

Interim Core Map Documentation for Northeastern Beach Tiger Beetle

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Interim core map developed by the Center for Biological Diversity¹

Documentation supplemented by EPA's Office of Pesticide Programs

Species Summary

Northeastern beach tiger beetle (*Habroscelimorpha (=Cicindela) dorsalis dorsalis*; EntityID #442) is a threatened terrestrial invertebrate, which once was abundant along coastal beaches throughout much of the northeast. There is no designated critical habitat for this species. This species inhabits northeastern natural and wider beaches (>2 meters [m]) including Maryland, Massachusetts, New Jersey, Virginia. Additional information is provided in **Appendix 1**. This species is currently included in the Insecticide Strategy.

Description of Core Map

The core map for the Northeastern beach tiger beetle is based on species range, which spans coastal beaches throughout Maryland, Massachusetts, New Jersey, and Virginia states. The species range is reasonably refined and represents areas important for this species' conservation. There is no designated critical habitat. Figure 1 depicts the interim core map for Northeastern beach tiger beetle. The core map represents approximately 31,000 acres spread out along the beaches of the Maryland, Massachusetts, New Jersey, Virginia coastal areas.

Landcover categories within the core map area are included in Table 1. Landcover is predominantly open water, herbaceous wetland, and barren land, which are generally consistent with the habitat of this species.

The core map developed for the Northeastern beach tiger beetle is considered interim. This core map will be used to develop pesticide use limitation areas (PULAs) that include the Northeastern beach tiger beetle. This core map incorporates information developed by FWS and made available to the public; however, the core map has not been formally reviewed by FWS. This interim core map may be revised in the future to incorporate expert feedback from FWS. This interim core map has a "none" best professional classification because it consists of the species' range without additions or subtractions. There is confidence in the core map because the species' range is reasonably refined, represents areas important for this species' conservation, and contains all known occurrences of this species. This core map does not replace or revise any range or designated critical habitat developed by FWS for this species.

¹ CBD sent EPA the core map for this species before EPA released its mapping process document and example documentation. EPA supplemented the documentation and supporting analysis for consistency with EPA's most recent documentation examples made available after CBD developed this core map.

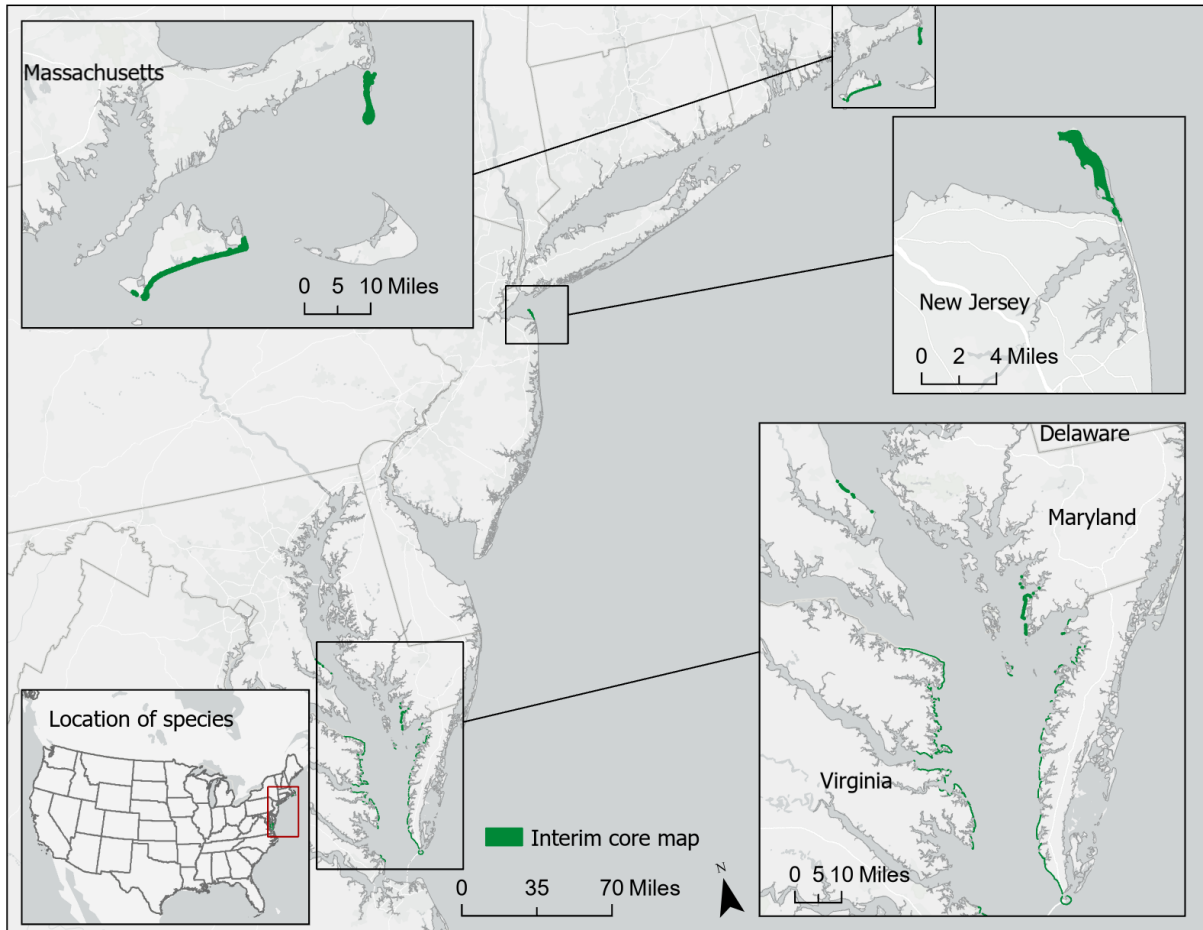


Figure 1. Interim core map for Northeastern beach tiger beetle. Total acreage of the interim core map is approximately 31,000 acres.

Table 1. Percentage of Interim Core Map Represented by NLCD² Land Covers and Associated Example Pesticide Use Sites/Types.

Example pesticide use sites/types	NLCD Class/Value	% Area	Total area for landcover type
Forestry	Deciduous Forest (41)	3	5
	Evergreen Forest (42)	1	
	Mixed Forest (43)	1	
Agriculture	Pasture/Hay (81)	0	1
	Cultivated Crops (82)	1	
Mosquito adulticide, residential	Open space, developed (21)	2	6
	Developed, Low intensity (22)	2	
	Developed, Medium intensity (23)	2	
	Developed, High intensity (24)	0	
Invasive species control	Woody Wetlands (90)	3	88
	Emergent Herbaceous Wetlands (95)	12	
	Open water (11)	55	
	Grassland/herbaceous (71)	4	
	Scrub/shrub (52)	2	
	Barren land (rock/sand/clay; 31)	12	
Total Acres	Interim Core Map Acres	~31,000	

Evaluation of Known Location Information

There are four datasets with known location information for this species:

- Descriptions of locations provided by FWS;
- Occurrence locations included in iNaturalist;
- Occurrence locations included in GBIF; and
- Occurrence locations included in NatureServe.

FWS provided the most refined descriptions of the occurrence information and confirmed that all known locations of extant populations are located within the range. iNaturalist had 43 research grade observations, which are consistent with the species range. GBIF's occurrence data consisted only of occurrences that had also been accounted for in iNaturalist. NatureServe included 1 documented area, all of which were consistent with the location of the species range. **Appendix 1** includes more information on the available known location information.

² Dewitz, J., 2023, National Land Cover Database (NLCD) 2021 Products: U.S. Geological Survey data release, <https://doi.org/10.5066/P9JZ7AO3>.

Discussion of Approaches and Data that were Considered but not Included in Core Map

Alternative approaches and data were not considered in the development of this interim core map.

Appendix 1. Information Compiled for Species

1. Recent FWS Documents

- [Technical Correction \(2021\)](#)
- [5-Year Review \(2019\)](#)
- [5-Year Review \(2009\)](#)
- [Recovery Plan \(1994\)](#)

2. Background Information on Species

- **Status**
 - Threatened
- **Habitat, life history and ecology**
 - 5-Year Review (2019):
 - Continuing studies have found that beach width is a critical indicator of suitable habitat, with natural and wider beaches (>2 meters [m]) supporting higher densities of adult and larval NBTBs (Knisley 2011, Knisley et al. 2016). In a study of beach renourishment effects, Fenster et al. (2006) observed qualitatively that the NBTB preferred beaches at least 6 m wide, likely because they provide more habitat and decrease mortality risk caused by erosion and storm events. 7 Knisley et al. (2016) suggested shoreline recession and narrowing beaches were the major cause of decline and loss of NBTB sites and populations. Contrary to the 2009 5-year review indicating that adult and larval NBTBs are rarely found on beaches <2 m wide, Knisley et al. (2016) also found that beaches with mean widths of 1.4 and 1.5 m and groins had mean larvae densities of 1 and 1.6 larvae per 2 m and mean adult densities of 1.3 and 5.6 adults per 10 m, respectively. Third instar larvae have been observed at beaches <2 m wide and may be found at narrower beaches, especially if the beaches were wider during the ovipositional period then recessed during erosional events (B. Knisley, Randolph Macon College [RMC], email to J. Stanhope, Service, April 28, 2019; J. Stanhope, Service, pers. obs. 2019). However, these larvae may have higher mortality rates, due to less beach habitat available to relocate to avoid long periods of inundation from high tide and erosional events during storms over their 2-year life cycle.
 - Recent survey data also indicate that beaches with <30 adults may serve as breeding sites, counter to previous survey data from 1998 to 2002 as described in the Service's 2009 5-year review. In a 2018 adult and larval survey at the Cape Charles North site on the Chesapeake Bay's eastern shoreline in Virginia, a large number of third instar larvae were observed in a section of beach where 15 to 18 adult NBTBs were counted annually from 2016 to 2018, and a low number of larvae were counted in 2016 and 2017 (Knisley 2018b). The results suggest that beaches with lower numbers of adult NBTBs may serve as suitable breeding habitat. In addition at an adjacent site, >30 adults were observed and they may have dispersed to this site to oviposit.

of the Chesapeake Bay. The decline of numbers and occupied sites on the western shoreline is likely due to greater habitat loss, development, and hardening of the shoreline than on the eastern shoreline. The threats of SLR and hurricanes and associated coastal erosion are likely increasing, with studies indicating high or accelerating rates of relative SLR in the U.S. Mid-Atlantic region along the Atlantic coast and the Chesapeake Bay and models predicting an increase in frequency of more intense hurricanes. In addition, existing regulatory mechanisms are inadequate in addressing the threats of development and shoreline structures and subsequent loss of habitat in the Chesapeake Bay.

- Overall, the NBTB is facing increased threats to its continued existence throughout its range. In conjunction with declining numbers through most of its range, we conclude that the NBTB continues to meet the definition of a threatened species under the ESA.

- **Evidence of pesticide threat**

- Recovery Plan (1994)

- The extirpation of *C. d. dorsalis* from most of its range has been attributed primarily to destruction and disturbance of natural beach habitat from shoreline developments, beach stabilization structures, and high recreational use (Hill and Knisley 1994), all of which may affect the larval stage (Knisley et al. 1987). Stamatov (1972) suggested that oil slicks, use of pesticides for mosquito control, increased vehicular traffic, and natural phenomena such as winter beach erosion, flood tides, and hurricanes have also contributed to the decline of this beetle. While each of these factors may have had some level of effect, especially when combined with high natural larval mortality, their relative importance is not known and specific evidence of their impact is limited.

3. Description of Species Range

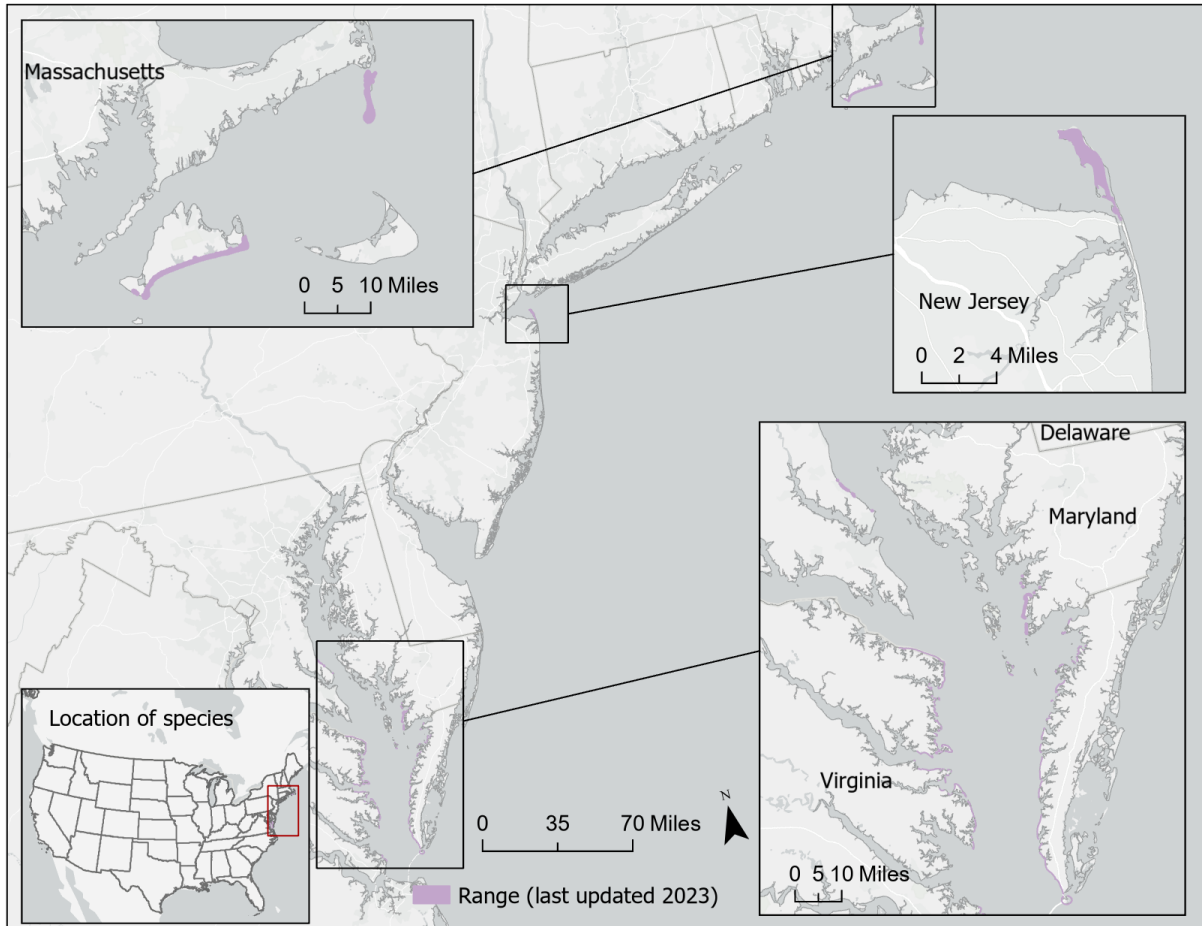


Figure A1- 1 depicts the FWS range map of the. This range was last updated 4/11/2023 and has an area of approximately 31,000 acres.

4. Critical Habitat

There is no designated critical habitat for this species.

5. Known Locations

- **Occurrences Described in FWS Documents (5-Year Review (2019))**
 - Rhode Island, Connecticut, and New York: No new information. The NBTB continues to be extirpated from these states.
 - Geographic Recovery Areas (GRAs)
 - i. GRA-1 Coastal Massachusetts and Islands. As of 2018, there are two occupied sites (>1 adult) in this GRA of which one large population is permanently protected: Monomoy National Wildlife Refuge (MNWR), Barnstable County,

owned and managed by the Service (M. Hillman, Service, email to J. Stanhope, Service, May 14, 2019).

- ii. GRA-2 Rhode Island, Block Island, and Long Island Sound. There are no occupied sites in this GRA.
- iii. GRA-3 Long Island. NY. There are no occupied sites in this GRA.
- iv. GRA-4 Sandy Hook to Little Egg Inlet, NJ. There are no occupied sites in this GRA.
- v. GRA-5 Calvert County, MD - four largest populations. As of 2018, there are two occupied sites (>1 adult) in this GRA, one with >500 adults and one with two adults (likely dispersers), but neither are protected (Knisley 2019).
- vi. GRA-6 Tangier Sound, MD - two large (>500 adults) populations. As of 2017 (year of the last survey), there are two large populations in this GRA that are permanently protected: Janes Island State Park and Cedar Island Wildlife Management Area (WMA), Somerset County, owned and managed by the Maryland Department of Natural Resources (MDNR) (Knisley 2018a).
- vii. GRA-7 Eastern Shore of Chesapeake Bay, VA - four large populations, four others. "Other" sized population is not defined, and therefore it is not possible to determine if this part of the criterion has been met. As of 2016 (year of last survey of entire Eastern Shore), there are 35 occupied sites (>1 adult) in this GRA (Knisley 2016), of which three large populations are permanently protected:
 - 1. Parker's Marsh Natural Area Preserve (NAP), Accomack County: owned and managed by the Virginia Department of Conservation and Recreation (VDCR) (D. Fields, VDCR, email to J. Stanhope, Service, June 13, 2019).
 - 2. Savage Neck Dunes NAP, Northampton County: owned and managed by the VDCR (D. Fields, VDCR, email to J. Stanhope, Service, June 13, 2019). In addition, the privately owned land (approximately 0.5 kilometers [km] of shoreline) south of the NAP has a conservation easement co-held by the Virginia Eastern Shore Land Trust, Inc. (VESLT) and the Eastern Shore Soil and Water Conservation District (ESSWCD). This easement has deed restrictions that provide protections for the NBTB, in addition to 100-foot (ft) waterfront buffer restrictions (appendix A) (H. PlourdeRogers, VAESLT, email to J. Stanhope, Service, June 27, 2019).
 - 3. Church Neck North site, Northampton County: adjacent, privately owned land has a conservation easement co-held by the VESLT and the ESSWCD. This easement has deed restrictions that specifically protect the NBTB, in addition to 100-ft waterfront buffer restrictions (appendix

A) (H. Plourde-Rogers, VAESLT, email to J. Stanhope, Service, June 27, 2019).

- viii. GRA-8 Western Shore of Chesapeake Bay (Rappahannock River north), VA- three large populations, three others. As of 2017 (year of last survey of entire Western Shore), there are 23 occupied sites (>1 adult) in this GRA (Knisley 2017a), of which one large population is permanently protected: Dameron Marsh NAP, Northumberland County: owned and managed by the VDCR (Z. Bradford, VDCR, email to J. Stanhope, Service, June 20, 2019). “Other” sized population is not defined, and therefore it is not possible to determine if this part of the criterion has been met.
- ix. GRA-9 Western Shore of Chesapeake Bay (Rappahannock River south), VA - three large populations, three others. “Other” sized population is not defined, and therefore it is not possible to determine if this part of the criteria has been met. As of 2017 (year of last survey of entire Western Shore), there are 14 occupied sites (>1 adult) in this GRA (Knisley 2017a), of which three large populations are permanently protected:
 - 1. New Point Comfort NAP, Mathews County: owned and managed by The Nature Conservancy (TNC) (Z. Bradford, VDCR, email to J. Stanhope, Service, June 20, 2019);
 - 2. Plum Tree Island NWR: owned and managed by the Service (additional survey conducted in 2018; L. Cruz, Service, email to J. Stanhope, Service, July 30, 2018).
 - 3. Grandview Nature Preserve, owned and managed by the City of Hampton, VA (Knisley 2017a).
- o Massachusetts:
 - i. On Martha’s Vineyard, Dukes County, adult NBTB surveys have been conducted annually at two subpopulations, Aquinnah/Chilmark and the South Shore, since 2010 (Massachusetts Natural Heritage and Endangered Species Program [MA-NHESP] 2019; S. Maier, MA-NHESP, email to J. Stanhope, Service, July 8, 2019).
 - 1. At the Aquinnah/Chilmark subpopulation, numbers of the NBTB have decreased substantially, with a peak of 3,072 adults in 2010 and a progressive decline annually from 2,106 adults in 2013 to 239 adults in 2018. Potential causes of decline are eroded habitat due to increased frequency and intensity of storms, especially in the winter, and high-intensity beach recreation at public beaches (M. Nelson, MA-NHESP, email to J. Stanhope, Service, May 30, 2019).

2. At the South Shore subpopulation, numbers have remained relatively stable from 2010 to 2018, ranging from 25 to 135 adults.
- ii. At Monomoy NWR, since the 2000 to 2003 larval translocations from Martha's Vineyard, surveys indicated a rapid increase in peak numbers of adults from 102 in 2009 to 8,436 in 2016 (Kapitulik 2014; Service 2016; M. Hillman, Service, email to J. Stanhope, Service, May 14, 2019). After 2016, survey protocols were changed to visual index counts due to the increased population; however, these counts do not represent an accurate measure of population or allow for analysis of recent trends. Recent index counts were 4,322 and 2,687 adults in 2017 and 2018 respectively.
 - iii. The Westport site in southeastern Massachusetts continues to be extirpated (M. Nelson, MA-NHESP, email to J. Stanhope, Service, May 30, 2019).
- New Jersey:
 - i. Surveys in 2017 and 2018 found no adult or larval NBTBs at the translocation area in the Sandy Hook Unit of the Gateway National Recreation Area (Gwiazdowski and Knisley 2019). These surveys confirmed that the translocation effort conducted from 1997 to 2000 was unsuccessful (Knisley et al. 2005).
 - Maryland:
 - i. In Calvert County, adult NBTB surveys were conducted at 4 sites (Western Shores/Calvert Beach, Flag Ponds, Scientific Cliffs, and Calvert Cliffs) in 1986 and annually from 1988 to 2018 (Knisley 2019). Only 2 of the 4 sites are occupied.
 1. Western Shores/Calvert Beach experienced a significant increase in population size in recent years, peaking at 2,307 adult NBTBs in 2018 from a low of 72 in 2009.
 2. At Flag Ponds, there was a large population in the 1990s (peak of 4,351 adults in 1992) and no adult NBTBs were observed from 2009 to 2016. Two and four adults were observed in 2017 and 2018, respectively, and it is hypothesized that these dispersed from the neighboring Western Shores/Calvert Beach site. Potential causes of decline include: shoreline erosion due to Hurricane Isabel in 2003, shoreline changes (formation of spit in front of beach section where most of the population occurred), and increased usage of the public beach at the site, including small 4-wheeled vehicles driving along the shoreline for patrols by Flag Ponds Nature Park personnel and heavy human foot traffic and activities (e.g., digging).

3. No NBTBs have been observed at Scientific Cliffs since 2003, except for two adults in 2015 that likely dispersed from the Western Shores/Calvert Beach site; this public beach site is likely extirpated.
 4. Calvert Cliffs site (named “Cove Point” in Knisley 2019) is also likely extirpated with no NBTBs observed since 2004; the cause of decline is possibly shoreline erosion.
- ii. Surveys on Janes and Cedar Islands were conducted in 2002, 2004, 2005, and 2006 and annually from 2009 to 2017 (Knisley 2018a).
1. The Janes Island’s site declined from 3,081 adults in 2006 to 1,330 adults in 2009, then appeared to decrease slightly each year to a low of 725 adults in 2014 and has been steadily increasing from 725 to 4,286 adults from 2014 to 2017.
 2. The Cedar Island site has been relatively stable, ranging from approximately 1,000 to 2,000 adults during 2004 to 2017 with peaks of 2,454 and 3,202 adults in 2006 and 2016, respectively.
- o Virginia:
- i. Eastern Shore
1. The Service funded comprehensive adult NBTB surveys along the eastern shoreline of the Chesapeake Bay in 2009 and 2016 (Knisley 2009a, 2016, 2017b).
 - a. Table 1 provides a summary of survey results of these and previous years, indicating that between the 2009 and 2016 surveys, there was a 43-percent decline in the number of adults observed, but the total number of occupied sites and sites with >500 adult NBTBs was relatively constant. There appears to be a declining trend in the number of sites with >1,000 adults. However, we are not certain if the trend of decline in total adult NBTBs is due to the year-to-year variability.
 2. Most of the sites had large declines in numbers of adults from 2009 to 2016, in particular sites with large populations, including Church Neck North, Savage Neck, Tankards Beach, Scarborough Neck, Occohannock Neck, Parkers Marsh, and Hyslop Marsh. Narrower beaches due to shoreline recession and erosion were observed at some sites and may be a factor contributing to the decline.

3. Three sites had significant increases in numbers of adults (Cape Charles South, Wilkins Beach, and Smith Beach), and a new site was found (Hungars Beach).

Table 1. Survey results for eastern shoreline of Chesapeake Bay, VA (Knisley 2016, 2017b).

Year	Total Number of Adult NBTBs	Number of Sites with >500 Adult NBTBs	Number of Sites with >1,000 Adult NBTBs ¹	Number of Occupied Sites (>1 adult)	Number of Surveyed Sites	Percent of Surveyed Sites Occupied
2016	25,488	13	7	35	39	90
2009	46,082	13	9	32	38	84
2005	38,498	13	10	36	38	95
2002	33,469	16	12	33	36	92
1999	32,143	13	9	35	35	100

¹Includes sites with >500 adult NBTBs.

ii. Western Shore

1. The Service funded or conducted comprehensive surveys along the western shoreline of the Chesapeake Bay in 2012, 2014, and 2017 (Knisley et al. 2016, Knisley 2017a).
 - a. Table 2 provides a summary of survey results of these and previous years, indicating an overall declining trend of total adults, number of sites with >500 and >1,000 adults, and number of occupied sites from 1998 to 2017. The number of occupied sites and sites with >500 adults have been somewhat stable from 2012 to 2017.
2. Knisley (2017a) divided the western shoreline into nine regions, and numbers of NBTBs have declined or remained relatively stable in all regions during this time period (2012-2017), except regions 4 (Great Wicomico) and 9 (Grandview Beach) where numbers of NBTBs increased.
 - a. Region 4 has only one large population at Dameron Marsh NAP that is permanently protected from human activities.
 - b. Region 9 has Plum Tree Island NWR and Grandview NAP, which are both permanently protected. Although Grandview NAP is open to the public, certain activities are prohibited, including off-road vehicles and entering into the designated posted bird nesting areas at the northern end of Factory Point from April 1 through September 15
(<https://hampton.gov/Facilities/Facility/Details/Grandview->

Nature-Preserve-andFactory-Po-57; accessed August 8, 2019). In addition, at Grandview NAP, habitat quality and quantity for larvae and adults were increased after breakwater construction and beach nourishment were conducted to connect Factory Point to Grandview Beach in 2010; counts of adults increased with 57 in 2012, 342 in 2014, and 1,117 in 2017 (Knisley 2012, 2017a).

- c. More severe beach erosion was observed at many sites on the western shoreline compared to sites on the eastern shoreline after hurricanes, including Hurricane Isabel in 2003, Ernesto in September 2006, and Sandy in October 2012 (Knisley et al. 2016). Greater numbers of shoreline structures were also observed on the western shoreline than the eastern shoreline. Narrower beaches and decreased habitat quality from increased erosion, shoreline structures, and sea level rise (SLR) are likely contributing factors to the overall decline on the western shore. Habitat loss and loss of sites also contribute to the increasing separation and fragmentation of the western shoreline populations, and possibly their ability to disperse and recover after stochastic events, such as hurricanes and large storms.

Table 2. Survey results for western shoreline of Chesapeake Bay, VA (Knisley 2017a).

Year	Total Number of Adult NBTBs	Number of Sites with >500 Adult NBTBs	Number of Sites with >1,000 Adult NBTBs ¹	Number of Occupied Sites (>1 adult)	Number of Surveyed Sites	Percent of Surveyed Sites Occupied
2017	7,832	6 ^[2]	2	37	68	54
2014	9,539	5	2	34	57	60
2012	10,171	5	4	37	49	76
2008	10,021	7	0	45	49	92
2005	19,410	9	5	47	47	100
2004	12,185	8	2	48	57	84
2001	33,624	21	14	64	78	82
1998	26,693	15	9	61	74	82

¹Includes sites with >500 adult NBTBs.

²Plum Tree NWR is included in this count of sites with >500 adults because 478 and 702 adults were counted in 2017 and 2018, respectively, by Eastern Virginia Rivers NWR Complex biologists (L. Cruz, Service, email to J. Stanhope, Service, July 30, 2018). Knisley (2017a) counted 233 in 2017.

Table 3. Summary of rangewide NBTB status in 2009 (Service 2009) and 2016-2018.

GRA	State(s)	2009 5-year Review	2016-2018 Status
1	MA	<ul style="list-style-type: none"> - Martha's Vineyard site numbers appear to be stable - Monomoy NWR site translocation may be failing³ 	<ul style="list-style-type: none"> - Westport site extirpated - Martha's Vineyard site numbers appear to be declining, more than 90 percent decrease from 2010 - Monomoy NWR site translocation successful, with expanding range and large population (>8,000 adults in 2016) on South Monomoy Island, expanding northward to Town-owned lands
2 & 3	RI, CT, NY	<ul style="list-style-type: none"> - At listing extirpated from RI, CT, and NY 	<ul style="list-style-type: none"> - Extirpated from RI, CT, and NY
4	NJ	<ul style="list-style-type: none"> - Sandy Hook, NJ translocation sites extirpated 	<ul style="list-style-type: none"> - Sandy Hook, NJ translocation sites confirmed extirpated
5	MD – Calvert County (Western Shore)	<ul style="list-style-type: none"> - 6 of 10 occupied sites extirpated, habitat lost or in very poor condition - 2 of 4 remaining sites with <5 NBTBs in 2005, these sites have marginal habitat - The 2 primary sites (Scientist Cliffs and Western Shores/Calvert Beach) have declined in numbers >75 percent since 2003 	<ul style="list-style-type: none"> - 8 of 10 occupied sites extirpated - 2 remaining sites (Flag Ponds, Western Shores/Calvert Beach) - Flag Ponds has 2-4 adult NBTBs observed in 2017-2018, likely dispersed from other occupied site - Western Shores/Calvert Beach is only viable population with increasing numbers (>2,000 adults in 2018) since 2009, but not near peak of about 4,000 adults in 1988
6	MD – Tangier Sound (Eastern Shore)	<ul style="list-style-type: none"> - Both sites (Janes and Cedar Islands) are stable or may be increasing 	<ul style="list-style-type: none"> - Janes Island's numbers increased in recent years (>4,000 adults in 2017), after declining 2006-2014 - Cedar Island's numbers relatively stable and no apparent trend, with large fluctuations in numbers (1,000-3,000 adults)
7	VA – Eastern Shore	<ul style="list-style-type: none"> - Total NBTB numbers stable - 55 percent of NBTBs found on 2 of 35 occupied sites in 2005 (Parker's Marsh, Savage Neck) - 4 occupied sites extirpated (habitat gone) - 12 occupied sites showing declining numbers and available habitat 	<ul style="list-style-type: none"> - Total NBTB numbers significantly lower in 2016 (43 percent decline) than peak in 2009, but not certain if trend of decline due to year-to-year variability - 35 occupied sites in 2016 (32-36 sites in 1999-2009) - 7 sites >1,000 adults in 2016 (9-12 sites in 1999-2009) - Most sites had declining numbers - 3 sites had large increases in numbers and a new site was found
8 & 9	VA – Western Shore	<ul style="list-style-type: none"> - Since 2001 there has been a 20 percent loss in occupied sites (12 of 58 occupied sites) 	<ul style="list-style-type: none"> - Total NBTB numbers lower in 2017 than 2008 (22 percent decline) and significantly lower than peak in 2001

GRA	State(s)	2009 5-year Review	2016-2018 Status
		<ul style="list-style-type: none"> - The majority of occupied sites show evidence of habitat loss as a result of Hurricane Isabel and Hurricane Ernesto - Total numbers declined 70 percent since 2001 - Since 2001, the 8 largest sites that support approximately 50 percent of the total NBTBs in 2001 have declined by 78 percent 	<ul style="list-style-type: none"> (77 percent decline) - 37 occupied sites in 2017 (45 sites in 2008 and 64 in 2001) - The number of sites >500 and >1,000 adults in 2017 (6 and 2, respectively) lower than peak in 2001 (21 and 14, respectively) - 7 of 9 sites had declining numbers - The majority of occupied sites showed evidence of severe beach erosion

6. Knisley et al (2016)²

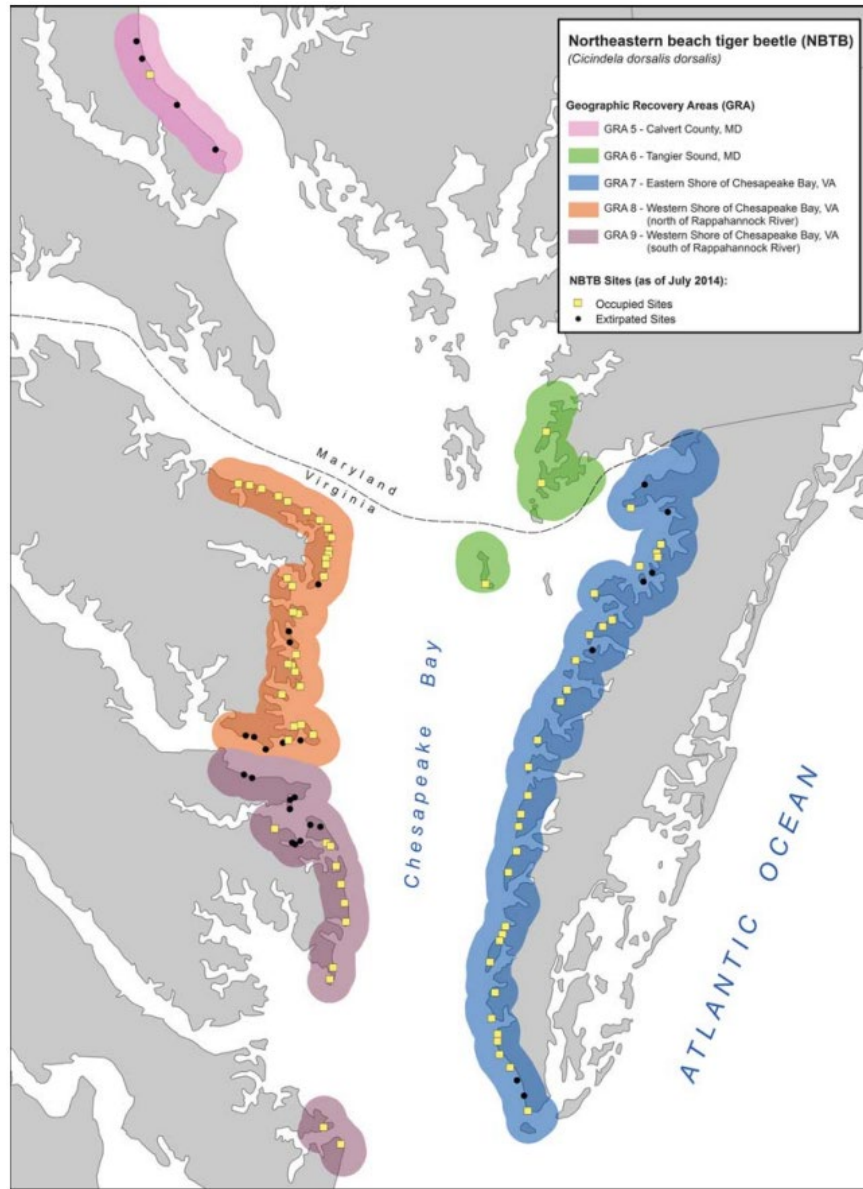


Fig. 1. Occupied and extirpated sites for *Cicindela dorsalis dorsalis* within Geographic Recovery Areas 5–9, Maryland and Virginia as of July 2014.

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<https://www.researchgate.net/publication/304066468> Population Trends of the Northeastern Beach Tiger Beetle *Cicindela dorsalis dorsalis* Say Coleoptera Carabidae Cicindelinae in Virginia and Maryland 1980s Through 2014

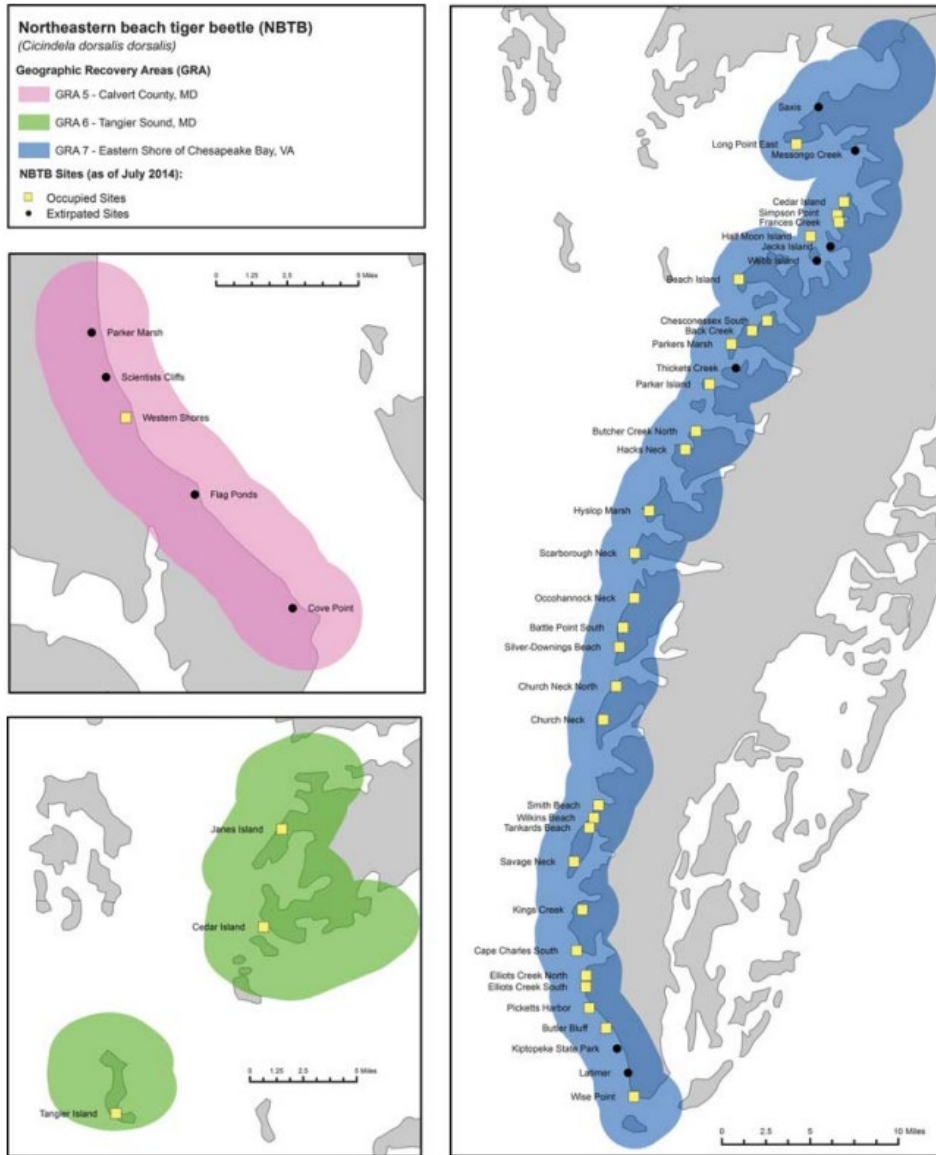


Fig. 2. Occupied and extirpated sites for *Cicindela dorsalis dorsalis* within Geographic Recovery Area 5 (Calvert County, Maryland), Geographic Recovery Area 6 (Tangier Sound, Maryland), and Geographic Recovery Area 7 (Eastern Shore of Chesapeake Bay, Virginia) as of July 2014.

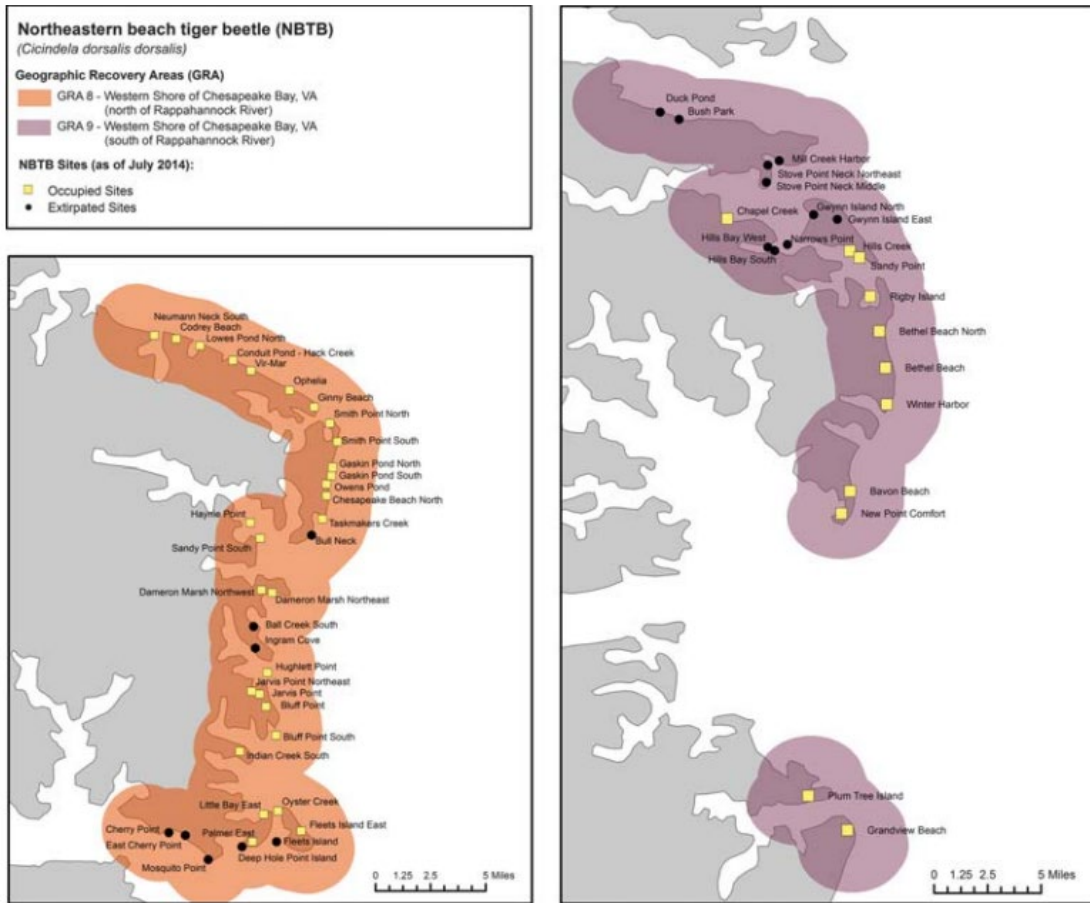


Fig. 3. Occupied and extirpated sites for *Cicindela dorsalis dorsalis* within Geographic Recovery Area 8 (Western Shore of Chesapeake Bay, north of Rappahannock River, Virginia) and Geographic Recovery Area 9 (Western Shore of Chesapeake Bay, south of Rappahannock River) as of July 2014.

Table 4. Numbers of adult *Cicindela dorsalis dorsalis* at sites along the western Chesapeake Bay shoreline, Virginia, 1998–2014. Blanks indicate no survey. “No site” indicates that on visual inspection the shoreline was too narrow to support larval habitat and in some cases adult habitat at the site. Surveys in 2007 and 2013 did not include all sites.

Site name	1998	2001	2004	2005	2007	2008	2012	2013	2014	Shoreline notes
Region 1: Potomac River										
Walnut Point	0	0								natural
Balls Creek	0	0								natural
Great Point	0									natural
Presley Creek North	4	0								natural, short part with
Presley Creek South	0	0								breakwater
Neumann Neck South	49	177	37	4	3	2	0		4	natural, short
Cordrey Beach	0	13	15	1	0	15	0		0	natural, groins
Marshalls Beach	2									groins, houses
Lowes Pond North	0	0	18	6	2	0	0		7	natural
Subtotal:	55	190	70	11	5	17	0		11	
Region 2: Smith Point and North										
Conduit Pond-Hack Ck.	5,016	2,070	410	381	509	288	38		460	groins, some revet, houses
Vir-mar	795	1,267	1,294	1,209	1,307	980	1,095		954	groins, houses
Ophelia	1,872	1,556	156	703	296	153	157		101	groins, some revet, dense houses
Ginny Beach	1,381	1,024	107	293	151	144	44		154	groins, natural, few houses
Smith Point North	2,727	2,015	275	1,141	497	727	220	13	80	natural, depositions, 2 jetties
Subtotal:	11,791	7,932	2,242	3,727	2,760	2,292	1,554	13	1,749	
Region 3: Smith Point South to Great Wicomico										
Smith Point South	1,209	772	442	422	262	571	698	442	345	groins, some revet, houses
Gaskins Pond North	106	1,188	102	200	24	229	165	8	8	groins, few houses
Gaskins Pond South	353	487	221	1	43	127	48	9	16	groins, some revet, few houses
Owens Pond	44	201	2						0	groins
Chesapeake Beach North	283	395	58	19		11	0		3	natural, 3 spurs
Chesapeake Beach	0	6	0							groins, much revet, houses
Taskmakers Creek	210	594	8	36	3	2	0		0	natural, some groins, revetment
Bull Neck	5	33	0							no site
Fleeton Point	1	2	8							natural, small houses ,small
Subtotal:	2,211	3,678	841	678	332	940	911	459	372	
Region 4: Great Wicomico										
Gougher Creek	0	0								
Haynie Point	191	151	197	29		28	14	7	3	natural, small
Sandy Point South	85	72	9	22		18	0		0	piers, revetment
Sandy Point North	83	70								piers, groins
Bussell Point (no map)	4	0								

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Table 4. Continued.

Site name	1998	2001	2004	2005	2007	2008	2012	2013	2014	Shoreline notes
Harveys Creek (no map)	132	0	0							small
Dameron Northeast	426	410	0						147	natural
Dameron Northwest	57	162	45	34		59	37		8	natural
Subtotal:	978	865	251	85		105	51	7	158	
Region 5: Ball Creek to Fleets Bay										
Ball Creek South	282	302					0		no site	natural,small
Salt Pond North		13								natural
Ingram Cove	95	478					11		no site	natural
Cloverdale North	0	0								
Cloverdale South	0	0								
Hughlett Point	588	1,571	21	306	739	366	321		54	natural
Jarvis Point NE			102	352		486	35	0	259	natural, small
Jarvis Point	131	190	75	125		198	12	0	68	natural
Bluff Point	526	566	138	434		502	1,492		1,097	natural
Bluff Point South	26	544	11	129		198	59		87	natural
Barnes Creek (no map)		0	3							
Henry Creek South	0									
Indian Creek South		375	2	14		138	32		8	natural, pier, small
Rones Bay West		0								
Dymer Creek Southeast	8	5								natural, small
Little Bay West	76	237								pier, small
Little Bay East	69	188	19	59		18	18		32	
Oyster Creek	2,159	2,325	956	3,612		917	36		535	natural
Fleets Island East			19	91		60	41	3	37	breakwaters
Subtotal:	3,960	6,794	1,346	5,122	739	2,883	2,057	3	2,177	
Region 6: Rappahannock River										
Fleets Island	102	6	0	380		47	2	0	no site	groins,piers, houses,
Deep Hole Point	372	576	313	540		210	141	0	no site	natural
Palmer East	196	357	31	470		455	291		1	groins, piers, houses
Mosquito Point	184	28	0	4		1	0		no site	pier
Mosquito Point NW	15	0								groins, piers, houses
Cherry Point	280	352	0	2		0	0		no site	piers, revetment
East Cherry Point	0	195	26	39		37	8	0	no site	piers
Sunders Cove SE	0	6								
Duck Pond	28	5	0	1		1	0		no site	piers, small
Bush Park	169	318	35	6		16	0	0	no site	few groins
Greys Point	0	10	0							
Subtotal:	1,346	1,853	405	1,442		767	442	0	1	
Region 7: Piankatank River Mouth to Gwynn Island										
Timber Neck NW	3	1								
Mill Creek Harbor	57	145	22	1		0	0		no site	groins, natural, small
Stove Point Neck NE	161	125	32	116		12	0		no site	natural, small
Stove Point East Middle	14	130	0	18		31	2	2	no site	groins, small
Stove Point	0	1								

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Table 4. Continued.

Site name	1998	2001	2004	2005	2007	2008	2012	2013	2014	Shoreline notes
Chapel Creek	608	450	463	301		75	105		102	north natural, south piers
Hills Bay West	4	18							no site	natural
Hills Bay South	43	91	10						no site	groins, small
Narrows Point	1	27	8						no site	natural, small
Gwynn Island North	191	495	205	19		0	94		no site	groins, no beach
Gwynn Island East	46	742	55	41		18	1	0	no site	all groins
Hills Creek	79	35	4	33		23	1		0	breakwaters, revetment
Subtotal:	1,207	2,260	799	529		159	203		102	
Region 8: Mathews County South										
Sandy Point	644	283	479	464	241	426	237		152	natural
Lillys Neck	0	0								
Rigby Island	104	995	562	574	218	648	196		93	natural
Bethel Beach North	996	2,301	801	360	664	371	259		427	few groins
Bethel Beach	271	435	66	57	16	285	34		172	natural, public use
Winter Harbor	608	2,955	2,381	3,767	233	422	2,301		368	natural
New Point Campground	0	2								
Bavon Beach	399	732	875	536		36	161		94	natural, houses
Bavon Beach South	853	1,300	524							natural
New Point Comfort	1,230	1,031	539	2,057		670	1,765		2,800	natural
Subtotal:	5,105	10,034	6,227	7,815	1,372	2,858	4,953		4,106	
Region 9: Grandview Beach										
Grandview Beach	30	44	4		0	20	57	615	342	natural, breakwaters
Plum Tree					2	17	329	282	521	natural
Subtotal:	30	44	4		2	37	386	897	863	
Total (all sites)	26,683	33,650	12,185	19,409	5,210	10,058	10,557	1,379	9,539	

Table 5. Number of adults of *Cicindela dorsalis dorsalis* at sites along the eastern Chesapeake Bay shoreline, Virginia, 1999–2009. Blanks indicate no survey.

Site name	1999	2002	2005	2009	Shoreline notes
Saxis Island	136	11	0	0	natural, some revetment
Long Point East		598	140	74	natural
Messongo Creek	418	0	4	0	natural, small
Simpson Point		378	122	5	natural
Cedar Island, Flood Pt.	43	2	3	6	natural, small
Frances Creek	179	401	131	112	natural, small
Half Moon Island	1	1	3	101	natural, small
Jacks Island, Sandy Pt.	2	0	0	0	natural, small
Webb Island	5	0		0	natural, small
Beach Island	213	273	46	636	natural
Chesconessex South	4	49	47	81	natural, small
Back Creek	84	66	162	130	natural, small
Parkers Marsh	3,343	4,587	12,554	1,629	natural
Thickets Creek	12	28	40	20	natural, small
Parkers Island	407	1,278	60	109	natural
Butcher Creek North	83	136	531	418	natural
Hacks Neck	751	662	126	874	natural, some rocks
Hyslop Marsh	640	2,424	1,954	2,988	natural
Scarborough Neck	1,493	2,996	1,789	4,087	natural
Occhohannock Neck North	1,537	1,031	1,187	2,606	natural
Battle Point South	19	164	65	520	groins, revetment, some natural
Silver-Downings Beach	547	2,478	1,413	4,417	north, south groins, piers; middle natural
Church Neck North			2,297	8,322	natural
Church Neck	3,384	2,566	1,807	2,678	groins, revetment in north, most natural
Smith Beach	307	113	365	390	all groins, some revetment
Wilkins Beach	1,678	667	214	59	all groins, some revetment
Tankards Beach*	1,791	1,146	1,248	5,107	natural
Savage Neck*	7,368	4,375	8,619	9,657	natural, but 3 breakwaters
Kings Creek*	176	1,247	751	535	breakwaters
Cape Charles South	3,452	2,458	1,491	194	breakwaters and natural, heavy use
Elliot's Creek North	739	631	85	145	revetment, groins, few breakwaters
Elliot's Creek South*	204	425	203	11	revetment, rocks, few breakwaters, small
Picketts Harbor*	2,412	2,166	792	149	natural
Butlers Bluff*	245	30	22	10	north natural, south breakwaters
Kiptopeke State Park	301	37	175	0	natural, heavy use
Latimer	51	10	9	0	natural, some groins
Wise Point	80	35	43	12	natural
Tangier Island	38				natural
Total	32,143	33,469	38,498	46,082	

- Occurrences Described in iNaturalist:

- https://www.inaturalist.org/observations/export?verifiable=true&page=1&spam=false&quality_grade=research&taxon_id=509933&place_id=any&user_id=&project_id=
- iNaturalist includes 43 observations consistent with the indigenous range (all in Maryland, Massachusetts, New Jersey, and Virginia states)
- Figure A1-3 depicts the locations of these observations.

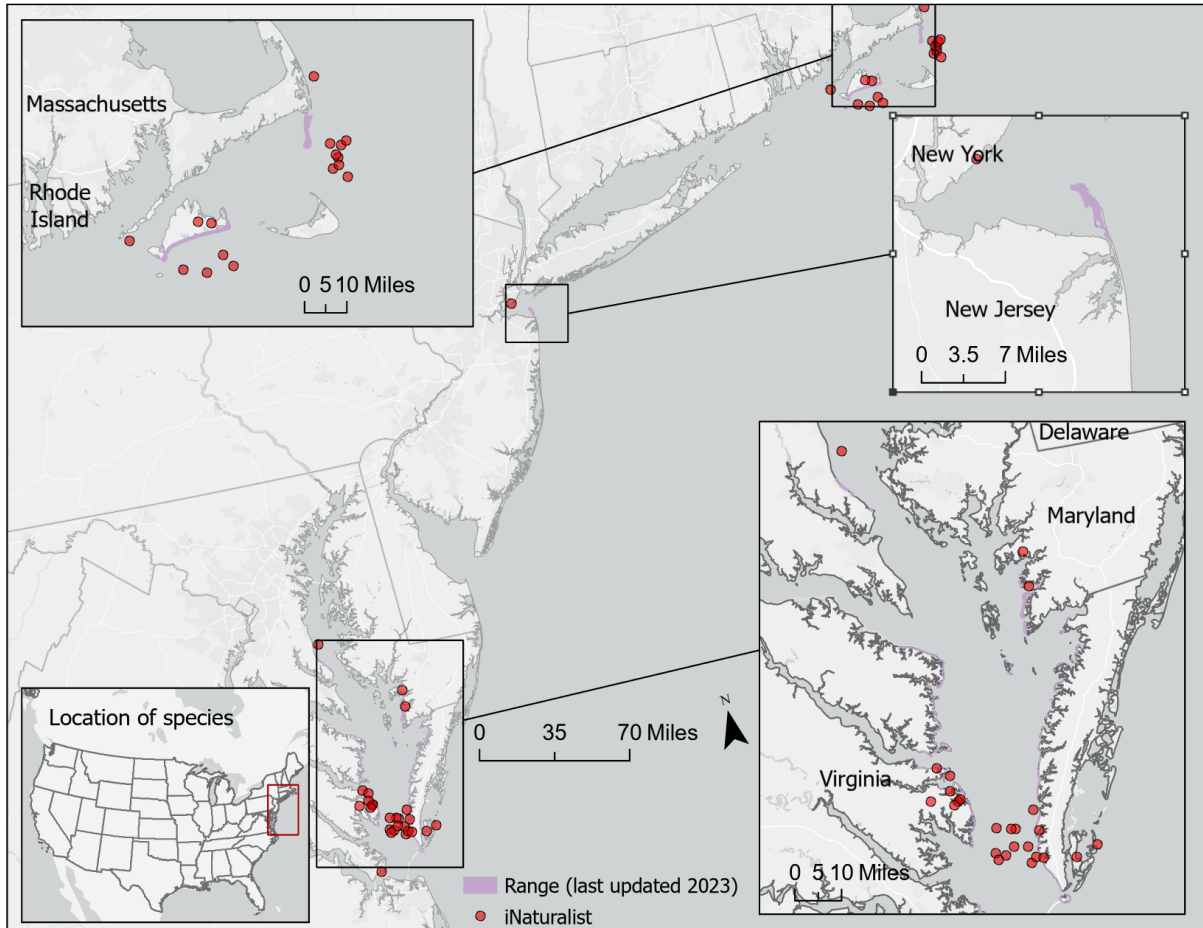


Figure A1- 2. Occurrences available in iNaturalist

- **Occurrences Described in GBIF (<https://www.gbif.org/>)**
 - Two observations listed are also included in iNaturalist (Figure A1-3)

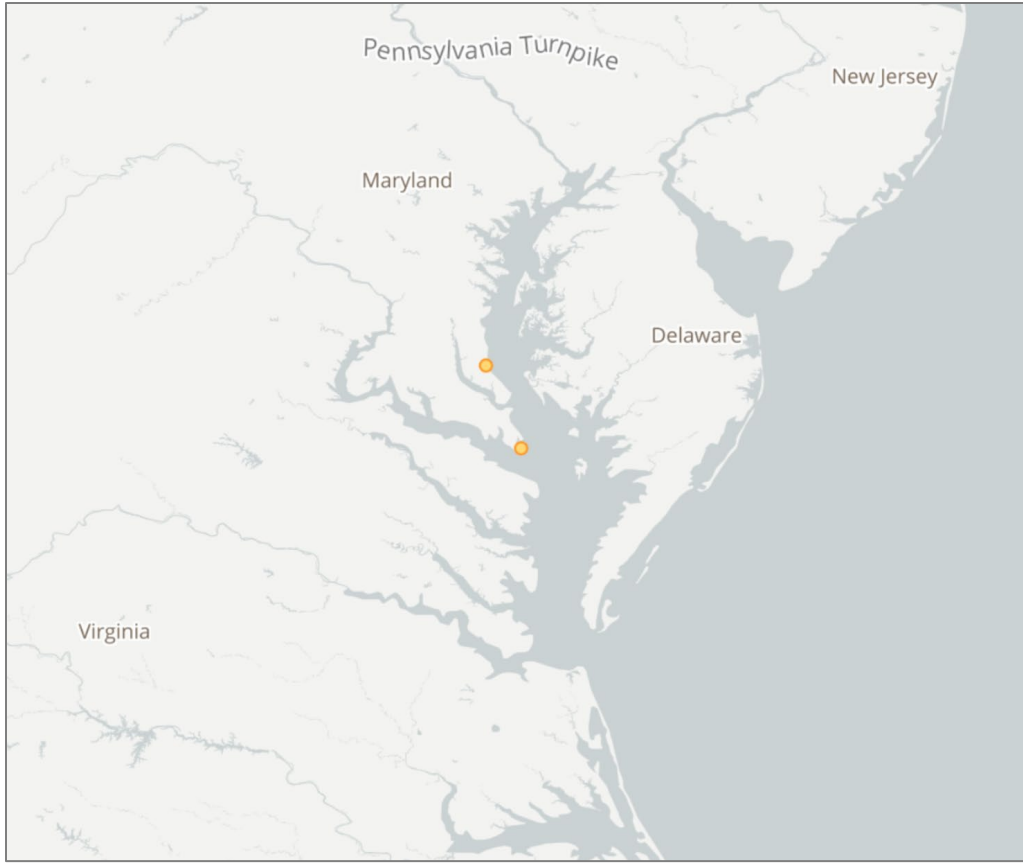


Figure A1- 3. Occurrences available in GBIF

- **Occurrences Described in NatureServe** (<https://explorer.natureserve.org/pro/Welcome>)
 - NatureServe has several documented locations consistent with the indigenous range.