Survey Report on the Leaf Beetles

(Insecta: Coleoptera: Chrysomelidae)

of Cove Point LNG Property and Vicinity, Calvert County, Maryland

Prepared by Joseph F. Cavey
June 2004

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Abstract

A survey was funded by the Cove Point Natural Heritage Trust to document the leaf beetles (Insecta: Coleoptera: Chrysomelidae) of the Cove Point Liquefied Natural Gas (LNG) Limited Partnership Site in Calvert County, Maryland. The survey was conducted during periods of seasonal beetle activity from March 2002 to October 2003. The survey detected 92 leaf beetle species, including two species not formerly recorded for the State of Maryland and 55 additional species new to Calvert County. The detection of the rare flea beetle, *Glyptina maritima* Fall, represents only the third recorded collection of this species and the only recorded collection in the past 32 years. *Dichanthelium* (*Panicum*) *dichromatum* (L.) Gould is reported as the larval host plant of the leaf-mining hispine beetle *Glyphuroplata pluto* (Newman), representing the first such association for this beetle.

Introduction

This manuscript summarizes work completed in a two year survey effort begun in March 2002 to document the leaf beetles (Insecta: Coleoptera: Chrysomelidae) of the Cove Point Liquefied Natural Gas (LNG) Limited Partnership Site in Calvert County, Maryland, USA. Fieldwork for this study was conducted under contract with the Cove Point Natural Heritage Trust, dated February 28, 2002.

One of the largest insect families, the Chrysomelidae, or leaf beetles, contains more than 37,000 species worldwide, including some 1,700 North American species (Jolivet 1988, Riley *et al*. 2002). This herbivorous group includes some general feeders and many relatively host-specific beetles that feed and develop on one or a few related plants. Some leaf beetles, such as the Colorado potato beetle, cereal leaf beetle and western corn rootworm, cause significant agricultural crop losses or damage environmentally important plants. Others serve as effective biological control agents for invasive weeds, including *Galerucella* beetles on purple loosestrife, Klamath weed beetle on St. Johnswort and *Aphthona* flea beetles on knapweed. Some Chrysomelidae may serve as indicators of environmental composition and condition. By virtue of their host specificity, the discovery of rare chrysomelid species in a particular area can indicate the presence of rare plants or unusual habitat. Conversely, habitats high in floral diversity should exhibit a relatively diverse leaf beetle fauna.

Survey Methods and Materials

Chrysomelids comprise a large group of small, mostly inconspicuous beetles that occupy numerous herbivorous niches in the ecosystem. Many have cryptic habits, drop to the ground, move quickly, jump and/or take flight when disturbed, thereby often evading detection. Adult beetles may be collected on herbaceous and woody plants. In the Mid Atlantic United States, some species persist in the environment as adults throughout the season, while others are present for a short period early or later in the season. However, most species overwinter as adults, feed in the Spring to mature sexually and mate, spend mid Summer in immature stages, and emerge as new adults in late Summer. Thus, in Maryland, although adult leaf beetles may be collected throughout the warm season, peak collection periods occur in mid Spring to early summer and in late summer. At Cove Point in 2002 and 2003, I surveyed a minimum of one day per month from March to September or October and planned additional field days for the peak collection periods. However, excessive drought conditions, heat and dried vegetation reduced leaf beetle activity and incidence significantly throughout most of the summer of 2002 in Maryland. In response, I reduced fieldwork, somewhat, after severe drought effects became evident. In 2003, record moisture limited available survey dates. Nonetheless, I surveyed the property and vicinity on nine days in 2002 and 11 days in 2003.

To organize the Cove Point survey, I artificially divided the property and adjacent area into five collection sites. One site corresponds to the lowland marsh area and the remaining four sites comprise different upland areas. These areas represent habitat at Cove Point most suitable to the majority of leaf beetles, *i.e.* mostly open habitats, composed of numerous and diverse herbaceous and woody plants. Names I chose for these sites indicate major landmarks and include the general vicinity of (1) Beach and Marsh, (2) Lake Levy, (3) Osborne Pond, (4) Pipeline and (5) Route 497. The Pipeline site comprises the open, right-of-way pipeline area located outside of Cove Point LNG security fences, adjacent to and extending into Cove Point Park. The Route 497 site includes roadside habitat adjacent to the Cove Point LNG property. I apportioned survey

time to equitably cover lowland and upland areas and in response to success in collecting unusual and numbers of leaf beetle species.

The most efficient, standard method used to collect most leaf beetle species involves sampling plants with a sweep net. In order to associate host plants with collected leaf beetles, I selectively swept individual plant species or small groups of plants whenever possible, investigated net contents, extracted and preserved captured leaf beetles, and verbally recorded notes on the sampled plants and captured beetles on a digital audio recorder. I also observed plants for signs of leaf beetle damage and hand picked specimens found in the process.

Yellow water pan traps attract and capture some leaf beetles. I used shallow, eight-inch pie pans, painted yellow inside and filled with water and a few drops of detergent to break surface tension. Attracted beetles sink and drown in the water and surfactant. With its varied, low growing flora and diverse habitat, the Pipeline site offered the best potential for trapping with yellow water pans. I set seven water pan traps to capture beetles in different areas of the pipeline site on April 19, June 8 and June 26, 2002. Traps were set at the beginning and collected at the end of each field day. Trap contents were poured through a fine sieve to collect all insects. In the laboratory, trap samples are screened for leaf beetles under the microscope. Because 2002 collection efforts were unsuccessful using this method, I did not employ pan traps in 2003.

Most leaf beetles overwinter as adults in Maryland. As nights cool in September and October, beetles search out protected sites for refuge until Spring. Crevices in thick or loose bark on large trees offer protection from winter weather and, presumably, from predators. Under these conditions, it is very difficult to find inactive, overwintering leaf beetles. To extract them from bark on living trees, I spread a cloth tarp on the ground under the leaning trunk at its most acute angle with the ground and briefly sprayed bark above the tarp with a pyrethrin-based aerosol pesticide. Within 10-15 minutes, beetles hidden in bark crevices lose their grip on the tree and fall to the tarp where they are collected. I sampled 10 trees using this technique on October 12, 2003, at the Pipeline and Beach sites.

Leaf beetles and other insects are often blown by winds into large bodies of water during storms. Some survive the event by grasping onto floating debris that eventually washes onto shore. Moving survivors and less active or dead beetles that visually contrast with beach drift debris may be detected upon close inspection of these materials. This technique is most effective if practiced within one or two days after a storm at times of the year when beetles are actively flying. I examined beach drift for leaf beetles along the shoreline of the Chesapeake Bay at Cove Point on October 12, 2003.

Some leaf beetles are attracted to lights. Approximately 11% (51 of 470) of leaf beetle species that are recorded from or may occur in Maryland have been collected at lights (Cavey & Staines, in prep.). Black light traps have captured or would likely attract and capture most of these species. However, I have collected all but two of these species by other means and, consequently, did not employ light traps for the survey.

Most leaf beetle specimens taken in the survey were killed and preserved in 70% isopropyl or ethyl alcohol. Most specimens were collected in the adult stage; several species were taken as larvae and subsequently reared to the adult stage on their host plants in the laboratory. Teneral specimens (*i.e.* those recently emerged from the pupal stage) were maintained alive until their exoskeleton hardened. In the laboratory, specimens were dried, mounted on pins, labeled and identified. To identify the survey material, I used my personal resources gathered over the past 23 years. These include a library of more than 650 references on leaf beetle taxonomy, distribution and biology, and my specimen collection containing at least several thousand leaf beetles, many collected in Maryland and other Eastern States. I had my identification of one particularly rare species confirmed by a taxonomic specialist with the U.S. Department of Agriculture (USDA).

Results

The survey of leaf beetles at Cove Point began on March 29, 2002. In 2002, the survey consisted of nine collection dates – March 29, April 19, May 10, May 24, June 8, June 26, July 6, August 31, and September 7. Thomas Cavey, my son, assisted me on May 24, July 6 and August 31. I spent a total of 48.5 hours surveying in 2002 and Thomas spent 13.5 hours for a total survey effort of 62 hours. Survey dates in 2003 were April 15, April 27, May 2, June 5, June 29, July 5, July 12, August 9, August 19, September 6 and October 12. On July 12, 2003, a leaf beetle specialist from the USDA, Agricultural Research Service (ARS), Systematic Entomology Laboratory, Dr. Alexander Konstantinov aided in the survey. An entomologist from the USDA Animal and Plant Health Inspection Service (APHIS), Greg Bartman surveyed with me on September 6, 2003. In 2003, I surveyed for 46.25 hours and my colleagues spent 9.75 hours for a total survey effort of 56 hours.

Table 1. **Numbers of Survey Hours Spent by Survey Area in 2002-3003.**

Survey Area	Hours
Beach & Marsh	46.8
Lake Levy	11.5
Osborne Pond	5.5
Pipeline	27.5
Rt. 497	3.5
Total	94.8

Table 1 records the number of survey hours I spent at each area and total hours spent in the field. It does not include an additional 23.25 hours contributed by colleagues. I spent an additional 80 hours traveling to and from the sites (four hour round trips from my residence). I did not record time spent screening, preparing and identifying survey material. An estimate in excess of 55 hours seems reasonable for this taxonomic function.

Figure 1 indicates the percentage of time dedicated to survey at each of the five sites. Nearly half of survey time (49%) was spent in the Beach and Marsh area. Upland areas comprised 51% of survey time, with most effort spent in the productive Pipeline area habitat (29%).

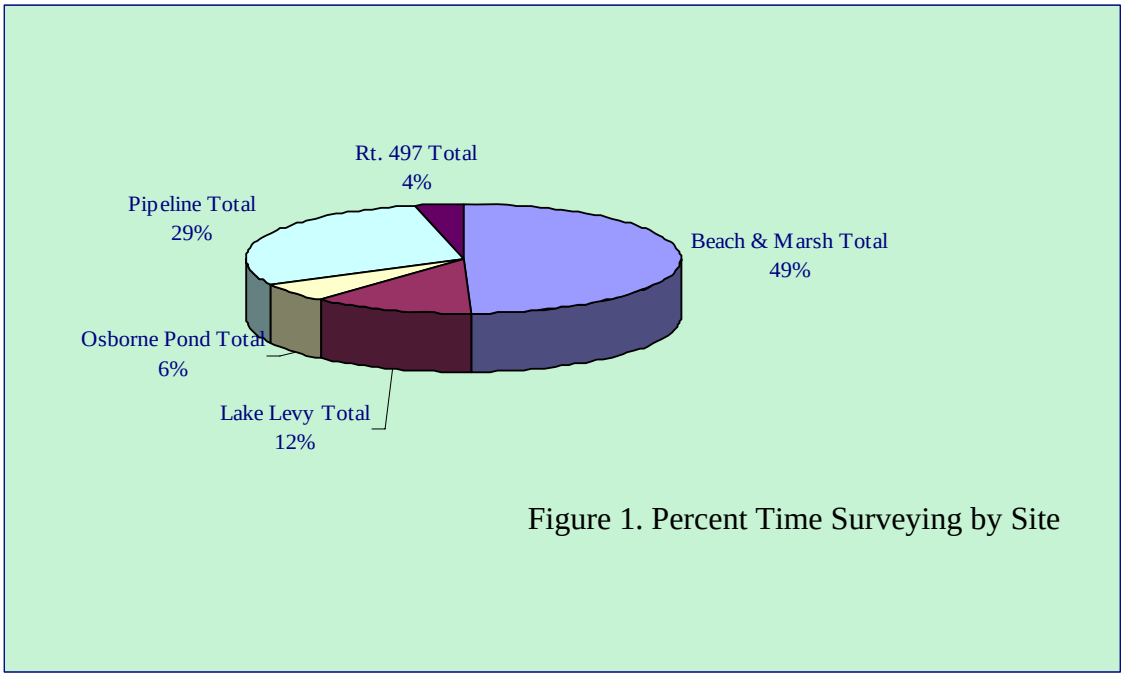

Figure 1. Percent Time Surveying by Site

The survey recorded 92 leaf beetle species at Cove Point LNG and vicinity (Appendices 1 and 2). Two of these species represent new state records and 55 are additional new county records (Cavey & Staines, in prep.). In 2002, I recorded 60 species and the remaining 32 species were recorded in 2003. Appendices 1 and 2 list all collected species and indicates which species are county or state records, whether they were collected in upland or beach and marsh habitat, and collection dates. Table 2 records the number and proportion of leaf beetle species collected in the upland versus the marsh and beach habitat in the Cove Point property and vicinity including those taken from both habitats. Table 3 documents the number of leaf beetle species found by survey date.

Table 2. **Numbers and Proportions of Leaf Beetle Species Collected at Cove Point in 2002-2003 by Habitat**

Cove Point Habitat	**No. Species Collected**	**Proportion of Species Recorded for Cove Point**
Beach/marsh	30	33%
Uplands	45	49 %
Combined Habitats	17	18 %

Table 3. **Numbers of Leaf Beetle Species Detected at Cove Point on Survey Dates in 2002-2003.**

Survey Date	No. Species	Survey Date	No. Species
March 29	5	April 15	8
April 19	5	April 27	12
May 10	17	May 2	14
May 24	18	June 5	21
June 8	17	June 29	19
June 26	17	July 5	6
July 6	17	July 12	13
August 31	10	August 9	20
September 7	6	August 19	8
		September 6	7
		October 12	8

Discussion

Cavey and Staines (in prep.) documented 383 leaf beetles known to occur in Maryland and noted that Maryland's number exceeds numbers of species for all but Georgia of the 14 other States with published lists. The diverse habitat and flora in Maryland undoubtedly contribute to leaf beetle species diversity in the State. However, this high number also likely reflects a long history of collecting insects in Maryland by entomologists employed by and living near the Smithsonian Institution in Washington, D.C., the University of Maryland in College Park, the Maryland Department of Agriculture in Annapolis, USDA-APHIS in Baltimore and the USDA Beltsville Agricultural Research Center. Despite the relatively high incidence of insect survey in Maryland, numbers of recorded leaf beetle species for Calvert County were relatively low. Prior to this survey at Cove Point, 77 species were recorded from Calvert County, and adjacent St. Mary's County has only 63 recorded species (Cavey & Staines, in prep.). By comparison, central Maryland counties have more recorded leaf beetle species, including Baltimore County with 208 and Prince Georges County with 216. These numbers indicated from the beginning that the Cove Point survey offered potential to document additional leaf beetles, particularly those that may be confined to or are more prevalent on the Coastal Plain habitat on the western shore of the Chesapeake Bay in Maryland.

I collected 60 leaf beetle species at the Cove Point LNG and vicinity in 2002 (Appendix 1). In 2003, survey effort produced an additional 32 species, representing a 53% increase in recorded species at this location Appendix 2). Only 37 of 69 species taken in 2003 (54%) were also captured in 2002. The pronounced discrepancy in Maryland between extreme drought in 2002 and record precipitation in 2003 may explain the detection of additional species in the second survey year above expected levels. Nonetheless, this

significant increase illustrates the importance of surveying over multiple seasons to adequately and more accurately inventory the insect fauna of a given area or habitat.

The 92 species collected in two years at Cove Point compares well with numbers listed for some of the most productive sites in Maryland. These sites include Soldier's Delight Natural Environment Area with 115 species, Greenridge State Forest with 82 species, Patuxent Research Refuge with 57 species and Sideling Hill Wildlife Management Area with 54 species (Cavey & Staines, in prep.). These numbers reflect documented holdings of all of the major leaf beetle collections in Maryland including those of state institutions, private workers and the U.S. National Museum of Natural History. This comparison of gross numbers of collected leaf beetles is significant because these four locations have been surveyed repeatedly by entomologists who study beetles (including myself) for one or more decades.

The diverse flora of the Cove Point property likely contributes to the high numbers of leaf beetles found in the vicinity. In the uplands area alone, some 406 hectares of property contains 696 plant species, including 22 species listed as state endangered or endangered extirpated and two species listed as state threatened (Steury 1999). The relatively host-specific, herbivorous Chrysomelidae should thrive in an area of such rich flora. As noted above, these survey results substantiate this relationship.

Figure 1 illustrates how survey effort was divided among the five survey sites. That effort is measured in units of hours spent surveying the property and vicinity. Reduced effort at Osborne Pond and Rt. 497 reflects adjustment to comparably less suitable leaf beetle habitat and limited success in detecting beetles at those sites. Survey effort was nearly evenly divided between sites located in the upland areas (Pipeline, Lake Levy, Osborne Pond and Rt. 497 sites) and that of the lowland Beach and Marsh site. Despite the equivalent effort, more species were detected exclusively in upland sites (49%) than in the beach and marsh site (33%), while 18% of detected species were found in both areas (Table 2). This higher beetle diversity likely reflects higher plant diversity available collectively at upland sites, including that associated with forest seeps and streams at the Pipeline site and the banks and low areas near Lake Levy.

The survey detected leaf beetles rarely collected in Maryland from upland and lowland sites in Cove Point. Both new state records for Maryland, *Glyptina maritima* Fall and *Bassareus detritus* (Olivier) were collected in the Beach and Marsh site. Also from the Beach and marsh area, *Plateumaris shoemakeri* (Schaeffer) was formerly recorded only from Prince George's County and *Phaedon viridis* Melsheimer only from Anne Arundel County and Prince George's County (Cavey & Staines, in prep.). From upland sites, *Cryptocephalus trivittatus* Olivier was formerly recorded only from Worcester County (Cavey & Staines, in prep.) and *Paria pratensis* Balsbaugh from Maryland with no township or county indicated (Balsbaugh 1970).

Results of the Cove Point survey add to our knowledge of leaf beetle distribution and biology. The number of species collected at Cove Point in 2002-2003 represents 70% (92 of 132) of those now recorded for Calvert County (Cavey & Staines, in prep.). By

adding 55 new county and two new state records, the survey increased our knowledge of Calvert County's leaf beetle fauna by 76% (57 new species added to 75 species formerly recorded). Records of all 92 Cove Point detections made during the survey and reports of the two new state records will be published in Cavey & Staines (in prep.). But more importantly, the survey detected several rare leaf beetle species.

The Cove Point specimen of *Cryptocephalus trivittatus* Olivier (taken on June 26, 2002) is only the second specimen I have seen from Maryland (Cavey & Staines, in prep.), although White (1968) reported the occurrence in many Atlantic Coast States, including Maryland. The other specimen was collected in Ocean City in 1976. Little is known of the biology of this species. The literature notes only that *C. trivittatus* was found on hazelnut (*Corylus*) in Indiana and "sweeping herbage in a vacant lot" in Florida (Blatchley 1910, 1924). The Cove Point specimen was collected sweeping mixed plants in the Pipeline site, and no host association could be determined.

Phaedon viridis Melsheimer is a widespread species in the eastern United States but known only from Prince Georges and Anne Arundel Counties in Maryland (Cavey & Staines, in prep.). Although this species was collected from beach drift, cruciferous (cabbage family) hosts known for the beetle (Balsbaugh 1983) occur at Cove Point.

Paria pratensis Balsbaugh was first described as a new species by Balsbaugh in 1970 and recorded from Maryland with no township or county indicated. Because this species closely resembles the common and diverse *Paria fragariae fragariae* Wilcox, the paucity of recorded *P. pratensis* from Maryland may reflect the difficulty in differentiating these two species. Nonetheless, the Cove Point specimen is the first that I have identified from among several hundred *P. f. fragariae* that I have studied.

Glyphuroplata pluto (Newman) belongs to a group of leaf beetles (in the subfamily Hispinae) that mine plant leaves as larvae. Although this uncommon species has been collected from eight other locations in Maryland, it is usually collected as single specimens (Cavey & Staines, in prep.). The biology of *G. pluto* is poorly known. Wilcox (1979) associated this beetle with *Panicum capillare* L. (old-witch grass) without indication of whether the beetle was observed to feed on or mine the leaves of this plant. Although many larvae of hispine leaf beetles occurring in Maryland were described by Ford & Cavey (1985), the larval and pupal stages of *G. pluto* remain unknown to science.

In 2003, I collected four adult specimens of *G. pluto* by sweeping vegetation at the Pipeline site at Cove Point. These detections indicate the largest population of this beetle that I have ever encountered. The specimens were likely taken by sweeping a panic grass, later identified as *Dichanthelium* (*Panicum*) *dichromatum* (L.) Gould, forked panicgrass. Close observation of this plant revealed the presence of some vacant leaf mines and a few occupied by hispine larvae. However, I later reared these larvae in the laboratory and identified the adult beetles as a different, common hispine leaf beetle species, *Chalepus bicolor* (Olivier). Despite these negative results, I believed that it was likely that *G. pluto* develops in this plant because adults of this leaf beetle were swept from *D. dichromatum* on June 29 and July 12, 2003. These collections warranted

subsequent investigation at this productive site, planned for in mid-June 2004, to locate the elusive, undescribed immature stages of *G. pluto.*

On June 9, 2004, I returned to the Cove Point survey site and collected three hispine leaf beetle larvae and three pupae in leaves of *D. dichromatum*. Leaf mines were found sparsely scattered in the host stands (Figure 2), indicating oviposition habits similar to hispine genera *Anisostena* and *Chalepus*. By June 12, one adult *Glyphuroplata pluto* was reared from the collected material, confirming for the first time a larval host, *D. dichromatum*, for this hispine beetle. I preserved the remaining immature specimens of *G. pluto* in anticipation of describing the larval and pupal stages in the future.

Bassareus detritus (Olivier) (Figure 3) was formerly recorded primarily from Atlantic coastal States (Cavey & Staines, in prep.), but not Maryland. At Cove Point, I collected the first of three specimens on June 8, 2002, sweeping sapling hickory and ferns under the hardwood forest canopy west of, and adjacent to the freshwater marsh. Two more specimens were taken on June 5, 2003 in the backdune area of the Chesapeake Bay shoreline, at N38deg26.992', W076deg27.301', by sweeping mixed hardwood trees, including *Prunus*, *Myrica*, indigo bush, sumac, and red cedar. Habits of this species are poorly known. Blatchley (1924) noted one specimen taken by beating Spanish moss in Florida, but no other host associations are reported in the literature. Considering that other species in the genus *Bassareus* have been associated with woody plants (Cavey & Staines, in prep.) and that very few if any leaf beetles feed on ferns, woody plants and, in particular, hickory may be valid host plants for adult *B. detritus*. The larvae and larval habits have not been described for this rare species.

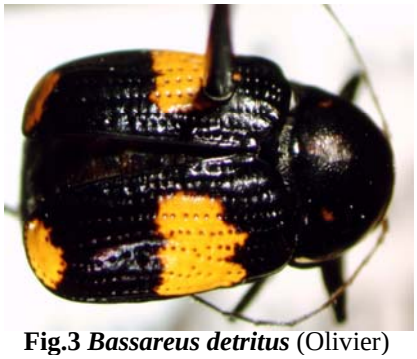

Fig.3 *Bassareus detritus* (Olivier)

The most significant detection of the Cove Point survey was that of *Glyptina maritima* Fall (Figure 4). My identification of this rare species was confirmed by Dr. Alexander Konstantinov, USDA, ARS chrysomelid specialist, in Washington, D.C. *Glyptina maritima* belongs to the largest subfamily of leaf beetles known as flea beetles (the Alticinae), a group so named because powerful femora of their hind legs allow them to jump some distance, like fleas. The exceedingly rare *G. maritima* has been reported only twice, including six specimens from Massachusetts in 1927 and one specimen from Alabama in 1972 (Balsbaugh & Hays 1972). I collected a series of 13 *G. maritima* on the beach at Cove Point on May 10, May 24 and June 26, 2002. Thomas Cavey also collected one specimen on May 24. We collected all specimens of *G. maritima* on the beach in the vicinity of coordinates N38deg23.279', W076deg23.389'. This series of beetles represents the majority of specimens of *G. maritima* ever collected.

Fig.4 *Glyptina maritima*

The only information that we have on the habits of *G. maritima* is speculation that it may be "restricted to the shoreline" (Balsbaugh & Hays 1972). The larva of this species has never been described and its host plant(s) never identified. The Cove Point beetles were swept from *Cakile edentula* (Bigl.) Hook (sea rocket) and *Spartina patens* (Aiton) Muhl. (marsh grass) plants growing in the intertidal zone on the beach of the Chesapeake Bay. Other species in this genus are known to use unrelated plants only in the Euphorbiaceae and Geraniaceae. Steury (1999) recorded six species of Euphorbiaceae and three Geraniaceae from Cove Point. However, I did not locate plants in either of these plant families near the collection site. In fact, all of the *G. maritima* we collected at Cove Point were taken within one 40-50 meter stretch of the beach (Figure 5), mostly within the shade of adjacent honey locust trees. None were found in the backdune area behind the high tide line, even directly behind the collection site. Although the same two potential host plants (*Spartina patens* and *Cakile edentula*) were common throughout much of the beach, intensive survey of other areas along the beach on the same and subsequent survey dates produced no *G. maritima*. This spatial confinement of the *G. maritima* population on plant species common throughout the beach area at the Cove Point survey site suggests that the larval host for *G. maritima* may be a different plant that exists near the collection site.

Fig. 5. Site of G. maritima collections at Cove Point

Continued, careful study of nearby plants may reveal a larval host for this beetle. However, intensive survey of the backdune and intertidal areas of the Cove Point beach during 11 visits in 2003 and a visit on June 9, 2004 produced no more specimens or new information. Larval habits of *Glyptina* species are not documented, and those of *G. maritima* could be any of the varied flea beetle habits. If these larvae feed on plant roots, as do many other flea beetles, it may be difficult to locate larvae of the Cove Point *G. maritima* population.

In that *G. maritima* was previously known from only seven specimens, the detection of this rare species at Cove Point may provide enough biological data to nominate this species for inclusion on State Endangered and Threatened Species list. The limited data we have on *G. maritima* seems to indicate a threatened or endangered status. The known range of this species appears broad, potentially including beaches on the Atlantic and Gulf coastal plains from Massachusetts to Alabama at least. However, very few specimens of *G. maritima* are known to science (21 in all; only seven before the Cove Point discovery).

For most rare beetle species, we cannot conclusively discern whether their rarity reflects a lack of sufficient survey effort, limited ecological niches suitable to those beetles or the effect of other environmental conditions. However, in this case, survey results from Cove Point indicate that *G. maritima* adult beetles were available for detection for nearly seven weeks (May 10 to June 26) and should be easily detected by conventional beetle collection methods (sampling plants with a sweep net). Additionally, the beetle's range

in Atlantic coastal States encompasses one of the U.S. regions with a comparatively high level of beetle collecting activity by professional entomologists. Therefore, we may conclude that populations of *G. maritima* should have been detected more frequently unless they exist in limited locations and/or exhibit low numbers of individuals.

Glyptina maritima may be limited in distribution and numbers of individuals by declining beach habitat. Validation of this theory will likely require definitive identification of one or more host plants used by *G. maritima*, *i.e.* if the beetle uses a single host plant that plant is tied to beach habitat and the plant is declining in numbers and/or geographic range, then populations of the beetle are threatened.

In summary, results from this two-year survey for leaf beetles of the Cove Point LNG area indicate the need to survey Coastal Plain ecosystems to better document the fauna. The survey added 57 leaf beetle species to the 77 formerly recorded for Calvert County, Maryland. Two of those new records were also new to the State of Maryland. Several of these records represent uncommon species reported from the Atlantic States but with little known of their biology. One particularly rare species, *Glyptina maritima*, was collected in sufficient numbers exclusively on the Cove Point beach to substantiate previous speculation that it may be restricted to beach communities. Further investigation at the collection site could provide currently unknown information on the adult and larval host plant(s), biological habits and previously undiscovered larval specimens. Furthermore, *G. maritima* may merit State endangered or threatened candidate status because of its rarity and apparent ties to limited estuarine beach habitat.

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Appendix 1. Alphabetical List of Leaf Beetles Collected During a Survey of Cove Point, Calvert County, Maryland, from March 29 to September 7, 2002

Species	Subfamily	Marsh	Upland	29-Mar	19-Apr	10-May	24-May	8-Jun	26-Jun	6-Jul	31-Aug	7-Sep	Record
Acalymma vittatum (Fabricius)	Galerucinae	x								x			x
Altica foliaceae LeConte	Alticinae	x								x		x	County
Altica litigata Fall	Alticinae	x	x				x	x	x				x
Anomoea laticlavia laticlavia Forster	Clytrinae		x							x			County
Baliosus nervosus (Panzer)	Hispinae		x										x
Bassareus detritus (Olivier)	Cryptocephalinae	x						x					County
Blepharida rhois (Forster)	Alticinae	x				x							State
Calligrapha bidenticola bidenticola Brown	Chrysomelinae	x	x							x			County
Capraita circumdata (Randall)	Alticinae		x			x	x						County
Capraita obsidiana obsidiana (Fabricius)	Alticinae		x										x
Capraita sexmaculata (Illiger)	Alticinae	x											County
Ceratoma trifurcata (Forester)	Galerucinae		x				x		x				County
Chaetocnema denticulata (Illiger)	Alticinae	x				x			x	x		x	x
Chaetocnema minuta Melsheimer	Alticinae		x										x
Chaetocnema pulicaria Melsheimer	Alticinae	x	x			x	x	x		x	x		County
Chaetocnema quadricollis Schwarz	Alticinae		x										x
Chalepus bicolor Olivier	Hispinae		x			x							x
Chelymorpha cassidea	Cassidinae	x							x				County

(Fabricius)													
Chrysochus auratus (Fabricius)	Eumolpinae	x	x			x	x	x	x	x			x
Colaspis brunnea (Fabricius)	Eumolpinae		x						x				x
Colaspis costipennis Crotch	Eumolpinae	x								x			County
Crepidodera nana (Say)	Alticinae	x	x							x			County
Crioceris asparagi (L.)	Criocerinae	x											County
Cryptocephalus leucomelas leucomelas Suffrian	Cryptocephalinae	x											County
Cryptocephalus quadruplex Newman	Cryptocephalinae	x	x					x					County
Cryptocephalus trivittatus Olivier	Cryptocephalinae		x						x				County
Cryptocephalus venustus Fabricius	Cryptocephalinae		x								x		County
Derocrepis eurythropus (Melsheimer)	Alticinae		x	x									County
Diabrotica undecimpunctata howardi Barber	Galerucinae	x	x	x	x		x	x	x	x	x	x	x
Diabrotica virgifera virgifera LeConte	Galerucinae	x											County
Diachus auratus (Fabricius)	Cryptocephalinae	x	x			x						x	County
Dibolia borealis Chevrolat	Alticinae	x					x	x					County
Disonycha admirabilis Blatchley	Alticinae	x											County
Disonycha caroliniana (Fabricius)	Alticinae		x						x				County
Disonycha glabrata (Fabricius)	Alticinae	x											County
Disonycha pensylvanica (Illiger)	Alticinae		x										County
Disonycha xanthomelas	Alticinae		x										x

xanthomelas (Dalman)										
Donacia biimpressa Melsheimer	Donaciinae		x			x				County
Epitrix fuscula Crotch	Alticinae		x			x			x	County
Epitrix hirtipennis (Melsheimer)	Alticinae		x				x			x
Exema canadensis Pierce	Chlamisinae		x		x	x				County
Exema dispar (Lacordaire)	Chlamisinae		x					x		x
Fidia longipes Melsheimer	Eumolpinae	x					x	x		County
Fidia viticida Walsh	Eumolpinae	x								x
Glyphuroplata pluto (Newman)	Hispinae		x							County
Glyptina maritima Fall	Alticinae	x	x		x	x		x		County
Glyptina spuria LeConte	Alticinae		x		x					State
Graphops curtipennis curtipennis (Melsheimer)	Eumolpinae		x	x	x				x	County
Gratiana lutescens pallidula (Boheman)	Cassidinae		x							County
Kuschelina gibbitarsa (Say)	Alticinae	x								County
Kuschelina petuarista (Fabricius)	Alticinae		x			x				x
Kuschelina thoracica (Fabricius)	Alticinae		x			x				x
Kuschelina vians (Illiger)	Alticinae		x							x
Lema trivittata trivittata Say	Criocerinae	x	x						x	County
Leptinotarsa decemlineata (Say)	Chrysomelinae	x			x	x				x
Leptinotarsa juncta juncta (Germar)	Chrysomelinae	x				x				x
Longitarsus insolens Horn	Alticinae		x							County
Longitarsus sp.	Alticinae		x				x		x	County
Mantura	Alticinae		x							x

chrysanthemi floridana (Koch)													
Microrhopala vittata (Fabricius)	Hispinae	x	x	x		x							County
Microrhopala excavata excavata (Olivier)	Hispinae		x										x
Neochlamisus bebbianae (Brown)	Chlamisinae	x	x										County
Neochlamisus gibbosus (Fabricius)	Chlamisinae		x				x		x		x		County
Odontota dorsalis (Thunburg)	Hispinae	x	x		x	x	x	x	x	x	x		County
Ophraella communa LeSage	Galerucinae		x										x
Orsodacne atra (Ahrens)	Orsodacninae		x	x									x
Oulema melanopus (L.)	Criocerinae	x	x	x	x					x		x	County
Pachybrachis hepaticus Melsheimer	Cryptocephalinae	x								x			x
Pachybrachis relictus Fall	Cryptocephalinae	x											County
Pachybrachis spumarius Suffrian	Cryptocephalinae	x											x
Paria fragariae fragariae Wilcox	Eumolpinae	x	x					x					County
Paria pratensis Balsbaugh	Eumolpinae		x								x		x
Paria sexnotata (Say)	Eumolpinae		x		x								County
Paria thoracica (Melsheimer)	Eumolpinae		x										x
Phaedon viridis Melsheimer	Chrysomelinae	x											x
Phyllotreta cruciferae Goeze	Alticinae	x							x				County
Phyllotreta liebecki Schaeffer	Alticinae	x											x
Phyllotreta striolata (Fabricius)	Alticinae	x					x			x			County
Plagiodera versicolora (Laicharting)	Chrysomelinae	x						x		x			County
Plateumaris metallica	Donaciinae		x			x							x

(Ahrens)													
Plateumaris shoemakeri (Schaeffer)	Donaciinae	x					x	x					County
Psylliodes convexior LeConte	Alticinae	x				x							County
Rhabdopterus deceptor Barber	Eumolpinae		x					x					County
Rhabdopterus picipes (Olivier)	Eumolpinae	x						x					County
Rhabdopterus praetextus (Say)	Eumolpinae		x										County
Stenispa metallica Fabricius	Hispinae		x			x							x
Sumitrosis inaequalis (Weber)	Hispinae		x										County
Sumitrosis pallescens (Baly)	Hispinae		x										County
Systena elongata (Fabricius)	Alticinae	x	x						x				County
Trirhabda bacharidis (Weber)	Galerucinae	x	x						x			x	x
Tymnes tricolor (Fabricius)	Eumolpinae		x					x					x
Zygogramma suturalis suturalis (Fabricius)	Chrysomelinae		x						x				x

Appendix 2. Alphabetical List of Leaf Beetles Collected During a Survey of Cove Point, Calvert County, Maryland, from April 15 to October 12, 2003

Species	**Subfamily**	**15-Apr**	**27-Apr**	**2-May**	**5-Jun**	**29-Jun**	**5-Jul**	**12-Jul**	**9-Aug**	**19-Aug**	**6-Sep**	**12-Oct**	**Record**
Acalymma vittatum (Fabricius)	Galerucinae				x								x
Altica foliaceae LeConte	Alticinae												County
Altica litigata Fall	Alticinae	x			x								x
Anomoea laticlavia laticlavia Forster	Clytrinae												County
Baliosus nervosus (Panzer)	Hispinae					x							x
Bassareus detritus (Olivier)	Cryptocephalinae				x								County

Blepharida rhois (Forster)	Alticinae					x				x	x		State
Calligrapha bidenticola bidenticola Brown	Chrysomelinae				x	x		x	x	x	x	x	County
Capraita circumdata (Randall)	Alticinae												County
Capraita obsidiana obsidiana (Fabricius)	Alticinae								x	x			x
Capraita sexmaculata (Illiger)	Alticinae					x							County
Ceratoma trifurcata (Forester)	Galerucinae							x	x				County
Chaetocnema denticulata (Illiger)	Alticinae												x
Chaetocnema minuta Melsheimer	Alticinae		x										x
Chaetocnema pulicaria Melsheimer	Alticinae	x	x	x									County
Chaetocnema quadricollis Schwarz	Alticinae										x		x
Chalepus bicolor Olivier	Hispinae			x	x	x		x	x				x
Chelymorpha cassidea (Fabricius)	Cassidinae												County
Chrysochus auratus (Fabricius)	Eumolpinae				x	x		x	x	x			x
Colaspis brunnea (Fabricius)	Eumolpinae								x				x
Colaspis costipennis Crotch	Eumolpinae												County
Crepidodera nana (Say)	Alticinae				x								County
Crioceris asparagi (L.)	Criocerinae					x							County
Cryptocephalus leucomelas leucomelas Suffrian	Cryptocephalinae					x							County
Cryptocephalus quadruplex Newman	Cryptocephalinae				x		x						County

Cryptocephalus trivittatus Olivier	Cryptocephalinae												County
Cryptocephalus venustus Fabricius	Cryptocephalinae					x	x		x				County
Derocrepis eurythropus (Melsheimer)	Alticinae												County
Diabrotica undecimpunctata howardi Barber	Galerucinae	x			x	x		x	x	x	x	x	x
Diabrotica virgifera virgifera LeConte	Galerucinae									x			County
Diachus auratus (Fabricius)	Cryptocephalinae								x				County
Dibolia borealis Chevrolat	Alticinae												County
Disonycha admirabilis Blatchley	Alticinae			x									County
Disonycha caroliniana (Fabricius)	Alticinae				x								County
Disonycha glabrata (Fabricius)	Alticinae											x	County
Disonycha pensylvanica (Illiger)	Alticinae		x	x	x	x							County
Disonycha xanthomelas xanthomelas (Dalman)	Alticinae		x	x									x
Donacia biimpressa Melsheimer	Donaciinae	x	x	x									County
Epitrix fuscula Crotch	Alticinae												County
Epitrix hirtipennis (Melsheimer)	Alticinae												x
Exema canadensis Pierce	Chlamisinae					x							County
Exema dispar (Lacordaire)	Chlamisinae												x
Fidia longipes Melsheimer	Eumolpinae												County
Fidia viticida Walsh	Eumolpinae								x				x
Glyphuroplata pluto (Newman)	Hispinae					x		x					County

Glyptina maritima Fall	Alticinae												County
Glyptina spuria LeConte	Alticinae					x	x	x					State
Graphops curtipennis curtipennis (Melsheimer)	Eumolpinae								x				County
Gratiana lutescens pallidula (Boheman)	Cassidinae					x			x	x			County
Kuschelina gibbitarsa (Say)	Alticinae			x				x	x				County
Kuschelina petuarista (Fabricius)	Alticinae								x				x
Kuschelina thoracica (Fabricius)	Alticinae												x
Kuschelina vians (Illiger)	Alticinae	x											x
Lema trivittata trivittata Say	Criocerinae				x								County
Leptinotarsa decemlineata (Say)	Chrysomelinae												x
Leptinotarsa juncta juncta (Germar)	Chrysomelinae												x
Longitarsus insolens Horn	Alticinae		x				x						County
Longitarsus sp.	Alticinae												County
Mantura chrysanthemi floridana (Koch)	Alticinae				x	x			x			x	x
Microrhopala vittata (Fabricius)	Hispinae		x	x	x								County
Microrhopala excavata excavata (Olivier)	Hispinae				x								x
Neochlamisus bebbianae (Brown)	Chlamisinae												County
Neochlamisus gibbosus (Fabricius)	Chlamisinae		x		x	x		x			x	x	County
Odontota dorsalis (Thunburg)	Hispinae			x	x	x		x	x				County
Ophraella communa LeSage	Galerucinae	x											x

Orsodacne atra (Ahrens)	Orsodacninae												x
Oulema melanopus (L.)	Criocerinae	x		x		x				x		x				County
Pachybrachis hepaticus Melsheimer	Cryptocephalinae									x						x
Pachybrachis relictus Fall	Cryptocephalinae						x									County
Pachybrachis spumarius Suffrian	Cryptocephalinae									x						x
Paria fragariae fragariae Wilcox	Eumolpinae	x			x	x				x						County
Paria pratensis Balsbaugh	Eumolpinae															x
Paria sexnotata (Say)	Eumolpinae					x							x			County
Paria thoracica (Melsheimer)	Eumolpinae									x						x
Phaedon viridis Melsheimer	Chrysomelinae													x		x
Phyllotreta cruciferae Goeze	Alticinae							x								County
Phyllotreta liebecki Schaeffer	Alticinae				x											x
Phyllotreta striolata (Fabricius)	Alticinae							x	x							County
Plagiodera versicolora (Laicharting)	Chrysomelinae															County
Plateumaris metallica (Ahrens)	Donaciinae			x												x
Plateumaris shoemakeri (Schaeffer)	Donaciinae					x										County
Psylliodes convexior LeConte	Alticinae			x												County
Rhabdopterus deceptor Barber	Eumolpinae															County
Rhabdopterus picipes (Olivier)	Eumolpinae															County
Rhabdopterus praetextus (Say)	Eumolpinae									x				x		County
Stenispa metallica Fabricius	Hispinae			x	x											x
Sumitrosis inaequalis (Weber)	Hispinae					x										County
Sumitrosis pallescens	Hispinae				x											County

(Baly)						
Systena elongata (Fabricius)	Alticinae		x		x	County
Trirhabda bacharidis (Weber)	Galerucinae	x		x		x
Tymnes tricolor (Fabricius)	Eumolpinae					x
Zygogramma suturalis suturalis (Fabricius)	Chrysomelinae					x