

**Northeastern Beach Tiger Beetle**  
*(Cicindela dorsalis dorsalis)*

**5-Year Review:  
Summary and Evaluation**

**August 2019**

**U.S. Fish and Wildlife Service  
Virginia Field Office  
Gloucester, Virginia**

## **5-YEAR REVIEW**

### **Northeastern Beach Tiger Beetle/*Cicindela dorsalis dorsalis***

#### **1.0 GENERAL INFORMATION**

##### **1.1 Reviewers**

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**1.2 Methodology used to complete the review:** This 5-year review, conducted primarily by the lead recovery biologist for the northeastern beach tiger beetle (NBTB), summarizes and evaluates new information relevant to the listing status of the species. New data and information regarding the species' population status and habitat used in this report were based on peer reviewed literature and internal reports of surveys conducted or contracted by the U.S. Fish and Wildlife Service (Service) and surveys conducted by state natural resource agencies, refuges, and researchers. In addition, Service Field Offices (FOs) and refuges, state natural resource agencies, and researchers were contacted for up-to-date information on species' occurrences, threats, and recovery activities. All pertinent literature and documents on file at the Virginia Field Office were used for this review.

### 1.3 Background:

**1.3.1 FR Notice citation announcing initiation of this review:** 83 FR 39113-39115 (August 8, 2018)

#### 1.3.2 Listing history:

Original Listing

**FR notice:** 55 FR 32088-32094

**Date listed:** August 7, 1990

**Entity listed:** Subspecies

**Classification:** Threatened

**1.3.3 Associated rulemakings:** None

#### 1.3.4 Review History:

Previous 5-Year Review

**Initiated:** 73 FR 3991-3993

**Date Finalized:** March 19, 2009

**Results:** No change in status

**1.3.5 Species' Recovery Priority Number at start of 5-year review:** 6. This designation corresponds to a subspecies with a high degree of threat and low recovery potential.

#### 1.3.6 Recovery Plan:

**Name of plan:** Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*)  
Recovery Plan

**Date issued:** September 29, 1994

## 2.0 REVIEW ANALYSIS

### 2.1 Application of the 1996 Distinct Population Segment (DPS) policy:

**2.1.1 Is the species under review a vertebrate?** The NBTB is an invertebrate; therefore, it is not covered by the DPS policy.

### 2.2 Recovery Criteria

**2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria?** Yes, the species has an approved plan containing recovery criteria; however, not all of the recovery criteria are objective and/or measurable.

#### 2.2.2 Adequacy of recovery criteria

**2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?** No. Due to new

information that has become available since the 1994 recovery plan was written, the criteria are incomplete in terms of number of known occupied sites, abundance, and connectivity of these sites. The population-based criteria in the plan may be inadequate with regard to the maintenance of a metapopulation and movement among sites that may be necessary for persistence of the species and its ability to respond to large-scale events, such as hurricanes and storms causing significant coastal erosion. In addition, “other” sized population is not defined in the recovery plan.

#### 2.2.2.2

Factor B (overutilization) is not relevant to this species.

### **2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information:**

The criteria for delisting are:

1. At least three populations have been established<sup>1</sup> and permanently protected<sup>2</sup> within each of the four designated Geographic Recovery Areas (GRA) covering the historical range of the subspecies in the Northeast, with each GRA having one or more sites with large populations (peak count >500 adults) with sufficient protected habitat for expansion and genetic interchange.  
[Listing Factors A, D, E are addressed by this criterion]. This criterion has not been met. The four GRAs described in the criterion above are:

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).

GRA-2 Rhode Island, Block Island, and Long Island Sound. There are no occupied sites in this GRA.

GRA-3 Long Island, NY. There are no occupied sites in this GRA.

GRA-4 Sandy Hook to Little Egg Inlet, NJ. There are no occupied sites in this GRA.

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<sup>1</sup> “Established” is defined as self-maintaining for at least five years, with no foreseeable threats.

<sup>2</sup> “Permanently protected” is defined as long-range protection from present and foreseeable anthropogenic and natural events that may interfere with their survival. Adequate protection measures include land acquisition, conservation agreements and/or easements, and management measures to protect the species’ habitat; this includes accounting for off-site impacts such as littoral sand drift.

2. At least 26 populations are permanently protected at extant sites distributed among the five Chesapeake Bay GRAs as follows:  
[Listing Factors A, D, E are addressed by this criterion]. This criterion has not been met. Nine populations are permanently protected among the five Chesapeake Bay GRAs.

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).

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).

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:

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

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.

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:

- 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);
- 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).
- Grandview Nature Preserve, owned and managed by the City of Hampton, VA (Knisley 2017a).

3. Life history parameters (including population genetics and taxonomy), human impacts, and factors causing decline are understood well enough to provide needed protection and management.

[Listing Factors A, C, D, E are addressed by this criterion]. This criterion is subjective. Additional research on life history parameters and factors causing decline have been conducted since 2009 to aid in making some management decisions, but more information, research, and financial resources are needed to provide sufficient protection and management of the NBTB.

4. There exists an established, long-term management program in all states where the species occurs or is reintroduced.

[Listing Factors A, D, E are addressed by this criterion]. This criterion has not been met.

## 2.3 Updated Information and Current Species Status

### 2.3.1 Biology and Habitat

**2.3.1.1 New information on the species’ biology and life history:** Information obtained since the Service’s 2009 5-year review is discussed below. The discussion is supplemented where necessary with information obtained prior to 2009.

Continuing studies have found that beach width is a critical indicator of suitable habitat, with natural and wider beaches ( $\geq 2$  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.

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.

During a study of two beach nourishment projects at Winter Harbor Beach and Smith Point Beach on the western shoreline of the Chesapeake Bay in Virginia, Fenster et al. (2006) found that within weeks of deposition of dredged sand, adult NBTBs moved to the nourished beach and recruited large number of larvae. This study also found that adult and larval NBTBs preferred beaches with moderately well-sorted (mean of 0.43-0.55 phi), medium- to coarse-grain sized sand (mean of 0.5-0.6 millimeters [mm]), and relatively compacted sediment (means of 69 pounds per square inch [psi] and 110 psi at depths of 10 and 15 centimeters [cm], respectively). These indicators of sediment type (grain size and sediment compaction) likely support suitable habitat for female ovipositing and larval burrow building (i.e., burrows less likely to collapse).

**2.3.1.2 Abundance, population trends (e.g., increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate), or demographic trends:**

Rhode Island, Connecticut, and New York: No new information. The NBTB continues to be extirpated from these states.

Massachusetts: 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). 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). At the South Shore subpopulation, numbers have remained relatively stable from 2010 to 2018, ranging from 25 to 135 adults.

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.

The Westport site in southeastern Massachusetts continues to be extirpated (M. Nelson, MA-NHESP, email to J. Stanhope, Service, May 30, 2019).

New Jersey: 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: 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. 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. 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). 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. 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.

Surveys on Janes and Cedar Islands were conducted in 2002, 2004, 2005, and 2006 and annually from 2009 to 2017 (Knisley 2018a). 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. 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.

### Virginia

*Eastern Shore* – The Service funded comprehensive adult NBTB surveys along the eastern shoreline of the Chesapeake Bay in 2009 and 2016 (Knisley 2009a, 2016, 2017b). 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. 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. 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 <sup>1</sup>	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

<sup>1</sup>Includes sites with >500 adult NBTBs.

*Western Shore* – 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). 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. 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. Region 4 has only one large population at Dameron Marsh NAP that is permanently protected from human activities. 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-and-Factory-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). 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 <sup>1</sup>	Number of Occupied Sites (>1 adult)	Number of Surveyed Sites	Percent of Surveyed Sites Occupied
2017	7,832	6 <sup>2</sup>	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

<sup>1</sup>Includes sites with >500 adult NBTBs.

<sup>2</sup>Plum 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.

**2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding):** The Service funded the U.S. Geological Survey (USGS), through a Science Support Partnership grant in 2017, to conduct molecular genetic studies to delineate population structure within *Cicindela d. dorsalis*, *C. puritana*, and *C. d. media* and to examine the validity of

the subspecific taxonomy of *Cicindela d. dorsalis* and *C. d. media*. Their research included: (1) designing and optimizing a suite of polymorphic microsatellite loci for population genetic investigation of *C. d. dorsalis*, *C. d. media*, and *C. puritana*; (2) comparing the two distinct geographic areas inhabited by *C. d. dorsalis* (Massachusetts and Chesapeake Bay) and *C. puritana* (Chesapeake Bay and Connecticut River) to examine patterns of genetic population structure; (3) utilizing nuclear and mitochondrial DNA markers to investigate the validity of the sub-specific status of *C. d. dorsalis* and *C. d. media*. Results of the study will be available in fall 2019 (A. Aunins, USGS, email to J. Stanhope and J. Slacum, Service and D. Kazyak, USGS, May 30, 2019).

**2.3.1.4 Taxonomic classification or changes in nomenclature:** Bousquet (2012) provided a comprehensive cataloguing of the carabid beetles, including tiger beetles recorded in America, north of Mexico, and listed the NBTB's genus as *Habroscelimorpha*. This change involves the elevation of multiple subgenera within the genus *Cicindela* to independent genus. This usage is also followed in other recent tiger beetle studies including Pearson et al. (2015) and Knisley (2017b). Gough et al. (2018) further supports this elevation of subgenus to genus through a taxonomically comprehensive molecular phylogenetic analysis of Cicindelinae. The commonly accepted scientific name for the NBTB is *Habroscelimorpha dorsalis dorsalis*.

**2.3.1.5 Spatial distribution, trends in spatial distribution (e.g., increasingly fragmented, increased numbers of corridors), or historical range (e.g., corrections to the historical range, change in distribution of the species' within its historical range):** The extent of the NBTB's historical range has not changed, with the northernmost sites located in Massachusetts (Martha's Vineyard, Monomoy NWR) and the southernmost sites located in southeastern Virginia (Plum Tree NWR, Grandview NAP). The NBTB continues to be extirpated from Rhode Island, Connecticut, New York, and New Jersey. While the translocation efforts at Sandy Hook, NJ were unsuccessful, they were successful at Monomoy NWR, providing the only large population (>500 adults) in the northeastern portion of the NBTB's range. Since 2008/2009, the number of occupied sites has continued to decrease in Maryland and Virginia on the western shoreline of the Chesapeake Bay, while the number of occupied sites has remained relatively stable on the eastern shoreline. The decline on the western shoreline is likely due to greater habitat loss and development than on the eastern shoreline.

The overall trend for the NBTB's distribution continues to be a decreasing number of occupied suitable sites and increased fragmentation of large, contiguous areas of occupied habitat, as described in the Service's 2009 5-year review. This could result in the creation of multiple smaller population segments separated by unsuitable habitat, leading to increased isolation, reduced gene flow, and eventual extirpation, as observed in Calvert County, MD with only one viable site remaining (the other site only had two adults, which were likely dispersers).

**2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):** There remains little suitable habitat within the NBTB's northeast range on the Atlantic Ocean coastline, due to greater development pressure and human activity use levels compared to those in the Chesapeake Bay. In the Chesapeake Bay (VA and MD), observations during surveys and preliminary analysis indicate a decreased amount of suitable habitat across this part of the range due to increased shoreline erosion (caused by development, hurricanes, large storms), hardening of shoreline (e.g., rip-rap, bulkheads), changing shoreline due to storms, and SLR (Knisley et al. 2016; Knisley 2016, 2017a, 2017b, 2019).

In few instances, storms may create more NBTB habitat. A fall 2006 storm deposited a large amount of sand and caused a land bridge to form between the southern tip of South Beach and South Monomoy Island (Kapitulik 2011), creating additional NBTB habitat at Monomoy NWR and South Beach, owned by the Town of Chatham, MA.

**2.3.1.7 Other:** Some research has been conducted to determine the best, cost-effective survey methods to accurately estimate population size at sites. Smith and Kapitulik (2010) recommended combining repeated counts over the active NBTB season (including emergent, peak, and post-peak period) with low-intensity mark-recapture method (i.e., marking a subset of NBTB) to estimate recapture and survival probability. Knisley (2009b) compared visual index counts, mark-recapture, and removal methods to estimate NBTB numbers; he found that index counts underestimated the population size, frequently by about half relative to the estimates from the other two methods, and that the removal method was more accurate and reliable than the mark-recapture method. However, he concluded that the index count method is the most cost-effective and recommended that counts be adjusted to represent accurate population size.

Knisley and Fenster (2010) reported no change in the number of NBTB larvae before and after application of 1.75-percent Rodeo with 0.5-percent Li700 surfactant to the back beach area for the control of invasive *Phragmites australis*. In four laboratory tests, testing the direct and indirect application of 1.75-percent Rodeo and 0.5-percent surfactant on NBTB larvae, no NBTB mortality was recorded and no apparent effects to any larvae were observed over 3 days, including digging burrows when transferred to new terraria.

A new effort to translocate NBTB larvae to Sandy Hook, NJ is planned for 2020, funded via the Service's Recovery Challenge Grant (Gwiazdowski 2019). As described in the Service's 2009 5-year review and Knisley et al. (2005), larvae from the Chesapeake Bay were used for the unsuccessful translocation effort in the 1990s. The cause of the decline and extirpation is uncertain, but one hypothesis was that Chesapeake Bay NBTBs were not adapted to survive on ocean beaches due to potential genetic, behavioral, and ecological differences

(Knisley et al. 2005). Therefore, the planned translocation will utilize larvae from Monomoy NWR, another ocean beach site.

### **2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)**

The purpose of a 5-year review is to recommend whether a listed taxon continues to warrant protection under the Endangered Species Act (ESA) and, if so, whether it should be reclassified (from threatened to endangered or from endangered to threatened). This task requires that the analysis of the threats to the species be performed while assuming that the species is not receiving the regulatory protections, funding, recognition, and other benefits of ESA listing. Summaries of ongoing applications of ESA protections may shed light on some future activities that constitute threats to the species. However, the analysis under Factor D (*Inadequacy of Existing Regulatory Mechanisms*) focuses on the adequacy of alternative (i.e., non-ESA) mechanisms to address the continuing and foreseeable threats.

**2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:** The primary threat to NBTB continues to be the loss of suitable beach habitat due to multiple factors, including increasing development and shoreline structures, hurricanes/large storms, intense recreational use, and SLR.

The Service's 2009 5-year review described in detail the negative impacts of development and shoreline structures on NBTB habitat. New research also indicates adverse impacts from certain shoreline structures where "sites with bulkheads and revetments (rip-rap) had almost no beach at high tide and supported few adults and no larvae" (Knisley et al. 2016). For the western shoreline of the Chesapeake Bay in Virginia, over half of the sites have shoreline structures while approximately one-fifth of the sites on the eastern shoreline have shoreline structures (Knisley et al. 2016). The overall declining trend of total adults, number of sites with >500 and >1,000 adults, and number of occupied sites on the western shoreline may be associated with a greater proportion of shoreline armoring. This decline may also be attributed to several major hurricanes and large storms (i.e., nor'easters), notably Hurricanes Isabel in 2003, Ernesto in 2006, and Sandy in 2012, causing significant erosion and loss of NBTB habitat; the potential effects of the first two hurricanes were described in the Service's 2009 5-year review. However, coastal development and shoreline structures may limit the ability of beaches to recover from hurricanes and storms due to disruption of the sediment budget (i.e., sediment starved due to trapping behind structures and upriver dams) and less natural upland for beaches to migrate landward, thereby causing them to recede or disappear (Defeo et al. 2009, National Academy Press 2000).

In some cases, offshore breakwaters and beach nourishment may be beneficial, as

described in the Service's 2009 5-year review, providing protection from wave energy and increasing the amount of habitat to support large numbers of adult NBTBs observed at sites such as Grandview NAP (Knisley 2012, 2017a). Fenster et al. (2006) determined that two beach nourishment projects on the western shoreline of the Chesapeake Bay (Winter Harbor Beach and Smith Point) had a short-term positive effect on NBTB habitat. Within weeks of the sand placement, adults laid eggs and produced a large number of larvae at both sites. Knisley (2004) further studied one of these projects (Winter Harbor Beach) and found that placing dredged material adjacent to and seaward of the existing shoreline (i.e., not on the shoreline) and conducting all depositional work with equipment offshore in mid-April to May 2002 did not have an apparent negative impact on the NBTB or their habitat. Knisley (2004) also observed *C. hirticollis*, a nonlisted tiger beetle species, ovipositing on the beach before sand deposition and a large number of *C. hirticollis* larvae along the original shoreline in early June. In addition, the total number of NBTB adults and larvae and mean number of NBTB larvae per transect were significantly greater in the deposition section of the beach from 2002 to 2004 compared to the nondeposition section.

Sea level rise and land subsidence (natural and human-induced) are also exacerbating and increasing beach erosion and shoreline recession (Hinkel et al. 2013, Knisley et al. 2016). Leatherman et al. (2000) linked SLR to shoreline retreat along the U.S. Atlantic coast, finding that the long-term shoreline retreat rate was averaging approximately 150 times that of SLR. Multiple authors (Boon et al. 2010, Ezer and Corlett 2012, Boon and Mitchell 2015, Boon et al. 2018) have also found that relative SLR rates are high or accelerating in the U.S. Mid-Atlantic region along the Atlantic coast and the Chesapeake Bay. The Intergovernmental Panel on Climate Change (2013) attributed the higher SLR rates worldwide to rising atmospheric and oceanic temperatures since the late eighteenth century. Furthermore, in the Chesapeake Bay, Boon et al. (2010) found that local subsidence contributed on average about 53 percent of relative SLR. With a warming climate, some studies predict an increase in the frequency of more intense hurricanes (e.g., category 4 and 5) by the end of the 21st century, in particular in the western Atlantic Ocean north of 20°N latitude (i.e., Cuba and north), which would likely cause increased coastal erosion, resulting in further loss of NBTB habitat (Bender et al. 2010, Knutson et al. 2010).

**2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:** This factor is not relevant to the species. There is no new information or changes to this section from the Service's 2009 5-year review.

**2.3.2.3 Disease or predation:** There are no known diseases of NBTB. Predation by a common robber fly (family Asilidae) was found to cause 6-percent mortality of adult NBTBs at the Flag Pond site and was observed at other sites (Knisley et al. 2016). Another predator observed at NBTB sites was a parasite tephritid wasp (genus *Methocha* Latreille) that lays parasitic eggs in burrows on NBTB larvae; the eggs hatch and consume the NBTB larvae (Knisley et al. 2016). The effect of

predation on NBTB populations is not known, but is not likely an increasing threat.

**2.3.2.4 Inadequacy of existing regulatory mechanisms:** The Service's 2009 5-year review generally describes the existing regulatory mechanisms for permitting of shoreline stabilization projects by the U.S. Army Corps of Engineers (Corps) and variability of state and local requirements regarding construction of shoreline projects. The Virginia Institute of Marine Science's Center for Coastal Resource Management (VIMS) conducted a study of tidal shoreline management in Virginia (VIMS 2010) and found that "[d]espite the regulatory attention to protection of shoreline resources, Virginia continues to lose tidal wetlands, beaches and natural riparian vegetation. Impacts arise as a result of both human and natural causes." They further state "[w]hile erosion and sea level rise are responsible for some of the losses, the most dramatic changes have resulted from human activities. With the expansion of regulatory coverage over the past several decades, most of these impacts have resulted from activities that were permitted. Some of these impacts have been approved after a finding that the benefits outweigh the detriments. Other impacts have been a result of regulatory conundrums created when overlapping programs do not have coordinated visions of the best strategy for managing a shoreline element." This study suggests that existing regulatory mechanisms, with ESA protections currently provided to the NBTB, are inadequate in addressing the NBTB's major threats of development and shoreline structures and subsequent loss of habitat in Virginia. Furthermore, local, state, and Federal agencies may not be fully evaluating the effects of shoreline structures on adjacent beaches when permitting projects; increased erosion has been observed at beaches adjacent to shoreline structures after construction (Knisley 2016, 2017a; D. Fields, VDCR, emails to J. Stanhope, Service, June 13, 2019 and July 9, 2019).

Without ESA protection for the NBTB, the Corps would likely approve permits for shoreline structures and other shoreline projects without requiring measures to avoid or minimize impacts to the species (e.g., time-of-year restrictions for beach construction activities during adult active season, conduct activities from offshore to reduce direct impacts on beach, specify sand grain size for beach nourishment projects). There would likely be a further reduction in NBTB habitat quality and quantity and a resultant decrease in total numbers of NBTBs and number of occupied sites.

The NBTB currently receives some protections in Maryland, Virginia, and Massachusetts under state endangered species acts. Maryland's protections are briefly described in the Recovery Plan (Service 1994). In Massachusetts, the NBTB is listed as endangered under the Massachusetts Endangered Species Act (MESA). As such, the NBTB is protected from "take," which means "to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, process, disrupt the nesting, breeding, feeding or migratory activity or attempt to engage in any such conduct, or to assist such conduct. Disruption of nesting, breeding, feeding or

migratory activity may result from, but is not limited to, the modification, degradation or destruction of habitat.” Protection of the NBTB and its habitat under the state Wetlands Protection Act and the MESA, in combination, are considered adequate and possibly greater than the other states (M. Nelson, MA-NHESP, email to J. Stanhope, Service, May 30, 2019). In Virginia, the NBTB is listed as threatened under the Virginia Endangered Plant and Insect Species Act. As such, the NBTB has the following protections: “It shall be unlawful for any person to dig, take, cut, process, or otherwise collect, remove, transport, possess, sell, offer for sale, or give away any species native to or occurring in the wild in the Commonwealth that are listed in this chapter or the regulations adopted hereunder as threatened or endangered, other than from such person's own land.” However, if the NBTB is delisted at the Federal level, states may follow suit and remove state protections.

#### **2.3.2.5 Other natural or manmade factors affecting its continued existence:**

High intensity usage and off-road vehicles on public beaches continue to impact adult and larval NBTBs, as described in the Service’s 2009 5-year review. Sites where declines of the NBTB may be associated with these stressors include: Martha’s Vineyard (MA), Flag Ponds (MD), and Kiptopeke State Park (VA) (Knisley et al. 2016; Knisley 2016, 2017a; S. von Oettingen, Service, email to J. Stanhope, Service, May 29, 2019; M. Nelson, MA-NHESP, email to J. Stanhope, Service, May 30, 2019). Although multiple surveys of beaches have identified unoccupied, potential suitable habitat in the Northeast, recreational impacts at heavily used beaches precludes the ability of the NBTB to expand into these areas, curtailing its distribution.

South Monomoy Island (MA) has a growing grey seal population, and in the spring months, tens of thousands of seals haul out on beaches inhabited by NBTBs. It is not known if these animals (weighing in excess of 800 pounds) affect NBTBs and their habitat; they may potentially compact sand, crush larvae, or contribute nutrients for prey for NBTBs (M. Hillman, Service, email to J. Stanhope, Service, May 31, 2019).

## **2.4 Synthesis:**

The NBTB’s historical range was from Massachusetts to Virginia. The species is now extirpated from Rhode Island, Connecticut, New York, and New Jersey and found only in the Chesapeake Bay of Maryland and Virginia and two sites in Massachusetts. Table 3 summarizes the current status and threats to the NBTB throughout its range. Except for GRAs 1 (Massachusetts) and 6 (Tangier Sound, MD), surveys document a continued decline in NBTB numbers and occupied sites. The number of occupied sites, in particular those with greater than 500 adults, have continued to decrease in Maryland and Virginia on the western shoreline of the Chesapeake Bay. The number of occupied sites have remained relatively stable on Virginia’s eastern shoreline; however, most sites had declining numbers, and there were fewer sites with very large populations (>1,000 adults). With increasing fragmentation of contiguous areas of occupied habitat, smaller population segments will become increasingly separated by unsuitable habitat,

leading to greater isolation, reduced gene flow, and eventual extirpation, as observed in Calvert County, MD with just one viable population remaining. Only one of the GRAs, Tangier Sound, MD, meets the recovery criteria. Some occupied sites are permanently protected, owned and managed by state agencies, Federal agencies, or nongovernmental organizations (NGOs) or protected through conservation easements; however, it is likely difficult for these entities to address offsite impacts such as littoral sand drift and SLR.

The primary threat to the NBTB continues to be the loss of suitable beach habitat due to multiple factors, including increasing development and shoreline structures, hurricanes/large storms, and SLR. Some sites are impacted by high intensity usage and off-road vehicles on public beaches. There remains little suitable, functionally available habitat within the NBTB's Northeast range on the Atlantic Ocean coastline, and observations during surveys and preliminary analysis indicate a decreased amount of suitable habitat across both shorelines 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.

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"> <li>- Westport site extirpated</li> <li>- Martha's Vineyard site numbers appear to be stable</li> <li>- Monomoy NWR site translocation may be failing</li> </ul>	<ul style="list-style-type: none"> <li>- Westport site extirpated</li> <li>- Martha's Vineyard site numbers appear to be declining, more than 90 percent decrease from 2010</li> <li>- Monomoy NWR site translocation successful, with expanding range and large population (&gt;8,000 adults in 2016) on South Monomoy Island, expanding northward to Town-owned lands</li> </ul>
2 & 3	RI, CT, NY	<ul style="list-style-type: none"> <li>- At listing extirpated from RI, CT, and NY</li> </ul>	<ul style="list-style-type: none"> <li>- Extirpated from RI, CT, and NY</li> </ul>
4	NJ	<ul style="list-style-type: none"> <li>- Sandy Hook, NJ translocation sites extirpated</li> </ul>	<ul style="list-style-type: none"> <li>- Sandy Hook, NJ translocation sites confirmed extirpated</li> </ul>
5	MD – Calvert County (Western Shore)	<ul style="list-style-type: none"> <li>- 6 of 10 occupied sites extirpated, habitat lost or in very poor condition</li> <li>- 2 of 4 remaining sites with &lt;5 NBTBs in 2005, these sites have marginal habitat</li> <li>- The 2 primary sites (Scientist Cliffs and Western Shores/Calvert Beach) have declined in numbers &gt;75 percent since 2003</li> </ul>	<ul style="list-style-type: none"> <li>- 8 of 10 occupied sites extirpated</li> <li>- 2 remaining sites (Flag Ponds, Western Shores/Calvert Beach)</li> <li>- Flag Ponds has 2-4 adult NBTBs observed in 2017-2018, likely dispersed from other occupied site</li> <li>- Western Shores/Calvert Beach is only viable population with increasing numbers (&gt;2,000 adults in 2018) since 2009, but not near peak of about 4,000 adults in 1988</li> </ul>
6	MD – Tangier Sound (Eastern Shore)	<ul style="list-style-type: none"> <li>- Both sites (Janes and Cedar Islands) are stable or may be increasing</li> </ul>	<ul style="list-style-type: none"> <li>- Janes Island's numbers increased in recent years (&gt;4,000 adults in 2017), after declining 2006-2014</li> <li>- Cedar Island's numbers relatively stable and no apparent trend, with large fluctuations in numbers (1,000-3,000 adults)</li> </ul>
7	VA – Eastern Shore	<ul style="list-style-type: none"> <li>- Total NBTB numbers stable</li> <li>- 55 percent of NBTBs found on 2 of 35 occupied sites in 2005 (Parker's Marsh, Savage Neck)</li> <li>- 4 occupied sites extirpated (habitat gone)</li> <li>- 12 occupied sites showing declining numbers and available habitat</li> </ul>	<ul style="list-style-type: none"> <li>- 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</li> <li>- 35 occupied sites in 2016 (32-36 sites in 1999-2009)</li> <li>- 7 sites &gt;1,000 adults in 2016 (9-12 sites in 1999-2009)</li> <li>- Most sites had declining numbers</li> <li>- 3 sites had large increases in numbers and a new site was found</li> </ul>
8 & 9	VA – Western Shore	<ul style="list-style-type: none"> <li>- Since 2001 there has been a 20 percent loss in occupied sites (12 of 58 occupied sites)</li> <li>- The majority of occupied sites show evidence of habitat loss as a result of Hurricane Isabel and Hurricane Ernesto</li> <li>- Total numbers declined 70 percent since 2001</li> <li>- Since 2001, the 8 largest sites that support approximately 50 percent of the total NBTBs in 2001 have declined by 78 percent</li> </ul>	<ul style="list-style-type: none"> <li>- Total NBTB numbers lower in 2017 than 2008 (22 percent decline) and significantly lower than peak in 2001 (77 percent decline)</li> <li>- 37 occupied sites in 2017 (45 sites in 2008 and 64 in 2001)</li> <li>- The number of sites &gt;500 and &gt;1,000 adults in 2017 (6 and 2, respectively) lower than peak in 2001 (21 and 14, respectively)</li> <li>- 7 of 9 sites had declining numbers</li> <li>- The majority of occupied sites showed evidence of severe beach erosion</li> </ul>

### 3.0 RESULTS

#### 3.1 Recommended Classification:

Downlist to Threatened

Uplist to Endangered

Delist:

No change is needed

**3.2 New Recovery Priority Number:** No change. Retain as 6.

**Brief Rationale:** Remains subject to a high degree of threat, has a low recovery potential, and is a subspecies.

### 4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

**Revise recovery plan** - More detailed and new information regarding the species' threats, habitat, and populations has become available since the recovery plan was written in 1994. A revised recovery plan should take this new information into account. Specific revisions may include:

- Revising population-based recovery criteria so that they incorporate maintenance of metapopulations and connectivity of these sites to allow for movement and dispersal among sites, which may be necessary for persistence of the species and its ability to respond to large-scale events, such as hurricanes and storms, causing significant coastal erosion. The use of GRAs should be evaluated and changed to fit the Service's use of recovery units for species that use a metapopulation strategy.
- Defining or deleting use of "other" sized population.
- Revising recovery criteria to more explicitly address threats and include objective metrics regarding protection and management of the NBTB.

**Recommendations for specific recovery actions and priority number (1-3, as defined in the NBTB Recovery Plan [Service 1994]):**

1. Pursue long-term protection of additional priority sites in the Chesapeake Bay (appendix B). [Priority 1]
2. Develop best management practices for conserving and protecting the NBTB and its habitat and provide to private landowners, NGOs (e.g., conservation easement holders), and local, state, and Federal government entities. [Priority 1]
3. Work with the Corps, state agencies, and shoreline erosion experts to design appropriate structural and nonstructural methods that will increase or maintain NBTB habitat and find opportunities to implement these methods. [Priority 1]
4. Update the population viability analysis to determine minimum viable population size, number of subpopulations, and proximity of sites and to compare management

strategies, while taking into account habitat quantity and quality (e.g., habitat models that account for site-specific SLR projections). [Priority 2]

5. Conduct a rangewide assessment of available and potential habitat and shoreline alterations/hardening that have occurred to date. [Priority 2]
6. Evaluate the potential effects of relative SLR on NBTB and its habitat, and develop appropriate management strategies to address this potential threat. [Priority 2]
7. Identify additional priority sites, based on the results of analyses in item numbers 4, 5, and 6, to pursue long-term protection throughout the NBTB's range. [Priority 2]
8. Continue surveys (by staff and/or contract) to monitor population and habitat trends to obtain a better understanding of the NBTB's status and metapopulation structure. These data will also be needed to assist the Service with project consultations. [Priority 2]
9. Reintroduce populations at sites within the NBTB's historical range at beaches that have suitable habitat and long-term protection and are likely to have resiliency in response to SLR. [Priority 2]
10. Work with local governments to ensure that permitting authorities are aware of the NBTB and threats to its habitat from shoreline projects, including effects from shoreline structures on adjacent beaches. [Priority 2]
11. Work with the Corps, state agencies, and shoreline erosion experts to develop models or methods to assess and account for effects from shoreline structures on adjacent beaches. [Priority 2]
12. Convene an ad hoc task force to meet periodically to discuss recovery of the NBTB. [Priority 2]
13. Evaluate previously occupied sites to determine if active management of the habitat could make it suitable (e.g., vegetation removal, change in beach grooming practices, restrictions on 4-wheel drive vehicles). [Priority 3]
14. Develop a cost-effective survey protocol and population estimation method to ensure consistent and accurate monitoring and estimation of populations. [Priority 3]
15. Conduct prey base studies for adult and larval NBTB to assist in identifying suitable habitat and determine factors that could limit prey base availability, which in turn impact NBTB survival and productivity. [Priority 3]
16. Determine preferred sand grain size for NBTB, in particular for female oviposition and larval recruitment, at sites throughout its range. [Priority 3]

17. Complete genetics work to evaluate the four subspecies of *C. dorsalis*, and to compare the NBTBs within the Chesapeake Bay to those in Massachusetts. This information will assist in understanding the metapopulation structure of this species over time. [Priority 3]
18. Evaluate the geomorphology of the Atlantic Ocean sites using the same parameters used for the Chesapeake Bay sites. These data are needed to evaluate and compare the habitat criteria of the Atlantic sites to those in the Chesapeake Bay. [Priority 3]

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**U.S. FISH AND WILDLIFE SERVICE**  
**5-YEAR REVIEW of Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*)**

**Current Classification:** Threatened

**Recommendation resulting from the 5-Year Review:**

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change needed

**Appropriate Listing/Reclassification Priority Number, if applicable:** Not applicable

**Review Conducted By:** Jennifer Stanhope, Fish and Wildlife Biologist, Virginia Field Office

**REGIONAL OFFICE APPROVAL:**

Approve Paul R. Fly Date 8/28/19

Assistant Regional Director - Ecological Services, DOI Unified Region 1 – North Atlantic–  
Appalachian, U.S. Fish and Wildlife Service

## **Appendix A - Conservation Easement Language**

### **Virginia Eastern Shore Land Trust conservation easements:**

- 100-foot waterfront buffer restrictions: This specific language varies in each of the conservation easements, but generally states that except as required by Grantor in connection with existing permitted residential uses, associated yards, docks, and/or piers, all land within one hundred (100) feet of tidal marshes, wetlands, mudflats, water bodies and streams shall be maintained as a buffer strip of forest, grass or natural vegetation, with no timber cutting, plowing, use by livestock, soil disturbance, or construction of new or relocated buildings, roads, substantial structures. For the Scarborough Neck site, selective harvest of individual trees is permitted with specific provisions to protect water quality and migratory bird habitat.
- Restrictions protective of NBTB at site below Savage Neck Dunes NAP: “The Maritime Community and Beach Zone as denoted on Exhibit B, the Map of the Protected Property, attached hereto and made a part hereof, shall be maintained in a natural state with the exception of the permitted activities outlined in Article 2.2 and Article 2.3. Except for providing access to the existing bayfront cottages and maintaining the existing roads associated with the aforementioned cottages, there shall be no mowing within the Maritime Community and Beach Zone. There shall be no use of off-road vehicles, construction of shoreline stabilization structures filling or grading (including beach nourishment), shoreline hardening, mechanical raking of the beach, or other activities that threaten the Natural Heritage Resources within the Maritime Community and Beach Zone with the exception of the permitted activities outlined in Article 2.2 and Article 2.3.”
- Restrictions protective of NBTB at Church Neck North site: “Within the Chesapeake Bay beachfront area labeled on Exhibit B as “Northeastern Beach Tiger Beetle Habitat” and within this Chesapeake Bay beachfront area as it migrates over time, there shall be no use of off-road vehicles, construction of shoreline stabilization structures, filling or grading (including beach nourishment), shoreline hardening, or mechanical raking of the beach without Grantee's prior review and written approval. Grantee shall only give such approval if they determine the above activities will protect the shoreline from erosion and in consultation with the Virginia Department of Conservation and Recreation's Division of Natural Heritage determine such activities will not negatively affect northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) habitat.”

### **Virginia Outdoor Foundation conservation easements:**

- 35-ft riparian buffer restrictions: “no plowing, cultivation, or similar earth disturbing activity within 35 feet from the banks of the Chesapeake Bay.”

**Appendix B: Additional priority sites to pursue long-term protection (occupied sites with >500 adult NBTB)**

GRA-5 Calvert County, MD

- Western Shores/Calvert Beach

GRA-7 Eastern Shore of Chesapeake Bay, VA

- Beach Island site, Accomack County.
- Hyslop Marsh site, Accomack County: adjacent, privately owned land has a conservation easement, co-held by the VESLT and ESSWCD, which has a 100-ft waterfront buffer restriction (appendix A), but no prohibitions from construction of shoreline protection/erosion control structures (H. Plourde-Rogers, VAESLT, email to J. Stanhope, Service, June 27, 2019).
- Scarborough Neck site, Accomack County: approximately half of the adjacent, privately owned land has a conservation easement, co-held by Virginia Outdoor Foundation (VOF) and VAELST, which has a 100-ft waterfront buffer restriction (appendix A), but no prohibitions from construction of shoreline protection/erosion control structures (H. Plourde-Rogers, VAESLT, email to J. Stanhope, Service, July 1, 2019).
- Occohannock Neck North site, Northampton County.
- Silver Downings Beach site, Northampton County.
- Church Neck site, Northampton County: a small portion (approximately 1,000 ft of 12,000 ft of shoreline) of the adjacent, privately owned land has a conservation easement, held by the VESLT, which protects a 300-ft buffer strip of vegetation, but has no prohibitions from construction of shoreline protection/erosion control structures (H. Plourde-Rogers, VAESLT, email to J. Stanhope, Service, July 1, 2019).
- Tankards Beach site, Northampton County.
- Cape Charles South site, Northampton County.

GRA-8 Western Shore of Chesapeake Bay (Rappahannock River north), VA

- Bluff Point site, Northumberland County: portions of the adjacent, privately owned land have conservation easements, co-held by the VOF, CBF, and Northern Neck Land Conservancy, which has 35-ft riparian buffer restrictions (appendix A) (E. Ronston, CBF, email to J. Stanhope, June 24, 2019). However, there are no prohibitions from construction of shoreline protection/erosion control structures.

GRA-9 Western Shore of Chesapeake Bay (Rappahannock River south), VA

- Winter Harbor site, Mathews County.