



United States Department of the Interior

FISH AND WILDLIFE SERVICE



Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

May 15, 2014

Mr. William T. Walker
Chief, Regulatory Branch
Norfolk District, Corps of Engineers
803 Front Street
Norfolk, VA 23510-1096

Attn: Greg Culpepper, Regulatory Branch

Re: Bay Creek at Cape Charles
Community Association, Inc.,
Northampton County, VA, Permit
NAO-2013-02115/13-V1723, Project
2014-F-0223

Dear Mr. Walker:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the referenced project and its effects on the federally listed threatened Northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) (NBTB) in accordance with section 7 of the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA). Your January 7, 2014 request for formal consultation was received on January 7, 2014.

This biological opinion is based on information provided in the November 25, 2013 project proposal, telephone conversations, field investigations, and other sources of information. A complete administrative record of this consultation is on file in this office.

CONSULTATION HISTORY

- 11-25-13 The Service received an email from the U.S. Army Corps of Engineers (Corps) with the project review package for the proposed project.
- 11-25-13 The Service emailed the Corps informing them the project review package was incomplete and was missing an official species list. The Service requested clarification on who applied for the proposed project.

- 11-26-13 The Corps responded to the Service's November 25, 2013 email acknowledging the missing official species list and provided clarification on the applicant for the proposed project.
- 12-17-13 to 12-26-13 Several phone conversations were held among the Service, Corps, and applicant to clarify proposed actions for the project.
- 01-07-14 The Service received the request to initiate formal consultation from the Corps.
- 01-13-14 The Service sent a letter to the Corps acknowledging initiation of formal consultation.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The project site is located in the Town of Cape Charles, Lots 1 through 5 of the Marina Village, Northampton County, VA (Latitude: 37.27778, Longitude: -76.01528) (Figure 1). Lots 1, 2, 4, and 5 are undeveloped, while lot 3 has a single family home. The proposed action is the issuance of a Corps permit for the construction of a single 22 foot (ft) wide by 100 ft long interbay breakwater with beach augmentation (Figure 2). Maximum channelward encroachment of the breakwater will be 118 ft from mean high water. Approximately 13,560 ft² of beach nourishment is proposed between mean high and mean low water landward of the breakwater. The new breakwater is to be placed between two existing outer breakwaters to reduce the extent of the tombolo that is negatively impacting the dune system fronting these lots.

Construction access will be by land, through lot 4, and the staging area will be on lots 4 and 5 (Figure 3). Access to the beach will be from a single point crossing the remaining dune system. The equipment will traverse the project area to construct an access path to the breakwater, move rock for construction of the breakwater, and grade sand placed for beach nourishment. No materials will be stock piled on the beach, and work will be conducted when adult NBTBs are not present (no work from June 1 to September 15).

Approximately 8,200 ft² of subaqueous bottom will be covered by the structure and by sand placed (approximately 774 cubic yards of beach quality sand) for beach augmentation. When completed, the structure with beach augmentation, will protect 18,841 ft² of non-vegetated wetlands and dune area (adult NBTB habitat), and 1,540 ft² of larval NBTB habitat. Plantings of American dunegrass (*Leymus mollis*) will be used to help stabilize the repaired dune system.



Figure 1. Site location of proposed breakwater, Bay Creek at Cape Charles Community Association, Inc., Town of Cape Charles, Northampton County, VA.

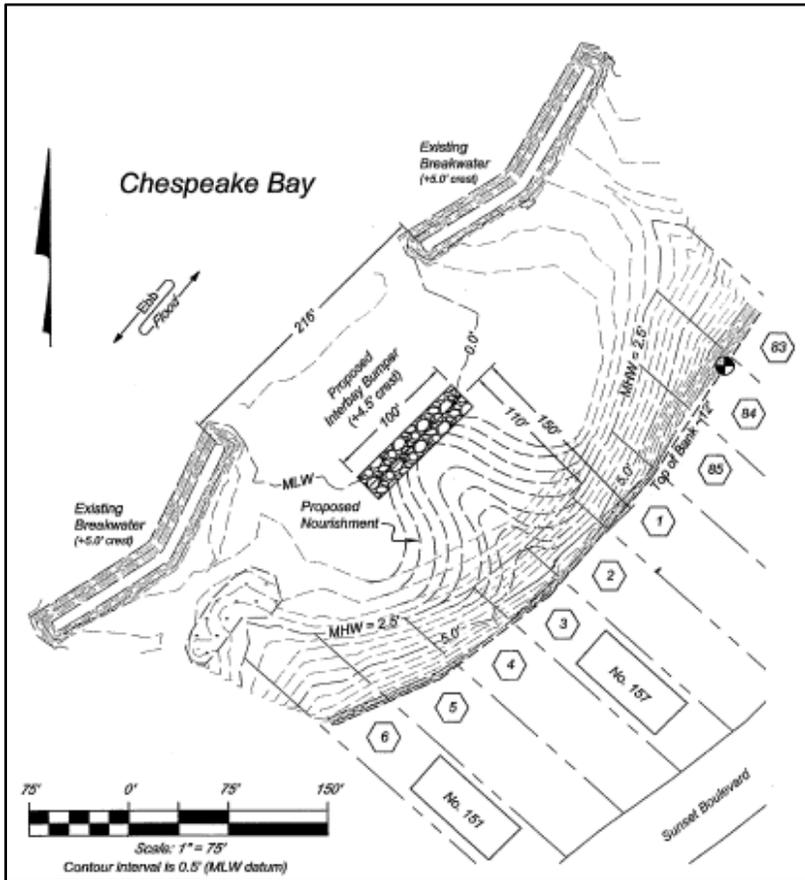


Figure 2. Breakwater design, Bay Creek at Cape Charles Community Association, Inc., Town of Cape Charles, Northampton County, VA.

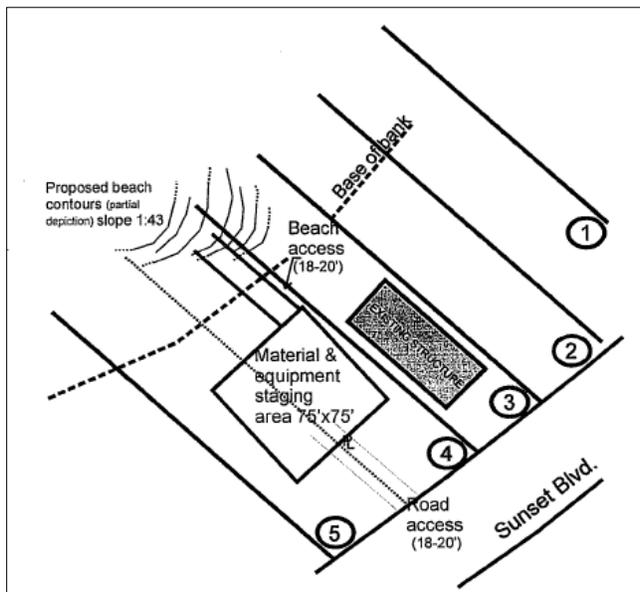


Figure 3. Beach access and material staging area for proposed breakwater project, Bay Creek at Cape Charles Community Association, Inc., Town of Cape Charles, Northampton County, VA.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The Service has determined that the action area for this project consists of:

1. Approximately 8,200 ft² of subaqueous bottom covered by the breakwater structure and sand placed for beach augmentation.
2. Approximately 1,650 ft² of subaqueous bottom indirectly impacted through siltation/turbidity as the structures and beach augmentation are put in place.
3. The existing stretch of beach and dune area (13,560 ft²) traversed by equipment and covered with sand to construct the project.
4. Access route connecting uplands staging area to dunes (400 ft²).
5. The uplands staging area (5,625 ft²).

The total size of the action area is 29,435 ft² (Figure 4).

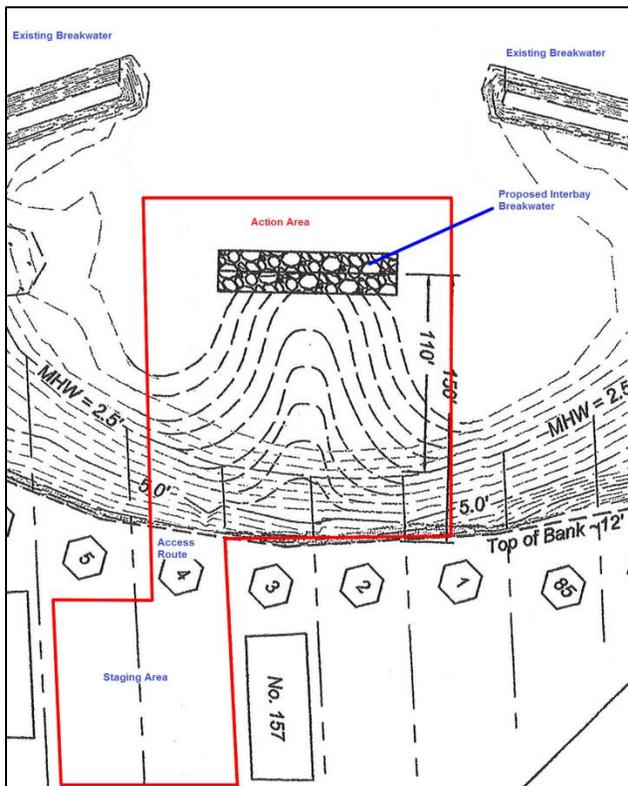


Figure 4. Action Area (29,435 ft²) for proposed breakwater project, Bay Creek at Cape Charles Community Association, Inc., Town of Cape Charles, Northampton County, VA.

STATUS OF THE SPECIES AND CRITICAL HABITAT RANGEWIDE

The species description, life history, population dynamics, status, and distribution and critical habitat description, if applicable, are at: Stamatov 1972; Rosen 1980; Knisley 1987, 1991, 1997a, b, c, 2001, 2002, 2005a, b, c, d, 2009, 2012; Knisley et al. 1987, 2001; Knisley and Hill 1989, 1990, 1998, 1999; Vogler et al. 1993; Blair et al. 1994; Service 1994, 2005, 2007, 2008, 2009; Hill and Knisley 1994, 1995; Vogler and DeSalle 1994; Vogler and Goldstein 1997; U.S. Geological Survey 1998; Gowan and Knisley 2001; Nothnagle 2001; Drummond 2002; Fenster et al. 2006; Pearson et al. 2006; Davis 2007; National Park Service 2007; and Kapitulik 2011.

ENVIRONMENTAL BASELINE

Status of the Species/Critical Habitat Within the Action Area - The action area is within the section of shoreline referenced by the Service as the Kings Creek NBTB site. The total number of adult NBTBs has fluctuated from a low of 176 in 1999 (Knisley and Hill 1999), to a high of 1,247 in 2002 (Knisley 2002). Surveys in 2005 and 2009 have shown a decline, 751 adult NBTBs and 535 adult NBTBs, respectively (Knisley 2009).

The action area contains 13,560 ft² of adult NBTB habitat. The presence of larval NBTBs is assumed by the presence of adult NBTBs and on-site observations (M. Drummond, Service, pers. obs. July 8, 2013) that the existing shoreline supports larval NBTB habitat. The southernmost end of the shoreline does not support larval habitat due to severe erosion, which has exposed the clay substrate and is eroding the dune system. The section of shoreline where the proposed breakwater is to be constructed is eroding into the dune system at an accelerated rate compared to the adjacent tombolos due to the extensive gap between the existing breakwaters. The northern end of the site is showing erosion but still supports the best NBTB habitat along this section of shoreline. Erosion has impacted the amount of larval NBTB habitat within the action area, and 949 ft² remains. The effects of Hurricane Sandy in 2012 on adult and larval NBTBs at this site are unknown.

Factors Affecting Species Environment Within the Action Area – Much of the Kings Creek NBTB site is protected by stone breakwaters, and has shown minimal impacts from a number of hurricane events. However, the width of the shoreline has narrowed and there has been erosion of sections of man-made dune along this reach.

The shoreline in the action area is part of a gated community comprised of individual homes and undeveloped lots, resulting in limited use of the beach by the landowner's family and their guests. The types of activities common along this shoreline are limited to low impact human activities such as foot traffic, sun-bathing, fishing, and swimming access. These types of activities are known to pose a minimal threat to the NBTB.

The Kings Creek NBTB site is 15 miles from the mouth of the Chesapeake Bay. The mouth of the Chesapeake Bay is experiencing a sea level rise of 0.16 inches/year, a rate higher than the worldwide average (U.S. Geological Survey 1998). A data analysis collected from tide stations from the last 75 years supports earlier estimates of a constant rate of sea level rise of 0.17

inches/year at Norfolk, VA which will result in an increase of 0.8 ft in mean sea level by 2050 (Boon 2012). Increased sea level is changing the dynamics that maintain beach habitats, including increased shoreline erosion rates in some areas, and changes in sand deposition (U.S. Geological Survey 1998). Field observations from Service personnel indicate that increased sea level rise is impacting conditions at existing NBTB sites. A number of the sites are underwater or have eroded to the back marsh.

EFFECTS OF THE ACTION

Direct Effects – Because no project-related actions will occur on the beach during NBTB breeding and egg-laying, no direct effects to adult NBTBs are expected.

Larvae will be impacted from placement of materials, use of equipment, and construction-related foot traffic. There is 949 ft² of larval NBTB habitat, and all larvae within this area are likely to be crushed or entombed in their burrows as a result of equipment traversing the project site or from the placement of materials. Larvae not killed outright may be prevented from feeding due to their sensitivity to vibrations, movements, and shadows, possibly resulting in injury or death.

Indirect Effects – Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR 402.02). Changes in sand movement and beach profile may occur following breakwater construction as the beach equilibrates. Since the action area will be contoured during beach nourishment, the severity of change that may occur will be reduced and the effects are expected to be minor and temporary. Changes in sand movement and beach profile will affect the location, amount, and suitability of adult NBTB habitat. Because these changes are expected to be minor, short-term in duration, and of a temporary nature, the Service anticipates that any affects to adult NBTBs will be insignificant and discountable. There will be a shift in the areas available for use by larval NBTBs. Because these changes are expected to be minor, short-term in duration, and of a temporary nature, any affects to larval NBTBs will be insignificant and discountable.

Interrelated and Interdependent Actions – An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. The Service is not aware of activities interrelated to or interdependent with the proposed action at this time.

Beneficial Actions – Construction of the interbay breakwater with beach nourishment will improve the stability of the beach and increase the extent of suitable NBTB habitat. Currently within the action area there is 13,560 ft² of adult NBTB habitat. When the project is completed, the amount of adult NBTB habitat will increase by 2,614 ft², resulting in a total of 18,841 ft² of adult NBTB habitat. Currently within the action area there is 949 ft² of larval habitat. When the project is completed, the amount of larval NBTB habitat will increase by 591 ft², resulting in a total of 1,540 ft² of larval habitat.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. The Service is not aware of any future State, tribal, local, or private actions within the action area at this time.

CONCLUSION

While some loss of larval NBTB habitat will occur, the overall magnitude and severity of effects to NBTBs from the proposed action are anticipated to be minor since the majority of effects are short-term and temporary and the area affected by the project represents a small fraction of NBTB's entire range. The project will result in an increase in adult and larval NBTB habitat. The sand grain quality for the project is within the parameters of sand grain size required by NBTBs, so repopulation of the nourished area by adults is expected to occur the first year after construction. The natural beach north of the action area currently supports the majority of larval NBTBs present along this section of shoreline and will serve as the source population for recolonization of the action area. The placement of the interbay breakwater will provide additional stability to this section of shoreline that is already partially protected by a breakwater system.

After reviewing the current status of NBTB, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the issuance of a Corps permit, as proposed, is not likely to jeopardize the continued existence of the NBTB. No critical habitat has been designated for this species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Sections 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns, which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are nondiscretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to the Bay Creek at Cape Charles Community Association, Inc., as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require the Bay Creek at Cape Charles Community Association, Inc. to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service anticipates incidental take of NBTB will be difficult to detect for the following reasons: coloring and small body size, tendency of larvae to remain in burrows beneath the surface of the sand, and finding a dead or impaired specimen is unlikely. However, the following level of take of this species can be anticipated by the areal extent of the adult and larval habitat affected.

The Service anticipates incidental take of all larval NBTBs within the 949 ft² of habitat present from equipment traversing the beach, placement of beach nourishment, and construction-related foot traffic. This take will be in the form of harm, harassment, or kill.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize take of NBTB:

- Ensure construction is conducted in a manner that minimizes disturbance to NBTB.

TERMS AND CONDITIONS

To be exempt from the prohibitions of section 9 of the ESA, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. No ground disturbance caused by construction-related foot traffic, equipment, or materials will occur on the beach outside of the action area.

2. Sand used for beach nourishment must have a mean grain size between 0.4 and 0.7 millimeters.
3. No use of pesticides on the beach.
4. Fuel, oil, and hydraulic fluids for equipment used will not be stored within 100 ft of any waterbody or wetland. Refueling of mobile equipment/vehicles will not occur within 100 ft of any waterbody or wetland (includes the beach area which is classified as non-vegetated wetlands). On-site personnel will select appropriate sites for these activities and subsequently use best management practices, secondary containment measures, or other standard spill prevention and countermeasures to manage the activity to prevent these fluids from entering the Chesapeake Bay.
5. Any small gasoline powered equipment, such as pumps and generators, and fuel tanks must be entirely enclosed or placed within a secondary containment structure that is large enough to completely contain all materials should a spill, leak, or overflow occur. Any spills of motor oil, hydraulic fluid, coolant, or similar fluids, not contained before entry into the action area, must be reported to this office at the contact number/email provided below and to the National Response Center (800-424-8802) immediately.
6. Notify the Service before initiation of construction and upon completion of the project via email at the contact information provided below.
7. Care must be taken in handling any dead specimens of proposed or listed species to preserve biological material in the best possible state. In conjunction with the preservation of any dead specimens, the finder has the responsibility to ensure that evidence intrinsic to determining the cause of death of the specimen is not unnecessarily disturbed. The finding of dead specimens does not imply enforcement proceedings pursuant to the ESA. The reporting of dead specimens is required to enable the Service to determine if take is reached or exceeded and to ensure that the terms and conditions are appropriate and effective. Upon locating a dead specimen, notify the Service's Virginia Law Enforcement Office at 804-771-2883 and the Service's Virginia Field Office at 804-693-6694.

The Service believes that no more than 949 ft² of larval NBTB habitat will be incidentally taken as a result of the proposed action. The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The Federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

- We recommend that the Corps establish a process to mitigate for habitat loss to shoreline projects. This could include a means to establish conservation easements for the protection of the NBTB and its habitat, restoration of beach habitat in areas where habitat has been altered significantly, or other appropriate measures. This would contribute to recovery efforts for the NBTB by formally protecting sites through conservation easements or natural areas.

For the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions, please contact Mike Drummond of this office at (804) 824-2408, or via email at Mike_Drummond@fws.gov.

Sincerely,

Cindy Schulz
Field Supervisor
Virginia Ecological Services

cc: VDACS, Richmond, VA (Attn: Keith Tignor)
VDCCR, DNH, Richmond, VA (Attn: René Hypes)

Literature Cited

- Blair, J.M., R.W. Parmelee, and R.L. Wyman. 1994. A comparison of the forest floor invertebrate communities of four forest types in northeastern United States. *Pedobiologia* 38(2):146-160.
- Boon, J.D. 2012. Evidence of sea level acceleration at U.S. and Canadian tide stations, Atlantic Coast, North America. *Journal of Coastal Research* 28(6):1437-1445.
- Davis, C. 2007. Monitoring and reintroduction of the northeastern beach tiger beetle, *Cicindela dorsalis dorsalis*, Monomoy National Wildlife Refuge, 2007. Report to the U.S. Fish and Wildlife Service, New England Field Office, Concord, NH.
- Drummond, M.R. 2002. The effects of geophysical factors on the distribution of the northeastern beach tiger beetle, *Cicindela dorsalis dorsalis* Say. M.S. Thesis, Christopher Newport University, VA.
- Fenster, M.S., C.B. Knisley, and C.T. Reed. 2006. Habitat preference and the effects of beach nourishment on the federally threatened northeastern beach tiger beetle. *Cicindela dorsalis dorsalis*: Western Shore, Chesapeake Bay, Virginia. *Journal of Coastal Research* 22(5):1133-1144.
- Gowan, C., and C.B. Knisley. 2001. A population viability analysis for the northeastern beach tiger beetle in the Chesapeake Bay region. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.
- Hill, J.M., and C.B. Knisley. 1994. A metapopulation study of the threatened northeastern beach tiger beetle, *Cicindela dorsalis dorsalis* in Northumberland County, Virginia. Report to Virginia Department of Conservation and Recreation, Richmond, VA.
- Hill, J.M., and C.B. Knisley. 1995. Distribution and abundance of a biological indicator species, *Cicindela dorsalis dorsalis* in relation to shoreline structures and modifications. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.
- Kapitulik, N. 2011. Northeastern beach tiger beetle, *Cicindela dorsalis dorsalis*, monitoring of adults and larvae at Monomoy National Wildlife Refuge and South Beach 2011. Report to U.S. Fish and Wildlife Service, New England Field Office, Concord, NH.
- Knisley, C.B. 1987. Habitats, food resources, and natural enemies of a community of larval *Cicindela* in southeastern Arizona (Coleoptera: Cicindelidae). *Canadian Journal of Zoology* 65:1191-1200.
- Knisley, C.B. 1991. Management plan for a population of the threatened tiger beetle, *Cicindela dorsalis* at Accawmacke Plantation, Virginia. Report to Espey Houston and Company, Austin, TX.

- Knisley, C.B. 1997a. Distribution and abundance of the northeastern beach tiger beetle, *Cicindela dorsalis dorsalis*, in relation to shoreline modifications, in Virginia. Report to Virginia Department of Agriculture and Consumer Affairs, Office of Plant Protection, Richmond, VA.
- Knisley, C.B. 1997b. Microhabitat preferences of *Cicindela dorsalis dorsalis*, the northeastern beach tiger beetle. Report to Virginia Department of Agriculture and Consumer Services, Richmond, VA.
- Knisley, C.B. 1997c. Monitoring of the northeastern beach tiger beetle, *Cicindela d. dorsalis*, at Peaceful Beach Estates (O'Leary site) Northampton County, Virginia. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.
- Knisley, C.B. 2001. A survey of the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) along the western shoreline of the Chesapeake Bay, 2001. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.
- Knisley, C.B. 2002. A survey of *Cicindela dorsalis dorsalis* along the eastern shoreline of the Chesapeake Bay, 2002. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.
- Knisley, C.B. 2005a. A survey of the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) at Eastern Shore of Virginia sites of the Chesapeake Bay, 2005. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.
- Knisley, C.B. 2005b. Distribution and abundance of *Cicindela puritana* and *C. dorsalis dorsalis* in Maryland, 2005. Report to Heritage and Biodiversity Conservation Programs, Maryland Department of Natural Resources, Annapolis, MD.
- Knisley, C.B. 2005c. A survey of the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) at all western and selected eastern shoreline sites of the Chesapeake Bay, 2004. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.
- Knisley, C.B. 2005d. A five-year study of the northeastern beach tiger beetle in relation to beach use at Camp Silver Beach (YMCA), Northampton County, Virginia, 2000-2005. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.
- Knisley, C.B. 2009. A survey of the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) at Eastern Shore of Virginia sites, 2009. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.
- Knisley, C.B. 2012. Survey for the northeastern beach tiger beetle, *Cicindela dorsalis dorsalis*, along the Virginia shoreline of the Chesapeake Bay, 2012. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.

- Knisley, C.B., and J.M. Hill. 1989. Human impact on *Cicindela dorsalis dorsalis* at Flag Ponds, Maryland. Report to U.S. Fish and Wildlife Service, Chesapeake Bay Field Office, Annapolis, MD.
- Knisley, C.B., and J.M. Hill. 1990. Distribution and abundance of two tiger beetles, *Cicindela dorsalis media* and *C. lepida* at Assateague Island, Maryland, 1990. Report to Maryland Department of Natural Resources, Natural Heritage Program, Annapolis, MD.
- Knisley, C.B., and J.M. Hill. 1998. Distribution and abundance of *Cicindela dorsalis dorsalis*, the northeastern beach tiger beetle, along the western shoreline of the Chesapeake Bay in Virginia. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.
- Knisley, C.B., and J.M. Hill. 1999. A survey of the eastern shore of Virginia for the northeastern beach tiger beetle, *Cicindela dorsalis dorsalis*, 1999. Report to U.S. Fish and Wildlife Service, Virginia Field Office, Gloucester, VA.
- Knisley, C.B., J.M. Hill, and A.M. Scherer. 2001. Translocation of threatened tiger beetle *Cicindela dorsalis dorsalis* (Coleoptera: Cicindelidae) to Sandy Hook, New Jersey. *Annals of the Entomological Society of America* 98(4):552-557.
- Knisley, C.B., J.L. Luebke, and D.R. Beatty. 1987. Natural history and population decline of the coastal tiger beetle *Cicindela dorsalis dorsalis* Say (Coleoptera: Cicindelidae). *Virginia Journal of Science* 38(4):293-303.
- National Park Service. 2007. Threatened and endangered species activity report, 2007 season. Report to Gateway National Recreation Area, Sandy Hook, NJ.
- Nothnagle, P.J. 2001. Monitoring of the northeastern beach tiger beetle, (*Cicindela dorsalis dorsalis*) in Massachusetts in 2001. Report to U.S. Fish and Wildlife Service, New England Field Office, Concord, NH.
- Pearson, D.L., C.B. Knisley, and C.J. Kazilek. 2006. A field guide to the tiger beetles of the United States and Canada. Oxford University Press, Inc., New York, NY.
- Rosen, P.S. 1980. Erosion susceptibility of the Virginia Chesapeake Bay shoreline. *Marine Geology* 34:45-59.
- Stamatov J. 1972. *Cicindela dorsalis* endangered on northern Atlantic coast. *Cicindela* 4:78.
- U.S. Fish and Wildlife Service. 1994. Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*) Recovery Plan. Hadley, MA. 60 p.

- U.S. Fish and Wildlife Service. 2005. Partial survey of the western shoreline of Chesapeake Bay, Virginia, for the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*). Unpublished data. Virginia Field Office, Gloucester, VA.
- U.S. Fish and Wildlife Service. 2007. Survey of the Potomac River for the northeastern beach tiger beetle, (*Cicindela dorsalis dorsalis*). Unpublished data. Virginia Field Office, Gloucester, VA.
- U.S. Fish and Wildlife Service. 2008. Survey of the western shoreline of Chesapeake Bay, Virginia, for the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*). Unpublished data. Virginia Field Office, Gloucester, VA.
- U.S. Fish and Wildlife Service. 2009. Northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*) 5-year review: summary and evaluation. Unpublished report. Virginia Field Office, Gloucester, VA.
- U.S. Geological Survey. 1998. The Chesapeake Bay: geologic product of rising sea level. Fact Sheet 102-98. Reston, VA.
- Vogler, A.P., and R. DeSalle. 1994. Diagnosing units of conservation management. *Conservation Biology* 8:354-363.
- Vogler, A.P., and P.Z. Goldstein. 1997. Adaptation, cladogenesis, and the evolution of habitat association in North American tiger beetles: a phylogenetic perspective. Pages 353-373 in T. Givnish and K. Systma, eds. *Molecular Evolution and Adaptive Radiation*. Cambridge University Press, Cambridge, MA.
- Vogler, A.P., R. DeSalle, T. Assmann, C.B. Knisley, and T.D. Schultz. 1993. Molecular population genetics of the endangered tiger beetle *Cicindela dorsalis dorsalis* (Coleoptera: Cicindelidae). *Entomological Society of America* 86:142-152.