2 and 3. Upland hardwoods sites 4 and 6 also yielded a few individuals. It occurs from Quebec to South Dakota and Texas, and appears to be statewide in Virginia, although records are lacking for the far southwestern counties. Erwin (1981: 176) noted that the only specimen taken on Plummers Island was found in 1907, obviously another case of transience rather than resident population.

65. *Trichiotichnus autumnalis* (Say). Eighty-four specimens of this beetle were taken in floodplain hardwood site 5 and upland hardwoods sites 4 and 6, all but one of them during the spring period. The species' range includes Ontario and most of northeastern United States west to Wisconsin, and southward along the Atlantic coast to Georgia. It is doubtless statewide in Virginia, although records are lacking for the southwestern part of the state. It is known from Plummers Island only from four specimens taken in 1974

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66. *Trichiotichnus dichrous* (Dejean). Only a single specimen of this uncommon species was collected at Quantico, from upland hardwoods site 6 in the fall. It occurs over most of North America east of the Great Plains, and is probably statewide in Virginia, although VMNH has only a few specimens from scattered localities. Specimens were taken on Plummers Island and the adjacent Virginia shore between 1902 and 1932, none after the latter date (Erwin 1981: 176).

67. *Cratacanthus dubius* (Palisot de Beauvois). The only capture of this species at Quantico was one specimen at old field site 2 in the fall. Like many other harpalines, the species' range is general over North America east of the Rockies, and it is statewide in Virginia. Paralleling our results at Quantico, only one specimen has been found on Plummers Island, in 1902 (Erwin 1981: 173).

Tribe Platyini

68. *Calathus opaculus* LeConte. Most of the 31 specimens taken during this study came from old field sites 2 and 3, and upland hardwoods site 6. Only one was trapped at floodplain hardwoods site 1, suggesting capture during dispersal. The range of the species extends from Quebec to Wyoming and Colorado, southward to the Gulf. VMNH records suggest a statewide distribution, with perhaps greatest abundance in the Coastal Plain. It has not been found on Plummers Island (Erwin 1981).

69. *Synuchus impunctatus* (Say). We examined 66 specimens taken in both spring and fall trapping periods, at all sites except 2 and 3 in old field habitat. This species is transcontinental in Canada and northern United States, southward as far as Missouri and Virginia. VMNH specimens are from the Ridge & Valley, Piedmont, and Coastal Plain provinces, those from the City of Virginia Beach being apparently the southeasternmost known and presage discovery of impunctatus in North Carolina. The species was not found on Plummers Island, although one was taken on the adjacent Virginia shore of the Potomac (Fairfax

County) in 1905.

70. *Olisthopus parmatus* (Say). Two specimens of this carabid were collected during the spring at upland hardwoods site 6. The species is known from southern Canada and most states east of the Great Plains, and appears to be statewide in Virginia. It was not found on Plummers Island *per se*, but one specimen was found on the adjacent shore of the Potomac River in Montgomery Co., Maryland (Erwin 1981: 159).

71. *Agonum pallipes* (Fabricius). Only a single specimen was trapped at Quantico, in old field site 2 during the fall period. This predominantly southern species occurs as far north as Indiana and Maryland and west to Texas and Kansas. Its distribution in Virginia is uncertain; VMNH has only a few specimens from Piedmont localities and it may not occur west of the Blue Ridge. The lack of Coastal Plain records is noteworthy. Erwin (1981) did not list it for Plummers Island.

72. *Agonum punctiforme* (Say). Most of the 11 specimens collected at Quantico were collected during the spring at upland hardwoods site 6, but old field sites 2 and 3 and floodplain hardwoods site 1 also yielded a few specimens each. The range covers most of United States east of Kansas and Texas, but not extending north to Minnesota, Michigan, and Maine. *A. punctiforme* also appears to be statewide in Virginia, but was not found at Plummers Island (Erwin 1981).

73. *Agonum ferreum* Haldeman. One specimen was collected at floodplain hardwoods site 1 during the spring period, reflecting the species' recognized preference for low wet habitats. This species is widespread over United States east of the Mississippi and southern Ontario. It is statewide in Virginia, with most records for the Piedmont and Ridge and Valley provinces, and common at Plummers Island (Erwin 1981: 157).

74. *Platynus decentis* (Say). Fifty specimens captured, most of them during the spring, from floodplain hardwoods sites 1 and 5, and upland hardwoods sites 4 and 6. This species is transcontinental in North America except for the southwestern states and peninsular Florida, and VMNH material is from all parts of Virginia. Erwin (1981: 157) characterized it as abundant at Plummers Island.

Tribe Lebiini

75. *Cymindis americanus* Dejean. The four specimens taken at Quantico were all from uplands hardwoods sites 4 and 6, during the fall period. The range of americanus includes most of North America east of the Great Plains, north as far as Quebec. VMNH material is from all parts of Virginia, but the species appears to be most abundant in the Coastal Plain, and localities in the western mountains are at low elevations. Erwin (1981: 189) had no records for the species at Plummers Island.

76. *Apenes lucidulus* (Dejean). We examined only two Quantico specimens, both from uplands hardwoods site 6 during the spring period. The species is widespread in United States east of the Mississippi, and VMNH specimens are from all five physiographic regions. Erwin (1981: 189) reported that *lucidulus* was found on Plummers Island between 1902 and 1963, but none after the latter date.

Tribe Galeritini

77. *Galerita bicolor* (Drury). We obtained 18 specimens of this large gangling beetle during both spring and fall sampling periods from floodplains hardwoods site 1 and upland hardwoods sites 4 and 6. The species occurs over most of North America east of the Great Plains, and is statewide in Virginia. The lack of specimens from the two old field sites in interesting, since the species is commonly found under stones and logs in quite dry situations elsewhere in Virginia. The species is common at Plummers Island, under stones and beneath bark of logs on the floodplain (Erwin 1981: 190).

78. *Galerita janus* (Fabricius). Somewhat more abundant than the preceeding species, *janus* was captured at Quantico in both spring and fall, and at all sites except old field site 2. Most of the 51 specimens were from upland hardwoods sites 4 and 6 during the spring. The species has also a larger range than *bicolor*, extending from Quebec to Manitoba and Arizona, thence into Mexico. It is doubtless statewide in Virginia, although records are lacking for the extreme southwestern counties. Despite its abundance at Quantico, only three specimens of *janus* were found at Plummers Island, all between 1909 and 1922 (Erwin 1981: 190).

Summary

Seventy-eight species of carabids are reported from the Marine Corps base at Quantico, Virginia, in Stafford and Prince William counties. All specimens were taken by pitfalls placed in duplicate in three primary habitat types.

Five species, either omitted from the states of known occurrence in Bousquet & Larochelle (1993) or included on the basis of unpublished information, are herewith documented on the basis of specimens from Quantico (and elsewhere), bringing the total known for the state to 458; *Loxandrus brevicollis, Pterostichus commutabilis, Dicaelus ambiguus, Anatrichis minuta, Stenolophus carbo.*

The following ten species are the most abundant carabids taken at Quantico (without respect to season): *Harpalus pensylvanicus* (397), *Cyclotrachelus spoliatus* (324), *Pterostichus coracinus* (183), *Carabus vinctus* (170), *Myas coracinus* (160), *Chlaenius aestivus* (159), *Poecilus lucublandus* (152), *Anisodactylus rusticus* (148), *Chlaenius emarginatus* (90), *Harpalus faunus* (88).

A breakdown by season, to be presented in a subsequent report, will show that some of the abovelisted species were trapped only in the fall (e.g., *H. pensylvanicus*), some only in the spring (*A. rusticus*), and still others throughout the warmer months of the year.

Several species taken at Quantico normally occur in Virginia only on the Blue Ridge and westward. Their occcurrence on or near the Fall Line, some 35 miles east of the Blue Ridge front, suggests the possibility of postglacial disjunct status, but this idea must be tested by collecting in intervening areas (such as the Bull Run Mountains). These species are *Harpalus plenalis, Carabus serratus,* and *Anisodactylus ovularis.*

Several carabids which are generally very common entirely across Virginia were not captured at Quantico, and it is difficult to explain their absence. These are *Poecilus chalcites, Calosoma scrutator, Cicindela punctulata, Platynus cincticolle,* and *Stenolophus comma* .

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References

Ball, G. E. 1959. A taxonomic study of the North American Licinini, with notes on the Old World species of the genus *Diplocheila* Brullé. Memoirs of the American Entomological Society 16: 1-268.

Bell, R. T. 1960. A revision of the genus *Chlaenius* Bonelli (Coleoptera, Carabidae) in North America. Miscellaneous Publications of the Entomological Society of America 1(3): 97-166.

Bosquet, Y. & 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 67: 1-197.

Brimley, C. S. 1938. The Insects of North Carolina. North Carolina Department of Agriculture, Raleigh, NC. 560 pp.

Davidson, R. L. 1995. First Virginia records for ten species of Carabidae (Coleoptera). Banisteria 5: 16-19.

Erwin, T. L. 1981. The ground beetles of a temperate forest site (Coleoptera: Carabidae): an analysis of fauna in relation to size, habitat selection, vagility, seasonality, and extinction. Bulletin of the Biological Society of Washington 5: 104-224.

Ferguson, H. J., & R. M. McPherson. 1985. Abundance and diversity of adult Carabidae in four soybean cropping systems in Virginia. Journal of Entomological Science 20:163-171.

Freitag, R. 1969. A revision of the species of the genus *Evarthrus* LeConte (Coleoptera: Carabidae). Quaestiones entomologicae 5: 89-212.

Gibbons, J. W., and R. D. Semlitsch. 1982. Terrestrial drift fences with pitfall traps: an effective technique for quantitative sampling of animal populations. Brimleyana 7: 1-16.

Kirk, V. M. 1969. A list of beetles of South Carolina. Part 1 - Northern Coastal Plain. South Carolina Agricultural Experiment Station Technical Bulletin 1033: 1-124.

Kirk, V. M. 1970. A list of beetles of South Carolina. Part 2 - Mountain, Piedmont, and Southern Coastal Plain. South Carolina Agricultural Experiment Station Technical Bulletin 1038: 1-117.

Los, L.M., & W.A. Allen. 1983. Abundance and diversity of adult Carabidae in insecticide-treated alfalfa fields. Environmental Entomology 12:1068-1078.

Mitchell, J. C., S. Y. Erdle, and J. F. Pagels. 1993. Evaluation of capture techniques for amphibian, reptile, and small mammal communities in saturated forested wetlands. Wetlands 13: 130-136.

Noonan, G. R. 1991. Classification, cladistics, and natural history of native North American *Harpalus* Latreille (Insecta: Coleoptera: Carabidae: Harpalini), excluding subgenera *Glanodes* and *Pseudophonus*. Monographs of the Thomas Say Foundation (Entomological Society of America) 13: 1-310.