

**DISTRIBUTION AND ABUNDANCE OF
CICINDELA PURITANA AND *C. DORSALIS*
DORSALIS IN MARYLAND, 2005**

Part 1: *Cicindela d. dorsalis* and *C. puritana* in Calvert County

Part 2: *Cicindela puritana* near the Mouth of the Sassafras River

Part 3: *Cicindela d. dorsalis* at Janes and Cedar Islands

FINAL REPORT

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ABSTRACT

1. This report presents the results of annual surveys of two rare Maryland tiger beetle species, *C. puritana* and *C. dorsalis*, in 2005. All sites where both species occur in Maryland were surveyed.
2. The 2005 Calvert County surveys produced a total count at all sites of 1101 *C. puritana* and 750 *C. dorsalis*. The numbers of *C. puritana* are the lowest recorded for any year and compare with other low recent counts of 1909 in 2003 and 2027 in 2002, and the higher count of 2167 in 2004. The 2005 results confirm a declining metapopulation since the early to late 1990's. This low count was caused primarily by the decline of adults numbers at Warriors Rest (and Scientists Cliffs) with only 111 compared to 447 last year and at Western Shores plus Calvert Beach with only 232 compared to 1279 last year. Calvert Cliffs State Park was surveyed for the first time since 1998 and produced a count of 242 adults of *C. puritana*.
3. The 750 *C. dorsalis* in 2005 was comparable to the lowest ever count of 722 last year and the 781 in 1998. The decline in abundance in these past two years were primarily a result of a significant decline at Western Shores (which had 2459 in 2003, but only about 600 in 2003 and 2004) and at Flag Ponds (which had 748 in 2003 but <130 in both 2003 and 2004). The low numbers for both *C. puritana* and *C. dorsalis* is uncertain but may be due at least in part to continuing effects of hurricane Isabel in September 2003. Recovery from this effect may be realized if there is increased abundance of both species in 2006 and 2007.
4. The total count for Sassafras River *C. puritana* was 386, the lowest ever numbers and comparable to other recent low counts of 398 in 2004, 400 in 2002 and 411 in 1999. The only other recent count was 630 in 2003. These low counts are largely a result of the significant decline at Grove Point which has typically had well over 50% of the total Sassafras metapopulation numbers. Three populations did have increases in 2005: West Betterton with 52 compared to 34 in 2004, East Lloyd with 73 compared to 11 in 2004, and East Turner with 35 compared to 8 in 2004. Numbers at all sites continue to be well below the peak numbers in the early 1990's. The low numbers at these sites in recent years are believed due to increasing vegetation growth on the bases and faces of the cliffs and/or narrowing beach width.
5. The populations of *C. d. dorsalis* at Janes and Cedar Islands increased significantly from last year, Janes numbers to 2475, compared to 369 in 2004 and a record high of 6094 in 2003 and Cedar to 1298 compared with 528 in 2004 and 2229 in 2003.

Part 1. Surveys of *Cicindela d. dorsalis* and *C. puritana* in Calvert County

INTRODUCTION AND METHODS:

This part of the report presents the results of continuing monitoring studies for two rare tiger beetles in Maryland. The two Federally Threatened species are *Cicindela puritana* (Puritan Tiger Beetle) and *C. d. dorsalis* (Northeastern Beach Tiger Beetle), and both occur in Calvert County. Annual surveys, using similar methods, have been conducted for these two species at these same sites in Calvert County since 1988. The survey results with these two insects have provided us with two of the longest monitoring histories for any insect.

The objectives of our 2005 surveys were the same as in previous years: to obtain counts of adults of these two tiger beetle species using a standard survey method under ideal conditions so that population trends can be determined. The surveys are done during the season of peak abundance, usually from late June to mid-July. In 2005, the surveys for adults at the Calvert County sites were conducted between July 5 and 9. Conditions on all survey days were sunny to partly cloudy with temperatures in the low to upper 80's. All of the sites were surveyed at low to mid-tide. The survey method we used was the same as in all previous years. One person walked slowly along the shoreline at the water edge and counted all adults that were seen. In areas where there was a narrow beach or cliffs near the water, the base of the cliffs was examined and beetles there included in the count. In sections of wider beach the surveyor moved more slowly so the back portions of the beach could be surveyed. In 2005 we made counts within the same sections of shoreline as in 2004. A Garmin GPS unit was used to locate these coordinates. Consequently, we used the same waypoint numbers and these were indicated on the same GIS/topographic map sections as in 2004. Shoreline characteristics were also recorded for each of these sections and included in the report tables.

RESULTS AND DISCUSSION:

Summary of *C. puritana* Trends. The **total number of adult *C. puritana* at all sites in 2005 was 2167** (Table 1). This count is the lowest ever recorded since the annual

counts were begun in 1988, and even included a count at Calvert Cliffs State Park for the first time since 1998. The 2005 total is similar to the previous lowest counts of 1909 in 2003, 2027 in 2002 and 2167 last year (2004). The low count of 1668 in 1994 was, in part, a result of one major site not being included. Although the counts have widely fluctuated over the years, often 2-3 fold from one year to the next, the Calvert metapopulation shows a distinct trend of declining numbers since the early to late 1990's. This is demonstrated by the progressive decline since 1998 to 2000 and by the recording of four of the five lowest counts in the last four years. Total counts in the late 1980's and most of the 1990's were over 3000 in most years and reached high counts of over 6000 in four years to a high count of 11,431 in 1988, the first year of the counts.

The low total count in 2005 was caused primarily by a significant decline of adults at Scientists Cliffs (including the Warrior Rest section in previous counts) and at Western Shores + Calvert Beach. In most previous years the totals for these sites combined had over 1000 adults and usually over 1500, but totaled only 498 in 2005. Even in 2004 when totals were only 2167, the count at these sites totaled 1747. Changes at other sites in recent years have had less of an effect on the total decline but numbers at Little Cove Point and Cliffs of Calvert were also among the lowest in recent years. The specific causes for this significant decline in recent years are uncertain, but our field observations suggest there is both increased vegetation growth on some of the cliff habitat and a narrowing of the sandy beaches at the cliff base. Each of these conditions reduce habitat quality for *C. puritana*. The negative effect of vegetation growth may be increasing because of the lack of significant beach and cliff erosion to keep the habitat open and suitable for *C. puritana*. However, there was a significant amount of new erosion of both beaches and cliffs seen in the 2004 surveys, apparently a result of Hurricane Isabel. This may explain some of the recent decline, especially in 2005 when reduced recruitment or high larval mortality in 2003 could have become realized. These erosional impacts could eventually benefit both *C. puritana* and *C. dorsalis*, possibly within the next year or two, by increasing habitat and thus recruitment of new larvae at these sites. The increased narrowing of beaches may be the result of increased water levels from sea level rise.

Summary of *C. dorsalis* Trends. The total count for **adult *C. dorsalis* at all sites in 2005 was 746, the second lowest ever count to the 722 in 2004.** The other lowest count was 781 in 1998 (Table 2). As with *C. puritana* adult numbers of this species have fluctuated widely from year-to-year but the two-year total for 2004 and 2005 is significantly lower than any other two-year period. In the early 1990's total numbers were over 6000 in most years and over 10,000 in both 1991 and 1992. The numbers in recent years have been largely driven by the numbers at Western Shores since all other populations have declined to very low levels during this period. After increasing declines in the 1990's numbers at Western Shores then increased to 2209 in 2003 before the significant declines in 2004 and again in 2005. It is likely that some of the decline in these past two years was a result of Hurricane Isabel. There was clear evidence of very significant erosion of the beach and cliff base at this site in summer 2004, some still evident in 2005. Hopefully, numbers will increase in 2006 and 2005 as a result of

additional habitat (beach width) and more adults from better recruitment in 2004 and 2005.

Summary Results for Individual Calvert Sites. Table 3 gives the results of the surveys at all Calvert sites in 2005. Included are the adult numbers for both *C. puritana* and *C. dorsalis*, shoreline characteristics for each section of shoreline, and the coordinates of each waypoint. The locations of these waypoints are shown on the topographic maps included with the report.

RANDALL CLIFFS. This is the northernmost *C. puritana* site in Calvert County and has had consistently low numbers of usually less than 100 since 1990, except for a count of 234 in 2001. The count of 31 in 2005 was comparable to the 27 in 2004 and the same number as in 2003. Numbers for this site have been less than the overall average of 72 per year for the past 4 years, but the cause of the decline is not known. It is apparent at least in recent years that this site has a relatively small amount of suitable habitat, primarily very narrow beach width throughout most of the length and only limited sections of suitable cliff. The beach here is restricted to very small patches and even those are covered at mid-tide levels. There seems to be evidence of progressive and significant erosion here in the past 10 or more years.

CAMP ROOSEVELT. There were no adults observed at this site again in 2005, as in each year since 2002. Since a count of 12 in 1995, this site has had counts of 0 to 2 adults, and only in three years from 1986 to 1991 were there more than 17 adults. This site has always been an apparent marginal site, although 73 adults were found here in 1988 and early workers seemed to regularly find adults at this site. It is a relatively long site but the beach is narrow and/or the cliffs are dry and with very little sandy substrate needed for oviposition by *C. puritana*.

BAYSIDE FOREST. This site had no adults in 2004 and only 2 were seen in 2005. There were only 6 adults in 1989 but most years there were 40 or more adults, and a peak number of 149 was recorded in 2003. Observations during the 2004 survey indicated this site experienced very severe erosion, apparently due to Hurricane Isabel. Most of the shoreline and especially the southern portions where beetles were always most common lost several meters or more of cliff face with extensive cliff breakdown and trees littering the beach and cliff base. There were also tracks and compaction from heavy equipment on the beach, apparently being used to clear the beach of downed trees. In 2005 there was no evidence of the downed trees and rubble or of heavy equipment on the beach. However, the beach was wide and cliffs relatively unvegetated. Numbers were probably low again in 2005 due to the hurricane impacts on the 2003 larval cohort which would have been adults in 2005.

WARRIOR'S REST AND SCIENTISTS CLIFFS. This very long section of shoreline is now separated into two sites because of differences in ownership and management. In previous years the beetle counts were combined. The Warrior Rest count was 155 *C. puritana* in 2005, and 111 were counted at Scientists Cliffs. This is the second lowest combined total (266) ever recorded for this area. The previous low total

was 256 in 2003, but numbers were also low in 2004 (447). The low numbers at these sites compared to earlier years have contributed significantly to the overall decline of the Calvert metapopulation. In most earlier years, numbers ranged from 1000 to over 2000 adults, and were as high as 3792 in 1998. There has been a recent pattern of decline from 2317 in 2000, 1375 in 2001, and 691 in 2002, and the two even lower counts in the past two years. Our observations in recent years suggest a decline in the amount and suitability of habitat at this site. One change is increasing vegetation along the very extensive groin section in the northern part of Scientists Cliffs. Only 37 adults were found in this section in 2005. Even though this section has never supported very large numbers of adults, the decline in more recent years is significant. Much more important in contributing to the decline in numbers in this section of shoreline is the decline at Warrior Rest which over the years has consistently supported a high proportion of adults of the combined Scientists Cliffs/Warrior Rest shoreline. Another major effect seems to be “natural” erosion. The Warriors Rest section has always had a narrow beach, making it difficult to survey, but the width seems to be getting increasingly narrow. Such narrow beaches make it impossible for adults to effectively forage, and thus may reduce feeding and ultimately oviposition and recruitment. Large numbers of *C. puritana* have apparently existed here because of the very good cliff habitat characterized by abundant deposits of suitable upper sandy strata. The southern end of Scientists Cliffs, south of the public beach has a length of suitable beach and cliff habitat and has supported variable numbers of adults over the years. This south section had 74 of the 111 total for Scientists Cliffs in 2005.

The public beach portion of Scientists Cliffs had a very large population of *C. dorsalis* until the mid-1990's, but after that numbers began a dramatic decline and had disappeared by 2001. Small numbers of adults were found at the far south end of Scientists Cliffs in 2002 and 2003 and 2 were found in 2005, but no population has become established there.

WESTERN SHORES ESTATES/CALVERT BEACH. These two sites are now combined because of comparable management options. This is also logical because they are part of the same section of shoreline and the same populations of *C. puritana* and *C. dorsalis*. It is the only site in Maryland with large populations of both of these species. The total number of *C. puritana* in 2005 was a second lowest ever (combined) count of 232. The lowest count of 101 in 1994 was recorded during unfavorable survey conditions. The 2005 count is significantly less than the 1279 in 2004 and the 577 in 2003. The *C. puritana* at this site have always been at the southern end of the Western Shores part, adjacent to Calvert Beach where cliffs are very well developed and beaches relatively narrow. There is some evidence for a recent decline in the quality of *C. puritana* habitat at this site because of increased growth of vegetation on and along the base of the cliffs. This vegetation now includes larger trees and dense shrubs which probably block the movement of adults of *C. puritana* up and down the cliffs as they switch from foraging on the beach to oviposition on the cliff face. Observations in 2004 indicated that erosion, probably from Hurricane Isabel, pushed up new sand onto the beach and cleared out some of the vegetation along the cliff base. This could prove beneficial for both species' populations in the next few years.

The number of *C. dorsalis* at this site in 2005 was 623, a count nearly identical to the 627 in 2004. This species has been variable in distribution over the years, sometimes along all sections but most often in the middle and north sections. Some years adults have also been present in the northern public beach. In 2005 and 2004, most adults were in the middle section (near where most *C. puritana* were found) and a smaller concentration in the northern section. This increasing overlap in the distribution of the two species may result in increasing competition, and has been caused by an interesting transition of the shoreline in the middle portion of the site, the area which formerly separated Western Shores and Calvert Beach. The beach has been progressively moving southward with increasing beach width. The result has been an extension of the *C. dorsalis* habitat southward into Calvert Beach where *C. puritana* has been dominant. Before 1999 there were few or no *C. dorsalis* within the limits of Calvert Beach, but the numbers there have increased from 2000 to the present, as the beach has widened in the northern part of the former Calvert Beach.

FLAG PONDS. The number of adult *C. dorsalis* here was 121 in 2005, a count similar to the second lowest ever count of 80 in 2004. This site has experienced a very significant decline in abundance since the mid-1990s when there were consistently over 1000 adults. Numbers were even higher into the early 1990s when they reached peaks of over 3000 in several years. The only high count (over 225) in the past nine years was 748 in 2003. That count suggested the population was building back up as adults were recruiting significantly in the northern part of the shoreline at the site. The declines in 2004 and 2005 could be due to impacts from Hurricane Isabel eroding out many developing larvae in September 2003 and thus reducing numbers of adults emerging in 2004 and 2005. If the hurricane was a factor, numbers should begin increasing in 2006. Most adults in recent years have been largely concentrated in the spit beach near the north end of the site.

CALVERT CLIFFS NUCLEAR POWER PLANT. This shoreline has supported a moderate population of *C. puritana*, but numbers have been highly variable from year-to-year. No count was made in 2005 because of difficulty of access due to a high security alert. The adult count was 121 in 2004, about half the 2003 count of 226. The range of numbers at this site included a high of 616 in 1998 and a low of 49 in 1999. Most adults have been concentrated near the middle and at the south end of the site where there is good cliff and beach habitat. Much of the rest of the site has a narrow or rocky beach.

COVE POINT. No adults of *C. dorsalis* were found at this site in 2005, suggesting the low and declining numbers here since 1996 have finally culminated in the apparent loss of this population. The very low numbers of adults (<20 counted in 4 of the past 5 years) indicated this population was at risk of extinction. Counts of over 300-400 were found in the late 1980's to early 1990's, but after that there was a significant decline. There has been significant erosion in the northern part of this site where beetles once occurred, but other factors could be involved in decline (such as heavy shell cover on the beach or *Phragmites* encroachment). The adults at this site in recent years have consistently been concentrated in a small section near the middle of the site.

LITTLE COVE POINT. This long section of shoreline with extensive cliffs and mostly narrow beach has consistently (except for a very few years) supported a moderately large population of *C. puritana*. The count of 298 in 2005 is very similar to the 251 in 2004. These two counts are however among the lowest at this site which has a current average of 399 per year. There were 586 in 2003 and a highest ever count of 913 in 1996. Adults have typically been found along the whole length of this site, but usually in concentrated patches where there are tall, bare cliffs with moderate to narrow width beaches. These alternate with areas without cliffs. Most adults in 2005 and in 2004 were in the middle section of the site (points 160-164). There have been some shoreline modifications in this and the adjacent Cliffs of Calvert shoreline in recent years, and these could be having some negative effect on habitat quality.

CLIFFS OF CALVERT. This site borders the above site and thus supports a part of the same *C. puritana* population. The count in 2005 was only 30 adults and comparable to the 42 adults counted here in 2004. The highest count at this site was 913 adults in 1996, and the current average per year is 241. As in previous years, nearly all of the adults were in a short section in the middle portion of the site. The limiting factor at this site may be the narrow beaches over most of the site's length since there is a long section of tall cliffs with suitable substrate, seemingly capable of supporting larger numbers.

DRUM POINT. No survey was done at this site in 2005, but in 2004 and other recent years, no adults of *C. dorsalis* have been found. This site supported a small number of adults for several years from 1988 to 1994 when the population built up to a peak count of 90 in 1989, but after that no adults were seen.

Part 2. Surveys of *Cicindela puritana* around the Mouth of the Sassafras River, Maryland.

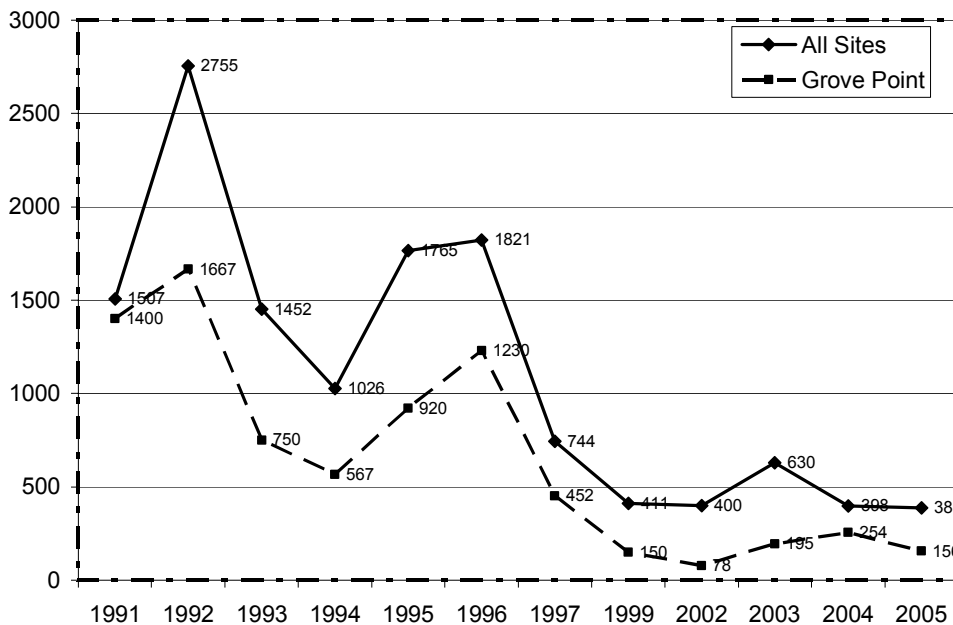
INTRODUCTION AND METHODS:

This part of the study involved a survey of the 9 sites in the area around the mouth of the Sassafras River in the upper Eastern Shore of Maryland. Surveys at these sites were conducted on July 12, 2005. Weather conditions were favorable for the surveys: clear skies with warm temperatures (in the 80's), light winds, and tides at mid- to low levels. Two workers conducted the surveys, each covering different sections of shoreline. The survey methods used were the same as in the Calvert surveys described previously. Adults were counted along separate sections of the shoreline at each site and shoreline characteristics noted. A GPS was used to match the waypoint locations from the 2004 surveys so that adult numbers within the same sections of shoreline could be compared.

RESULTS AND DISCUSSION:

The results of these surveys produced a **total count of 386 adult *C. puritana* for all Sassafra River sites in 2005**. This count is comparable to the 398 in 2004 and the counts of 400 in 2002 and 411 in 1999 (Tables 4, 5). The highest recent counts were 630 in 2003 and 744 in 1997. The 2005 results further confirm the significant decline of the Sassafra River metapopulation since 1996, and the decline of all individual populations. Counts from 1991 to 1996 were near or over 1500 in all years except 1994, but after 1996 there was a significant decline (Fig. 1). Even though numbers at all populations has declined, the largest portion of the decline in recent years has been accounted for by the decline at Grove Point, which has typically had more adults than all other sites combined.

Fig. 1. Counts of Adult *C. puritana* at Grove Point and all Sassafra River Sites, 1991-2005



Numbers at all sites in 2005, except West Betterton, East Lloyd and East Turner had similar or lower numbers than in 2004. The Grove Point count was 156 during our first survey, but a survey a week later produced a count of 182. Both of these counts are among the 4 lowest counts recorded at this site, and indicate a significant decline from the 254 adults counted in 2004. Other recent counts were 150 in 1999, 78 in 2002 and 195 in 2003. Adults at this site were scattered over a fairly large portion of the shoreline but most were concentrated in a short section near the middle of the site, points 63 to 65, and nearly all others from points 65 to 69. This is the section that has consistently supported the largest numbers of adults. Although this site includes a rather long section of shoreline, most is now less suitable habitat, either because the beach is too narrow or rocky and/or the cliffs are too vegetated or with too little sandy substrate. The new 2004 survey location site north of Grove Point which had 45 adults then had none in 2005.

This site had a narrow or rocky beach and mostly low or vegetated cliffs and did not seem to be high quality habitat.

Ordinary Point had 28 adults in 2004 compared to 40 in 2004, 9 in 2003 and 0 in 2002. Most adults were concentrated near the north end of the site as in 2004. This site includes a long section of shoreline with sections of suitable cliff habitat and other sections that are apparently too vegetated. There is very little wide beach at this site which reduces overall habitat suitability.

Adult numbers at other the sites with previous moderate to larger populations were again low: North Stillpond (26 in 2005, 42 in 2004) and West Betterton (52 in 2005, 34 in 2004). North Still Pond had adults along most of its length except at the south end and adults were in the same locations as in 2004. The beach at North Stillpond is relatively wide but only limited sections of the cliffs are suitable because they are too vegetated or rocky. West Betterton includes a relatively long section of shoreline, but adults were concentrated near the far eastern end of the site, nearest to the town of Betterton. Much of the length of the site is non-habitat because of rip-rap or heavily vegetated cliffs. Beaches are also very narrow along the whole length. East Lloyd has had highly variable numbers over the years, but some sections of suitable habitat. Observations in 2004 indicated that nearly all of the site had a very narrow beach and much cliff vegetation which might explain the small numbers of adults present.

East Betterton and West Turner both had counts of less than 15 adults in both 2004 and 2005. These numbers are low enough to seriously threaten the viability of these populations. East Betterton has had consistently low numbers and very little suitable habitat. The cliffs are very vegetated and the beach very narrow throughout. The West Turner Creek site includes small sections with limited habitat and has had counts of 20 or less since 1997. Probably the primary limiting factor at both of these sites were very narrow beaches and rather heavily vegetated cliffs and bases of the cliffs. Two sites did show a very significant increase in adult numbers. Numbers at East Lloyd increased to 73 in 2005, compared to 11 in 2004 but less than the 160 in 2003. Numbers at this site have been highly variable over the years, but some sections of the site have suitable habitat and sporadically produce moderate numbers. Observations in 2004 and 2005 indicated that nearly all of the site had a very narrow beach and much of the cliff was vegetated, possibly accounting for low numbers in most recent years. The East Turner Creek site showed a significant rebound in numbers in 2005 (35 adults counted) compared to the numbers of less than 10 since 1996.

The cause of the decline in the *Sassafras* metapopulation over the past 8 years is uncertain, but our observations during these surveys suggest it is probably a result of a decline in habitat suitability. We have noted a progressive increase in the growth of vegetation on the cliff faces and especially at the base of the cliffs at most sites. During the past few years' surveys we noticed that at several sites, there has been rapid growth of woody vegetation in areas of former habitat. This vegetation can have several negative impacts on the *C. puritana* population. The cliff vegetation and especially that along the back beach and base of the cliffs will prevent or reduce the movement of adults or

prevent them from utilizing the foraging areas on the beach. Their movement to suitable oviposition sites on the cliff faces may also be impeded. We are uncertain of the cause of this apparent increased vegetation growth. Shoreline erosion and coincidental cliff face erosion should be occurring and apparently has occurred regularly in the past, thus providing suitable habitat for *C. puritana*. An absence or reduction of storms and other erosional episodes in recent years could logically explain the increase in vegetation. It may also be the composition of the vegetation on the cliffs is changing to more invasive species or to plants more resistant to erosion and/ or more effective in stabilizing the cliff faces.

Part 3. Surveys for *Cicindela dorsalis dorsalis* on Janes and Cedar Islands, 2005.

INTRODUCTION AND METHODS

These two sites on Maryland's Eastern Shore have had the two largest populations of *C. d. dorsalis* in Maryland in recent years. They are at the northern end of the species range within the Chesapeake Bay, both isolated, large sites that are not affected by human impacts. The 2005 surveys were conducted by Jim McCann and Dave Brinker on July 11. Conditions were sunny and warm and suitable for producing a high level of *C. dorsalis* activity and thus abundance. The methods used were as described in part one of this report. Numbers of two other common tiger beetles, *Cicindela hirticollis* and *C. marginata*, were also recorded in Table 6.

RESULTS AND DISCUSSION

The results of the Janes and Cedar Islands surveys are given in Table 6 along with results from 2004. It includes the numbers of adults within shoreline sections at each site and relevant shoreline characteristics for each section. Locations of these sections and the waypoints recorded with GPS units are shown on the included topographic maps. **The total number of adult *C. d. dorsalis* counted at Janes Island in 2005 was 2475.** This number represents a significant increase from the lowest ever count of 369 in 2004. Previous counts at this site included an extremely high count of 6094 in 2002, and significantly lower numbers of 938 in 1997 and 1991 in 1998. In 2005 as in previous years, numbers varied significantly along the different sections of the island, but largest concentrations were in the area of Rock Pond (points 9-11), Back Creek (points 23-28), and just south of this previous section (points 31-33). A section near the middle (points 18 to 22) and at the south end (36-42) had no adults. Counts of co-occurring species were 201 for *C. hirticollis* (compared to 29 in 2004) and 1173 for *C. marginata*, a significant increase from the 400 in 2004.

The 2005 adult count at Cedar Island was 1298, compared to 1095 in 2004. This site exhibited generally less variation than Janes with previous counts of 2464 in 2002, 1495 in 1998, and 669 in 1997. In 2005 the adults were generally distributed along most of the length of the west-facing shoreline of the island, but highest concentrations were along the middle section of the shoreline (map points 7-10); this is the section of

shoreline fronting Cow Point Creek. Very few adults were found along the southern shoreline opposite Cedar Island Creek. These areas of concentration were comparable to those found in 2002 and 2004. Counts of other co-occurring species were 528 for *C. hirticollis* (compared to 483 in 2004) and 2229 for *C. marginata* (compared to 963 in 2004).

The cause of significant increase in adult abundance at Janes Island from 2004 along with the slight difference in adult numbers at Cedar Island from last year is puzzling. Most often these two sites have fluctuated in a relatively similar pattern of abundance, except in the last two years. The dramatic decline at Janes in 2004 may have been a result of impacts from Hurricane Isabel that struck the Chesapeake Bay area on September 18, 2003. Many western shoreline sites surveyed in Virginia has similar levels of decline in 2003, but most of a few eastern shoreline sites surveyed had little change. However, Cedar experienced a much lower decline in 2004. The 7-fold increase in numbers at Janes from 2004 suggests significant recovery if the 2004 decline was due to hurricane effects. In general, the causes of these increases and decreases of this species have not been easily determined, in part because more intensive studies of habitat and beetle ecology are necessary to monitor the many factors that might be involved in driving fluctuations.

Adult counts at Janes and Cedar Islands in all survey years:

	<u>1997</u>	<u>1998</u>	<u>2002</u>	<u>2004</u>	<u>2005</u>
Janes Island	938	1991	6094	369	2475
Cedar Island	669	1495	2464	1095	1298

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TOPOGRAPHIC MAPS OF SURVEY
SITES SHOWING SITE BOUNDARIES
AND SURVEY SECTIONS

CALVERT COUNTY SITES

SASSAFRAS RIVER SITES

CEDAR AND JANES ISLANDS