

DEPARTMENT OF THE INTERIOR**Fish and Wildlife Service****50 CFR Part 17**[Docket No. FWS-R5-ES-2024-0080;
FXES111105BBFLY-245-FF05E00000]

RIN 1018-BH52

Endangered and Threatened Wildlife and Plants; Threatened Species Status With Section 4(d) Rule for Bethany Beach Firefly**AGENCY:** Fish and Wildlife Service, Interior.**ACTION:** Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service), propose to list the Bethany Beach firefly (*Photuris bethaniensis*), a firefly species from Delaware, Maryland, and Virginia, as a threatened species under the Endangered Species Act of 1973, as amended (Act). This determination also serves as our 12-month finding on a petition to list the Bethany Beach firefly. After a review of the best available scientific and commercial information, we find that listing the species is warranted. We also propose protective regulations issued under section 4(d) of the Act to provide for the conservation of the Bethany Beach firefly. If we finalize this rule as proposed, it would add this species to the List of Endangered and Threatened Wildlife and extend the Act's protections to the species.

DATES: We will accept comments received or postmarked on or before December 2, 2024. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. eastern time on the closing date. We must receive requests for a public hearing, in writing, at the address shown in **FOR FURTHER INFORMATION CONTACT** by November 15, 2024.

ADDRESSES: *Written comments:* You may submit comments by one of the following methods:

(1) *Electronically:* Go to the Federal eRulemaking Portal:

<https://www.regulations.gov>. In the Search box, enter FWS-R5-ES-2024-0080, which is the docket number for this rulemaking. Then, click on the Search button. On the resulting page, in the panel on the left side of the screen, under the Document Type heading, check the Proposed Rule box to locate this document. You may submit a comment by clicking on "Comment."

(2) *By hard copy:* Submit by U.S. mail to: Public Comments Processing, Attn:

FWS-R5-ES-2024-0080, U.S. Fish and Wildlife Service, MS: PRB/3W, 5275 Leesburg Pike, Falls Church, VA 22041-3803.

We request that you send comments only by the methods described above. We will post all comments on <https://www.regulations.gov>. This generally means that we will post any personal information you provide us (see Information Requested, below, for more information).

Availability of supporting materials: Supporting materials, such as the species status assessment report, are available at <https://www.regulations.gov> at Docket No. FWS-R5-ES-2024-0080.

FOR FURTHER INFORMATION CONTACT: Genevieve LaRouche, Field Office Supervisor, U.S. Fish and Wildlife Service, Chesapeake Bay Ecological Services Field Office, 177 Admiral Cochrane Drive, Annapolis, MD 21401; telephone 202-341-5882. Individuals in the United States who are deaf, deafblind, hard of hearing, or have a speech disability may dial 711 (TTY, TDD, or TeleBraille) to access telecommunications relay services. Individuals outside the United States should use the relay services offered within their country to make international calls to the point-of-contact in the United States. Please see Docket No. FWS-R5-ES-2024-0080 on <https://www.regulations.gov> for a document that summarizes this proposed rule.

SUPPLEMENTARY INFORMATION:**Executive Summary**

Why we need to publish a rule. Under the Act (16 U.S.C. 1531 *et seq.*), a species warrants listing if it meets the definition of an endangered species (in danger of extinction throughout all or a significant portion of its range) or a threatened species (likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range). If we determine that a species warrants listing, we must list the species promptly and designate the species' critical habitat to the maximum extent prudent and determinable. We have determined that the Bethany Beach firefly meets the Act's definition of a threatened species; therefore, we are proposing to list it as such. Listing a species as an endangered or threatened species can be completed only by issuing a rule through the Administrative Procedure Act rulemaking process (5 U.S.C. 551 *et seq.*).

What this document does. We propose to list the Bethany beach firefly

as a threatened species with protective regulations issued under section 4(d) of the Act (a "4(d) rule") to provide for the conservation of the species.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species because of any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

We have determined that the Bethany Beach firefly meets the Act's definition of a threatened species due to habitat loss or degradation from the following activities or conditions: under Factor A, urban development and changes in land cover, light pollution, recreational activities, pesticides, invasive plants, and shoreline erosion control (including constructed dunes and sand fencing); and under Factor E, effects of small population size, climate change which includes more frequent and increased storm intensities and high tide flooding, rising sea levels causing periodic and/or total inundation, saltwater intrusion, and increased temperatures and drought).

Section 4(a)(3) of the Act requires that the Secretary of the Interior (Secretary), to the maximum extent prudent and determinable, concurrently with listing designate critical habitat for the species. Section 3(5)(A) of the Act defines critical habitat as (i) the specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination by the Secretary that such areas are essential for the conservation of the species. Section 4(b)(2) of the Act states that the Secretary must make the designation on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security, and any other relevant impacts of specifying any particular area as critical habitat.

We have determined that critical habitat is not determinable at this time for the Bethany Beach firefly. The Act allows the Service an additional year to publish a critical habitat designation that is not determinable at the time of listing (16 U.S.C. 1533(b)(6)(C)(ii)).

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments or information from other governmental agencies, Native American Tribes, the scientific community, industry, or any other interested parties concerning this proposed rule. We particularly seek comments concerning:

- (1) The species' biology, range, and population trends, including:
 - (a) Biological or ecological requirements of the species, including habitat requirements for feeding, breeding, and sheltering;
 - (b) Genetics and taxonomy;
 - (c) Historical and current range, including distribution patterns and the locations of any additional populations of this species;
 - (d) Historical and current population levels, and current and projected trends; and
 - (e) Past and ongoing conservation measures for the species, its habitat, or both.
- (2) Threats and conservation actions affecting the species, including:
 - (a) Factors that may be affecting the continued existence of the species, which may include habitat modification or destruction, overutilization, disease, predation, the inadequacy of existing regulatory mechanisms, or other natural or manmade factors;
 - (b) Biological, commercial trade, or other relevant data concerning any threats (or lack thereof) to this species; and
 - (c) Existing regulations or conservation actions that may be addressing threats to this species.
- (3) Additional information concerning the historical and current status of this species.

(4) Information to assist with applying or issuing protective regulations under section 4(d) of the Act that may be necessary and advisable to provide for the conservation of the Bethany Beach firefly. In particular, we seek information concerning:

- (a) The extent to which we should include any of the Act's section 9 prohibitions in the 4(d) rule; or
- (b) Whether we should consider any additional or different exceptions from the prohibitions in the 4(d) rule.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Please note that submissions merely stating support for, or opposition to, the

action under consideration without providing supporting information, although noted, do not provide substantial information necessary to support a determination. Section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or a threatened species must be made solely on the basis of the best scientific and commercial data available.

You may submit your comments and materials concerning this proposed rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in **ADDRESSES**.

If you submit information via <https://www.regulations.gov>, your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on <https://www.regulations.gov>.

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on <https://www.regulations.gov>.

Our final determination may differ from this proposal because we will consider all comments we receive during the comment period as well as any information that may become available after this proposal. Based on the new information we receive (and, if relevant, any comments on that new information), we may conclude that the species is endangered instead of threatened, or we may conclude that the species does not warrant listing as either an endangered species or a threatened species. In addition, we may change the parameters of the prohibitions or the exceptions to those prohibitions in the protective regulations issued under section 4(d) of the Act if we conclude it is appropriate in light of comments and new information received. For example, we may expand the prohibitions if we conclude that the protective regulation as a whole, including those additional prohibitions, is necessary and advisable to provide for the conservation of the species. Conversely, we may establish additional or different exceptions to the prohibitions in the final 4(d) rule if we conclude that the activities would facilitate or are compatible with the conservation and recovery of the species. In our final rule, we will clearly explain our rationale and the basis for

our final decision, including why we made changes, if any, that differ from this proposal.

Public Hearing

Section 4(b)(5) of the Act provides for a public hearing on this proposal, if requested. Requests must be received by the date specified in **DATES**. Such requests must be sent to the address shown in **FOR FURTHER INFORMATION CONTACT**. We will schedule a public hearing on this proposal, if requested, and announce the date, time, and place of the hearing, as well as how to obtain reasonable accommodations, in the **Federal Register** and local newspapers at least 15 days before the hearing. We may hold the public hearing in person or virtually via webinar. We will announce any public hearing on our website, in addition to the **Federal Register**. The use of virtual public hearings is consistent with our regulations at 50 CFR 424.16(c)(3).

Previous Federal Actions

On May 15, 2019, we received a petition from the Center for Biological Diversity (CBD) and Xerces Society for Invertebrate Conservation to list the Bethany Beach firefly as an endangered or a threatened species under the Act. In response to the petition, we published a 90-day finding on December 19, 2019 (84 FR 69713), in which we announced our finding that the petition contained substantial information indicating that listing may be warranted for the Bethany Beach firefly.

Peer Review

An SSA team prepared an SSA report for the Bethany Beach firefly. The SSA team was composed of Service biologists, in consultation with other species experts. The SSA report represents a compilation of the best scientific and commercial data available concerning the status of the species, including the impacts of past, present, and future factors (both negative and beneficial) affecting the species.

In accordance with our joint policy on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), and our August 22, 2016, memorandum updating and clarifying the role of peer review in listing and recovery actions under the Act (<https://www.fws.gov/sites/default/files/documents/peer-review-policy-directors-memo-2016-08-22.pdf>), we solicited independent scientific review of the information contained in the Bethany Beach firefly SSA report. We sent the SSA report to five independent peer reviewers and received three responses. Results of this structured peer review process can be

found at <https://www.regulations.gov>. In preparing this proposed rule, we incorporated the results of these reviews, as appropriate, into the SSA report, which is the foundation for this proposed rule.

Summary of Peer Reviewer Comments

As discussed in Peer Review above, we received comments from three peer reviewers on the draft SSA report. We reviewed all comments we received from the peer reviewers for substantive issues and new information regarding the contents of the SSA report. The peer reviewers generally concurred with our methods and conclusions, and they provided additional information, clarifications, and suggestions to improve the SSA report.

I. Proposed Listing Determination

Background

A thorough review of the taxonomy, life history, and ecology of the Bethany Beach firefly (*Photuris bethaniensis*) is presented in the SSA report (version 1.0; Service 2024, pp. 4–16). There are at least 15 current known “populations” of the Bethany Beach firefly. Each population exists on a complex of swales (low-lying freshwater marsh areas near coastal dunes) containing at least one occupied swale. The current known range occurs along the Atlantic Coast in Delaware, Maryland, and Virginia (see figure 1, below). This species was only known from Delaware sites until discovery of Maryland populations in 2020, and Virginia

populations in 2021. Additional populations may exist due to limited survey efforts. It is possible that the species occurs in additional swales or complexes, or on additional properties (e.g., publicly owned land), where there is similar habitat and plant communities (Edinger et al. 2014, p. 13 (New York); Breden et al. 2001, p. 109 (New Jersey); Shafale 2012, p. 185 (North Carolina); Nelson 1986, p. 26 (South Carolina)). Comparable intertidal swale habitats exist as far north as New York and as far south as South Carolina. Development of the Atlantic Coast has decreased the availability of swale habitat and the number of populations within the known current range (Delaware, Maryland, and Virginia).

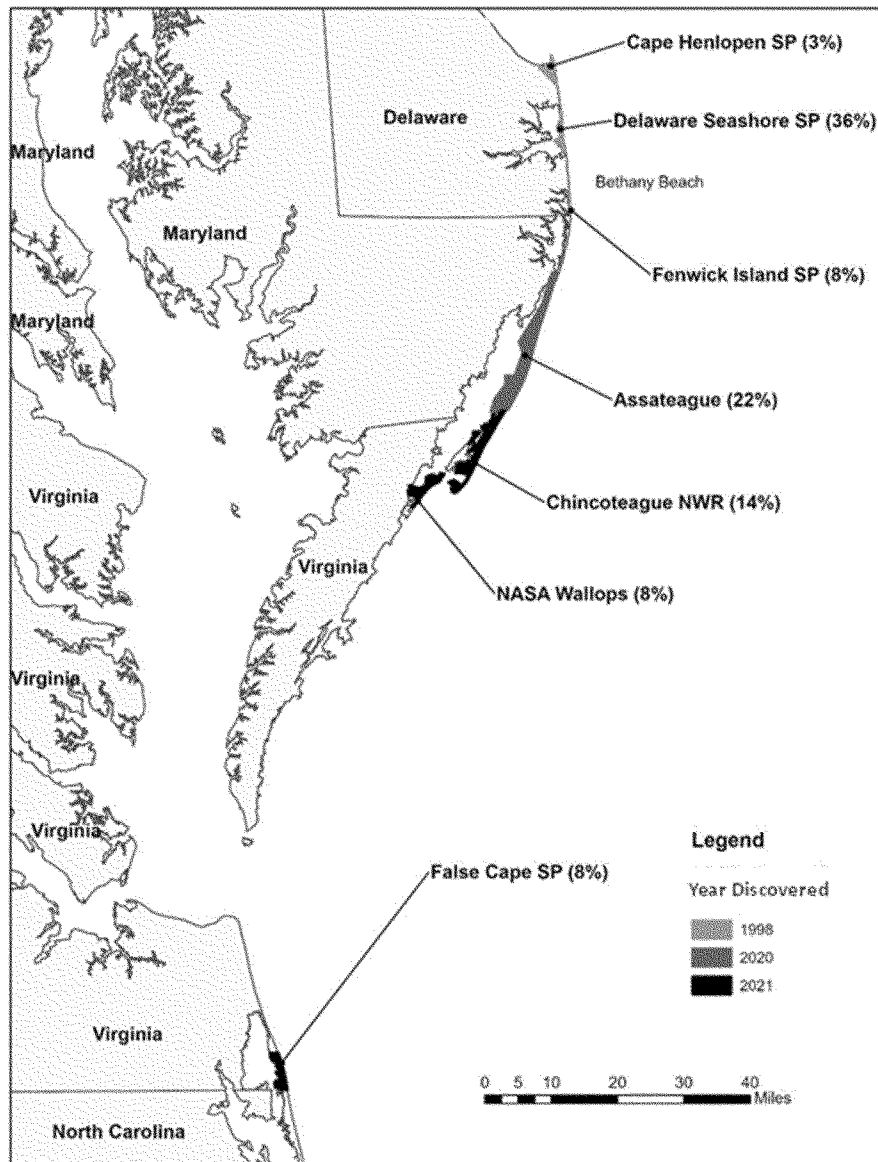


Figure 1. The seven properties across Delaware, Maryland, and Virginia where the Bethany Beach firefly occurs. The percentages after the property name refer to the percent of the rangewide occupied swales that are present on that property. Delaware populations were discovered in 1998, and Maryland and Virginia populations were discovered in 2020 and 2021, respectively.

Bethany Beach firefly is a nocturnal firefly characterized by two bright green flashes given off by males to attract females for mating, while females flash or emit a low glow in response. Like other beetles, fireflies complete metamorphosis with four distinct life stages: egg, larva, pupa, and adult. The longest stage is the larval stage (Fallon et al. 2022, p. 5, Lloyd 2018, pp. 5–7; Faust 2017, p. 39). Adult Bethany Beach fireflies are active from mid-late June through early-mid August and emerge well after sunset.

Bethany Beach fireflies occupy freshwater swales that form as groundwater and rain collect in shallow depressions between or behind coastal sand dunes. These communities are dynamic systems and are susceptible to saltwater intrusion and shifting sand formations. Water levels within the swales vary from standing water to saturated soil, and they can become flooded or dry out completely. Suitable swale habitat is dependent on an intermediate stage of succession (woody and herbaceous open swales) that is naturally driven by periodic dune overwash from storm surge.

Overall, this species requires adequate temporally stable swale habitat that typically has woody shrubs along the perimeter and that retains shallow freshwater seasonally. Moisture is needed for all of the life stages to prevent desiccation, provide food sources, and provide ample organic matter for overwintering and sheltering habitat for larvae. Sufficient population size and connectivity are needed to maintain genetic diversity and to support reproduction and recruitment within a population.

Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and the implementing regulations in title 50 of the Code of Federal Regulations set forth the procedures for determining whether a species is an endangered species or a threatened species, issuing protective regulations for threatened species, and designating critical habitat for endangered and threatened species.

The Act defines an “endangered species” as a species that is in danger of extinction throughout all or a significant portion of its range, and a “threatened species” as a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. The Act requires that we determine whether any species is an endangered species or a threatened species because of any of the following factors:

- (A) The present or threatened destruction, modification, or curtailment of its habitat or range;
- (B) Overutilization for commercial, recreational, scientific, or educational purposes;
- (C) Disease or predation;
- (D) The inadequacy of existing regulatory mechanisms; or
- (E) Other natural or manmade factors affecting its continued existence.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species’ continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects.

We use the term “threat” to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term “threat” includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term “threat” may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an “endangered species” or a “threatened species.” In determining whether a species meets either definition, we must evaluate all identified threats by considering the species’ expected response and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any

existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the Act’s definition of an “endangered species” or a “threatened species” only after conducting this cumulative analysis and describing the expected effect on the species.

The Act does not define the term “foreseeable future,” which appears in the statutory definition of “threatened species.” Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis, which is further described in the 2009 Memorandum Opinion on the foreseeable future from the Department of the Interior, Office of the Solicitor (M–37021, January 16, 2009; “M–Opinion,” available online at <https://www.doi.gov/sites/doi.opengov.ibmcloud.com/files/uploads/M-37021.pdf>). The foreseeable future extends as far into the future as the U.S. Fish and Wildlife Service and National Marine Fisheries Service (hereafter, the Services) can make reasonably reliable predictions about the threats to the species and the species’ responses to those threats. We need not identify the foreseeable future in terms of a specific period of time. We will describe the foreseeable future on a case-by-case basis, using the best available data and taking into account considerations such as the species’ life-history characteristics, threat projection timeframes, and environmental variability. In other words, the foreseeable future is the period of time over which we can make reasonably reliable predictions. “Reliable” does not mean “certain”; it means sufficient to provide a reasonable degree of confidence in the prediction, in light of the conservation purposes of the Act.

Analytical Framework

The SSA report documents the results of our comprehensive biological review of the best scientific and commercial data regarding the status of the species, including an assessment of the potential threats to the species. The SSA report does not represent our decision on whether the species should be proposed for listing as an endangered or threatened species under the Act. However, it does provide the scientific basis that informs our regulatory decisions, which involve the further application of standards within the Act and its implementing regulations and policies.

To assess the Bethany Beach firefly’s viability, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer

and Stein 2000, pp. 306–310). Briefly, resiliency is the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years); redundancy is the ability of the species to withstand catastrophic events (for example, droughts, large pollution events); and representation is the ability of the species to adapt to both near-term and long-term changes in its physical and biological environment (for example, climate conditions, pathogens). In general, species viability will increase with increases in resiliency, redundancy, and representation (Smith et al. 2018, p. 306). Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated the individual species' life-history needs. The next stage involved an assessment of the historical and current condition of the species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. The final stage of the SSA involved making predictions about the species' responses to positive and negative environmental and anthropogenic influences. Throughout all of these stages, we used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time, which we then used to inform our regulatory decision.

The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found at Docket No. FWS–R5–ES–2024–0080 on <https://www.regulations.gov>.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the species and its resources, and the threats that influence the species' current and future condition, in order to assess the species' overall viability and the risks to that viability.

Species Needs

The SSA report contains a detailed discussion of the Bethany Beach firefly's individual and population requirements (Service 2024, pp. 14–16); we provide a summary here. Based upon the best available scientific and commercial information, and acknowledging existing ecological uncertainties, the

resource and demographic needs for breeding, feeding, sheltering, and dispersal of the Bethany Beach firefly are characterized as:

(1) Sufficient quality and availability of interdunal swale habitat with moist soil, herbaceous vegetation, woody vegetation surrounding the swales, and decaying wood to support all life stages of Bethany Beach fireflies and their food sources.

(2) Sufficient quantities of snails, worms, and other soft-bodied invertebrates, and plant material such as berries, as food sources for Bethany Beach firefly larvae.

(3) Sufficient quantities of Bethany beach firefly individual adult males and females to be able to flash to find and select mates, copulate, oviposit, and disperse.

(4) Sufficient connectivity of habitat (swales within 1,000 feet (304.8 meters) of other occupied swales) to allow Bethany beach firefly populations to repopulate each other after catastrophes such as major coastal storms. Based on observations of flight patterns of this species, we assume that swales within 305 m (1,000 feet) of each other are close enough that individuals could travel this distance and reproduction and gene flow could occur between them (Service 2024).

(5) Sufficient stable (open) swales filled with ample organic matter, which provides overwintering and sheltering habitat for Bethany Beach firefly larvae.

Bethany Beach firefly abundance depends on the availability and condition of these resources in freshwater interdunal swales in proximity to the Atlantic shoreline.

Threats

A thorough review of the threats affecting the Bethany Beach firefly is presented in chapter 4 of the SSA report (version 1.0, Service 2024, pp. 17–35). The main threats affecting the Bethany Beach firefly are related to urban development and changes in land cover, light pollution, recreational activities, pesticides, invasive plants, shoreline erosion control (including constructed dunes and sand fencing), effects of small population size, climate change which includes more frequent and increased storm intensities and high tide flooding, rising sea levels causing periodic and/or total inundation, saltwater intrusion, and increased temperatures and drought. Habitat loss, degradation, and fragmentation due to urbanization and development has caused populations to be isolated with presumably no genetic transfer among them, leaving these small populations at increased risk of impacts from random stochastic and

unforeseen catastrophic events. The compounding effects of climate change include increased temperatures and drought, which could dry out swales, and increased storm frequency and intensity, which could degrade swale habitat due to excessive overwash and storm surges. Rising sea levels also pose a risk to first degrade and then remove habitat due to saltwater intrusion from swales being inundated periodically with the addition of storm surge, and then total inundation at some height above current sea levels.

Habitat Loss, Fragmentation, and Degradation

Development—Because the Bethany Beach firefly is believed to be a habitat specialist restricted to interdunal freshwater swales and likely has limited dispersal (Lewis et al. 2020, p. 159), destruction and degradation of swales result in the loss of or decline in populations and decreases connectivity between populations. Sandy ocean beaches are some of the most popular tourist and recreational areas, and constitute some of the most valuable real estate, in the United States (Hapke et al. 2011, p. 2). These Atlantic coastal areas are the sites of high-density residential and commercial development, despite the frequent natural hazards that can occur, including flooding, storm impacts, and coastal erosion. Extensive areas along the Atlantic Coast (Bethany Beach and Dewey Beach, Delaware; Ocean City, Maryland; and Virginia Beach, Virginia) likely contained additional swale habitat prior to development that primarily occurred between 1950 and 1970 after the completion of the Chesapeake Bay bridges (Delaware Department of Natural Resources and Environmental Control 2004, p. 27). There is evidence that the populations of Bethany Beach firefly in Delaware are much reduced from their historical levels. The two sites where the Bethany Beach firefly was originally observed and described by McDermott (1953, p. 35) near Bethany Beach, Delaware, have been lost to development (Lloyd 2018, p. 93). Surveys conducted from 1998 to 2000 in Delaware (Hecksher and Bartlett 2004, pp. 349–352) found the species in swales in three State parks but also in a swale located on privately owned land in the Tower Shores Beach Community (Tower Shores) (Hecksher and Bartlett 2004, pp. 349–352). The swale in Tower Shores was one of the largest-known global populations, consisting of an estimated 100 or more adults in the 1990s. The property was recently developed in 2019, and the population that was previously there is now

believed to be extirpated. In that area, an elevated roadway has altered hydrology and creates shade, while a cul-de-sac has been built over the entire swale, and lighting from the houses has degraded the surrounding area; no fireflies have been observed in surveys since construction was finished.

State laws in Delaware, Maryland, and Virginia do not prevent destruction of the swales via development. Non-tidal wetlands under 400 acres (161.87 hectares) in size are not regulated in Delaware (see the Delaware Wetlands Act, in title 7 of the Delaware Code at chapter 66, section 6603(h); and the Wetlands Regulations, in title 7 of the Delaware Administrative Code at 7502). Since many of the swales where the firefly occurs are smaller than 400 acres, the Delaware Wetlands Act does not regulate development of the swales. Non-tidal wetland laws are stronger in Maryland and Virginia, but some suitable firefly habitat that occurred historically was likely lost due to development (Ocean City, Maryland; Virginia Beach, Virginia) prior to these laws being established. The Maryland Non-Tidal Wetlands Act (1989) limits development in and around tidal wetlands (see title 5 of the Maryland Code, "Environment," at section 5-907). Similarly, in Virginia, developers must obtain a water protection permit before disturbing any wetland, tidal or non-tidal, or stream by clearing, filling, excavating, draining, or ditching (see article 2.2 of the Virginia Code at section 62.1-44.15:20). Although non-tidal wetland laws are stronger in Maryland and Virginia, there is still loss of habitat when permits are issued for development. However, the significant habitat loss that occurred prior to these regulations being enacted has likely limited the Bethany Beach firefly's distribution in these States.

Bethany Beach fireflies are made more vulnerable by their populations' relative isolation from one another. Based on observations from surveys conducted for the species since 2019, we find that fireflies can disperse from occupied swales to other interdunal swales and upland areas located within 1,000 feet (Davis, J. 2023c). The known extant populations in the Delaware State Parks have connectivity within each park but not among the parks due to development of the shoreline between State parks. The Delaware State Parks are also separated from Assateague Island National Seashore due to development and open water. While Assateague Island National Seashore, Chincoteague National Wildlife Refuge, and the National Aeronautics and Space Administration's (NASA's) Wallops

Island Flight Facility are in proximity to one another in Maryland and Virginia, and are not separated by developed areas, dispersal of individuals among these properties is not known to occur due to the distances of occupied swales from each other. False Cape State Park is to the south near the North Carolina/Virginia border and is not close to any other known populations of Bethany Beach fireflies. Without additional suitable habitat occurring within the dispersal distance of the species, it is unlikely that the Bethany Beach firefly could relocate if its habitat is destroyed (Lewis et al. 2020, p. 159).

Even in the parts of their range that are protected from development, Bethany Beach fireflies also face indirect impacts, such as habitat degradation. With the exception of NASA's Wallops Island Flight Facility, which does not allow public access to the shoreline, the sites in which the species is currently present occur primarily on public lands that receive high numbers of visitors for recreational use of the beaches and that border developed areas. As a result, the habitat in these areas is not pristine: the public lands themselves have significant infrastructure (such as parking lots, roads, trails, bathrooms, and visitor centers), and these parks are also adjacent to residential development at varying densities, with the highest densities occurring adjacent to the Delaware State Parks. Both in-park and adjacent development or infrastructure could destroy or degrade swales, alter swale hydrology, degrade water quality, and decrease connectivity among or between swales. Maintenance operations conducted in the past at the three Delaware State Parks may have impacted, drained, or filled in interdunal swales, notably some with populations of the Bethany Beach firefly or other firefly species of conservation concern. Several swales in which the species is present show evidence of filling, ditching, mowing, dumping, and heavy equipment use (Davis 2023d, pers. comm.).

However, impacts from development are not equally distributed among all public lands where occupied swales occur. Development is less of a threat where the species occurs in Maryland and Virginia because the density of development surrounding the properties is low. Assateague Island National Seashore is separated from the mainland of Maryland by Chincoteague Bay; therefore, it is not adjacent to any development occurring outside of the park. There is very little infrastructure (e.g., lights, roads, and buildings) throughout Assateague, although there

are roads and lights from a drive-in campground adjacent to one swale complex. There is also little infrastructure near the occupied swales at Chincoteague National Wildlife Refuge and False Cape State Park in Virginia, and only a two-lane road and some buildings occur adjacent to the three occupied swale complexes at NASA's Wallops Island Flight Facility. This is in contrast to Delaware, which has more infrastructure in the parks, a major highway visible from almost all of the swales running adjacent to two of the parks (Delaware Seashore State Park and Fenwick Island State Park), and a higher density of residential development surrounding the parks. However, four populations at Assateague Island National Seashore and all the populations at NASA's Wallops Island Flight Facility remain vulnerable due to altered hydrology from roads, which is evident due to the presence of the nonnative plant species *Phragmites australis* (often called *Phragmites*, or common reed) in those swales (for more information, see *Invasive Plant Species*, below).

Currently, the greatest threat of development is at Delaware Seashore State Park, where a lease granted for a desalinization project could entail directional drilling adjacent to an occupied swale and two proposed offshore wind projects (Maryland Wind and Skipjack Wind) with possible landfall locations (named "3Rs" and "Tower Road") for the cable route occurring near interdunal swales. It is anticipated that the two wind projects will be constructed within the next 10 years. It is unknown whether directional drilling has occurred at the desalinization plant at this time. For the Maryland Wind biological opinion, the project description includes avoiding land disturbance, including horizontal directional drilling, within 100 feet of any swale; a time-of-year restriction for the use of any light sources between June 1 and September 1 for any work at the 3Rs parking lot or Tower Road parking lot proposed landfall sites; and avoiding installation of permanent light fixtures at the Tower Road site. With these measures, there would be no anticipated impacts to the Bethany Beach firefly. The Service has not gone through section 7 consultation yet on Skipjack Wind.

Development can disrupt the groundwater regimes that sustain interdunal swales both directly and indirectly. Development directly affects the hydrology of swales by increasing impervious surfaces and compacting soils in adjacent areas, thereby reducing groundwater recharge and eventually

lowering the water table (Wright et al. 2006, p. 22). Indirectly, development results in depletion of groundwater by increasing the number of groundwater users in the area. A decrease in groundwater recharge will lower the water table and could result in swales becoming drier over time which could affect the ability of larvae and their prey to survive in the soil. Alteration of hydrology can also lead to an increase in invasive plants and woody vegetation, a change in herbaceous vegetation, and succession in the wetland, resulting in loss of wetland habitat over time. Development adjacent to the properties in which the Bethany Beach firefly occurs is greatest in Delaware (Delaware Seashore State Park and Fenwick Island State Park).

Stressors on groundwater supply are projected to increase in the future throughout the range of the Bethany Beach firefly. Within the U.S. Geological Survey's hydrologic unit code (HUC) 4 (HUC 4 focuses on watersheds in a subregion), in the Delaware-Mid Atlantic Coastal basin (which includes coastal areas of Delaware, Maryland, and Virginia), where a majority of the swale complexes are found, freshwater yield (from surface or ground water) is predicted to decrease by 10 percent while the demand is expected to increase 80 to 100 percent between 2046 and 2070 (when compared to a baseline from 1985–2010) (Brown et al. 2019, p. 225). Much of this is driven by climate change, and its effect on water use in multiple sectors, like agriculture (increased evapotranspiration) and energy use (increased temperatures) (Brown et al. 2019, p. 226). Demands higher than yields can result in reduced groundwater storage, which can reduce the quantity and quality of available swale habitat and decrease the resiliency of the Bethany Beach firefly.

Light Pollution—Firefly species, including the Bethany Beach firefly, rely on bioluminescent light to find mates and to ward off predators. Each species has a unique flash color, length, and frequency. Both male flash patterns and female response patterns are species-specific to prevent hybridization (Lloyd 1966, p. 65; Stanger-Hall and Lloyd 2015, in Owens et al. 2022, p. 2). Courtship dialogues are thought to be essential for mate success in nocturnal fireflies, as the males of most species are presumed not to use visual (color) or chemical (pheromone) cues and thus have no other method of locating receptive females (Demary et al. 2005, in Owens et al. 2022, p. 2).

Artificial light changes the night-time ambient brightness, which can change the intensity and timing of firefly

flashes (Owens and Lewis 2018, p. 13). Bethany Beach fireflies are phototactic, which means they are attracted to light of any kind, including artificial light (Lloyd 2018, p. 94). Artificial light at night can reduce reproduction by affecting mating signals, which prevents mates from finding each other or prevents males from receiving the correct light cues to begin their nocturnal flashing display or both (Lewis et al. 2020, pp. 160–161).

Light pollution is more of an issue in the Delaware State Parks, which are adjacent to development and infrastructure. Light pollution occurs at all three Delaware State Parks in more than 50 percent (26 of 52) of the occupied swales. There is little light pollution where the species occurs in Maryland and Virginia.

Recreation and Grazing—Because the species' occurrence is almost entirely on State or Federal parkland where visitation is high due to recreational use of the beach, there is the potential for foot traffic in the dunes, which could result in beachgoers trampling adults and larva. However, trampling by humans may be limited because the swales are wet, occupied by mosquitoes, and often surrounded by woody vegetation or invasive vegetation such as *Phragmites*. Trampling of adult females and larvae, destruction of microhabitat that supports fireflies, and increased light pollution have been identified as risks associated with increased numbers of visitors in parks in other parts of the country (Faust 2010, pp. 213, 215; Lewis et al. 2020, pp. 163–164).

In Delaware, there is a dune crossing located 350 feet (106.68 meters) from a swale in which the Bethany Beach firefly is present (Davis 2023d, pers. comm.). At Assateague Island National Seashore in Maryland, there are six dune crossings located near a campground that are adjacent to swale habitat where the species is present. However, all the other swale habitat where the species is present is in areas of the island that do not have camping. Thus, even if trampling occurred to some extent, the number of locations where it occurs is limited. There are also ponies on the island that freely graze throughout the park and walk through the swales, which could damage the soil and vegetation more than would be expected from visitors walking through the swales (Huslander 2023, pers. comm.). Grazing could also result in crushing individual eggs and larvae in the soil. However, ponies likely do not impact the species at the population level since ponies are not constantly grazing in swales, and this is

not the only habitat ponies visit. In other words, impacts to swales by ponies are believed to be limited or temporary or both. There is little potential for impacts from recreation at NASA's Wallops Island Flight Facility in Virginia, and while Chincoteague National Wildlife Refuge does have visitation by people, trails for visitors are not in the area where the Bethany Beach firefly occurs (Holcomb 2023, pers. comm.).

Pesticide Use—Pesticides are substances that are used to control pests; pesticides include herbicides, which are used to control vegetation, and insecticides, which are used to control insects. Both herbicides and insecticides have the highest use in agriculture. While some agricultural pesticides have shown negative effects to fireflies in laboratory studies (Wang et al. 2022, entire; Pearsons et al. 2021, entire), the exposure of Bethany Beach fireflies to agricultural use of pesticides is minimal at most. Bethany Beach fireflies occur on barrier islands or within 500 meters (1,640 feet) of the coastline. These areas do not have agriculture nearby. On barrier islands, there is extensive separation from mainland agricultural areas. There may be some garden and home use of pesticides in beach communities on the barrier islands, but the overall use in these areas would be relatively small and the sites occupied by Bethany Beach firefly are primarily on undeveloped public land. Thus, we do not view agricultural pesticide use as a threat to Bethany Beach firefly.

The main source of Bethany Beach firefly exposure to pesticides is through spraying to control mosquitoes in some areas and some limited herbicide use. Although only a few studies have investigated direct effects of herbicides and insecticides on fireflies, broad-spectrum insecticides are known to adversely affect numerous nontarget insects and other taxa (reviewed by Sanchez-Bayo 2011, pp. 74–76; Pisa et al. 2015, pp. 82–83).

Herbicides—The Bethany Beach firefly faces a moderate threat from herbicides. There is some control of *Phragmites* in interdunal swales at Assateague National Seashore, and exposure to herbicides could occur from control of invasive vegetation in and near swales. We expect exposure would be low because the only park that reported control of invasives in interdunal swales was Assateague Island National Seashore. Imazapyr and glyphosate are active ingredients commonly used to control the invasive vegetation using high-pressure or low-pressure foliar spray application,

primarily during the fall months, although imazapyr can be used at any time during the growing season. There is no literature that suggests that there are direct impacts to Bethany Beach firefly from the use of glyphosate and imazapyr, but indirect impacts could cause a reduction in Bethany Beach firefly prey. Some surfactants used in the application of glyphosate and imazapyr to increase efficacy of these two herbicides are more toxic to fish and aquatic invertebrates than glyphosate and imazapyr themselves (Brodman et al. 2010, pp. 80–81; Sinnott 2015, pp. 33–34; Breckels and Kilgour 2018, p. 4; Sinnott 2015, entire). The surfactant polyethoxylated tallowamine (POEA), which is used in glyphosate-based herbicides, has been found to cause the direct mortality of amphibians (Brodman et al. 2010, pp. 70, 80–81). A study of the aquatic surfactant, nonylphenol-polyethylene (NPE), was also found to be moderately toxic to amphibians at concentrations under 1.2 milligrams per liter (mg/L); however, more research is needed (Brodman et al. 2010, pp. 70, 80–81). Based on these results, there could be the potential for indirect effects to the Bethany Beach firefly from the use of surfactants with glyphosate or imazapyr through impacts to food sources. However, at this time, there is little exposure overall from herbicide use across the Bethany Beach firefly’s range.

Insecticides for Mosquito Control—The Bethany Beach firefly’s exposure to organophosphate adulticides for mosquito control varies across its range. Mosquito spraying is not conducted on Assateague Island National Seashore in Maryland or at the Virginia park properties where the species occurs (see table 3, below). However, there is some spraying in areas at NASA’s Wallops Island Flight Facility and at the Delaware State Parks. At Wallops Island, the Bethany Beach firefly’s exposure to these insecticides is likely low because spraying is only applied on the grass and local brush and not in waterways or storm drain/outfall areas (Levine 2023, pers. comm.).

Delaware uses two mosquito control chemicals. Within the Delaware State Parks, the current agreement with Delaware Division of Fish and Wildlife (DFW) is that there is no spraying of adulticides between June 15 and August 15, when adult Bethany Beach fireflies are most active. During this time, DFW uses Bti, which targets mosquito larvae. Bti (short for *Bacillus thuringiensis* subsp. *israelensis*) is a naturally occurring bacterium found in soils and targets only the larvae of the mosquito, blackfly, and fungus gnat ([https://](https://www.epa.gov/mosquitocontrol/bti-mosquito-control###4)

www.epa.gov/mosquitocontrol/bti-mosquito-control###4). Bti is considered very safe because it targets only specific insects.

Outside the June 15 to August 15 timeframe, Delaware has used Trumpet EC™, a common chemical for mosquito control with an active ingredient called naled. Trumpet EC™ is derived from phosphoric acid and is highly toxic to fish resources and a wide range of aquatic non-target organisms including mayflies, caddisflies, crustaceans, fresh and saltwater chironomids, and other marine invertebrates. Organophosphates are also highly toxic to terrestrial insects and aquatic beetles that are naturally occurring predators of mosquito larvae (Laskowski et al. 1999, p. 742; Pinkney et al. 2000, p. 678).

While we do not have data on the effects of Trumpet EC™ specifically on fireflies, Bethany Beach fireflies still occur in swales that have been sprayed by this chemical. Table 1 below describes the swales that have been sprayed over time, mostly in Delaware Seashore State Park, likely because they are near some park facilities. Swales 700, 701, 702, 703 have been sprayed in 11 of the 12 events described in table 1, starting in 2013 and continuing into 2023. All four swales continue to have Bethany Beach firefly presence with the most recent years of observation being 2021, 2023, 2020 and 2022, respectively. While more information would be helpful, the best available information does not show harmful effects of the Delaware spray regime to Bethany Beach firefly populations.

TABLE 1—OCCUPIED BETHANY BEACH FIREFLY SWALES SPRAYED WITH ADULTICIDE TRUMPET EC™ OUTSIDE THE ADULT FLIGHT SEASON SINCE 2013

[Davis 2023i, pers. comm.]

Date adulticide applied	Rate (ounces per acre)	Swale(s) ^{1 2}
June 23, 2013	1.0 oz./ac.	700, 701, 702, 703
September 9, 2016.	0.8 oz./ac.	159
September 14, 2016.	0.8 oz./ac.	700, 701, 702, 703
June 3, 2017 ..	1.0 oz./ac.	15, 16, 17, 24, 26, 30, 231, 400, 402, 700, 701, 702, 703

TABLE 1—OCCUPIED BETHANY BEACH FIREFLY SWALES SPRAYED WITH ADULTICIDE TRUMPET EC™ OUTSIDE THE ADULT FLIGHT SEASON SINCE 2013—Continued

[Davis 2023i, pers. comm.]

Date adulticide applied	Rate (ounces per acre)	Swale(s) ^{1 2}
August 9, 2017.	0.8 oz./ac.	15, 16, 17, 24, 26, 30, 231, 400, 402, 700, 701, 702, 703
July 31, 2018	0.8 oz./ac.	700, 701, 702, 703
September 20, 2018.	0.8 oz./ac.	700, 701, 702, 703
September 10, 2019.	0.8 oz./ac.	700, 701, 702, 703
August 26, 2020.	1.0 oz./ac.	24, 26, 30, 231, 700, 701, 702, 703
September 15, 2020.	1.0 oz./ac.	15, 16, 17, 24, 26, 30, 231, 400, 402, 700, 701, 702, 703
September 12, 2022.	0.8 oz./ac.	700, 701, 702, 703
September 12, 2023.	1.0 oz./ac.	30, 700, 701, 702, 703
October 6, 2023.	1.0 oz./ac.	15, 16, 17, 24, 26, 30, 231, 700, 701, 702, 703

¹ Swale 59 is Cape Henlopen.

² All other swales are in the Delaware Seashore State Park.

As discussed in section 5.2 of the SSA report, more severe storm events and sea level rise could increase the amount of time there is standing water, which could increase mosquito populations and necessitate more frequent use of adulticides (Davis 2023d, pers. comm.).

One additional insecticide used in the species’ habitat is GYPCHEK®, used at False Cape State Park to control gypsy moths on an as-needed basis. It was used as recently as spring 2023.

GYPCHEK® is an insecticide prepared from gypsy moth larvae that have been killed by the nuclear polyhedrosis virus. The active ingredient in GYPCHEK® is the virus, which is embedded in a protein particle called the polyhedron. GYPCHEK® specifically targets the gypsy moth and has no effect on other insects (Lewis et al. 1979, p. 1).

Invasive Plant Species—Invasive plant species, particularly common reed, are present in some of the interdunal swales where the Bethany

Beach firefly occurs. The common reed is an aggressive and competitive plant that grows rapidly and displaces naturally diverse vegetation communities with dense mono-cultural stands (Wilcox et al. 2003 p. 665; Gilbert 2014, p. 78). Expansion of common reed populations can be rapid: a single clone can cover an eighth of a hectare (0.31 acre) in 2 years (Hocking et al. 1983, in Asaeda and Karunarathe 2000, p. 302) and the slow decomposition of common reed detritus can significantly reduce the availability of nutrients, light, and space, making the survival or establishment of other species unlikely (Meyerson et al. 2000, p. 93). A number of studies have shown that once established, the common reed will increase marsh elevation to a greater extent than other marsh species through higher accumulation of organic and mineral matter. This is largely a result of its high biomass production and high rates of litter accumulation (Windham and Lathrop 1999, p. 931; Meyerson et al. 2000, p. 89; Rooth et al. 2003, p. 480).

There are several ways that *Phragmites*, the common reed, may reduce habitat quality for Bethany Beach fireflies. By elevating the marsh surface, hydrological flow within a marsh is modified. Establishment of monocultures of the common reed in interdunal swales would likely decrease available soil substrate and moisture for larva. In addition, the reduction in plant biodiversity in areas overtaken by the common reed can reduce prey species on which firefly larvae feed.

Phragmites occurs in many swales in Delaware. Botanical surveys conducted between 2015 to 2017 in Delaware's interdunal swales indicate that at least 34 swales had some level of common reed invasion. Other invasive species such as Japanese black pine (*Pinus thunbergii*) and Bermuda grass (*Cynodon dactylon*) are also growing in some of the swales, and DFW discovered silver grass (*Miscanthus* sp.) dumped in a swale (Davis 2023e, pers. comm.). There has been limited control of invasive plants using herbicides at an occupied swale in Cape Henlopen State Park for the purposes of protecting a rare plant, but control of invasives in other interdunal swales in Delaware State Parks does not occur unless initiated by DFW, which is rare (Davis 2023j, pers. comm.).

Phragmites are also present in Virginia and Maryland. At Assateague Island National Seashore, common reed occurs in the occupied swales adjacent to the campground, and herbicide is used to control its spread at the park (Huslander 2023, pers. comm.). In

Virginia, there are thousands of acres of common reed on NASA's Wallops Island Flight Facility, which, unless there is a direct fire threat during launch operations, are not managed (Miller 2023, pers. comm.). At Chincoteague National Wildlife Refuge, it is unknown whether the common reed occurs near the swales (Holcomb 2023, pers. comm.). The only park in which the common reed is not present in the interdunal swale habitat is False Cape State Park (Swain 2023, pers. comm.).

Other Habitat Stressors

Woody Plant Encroachment—Interdunal swales with Bethany Beach fireflies are typically shallow depressions (swales) with herbaceous vegetation in the depression and woody species such as southern wax myrtle (*Morella cerifera*), highbush blueberry (*Vaccinium corymbosum*), and groundsel (*Baccharis halimifolia*) found along the perimeter of the depression. When these low, shrub-like woody species are succeeded by tree species, such as *Pinus*, *Acer*, and *Liquidambar*, swales can become woody thickets that have altered hydrology, which can reduce habitat for Bethany Beach firefly larvae (Davis 2023f, pers. comm.). Woody plants become established when the depression wetlands or swales are dry for consecutive years. Thus, periods of drought trend towards shrub and tree communities (Service 2024, p. 12).

The Bethany Beach firefly requires temporally stable swales. Swales will eventually succeed to maritime forest if succession is not offset by periodic saltwater intrusion. Under natural conditions, disturbance to prevent succession is driven by periodic dune overwash from storm surge. Construction of shoreline erosion control structures, such as rock revetments, jetties, artificial dunes, and placement of sand fencing, can reduce the amount of overwash from storm surge (see also *Shoreline Erosion Control (shoreline erosion control, constructed dunes, sand fencing)*, below). In places where shoreline erosion control measures have been put in place, more woody succession has been observed. Thus, succession of woody species is occurring in some of the interdunal swales in Delaware, resulting in a loss of wetland function, plant species diversity, and wildlife diversity. Interdunal swales there are impacted by establishment of tree species such as loblolly pine (*Pinus taeda*), pond pine (*Pinus serotina*), red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*), and Japanese black pine (*Pinus thunbergii*).

By contrast, at Assateague Island National Seashore, where there has been limited shoreline erosion control, there is little tree encroachment (Huslander 2023, pers. comm.). There is some succession occurring at False Cape State Park (Swain 2023, pers. comm.). It is unknown if there is tree encroachment occurring at the other two Virginia properties, but there likely is some due to a lack of major storms occurring over the last several years.

Shoreline Erosion Control (sand fencing and constructed dunes)—There are several methods of shoreline erosion control used within the range of Bethany Beach firefly. The most common methods are the construction of artificial dunes and the use of sand fencing. Artificial dunes are engineered structures built to imitate the form of natural dunes and sand fencing is fencing placed on the beach to assist in building a new foredune or fill gaps in dune ridges. The Delaware Department of Transportation maintains the Route 1 highway after storm events and has replenished the dunes south of an occupied swale at Delaware Seashore State Park. There are dune crossings with sand fencing near seven swales in this park where Bethany Beach firefly has not been detected (Davis 2023g, pers. comm.). At Assateague National Seashore, there are constructed dunes and some sand fencing near the campground and in front of the swales where the species occurs. Constructed dunes and sand fencing are detrimental to Bethany Beach firefly because they hinder the natural disturbance needed to keep the swales open with herbaceous vegetation with sufficient soil moisture to support larvae and its prey sources. There are no constructed dunes adjacent to occupied or unoccupied swales occurring south of the campground in the area where vehicles may drive on the beach (*i.e.*, over the sand). There is a low likelihood that construction would occur in the future due to the lack of infrastructure and camping areas in the southern part of Assateague Island National Seashore (Huslander 2023, pers. comm.). There are no constructed dunes or sand fencing at Chincoteague or False Cape State Park (Holcomb 2023, pers. comm.; Swain 2023, pers. comm.). There is a constructed dune on NASA's Wallops Island Flight Facility that runs the length of the beach fill template. The core of the constructed sand dune is armor stone, which is periodically recovered with sand during Wallops Island beach renourishment events (on average, every 3 to 7 years) (Miller 2023, pers. comm.).

In summary, habitat loss, fragmentation, and degradation has occurred in the past, is occurring presently, and will continue to occur in the future. While the known species occurrences are entirely on public lands, there are likely impacts to the species and its habitat due to light pollution, mosquito spraying (only in Delaware), recreation, invasive plants, adjacent residential development (only in Delaware), and the potential for the development of additional infrastructure in the Delaware Parks. Therefore, the magnitude of the threat on the species' viability is moderate to high.

Small Population Size—Surveys conducted for the Bethany beach firefly involve watching for double flashes for a set period of time to confirm presence (see section 5.1 of the SSA report (Service 2024, pp. 36–37)). While surveys can quantify the number of double flashes observed, which can be compared among different sites, quantifying the actual abundance of individuals is not possible. Based on survey efforts that have occurred, only a few double flashes are observed at most sites, likely indicating small population sizes in these wetlands. Several swales in Delaware have a higher number of observations of double flashing than others, but none have been found to be as abundant as the Tower Shores wetland was in 1998, when hundreds of double flashes were observed. Small population sizes and lack of connectivity in certain areas can result in an Allee effect, which occurs when there is a population size or density correlation with some characteristics of individual fitness (Drake and Kramer 2011, p. 2). A strong Allee effect, or density dependence on fitness, means that individuals may be less likely to survive when overall population density is low, and may result in a critical population size below which the population cannot exist. Species with small or sparse populations, such as the Bethany Beach firefly, are susceptible to the Allee effect. For instance, where a population is not dense, there may be few males or females available, or there may not be individuals with high fitness, both of which can exacerbate the Allee effect by reducing instances of successful mating and reducing survival of young when mating does occur (Gascoigne et al. 2009, p. 356).

Similarly, the isolation of populations can reduce gene flow, which in turn can reduce the fitness of an entire population. Even a common, widespread firefly species, the common eastern firefly (*Photinus pyralis*), was

shown to have little gene flow among populations despite the adults being able flyers (Lower et al. 2018, p. 7). Genetic studies are needed to determine whether there is enough gene flow among Bethany Beach firefly populations to sustain those populations and to better assess the threat of the Allee effect. While abundance has not been quantified for the species, observations of just a few individuals in most swales likely indicates small population sizes throughout the species' range. The magnitude of the impacts of small population size on the species' viability is high.

Climate Change

Climate change refers to changes in temperature, precipitation, storm intensity, and sea level rise that are due to rising levels of greenhouse gases in the atmosphere. Individually and collectively, these changes are anticipated to increase environmental stochasticity and reduce habitat quality for the Bethany Beach firefly. Below, we analyze how rising temperatures, increased precipitation, increased storm intensity, and rising seas will affect the firefly.

Temperatures—Since 1901, temperatures in the Northeast have risen steadily. The amount of the increase depends on location and ranges from less than 0.6 degrees Celsius (°C) (1 degree Fahrenheit (°F); West Virginia) to about 1.7 °C (3 °F; New England). Temperatures are expected to continue to rise (Dupigny-Giroux et al. 2018, p. 672). As a consequence of warming temperatures, precipitation patterns are expected to become more extreme and less predictable. While total precipitation is expected to increase in the winter and spring, with little change in the summer, hotter and more intense droughts are also forecast. Increases in temperature and droughts could reduce soil moisture and hydrology of the interdunal swales during the summer months, which could result in egg and larval mortality and habitat degradation. Firefly eggs can dry out or become moldy if the humidity and temperatures are not suitable (Faust 2017, p. 40). High maximum temperatures in winter and spring during larval development have been shown to result in lower adult abundance the following summer (Evans et al. 2019, p. 6). An increase in temperature could also alter firefly phenology by advancing or desynchronizing the dates of male and female emergence or display time or both. For instance, one firefly species, the Smokies synchronous firefly (*Photinus carolinus*), now has its peak

mating time 10 days earlier than it did 20 years ago, and females now emerge and display flashes earlier than males (Faust and Weston 2009, pp. 1509–1510). Finally, increasing temperatures could change the ecology of the swales, for instance, by creating conditions conducive to the spread of invasive species (Angel et al. 2018, p. 875).

Increased Precipitation—Rainfall intensity, and consequently risk of flooding, has been increasing over the range of the Bethany Beach firefly and is expected to continue (Dupigny-Giroux et al. 2018, p. 672). The frequency and annual amount of heavy precipitation in the northeastern United States has increased over the past 100 years and has become significantly wetter from 1957–2010 (Kunkel et al. 2013, as cited in Collee et al. 2015, p. 133). The number of extreme precipitation events is expected to rise as much as 6 to 40 percent across the globe, and a 10 to 15 percent increase in the amount of precipitation is expected along the U.S. East Coast by the later 21st century (Allan et al. 2008 and Lombardo et al. 2015, as cited in Collee et al. 2015, pp. 133–135). Increased rainfall and floods increase the potential for soil erosion and habitat loss, and droughts can increase the spread of invasive species (Angel et al. 2018, p. 875). Drought can also reduce the hydroperiod, or length of time that standing water exists on the landscape which could remove the soil moisture needed for eggs and larva to survive.

Increased Storm Intensity—With increasing temperatures, a warming ocean will produce more intense storms and stronger winds, resulting in higher storm surge and more extensive flooding in the future. More frequent and severe storm events could result in more frequent saltwater intrusion, flooded swales, and overflow of salt water into the swales, which could result in larval mortality, mortality of prey resources, and a change in vegetation and hydrology in the swales. At current sea levels, coastal storms can cause surges between 0.61 and 1.2 meters (2 and 4 feet) along the Delaware Bay and Atlantic Coast; these heights are comparable to expected sea level rise by 2100 (Delaware Coastal Program 2012, pp. 4–5; see also *Sea Level Rise*, below). Saltwater intrusion and overflow increases salinity in swales until freshwater flushes out the system, which can take anywhere from weeks to months (Anderson 2002, pp. 415–417; see *Sea Level Rise*, below). The Delaware, Maryland, and Virginia Atlantic coastline is positioned latitudinally such that it experiences coastal flooding from extratropical (*e.g.*,

nor'easters) and tropical storm systems, together numbering about 30 to 35 coastal storms per year (Leathers et al. 2011, p. 10).

Sea Level Rise—A recently updated sea level rise report (Sweet et al. 2022, entire) generated global mean sea level (GMSL) projections and scenarios and adjusted these GMSL scenarios to specific regional conditions for the entire U.S. coastline. Local scenarios are provided for two locations within the known range of the Bethany Beach firefly, which estimate between 1.4 and 1.7 feet of sea level rise by 2050, and 4 to 7 ft of rise by 2100 (National Oceanic and Atmospheric Administration (NOAA) 2023, entire).

The impact of sea level rise on the species would be loss and degradation of suitable habitat from more frequent inundation and saltwater intrusion, as well as the potential for conversion to open water without marsh migration. Marsh migration landward cannot occur where there are physical barriers to migration such as roads and buildings, and where other features of the landscape, such as suitable elevation, slope, substrate, and other natural landscape features required for marsh habitat to establish and thrive, are not present. Construction of artificial dunes may increase in areas where there is residential development and/or infrastructure and may result in changes in vegetation and impact habitat suitability for the Bethany Beach firefly. Constructed dunes are detrimental to the Bethany Beach firefly because they hinder the natural disturbance needed to keep the swales open (*i.e.*, to maintain swales with herbaceous vegetation surrounded by some shrub-scrub habitat).

Even where habitat is not destroyed, storm events can temporarily inundate swales. At Assateague Island National Seashore, some swales are inundated for an average of 5 days after a storm event (Huslander 2023, pers. comm.). Although the Bethany Beach firefly has persisted through these events, and evidently has some ability to endure elevated water levels and elevated salinity levels on a temporary basis, it is unclear whether the species can withstand more frequent or more prolonged inundation.

Along with sea level rise, high tide flooding is projected to increase in frequency through the end of the century (Sweet et al. 2018, pp. vii–viii). High tide flooding is minor or “nuisance” flooding, caused by both tidal and non-tidal (*e.g.*, storm surges) factors, and these events have been increasing in frequency and depth over the last several decades. By 2050, days

with minor flooding events are expected to increase from approximately 2.5 days per year to between 45 and 130 days per year along the Northeast Atlantic coast (Sweet et al. 2018, pp. vii–viii). Such minor flooding events are expected to increase the amount of time that the swales are inundated with salt water. While the Bethany Beach firefly can tolerate some saltwater inundation, long periods of inundation will likely impact larval survival.

In addition to more frequent, severe storm events and sea level rise, elevation loss due to subsidence is a threat to coastal areas and many wetland habitat types and their distribution (Sweet et al. 2017, p. 1; Dupigny-Giroux et al. 2018, p. 17). Subsidence is a gradual settling or sinking of land. Recent considerations of the combined effect of sea level rise and subsidence indicates that subsidence increases the threat to coastal communities from sea level rise and may even triple estimates of potential flooding over the next several decades which could degrade or result in habitat loss for the species (Ohenhe et al. 2024, p. 1).

In summary, the impacts of climate change will alter or destroy habitat and have the potential to change reproductive success and behavior throughout the range of the Bethany Beach firefly by 2100.

Conservation Efforts and Regulatory Mechanisms

The species is listed as an endangered species at the State level by the Delaware Division of Fish and Wildlife. Delaware Endangered Species code prohibits the possession or sale of an endangered species. There are no population or habitat protection sections in the Delaware Endangered Species code but there is review of projects that are proposed on State lands for these species. The species currently has no protection in Maryland or Virginia. Some woody vegetation and phragmites control have occurred in interdunal swales in two locations and there have been successful efforts to reduce lighting near occupied swales in Delaware. These efforts are likely benefitting individuals and populations occurring in those locations. Conservation efforts have been focused on conducting surveys to better understand distribution and threats to help inform future conservation efforts for the species.

Synergistic and Cumulative Effects

We note that, by using the SSA framework to guide our analysis of the scientific information documented in

the SSA report, we have analyzed the cumulative effects of identified threats and conservation actions on the species. To assess the current and future condition of the species, we evaluate the effects of all the relevant factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative-effects analysis.

Current Condition

The current condition of the Bethany Beach firefly is described in terms of population resiliency, redundancy, and representation across the species' range. The analysis of these conservation principles to understand the species' current viability is described in more detail in chapter 5 of the SSA report (Service 2024, pp. 36–51).

Potential Habitat and Populations

We assume that there is little to no dispersal of adult fireflies occurring between swales greater than 1,000 feet (305 meters) apart. This is based on observations from surveys conducted since 2019. All swales within 1,000 feet (305 meters) of a known occupied swale were grouped into “complexes,” and these complexes were used as the analytical units to describe a population. Because swales have not been mapped for Virginia, and we only have detection locations, we buffered detection locations instead of the swales; therefore, complexes in Virginia are defined by survey locations that occur within 1,000 feet (305 meters) of each other. Since surveys occurred by swale in Maryland and Delaware, and by detections in Virginia, we consider the entire complex occupied if any swale within that complex has documented detections. We consider complexes to be occupied if there have been detections of the species since 2019.

Rangewide, we identified 143 swales in 31 complexes (see table 2, below), representing both actual and potential Bethany Beach firefly habitat. Identified complexes each contain between 1 and 19 swales. Fifteen complexes are known to be currently occupied, and these contain 36 total occupied swales (see table 2, below). Two properties, Delaware Seashore State Park and Assateague Island National Seashore, each have 4 occupied complexes containing a total of 21 occupied swales, accounting for more than half of the

occupied complexes and swales rangewide. NASA’s Wallops Island Flight Facility in Virginia has three occupied complexes. The greatest number of occupied swales within a given complex is five, which occurs in one complex at Chincoteague; three additional complexes across the range each have four known occupied swales. Six of the occupied complexes (40 percent) are known to have just one occupied swale each (see table 2, below).

Ten complexes have had surveys but no detections of Bethany Beach firefly,

although survey effort varies among these complexes (see table 2, below). However, one complex on Tower Shores land north of Bethany Beach (DE_PRIV_12) had detections of Bethany Beach firefly in 1998, but the species has not been detected since. Habitat in this complex has been degraded by development and an elevated roadway, making occupancy unlikely.

Forty-eight identified swales have not been surveyed (see table 2, below). Seven complexes (totaling 10 swales) have not had any surveys in any of their swales.

No complexes cross property boundaries; thus, we assume that there is no dispersal of individuals among Assateague Island National Seashore, Chincoteague National Wildlife Refuge, and NASA’s Wallops Island Flight Facility, despite these properties’ proximity to one another. This is based on our assumption that the species cannot disperse more than 1,000 feet (305 meters) based on observations from the surveys conducted from 2019 through 2024 (Davis, J. 2023c.).

TABLE 2—KNOWN COMPLEXES OF SWALES THAT PROVIDE POTENTIAL HABITAT TO THE BETHANY BEACH FIREFLY

[Information is provided by property, listed north to south, with the total swales with Bethany Beach firefly (BBFF) presence, number of swales that were surveyed but had no detections, number of swales not surveyed, total swales per complex, and overall complex status. Complexes with “current” status are those with detections since 2019 and are considered to be extant; “not detected” indicates that surveys since 2019 did not produce detections.]

State	Property	Complex	# of swales BBFF present	# of swales no detections	# of swales not surveyed	Total swales in each complex	Status
DE	Cape Henlopen	DE_CAHE_01		4	3	7	Not detected.
		DE_CAHE_02		1		1	Not detected.
		DE_CAHE_03	1	4		5	Current.
		DE_CAHE_04			1	1	Not surveyed.
		DE_CAHE_05			1	1	Not surveyed.
	DE Seashore SP	DE_SESP_06	4			4	Current.
		DE_SESP_07		3	5	8	Not detected.
		DE_SESP_08	4	10	5	19	Current.
		DE_SESP_09	3	2		5	Current.
		DE_SESP_10	2	1	2	5	Current.
		DE_SESP_11		4		4	Not detected.
		Private Land	DE_PRIV_12			1	1
	DE_PRIV_13				2	2	Not surveyed.
	DE_PRIV_14			1	1	2	Not detected.
	DE_PRIV_15				1	1	Not surveyed.
	Fenwick Island SP		DE_FENSP_16	3	9	2	14
		DE_FENSP_17		1		1	Not detected.
MD	Assateague Island	MD_ASIS_01	2	1	3	6	Current.
		MD_ASIS_02	1	1	6	8	Current.
		MD_ASIS_03	4	0	2	6	Current.
		MD_ASIS_04	1	3	9	13	Current.
		MD_ASIS_05			1	1	Not surveyed.
		MD_ASIS_06			2	2	Not surveyed.
		MD_ASIS_07			2	2	Not surveyed.
VA	Chincoteague NWR	VA_CHIN_01		1		1	Not detected.
		VA_CHIN_04	5	2		7	Current.
	NASA’s Wallops Island Flight Facility.	VA_WALL_02	1	2		3	Current.
		VA_WALL_03	1	2		3	Current.
		VA_WALL_05	1	3		4	Current.
	False Cape SP	VA_FCSP_06	3	2		5	Current.
		VA_FCSP_07		1		1	Not detected.

TABLE 2—KNOWN COMPLEXES OF SWALES THAT PROVIDE POTENTIAL HABITAT TO THE BETHANY BEACH FIREFLY—
Continued

[Information is provided by property, listed north to south, with the total swales with Bethany Beach firefly (BBFF) presence, number of swales that were surveyed but had no detections, number of swales not surveyed, total swales per complex, and overall complex status. Complexes with “current” status are those with detections since 2019 and are considered to be extant; “not detected” indicates that surveys since 2019 did not produce detections.]

State	Property	Complex	# of swales BBFF present	# of swales no detections	# of swales not surveyed	Total swales in each complex	Status
Total	31	36	59	48	143	

Resiliency

Currently, data are not available regarding the population structure or demographics of the Bethany Beach firefly which is typically used to estimate resiliency. Based on survey efforts that have occurred since 2019, only a few double flashes are observed at most sites, likely indicating small population sizes and low resiliency

across the range. More than half of the occupied complexes (n = 8) and more than half of the occupied swales (n = 21) occur on two properties, Delaware Seashore State Park and Assateague Island National Seashore (see table 2, above) which suggests higher resiliency compared to the other properties with respect to occupied habitat and connectivity among swales (complexes).

Cape Henlopen, Delaware Seashore, and Fenwick Island State Parks have some of the most numerous current stressors, including extensive invasive species in swales, light pollution in more than a third to more than half of swales, and mosquito spraying occurring or likely to occur (see table 2, below) which has likely resulted in decreased resiliency over time.

Species Redundancy and Representation

The Bethany Beach firefly exists as at least 15 current known “populations,” or complexes of swales containing at least one occupied swale. Given the recent discovery of the species and limited survey efforts, it is possible that other populations exist, as potentially suitable swales and complexes with similar plant communities extend north into New York and New Jersey and south into North and South Carolina. (Edinger et al. 2014, p. 13 (New York); Breden et al. 2001, p. 109 (New Jersey); Shafale 2012, p. 185 (North Carolina); Nelson 1986, p. 26 (South Carolina). Even so, the species is assumed to have low representation due to a narrow geographic range (approximately 260 kilometers (162 miles) of coastline) because of its specialized habitat requirements and no evidence of unique genetic distinctions ecological differences among different populations of Bethany Beach firefly across the range.

Although the species’ historical populations were likely limited by the availability of swale habitat along the Atlantic coast, the development of this habitat over the past century has a decreased the number of populations within the species’ range which has reduced representation and redundancy.

The redundancy of the species is believed overall to be low. Swales in the range of the Bethany Beach firefly are limited, localized habitats, so there are not many available populations nearby to repopulate areas that become extirpated; the species’ exclusive use of interdunal swale habitat prevents the expansion of the species into new areas.

Because of the species’ poor flying abilities (based on observations from surveys), we assume that there is no regular dispersal among complexes.

Due to the species’ small geographic range, catastrophic events (hurricanes, droughts, etc.) have the potential to affect all populations at once. For instance, a strong hurricane or other storm could affect swales across the species’ entire range. Although this species has evolved with hurricanes and likely has the adaptive capacity to withstand typical impacts from storms, such as repeated flooding by saltwater, it is unknown where the tolerance ends, and if prolonged flooding or too frequent overwash would lead to population decline or extirpation. The species does not have much ability to shift its range in the event of a catastrophic impact to existing habitat, due to the limited availability of swale habitat and the distance between complexes. Localized threats, such as light pollution, habitat loss, and insecticides (mosquito spraying), could reduce or extirpate populations in particular complexes.

Future Condition

A thorough review of the Bethany Beach firefly’s projected future condition is presented in chapter 6 of the SSA report (Service 2024, pp. 52–62).

The most significant threats to the Bethany Beach firefly in the future are the compounding effects of climate change, specifically increased frequency and intensity of coastal storms and sea level rise, as explained above under *Increased Storm Intensity and Sea Level Rise*.

In the SSA report, we focus our future condition analysis on how the effects of sea level rise due to climate change will impact the resiliency, redundancy, and representation of the species into the future. We evaluated the future condition of the Bethany Beach firefly in 30-year intervals at years 2040, 2070, and 2100, under both an intermediate and a high climate scenario. These scenarios use localized projections of sea level rise aligned with emissions-based model projections of global mean sea level rise and bound the upper and lower end of the likely scenarios. We did not include “intermediate low” or “low” projections, nor the 2000 extrapolation scenario, due to their high probability of being exceeded; the current NOAA projections also leave out an “extreme” scenario due to the low likelihood of it being realized (Sweet et al. 2017, pp. 11–13; Sweet et al. 2022, pp. 11–12).

Under an intermediate climate scenario, 9 of the 15 (60 percent) occupied complexes see some level of impacts by 2040, and all but one are impacted by 2070 (Table 4). At least one complex is projected to be extirpated by 2070, and at least seven become extirpated by 2100. Only one complex remains without any impacts by those timesteps.

Under a high climate scenario, 9 of the 15 occupied complexes see some level of impacts by 2040, and all but one are impacted by 2070 (Table 4). At least one complex is projected to be extirpated by 2040, with at least five projected to be extirpated by 2070. All but two are projected to be extirpated by 2100. All complexes have some level of impacts by 2100.

Future Resiliency

The Bethany Beach firefly's resiliency, which is already limited, is expected to continue to decline into the future. As discussed above, sea level rise is expected to degrade large portions of the species' known occupied habitat by 2040, and to destroy significant portions by 2070. Even if the firefly is able to withstand habitat degradation, it likely will not be able to withstand habitat destruction. As noted above, its habitat needs are specialized and due to dense urbanization of the coastal areas in its range and the narrow width of the barrier islands in which it occurs, it seems unlikely that the species will be able to colonize new habitats inland. Meanwhile, other stressors, such as mosquito spraying, are not expected to cease.

Future Redundancy and Representation

Redundancy is expected to decrease in the future, as extirpations are projected for the Bethany Beach firefly under both scenarios by 2070. Regarding representation, while there are no known subspecies or phenotypes of the Bethany Beach firefly, the loss of any single population is likely to decrease the genetic variation of the species. Given the distance between complexes, the species has limited ability to repopulate areas where populations have been extirpated. In addition, given its specific habitat needs, the species is unlikely to have the adaptive capacity to shift its range to avoid the impacts of sea level rise. While it may be able to persist despite some impacts from more frequent flooding, eventually inundation will become too frequent or too persistent for the species to tolerate.

In summary, under either an intermediate or high climate scenario, overall redundancy and representation are expected to decline in the future, and suitable habitat will be nearly eliminated by 2100. Given the species' specific habitat needs, the reduction in suitable habitat is expected to result in a reduction in resiliency.

Determination of Bethany Beach Firefly's Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of an endangered species or a threatened species. The Act defines an "endangered species" as a species in danger of extinction throughout all or a significant portion of its range, and a "threatened species" as a species likely to become an endangered species within the foreseeable future throughout all or

a significant portion of its range. The Act requires that we determine whether a species meets the definition of an endangered species or a threatened species because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence.

Status Throughout All of Its Range

After evaluating threats to the species and assessing the cumulative effect of the threats under the Act's section 4(a)(1) factors, we found that the Bethany Beach firefly meets the Act's definition of a threatened species throughout all of its range. We found that impacts from sea level rise, increased frequency and intensity of coastal storms, and increased frequency of high tide flooding are the most substantial threats to the viability of the Bethany Beach firefly. Rising sea levels and high tide flooding caused by climate change will first degrade and then remove habitat due to increased periodic inundation and then result in total inundation at some height above current sea levels with and without storm surges. In the foreseeable future, we anticipate that saltwater intrusion will continue to move inland as climate-change-induced sea level rise continues, causing the loss of Bethany Beach firefly habitat and having the greatest influence on Bethany Beach viability. Small population size in addition to urban development and changes in land cover, light pollution, recreational activities, pesticides, invasive plants, shoreline erosion control (including constructed dunes and sand fencing), and increased temperatures and drought are also threats to the species; we considered these for their cumulative effects.

Bethany Beach firefly is currently known to exist in 15 complexes (populations), containing 36 total occupied swales, in Delaware, Maryland, and Virginia. Rangewide, we identified 143 swales within 31 complexes that contain suitable habitat; however, the best available information does not allow us to determine if all of these areas with suitable habitat are occupied.

Currently, data are not available regarding the population structure or demographics of the Bethany Beach firefly which is typically used to estimate resiliency. Based on survey efforts that have occurred since 2019,

only a few double flashes are observed at most sites, likely indicating small population sizes and low resiliency across the range. More than half of the occupied complexes ($n = 8$) and more than half of the occupied swales ($n = 21$) occur on two properties, Delaware Seashore State Park and Assateague Island National Seashore (see table 2, above) which suggests higher resiliency compared to the other properties with respect to occupied habitat and connectivity among swales (complexes).

Cape Henlopen, Delaware Seashore, and Fenwick Island State Parks have some of the most numerous current stressors, including extensive invasive species in swales, light pollution in more than a third to more than half of swales, and mosquito spraying occurring or likely to occur (see table 3, above) which has likely resulted in decreased resiliency over time.

At current sea levels, coastal storms can cause surges between 0.61 to 1.2 meters (2 to 4 feet) along the Delaware Bay and Atlantic Coast, heights comparable to expected sea level rise by 2100 (Delaware Coastal Program 2012, pp. 4–5). Saltwater intrusion and overwash increase salinity in swales until freshwater flushes out the system, which can take anywhere from weeks to months (Anderson 2002, pp. 415–417). The Delaware, Maryland, and Virginia Atlantic coastline is positioned latitudinally such that it experiences coastal flooding from extratropical (e.g., nor'easters) and tropical storm systems, together numbering about 30 to 35 coastal storms per year (Leathers et al. 2011, p. 10). It is likely that some of these storm events result in temporary inundation of the swales. At Assateague Island National Seashore, some swales are inundated for an average of 5 days after a storm event (Huslander 2023, pers. comm.). To date, the species has persisted in varying degrees through these events, so there is likely some ability for the species to endure degraded habitat conditions on a temporary basis.

While redundancy and representation for this species are likely reduced from historical levels due to past development, there is occupied habitat located along 260 kilometers (162 miles) of coastline in three States and on seven properties. Given the current resiliency, redundancy, and representation of the Bethany Beach firefly across its range, we conclude that the species is not currently in danger of extinction throughout its range.

We next considered whether the species is likely to become in danger of extinction within the foreseeable future throughout all of its range. In

considering the foreseeable future for the Bethany Beach firefly, we analyzed expected changes in sea level rise and the resulting impacts to resiliency, redundancy, and representation in 30-year intervals at years 2040, 2070, and 2100 under both an intermediate and a high climate scenario (Service 2024, pp. 52–61). We determined that this timeframe represents a period for which we can make reasonably reliable predictions about both the threats to the species and the species' response to those threats.

For the majority of the 15 complexes currently occupied by the Bethany Beach firefly, resiliency is likely to decline in the future. By 2040, nine (60 percent) of the currently occupied complexes have some level of impact (degradation of habitat) to resiliency, regardless of scenario. All complexes at Assateague Island National Seashore and False Cape State Park avoid habitat impacts in 2040. By 2070, only one complex at False Cape State Park, will not be impacted. Under an intermediate scenario, one complex (7 percent) will be extirpated due to permanent inundation, while five (33 percent) will be extirpated under a high scenario. By 2100, the False Cape State Park complex would only avoid impact under an intermediate scenario. Seven (47 percent) of the complexes will be extirpated, with another four having a high level of impact, under the intermediate scenario, while a high scenario predicts the extirpation of all but two complexes (87 percent).

Redundancy is expected to decrease in the future, as extirpations are projected for the Bethany Beach firefly under both scenarios by 2070. Regarding representation, while there are no known "types" of Bethany Beach firefly, the loss of any single population is likely to decrease the genetic variation of the species. Given the distance between complexes, the species is unlikely to have the adaptive capacity to shift its range in space to avoid the impacts of sea level rise. While it may be able to persist in place given some impacts of high tide flooding, eventually the frequency of seawater inundation will become too frequent for the species to tolerate. However, it is unknown at what point the species will be unable to tolerate repeated flooding.

In summary, the Bethany Beach firefly already has a limited range with low redundancy and representation levels, meaning its survival is completely dependent on the availability of its habitat. Additionally, the Bethany beach firefly has no ability to disperse outside of its current range and is unlikely to be able to adapt to a saltwater

environment. Therefore, the projected loss of habitat in the foreseeable future would leave the species extremely vulnerable to stochastic or catastrophic events. Thus, after assessing the best available information, we conclude that the Bethany Beach firefly is not currently in danger of extinction but is likely to become in danger of extinction within the foreseeable future throughout all of its range.

Status Throughout a Significant Portion of Its Range

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so within the foreseeable future throughout all or a significant portion of its range. The court in *Center for Biological Diversity v. Everson*, 435 F. Supp. 3d 69 (D.D.C. 2020) (*Everson*), vacated the provision of the Final Policy on Interpretation of the Phrase "Significant Portion of Its Range" in the Endangered Species Act's Definitions of "Endangered Species" and "Threatened Species" (hereafter "Final Policy"; 79 FR 37578, July 1, 2014) that provided if the Services determine that a species is threatened throughout all of its range, the Services will not analyze whether the species is endangered in a significant portion of its range.

Therefore, we proceed to evaluating whether the species is endangered in a significant portion of its range—that is, whether there is any portion of the species' range for which both (1) the portion is significant; and (2) the species is in danger of extinction in that portion. Depending on the case, it might be more efficient for us to address the "significance" question or the "status" question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the species' range.

Following the court's holding in *Everson*, we now consider whether the species is in danger of extinction in a significant portion of its range. In undertaking this analysis for Bethany Beach firefly, we choose to address the status question first. We evaluated the range of the Bethany Beach firefly to determine if the species is in danger of extinction in any portion of its range. The range of a species can theoretically be divided into portions in an infinite number of ways. We focused our analysis on portions of the species' range that may meet the Act's definition of an endangered species. For the Bethany Beach firefly, we considered

whether the threats or their effects on the species are greater in any biologically meaningful portion of the species' range than in other portions such that the species is in danger of extinction in that portion. We examined the following threats: climate change; habitat loss, fragmentation, and degradation; and the cumulative effects of threats to the species. We found that impacts from sea level rise, increased frequency and intensity of coastal storms, and the related effects of increased frequency and depth of high tide flooding are the most substantial threats to the viability of the Bethany Beach firefly throughout its range in the future. As the sea level rises, many Bethany Beach firefly swale habitats will become inundated permanently with seawater. In addition to sea level rise, beaches will be affected by extreme high tides or flooding events, which are projected to increase in frequency (Sweet et al. 2018, pp. vii–viii). Habitat loss, degradation, and fragmentation due to past urbanization and development has caused populations to be isolated with presumably no genetic transfer among them, leaving these small populations at increased risk of impacts from random stochastic and unforeseen catastrophic events. We considered Delaware Seashore State Park and Assateague Island National Seashore as a portion because they have 58 percent of the occupied swales rangewide. Assateague Island has 22 percent of the occupied swales with few current stressors while Delaware Seashore State Park has 36 percent of the occupied swales and the most numerous stressors currently. However, current resiliency at Delaware Seashore State Park is higher than all of the other properties due to the number of occupied swales (33) and complexes (4). Habitat stressors that will have the most impact on the species, primarily sea level rise and high tide flooding will occur in the future with some habitat degradation occurring at intermediate and high climate scenarios in 2040 and habitat loss occurring across most of the species range by 2070. Based on the current condition of the species in Delaware Seashore State Park and Assateague Island National Seashore, we found no biologically meaningful portion of the Bethany Beach firefly's range where the biological condition of the species differs from its condition elsewhere in its range such that the status of the species in that portion differs from any other portion of the species' range.

Therefore, no portion of the species' range provides a basis for determining

that the species is in danger of extinction in a significant portion of its range, and we determine that the species is likely to become in danger of extinction within the foreseeable future throughout all of its range. This does not conflict with the courts' holdings in *Desert Survivors v. U.S. Department of the Interior*, 321 F. Supp. 3d 1011, 1070–74 (N.D. Cal. 2018) and *Center for Biological Diversity v. Jewell*, 248 F. Supp. 3d 946, 959 (D. Ariz. 2017) because, in reaching this conclusion, we did not apply the aspects of the Final Policy, including the definition of “significant” that those court decisions held to be invalid.

Determination of Status

Our review of the best available scientific and commercial information indicates that the Bethany Beach firefly meets the Act's definition of a threatened species. Therefore, we propose to list the Bethany Beach as a threatened species in accordance with sections 3(20) and 4(a)(1) of the Act.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened species under the Act include recognition as a listed species, planning and implementation of recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness, and conservation by Federal, State, Tribal, and local agencies, foreign governments, private organizations, and individuals. The Act encourages cooperation with the States and other countries and calls for recovery actions to be carried out for listed species. The protection required by Federal agencies, including the Service, and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Section 4(f) of the Act calls for the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

The recovery planning process begins with development of a recovery outline made available to the public soon after a final listing determination. The

recovery outline guides the immediate implementation of urgent recovery actions while a recovery plan is being developed. Recovery teams (composed of species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) may be established to develop and implement recovery plans. The recovery planning process involves the identification of actions that are necessary to halt and reverse the species' decline by addressing the threats to its survival and recovery. The recovery plan identifies recovery criteria for review of when a species may be ready for reclassification from endangered to threatened (“downlisting”) or removal from protected status (“delisting”), and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery outline, draft recovery plan, final recovery plan, and any revisions will be available on our website as they are completed (<https://www.fws.gov/program/endangered-species>), or from our Chesapeake Bay Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribes, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (e.g., restoration of native vegetation), research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and Tribal lands.

If this species is listed, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost-share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, pursuant to section 6 of the Act, the States of Delaware, Maryland, and Virginia would be eligible for Federal funds to implement management actions that promote the protection or recovery of the Bethany Beach firefly. Information on our grant programs that are available to aid

species recovery can be found at: <https://www.fws.gov/service/financial-assistance>.

Although the Bethany Beach firefly is only proposed for listing under the Act at this time, please let us know if you are interested in participating in recovery efforts for this species. Additionally, we invite you to submit any new information on this species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7 of the Act is titled, “Interagency Cooperation,” and it mandates all Federal action agencies to use their existing authorities to further the conservation purposes of the Act and to ensure that their actions are not likely to jeopardize the continued existence of listed species or adversely modify critical habitat. Regulations implementing section 7 are codified at 50 CFR part 402.

Section 7(a)(2) states that each Federal action agency shall, in consultation with the Secretary, ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Each Federal agency shall review its action at the earliest possible time to determine whether it may affect listed species or critical habitat. If a determination is made that the action may affect listed species or critical habitat, formal consultation is required (50 CFR 402.14(a)), unless the Service concurs in writing that the action is not likely to adversely affect listed species or critical habitat. At the end of a formal consultation, the Service issues a biological opinion, containing its determination of whether the Federal action is likely to result in jeopardy or adverse modification.

In contrast, section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any action which is likely to jeopardize the continued existence of any species proposed to be listed under the Act or result in the destruction or adverse modification of critical habitat proposed to be designated for such species. Although the conference procedures are required only when an action is likely to result in jeopardy or adverse modification, action agencies may voluntarily confer with the Service on actions that may affect species proposed for listing or critical habitat proposed to be designated. In the event that the subject species is listed or the relevant critical habitat is designated, a conference opinion may be adopted as a biological

opinion and serve as compliance with section 7(a)(2) of the Act.

Examples of discretionary actions for the Bethany Beach firefly that may be subject to conference and consultation procedures under section 7 are land management or other landscape-altering activities on Federal lands administered by the National Park Service and NASA, as well as actions on State, Tribal, local, or private lands that require a Federal permit (such as a permit from the U.S. Army Corps of Engineers under section 404 of the Clean Water Act or a permit from the Service under section 10 of the Act) or that involve some other Federal action (such as funding from the Federal Highway Administration, Federal Aviation Administration, or the Federal Emergency Management Agency). Federal actions not affecting listed species or critical habitat—and actions on State, Tribal, local, or private lands that are not federally funded, authorized, or carried out by a Federal agency—do not require section 7 consultation. Federal agencies should coordinate with the Chesapeake Bay Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**) with any specific questions on section 7 consultation and conference requirements.

II. Protective Regulations Under Section 4(d) of the Act

Background

Section 4(d) of the Act contains two sentences. The first sentence states that the Secretary shall issue such regulations as she deems necessary and advisable to provide for the conservation of species listed as threatened species. Conservation is defined in the Act to mean the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Additionally, the second sentence of section 4(d) of the Act states that the Secretary may by regulation prohibit with respect to any threatened species any act prohibited under section 9(a)(1), in the case of fish or wildlife, or section 9(a)(2), in the case of plants. With these two sentences in section 4(d), Congress delegated broad authority to the Secretary to determine what protections would be necessary and advisable to provide for the conservation of threatened species, and even broader authority to put in place any of the section 9 prohibitions for a given species.

The courts have recognized the extent of the Secretary's discretion under this

standard to develop rules that are appropriate for the conservation of a species. For example, courts have upheld, as a valid exercise of agency authority, rules developed under section 4(d) that included limited prohibitions against takings (see *Alsea Valley Alliance v. Lautenbacher*, 2007 WL 2344927 (D. Or. 2007); *Washington Environmental Council v. National Marine Fisheries Service*, 2002 WL 511479 (W.D. Wash. 2002)). Courts have also upheld 4(d) rules that do not address all of the threats a species faces (see *State of Louisiana v. Verity*, 853 F.2d 322 (5th Cir. 1988)). As noted in the legislative history when the Act was initially enacted, “once an animal is on the threatened list, the Secretary has an almost infinite number of options available to [her] with regard to the permitted activities for those species. [She] may, for example, permit taking, but not importation of such species, or [she] may choose to forbid both taking and importation but allow the transportation of such species” (H.R. Rep. No. 412, 93rd Cong., 1st Sess. 1973).

The provisions of this species' proposed protective regulations under section 4(d) of the Act are one of many tools that we would use to promote the conservation of the Bethany Beach firefly. The proposed protective regulations would apply only if and when we make final the listing of the Bethany Beach firefly as a threatened species. Nothing in 4(d) rules change in any way the recovery planning provisions of section 4(f) of the Act, the consultation requirements under section 7 of the Act, or the ability of the Service to enter into partnerships for the management and protection of the Bethany Beach firefly. As mentioned previously in Available Conservation Measures, section 7(a)(2) of the Act requires Federal agencies, including the Service, to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of designated critical habitat of such species. In addition, even before the listing of any species or the designation of its critical habitat is finalized, section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any agency action which is likely to jeopardize the continued existence of any species proposed to be listed under the Act or result in the destruction or adverse modification of critical habitat proposed to be designated for such species. These requirements are the same for a

threatened species regardless of what is included in its 4(d) rule.

Section 7 consultation is required for Federal actions that “may affect” a listed species regardless of whether take caused by the activity is prohibited or excepted by a 4(d) rule (under general application of the “blanket rule” option (for more information, see 89 FR 23919, April 5, 2024) or a species-specific 4(d) rule). A 4(d) rule does not change the process and criteria for informal or formal consultations and does not alter the analytical process used for biological opinions or concurrence letters. For example, as with an endangered species, if a Federal agency determines that an action is “not likely to adversely affect” a threatened species, this will require the Service's written concurrence (50 CFR 402.13(c)). Similarly, if a Federal agency determines that an action is “likely to adversely affect” a threatened species, the action will require formal consultation with the Service and the formulation of a biological opinion (50 CFR 402.14(a)). Because consultation obligations and processes are unaffected by 4(d) rules, we may consider developing tools to streamline future intra-Service and interagency consultations for actions that result in forms of take that are not prohibited by the 4(d) rule (but that still require consultation). These tools may include consultation guidance, Information for Planning and Consultation effects determination keys, template language for biological opinions, or programmatic consultations.

Provisions of the Proposed 4(d) Rule

Exercising the Secretary's authority under section 4(d) of the Act, we have developed a proposed rule that is designed to address the Bethany Beach firefly's conservation needs. As discussed previously in Summary of Biological Status and Threats, we have concluded that the Bethany Beach firefly is likely to become in danger of extinction within the foreseeable future primarily due to climate change, which includes more frequent and increased storm intensities and high tide flooding, rising sea levels causing periodic and/or total inundation, saltwater intrusion, and increased temperatures and drought. Urban development and changes in land cover, light pollution, recreational activities, pesticides, invasive plants, shoreline erosion control (including constructed dunes and sand fencing), and increased temperatures and drought (compounded by the effects of small population size) are also threats to the species.

Section 4(d) requires the Secretary to issue such regulations as she deems necessary and advisable to provide for the conservation of each threatened species and authorizes the Secretary to include among those protective regulations any of the prohibitions that section 9(a)(1) of the Act prescribes for endangered species. We are not required to make a “necessary and advisable” determination when we apply or do not apply specific section 9 prohibitions to a threatened species (*In re: Polar Bear Endangered Species Act Listing and 4(d) Rule Litigation*, 818 F. Supp. 2d 214, 228 (D.D.C. 2011) (citing *Sweet Home Chapter of Cmty. for a Great Or. v. Babbitt*, 1 F.3d 1, 8 (D.C. Cir. 1993), *rev’d on other grounds*, 515 U.S. 687 (1995))). Nevertheless, even though we are not required to make such a determination, we have chosen to be as transparent as possible and explain below why we find that, if finalized, the protections, prohibitions, and exceptions in this proposed rule as a whole would satisfy the requirement in section 4(d) of the Act to issue regulations deemed necessary and advisable to provide for the conservation of the Bethany Beach firefly.

The protective regulations we are proposing for the Bethany Beach firefly incorporate prohibitions from section 9(a)(1) to address the threats to the species. The prohibitions of section 9(a)(1) of the Act, and implementing regulations codified at 50 CFR 17.21, make it illegal for any person subject to the jurisdiction of the United States to commit, to attempt to commit, to solicit another to commit, or to cause to be committed any of the following acts with regard to any endangered wildlife: (1) import into, or export from, the United States; (2) take (which includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) within the United States, within the territorial sea of the United States, or on the high seas; (3) possess, sell, deliver, carry, transport, or ship, by any means whatsoever, any such wildlife that has been taken illegally; (4) deliver, receive, carry, transport, or ship in interstate or foreign commerce, by any means whatsoever and in the course of commercial activity; or (5) sell or offer for sale in interstate or foreign commerce. This protective regulation includes all of these prohibitions because the Bethany Beach firefly is at risk of extinction within the foreseeable future and putting these prohibitions in place will help to prevent further declines, preserve the species’

remaining populations, slow its rate of decline, and decrease synergistic, negative effects from other ongoing or future threats.

In particular, this proposed 4(d) rule would provide for the conservation of the Bethany Beach firefly by prohibiting the following activities, unless they fall within specific exceptions or are otherwise authorized or permitted: importing or exporting; take; possession and other acts with unlawfully taken specimens; delivering, receiving, carrying, transporting, or shipping in interstate or foreign commerce in the course of commercial activity; or selling or offering for sale in interstate or foreign commerce.

Under the Act, “take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Some of these provisions have been further defined in regulations at 50 CFR 17.3. Take can result knowingly or otherwise, by direct and indirect impacts, intentionally or incidentally. Regulating take would help preserve the species’ remaining populations, slow their rate of decline, and decrease cumulative effects from other ongoing or future threats. Therefore, we propose to prohibit take of the Bethany Beach firefly, except for take resulting from those actions and activities specifically excepted by the 4(d) rule.

Exceptions to the prohibition on take would include all of the general exceptions to the prohibition on take of endangered wildlife, as set forth in 50 CFR 17.21 and additional exceptions, as described below.

Despite these prohibitions regarding threatened species, we may under certain circumstances issue permits to carry out one or more otherwise-prohibited activities, including those described above. The regulations that govern permits for threatened wildlife state that the Director may issue a permit authorizing any activity otherwise prohibited with regard to threatened species. These include permits issued for the following purposes: for scientific purposes, to enhance propagation or survival, for economic hardship, for zoological exhibition, for educational purposes, for incidental taking, or for special purposes consistent with the purposes of the Act (50 CFR 17.32). The statute also contains certain exemptions from the prohibitions, which are found in sections 9 and 10 of the Act.

In addition, to further the conservation of the species, any employee or agent of the Service, any other Federal land management agency, the National Marine Fisheries Service, a

State conservation agency, or a federally recognized Tribe, who is designated by their agency or Tribe for such purposes, may, when acting in the course of their official duties, take threatened wildlife without a permit if such action is necessary to: (i) Aid a sick, injured, or orphaned specimen; (ii) dispose of a dead specimen; (iii) salvage a dead specimen that may be useful for scientific study; or (iv) remove specimens that constitute a demonstrable but nonimmediate threat to human safety, provided that the taking is done in a humane manner. Such taking may involve killing or injuring only if it has not been reasonably possible to eliminate such threat by live capturing and releasing the specimen unharmed, in an appropriate area.

We recognize the special and unique relationship that we have with our State natural resource agency partners in contributing to conservation of listed species. State agencies often possess scientific data and valuable expertise on the status and distribution of endangered, threatened, and candidate species of wildlife and plants. State agencies, because of their authorities and their close working relationships with local governments and landowners, are in a unique position to assist us in implementing all aspects of the Act. In this regard, section 6 of the Act provides that we must cooperate to the maximum extent practicable with the States in carrying out programs authorized by the Act. Therefore, any qualified employee or agent of a State conservation agency that is a party to a cooperative agreement with us in accordance with section 6(c) of the Act, who is designated by his or her agency for such purposes, would be able to conduct activities designed to conserve the Bethany Beach firefly that may result in otherwise prohibited take without additional authorization.

The proposed 4(d) rule would also provide for the conservation of the species by allowing exceptions that incentivize conservation actions or that, while they may have some minimal level of take of the Bethany Beach firefly, are not expected to rise to the level that would have a negative impact (*i.e.*, would have only de minimis impacts) on the species’ conservation. The proposed exceptions to these prohibitions include (1) take associated with conducting surveys; and (2) take associated with mechanical removal of invasive plants and woody vegetation. These proposed excepted activities are expected to have negligible impacts to the Bethany Beach firefly and its habitat.

Species-Specific Incidental Take Exceptions

The first proposed exception is for take associated with research and conservation activities to benefit Bethany Beach firefly conducted by an organization or individual, working cooperatively with a State conservation agency that is operating a conservation program pursuant to an approved cooperative agreement with the Service as set forth in § 17.31(b). The organization or individual must have obtained a permit from the State conservation agency, and the research activity is carried out in compliance with all terms and conditions of the State permit.

Research and conservation activities can include but are not limited to: population monitoring (including surveys and handling species); tissue collection for genetic analysis (removal of a leg). Our local Ecological Services Field Offices will meet annually with the State, or more frequently as warranted, to determine whether permit conditions need to be revised or updated based on the projects permitted the previous year. The State will also provide reports associated with permits, if requested by the Ecological Services Field Office.

The second proposed exception is for control of invasive plants and removal of native or invasive woody vegetation. These activities could be implemented in Bethany Beach firefly habitat at any time of the year, but they would have to be performed through mechanical removal using hand-operated machinery. When conducted appropriately, these activities are considered beneficial to the native ecosystem and are likely to improve habitat conditions for the species; therefore, mechanical removal of vegetation using hand-operated machinery is not expected to impair the species' conservation.

As mentioned above, nothing in this proposed 4(d) rule would change in any way the recovery planning provisions of section 4(f) of the Act, the consultation requirements under section 7 of the Act, or our ability to enter into partnerships for the management and protection of the Bethany Beach firefly. However, interagency cooperation may be further streamlined through planned programmatic consultations for the species between us and other Federal agencies, where appropriate. We ask the public, particularly State agencies and other interested stakeholders that may be affected by the proposed 4(d) rule, to provide comments and suggestions regarding additional guidance and

methods that we could provide or use, respectively, to streamline the implementation of this proposed 4(d) rule (see Information Requested, above).

III. Critical Habitat

Background

Critical habitat is defined in section 3 of the Act as:

(1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features

(a) Essential to the conservation of the species; and

(b) Which may require special management considerations or protection; and

(2) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Our regulations at 50 CFR 424.02 define the geographical area occupied by the species as an area that may generally be delineated around species' occurrences, as determined by the Secretary (*i.e.*, range). Such areas may include those areas used throughout all or part of the species' life cycle, even if not used on a regular basis (*e.g.*, migratory corridors, seasonal habitats, and habitats used periodically, but not solely by vagrant individuals).

Conservation, as defined under section 3 of the Act, means to use and the use of all methods and procedures that are necessary to bring an endangered or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking.

Critical habitat receives protection under section 7 of the Act through the requirement that each Federal action agency ensure, in consultation with the Service, that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of designated critical habitat. The designation of critical habitat does not affect land ownership or establish a refuge, wilderness,

reserve, preserve, or other conservation area. Such designation also does not allow the government or public to access private lands. Such designation does not require implementation of restoration, recovery, or enhancement measures by non-Federal landowners. Rather, designation requires that, where a landowner requests Federal agency funding or authorization for an action that may affect an area designated as critical habitat, the Federal agency consult with the Service under section 7(a)(2) of the Act. If the action may affect the listed species itself (such as for occupied critical habitat), the Federal agency would have already been required to consult with the Service even absent the designation because of the requirement to ensure that the action is not likely to jeopardize the continued existence of the listed species. Even if the Service were to conclude after consultation that the proposed activity is likely to result in destruction or adverse modification of the critical habitat, the Federal action agency and the landowner are not required to abandon the proposed activity, or to restore or recover the species; instead, they must implement "reasonable and prudent alternatives" to avoid destruction or adverse modification of critical habitat.

Under the first prong of the Act's definition of critical habitat, areas within the geographical area occupied by the species at the time it was listed are included in a critical habitat designation if they contain physical or biological features (1) which are essential to the conservation of the species and (2) which may require special management considerations or protection. For these areas, critical habitat designations identify, to the extent known using the best scientific data available, those physical or biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat).

Under the second prong of the Act's definition of critical habitat, we can designate critical habitat in areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Section 4 of the Act requires that we designate critical habitat on the basis of the best scientific data available. Further, our Policy on Information Standards Under the Endangered Species Act (published in the **Federal Register** on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the Treasury and General

Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106–554; H.R. 5658)), and our associated Information Quality Guidelines provide criteria, establish procedures, and provide guidance to ensure that our decisions are based on the best scientific data available. They require our biologists, to the extent consistent with the Act and with the use of the best scientific data available, to use primary and original sources of information as the basis for recommendations to designate critical habitat.

When we are determining which areas should be designated as critical habitat, our primary source of information is generally the information compiled in the SSA report and information developed during the listing process for the species. Additional information sources may include any generalized conservation strategy, criteria, or outline that may have been developed for the species; the recovery plan for the species; articles in peer-reviewed journals; conservation plans developed by States and counties; scientific status surveys and studies; biological assessments; other unpublished materials; or experts' opinions or personal knowledge.

Habitat is dynamic, and species may move from one area to another over time. We recognize that critical habitat designated at a particular point in time may not include all of the habitat areas that we may later determine are necessary for the recovery of the species. For these reasons, a critical habitat designation does not signal that habitat outside the designated area is unimportant or may not be needed for recovery of the species. Areas that are important to the conservation of the species, both inside and outside the critical habitat designation, will continue to be subject to: (1) Conservation actions implemented under section 7(a)(1) of the Act; (2) regulatory protections afforded by the requirement in section 7(a)(2) of the Act for Federal agencies to ensure their actions are not likely to jeopardize the continued existence of any endangered or threatened species; and (3) the prohibitions found in the 4(d) rule. Federally funded or permitted projects affecting listed species outside their designated critical habitat areas may still result in jeopardy findings in some cases. These protections and conservation tools will continue to contribute to recovery of the species. Similarly, critical habitat designations made on the basis of the best scientific data available at the time of designation will not control the direction and substance of future recovery plans,

habitat conservation plans, or other species conservation planning efforts if new information available at the time of those planning efforts calls for a different outcome.

Critical Habitat Determinability

We determine that designating critical habitat for the Bethany Beach firefly is prudent. Our regulations at 50 CFR 424.12(a)(2) state that critical habitat is not determinable when one or both of the following situations exist:

- (i) Data sufficient to perform required analyses are lacking, or
- (ii) The biological needs of the species are not sufficiently well known to identify any area that meets the definition of "critical habitat."

When critical habitat is not determinable, the Act allows the Service an additional year to publish a critical habitat designation (16 U.S.C. 1533(b)(6)(C)(ii)).

We reviewed the available information pertaining to the biological needs of the Bethany Beach firefly and habitat characteristics where this species is located. The species' habitat is well described and mapped in Maryland and Delaware. In Virginia, swale habitat is not mapped and not apparent when viewing National Wetland Inventory (NWI) layers or aerial imagery. Surveys in Virginia were conducted by roadsides and at vantage points where large expanses of wetlands could be seen. The purposes of the surveys were to document presence of the species. The species may be using different NWI habitat types that meet basic needs but are in a different arrangement. Field verification of habitat and additional surveys at these sites in Virginia will occur during the summer of 2024 and will inform a proposed critical habitat designation for the Bethany Beach firefly. Therefore, because we currently lack sufficient information on swale habitat in Virginia, we conclude that the designation of critical habitat for the Bethany beach firefly is not determinable at this time. The Act allows the Service an additional year to publish a critical habitat designation that is not determinable at the time of listing (16 U.S.C. 1533(b)(6)(C)(ii)).

Required Determinations

Clarity of the Rule

We are required by E.O.s 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

- (1) Be logically organized;
- (2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

Regulations adopted pursuant to section 4(a) of the Act are exempt from the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*) and do not require an environmental analysis under NEPA. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244). This includes listing, delisting, and reclassification rules, as well as critical habitat designations and species-specific protective regulations promulgated concurrently with a decision to list or reclassify a species as threatened. The courts have upheld this position (*e.g., Douglas County v. Babbitt*, 48 F.3d 1495 (9th Cir. 1995) (critical habitat); *Center for Biological Diversity v. U.S. Fish and Wildlife Service*, 2005 WL 2000928 (N.D. Cal. August 19, 2005) (concurrent 4(d) rule)).

Government-to-Government Relationship With Tribes

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951, May 4, 1994), E.O. 13175 (Consultation and Coordination with Indian Tribal Governments), the President's memorandum of November 30, 2022 (Uniform Standards for Tribal Consultation; 87 FR 74479, December 5, 2022), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with federally recognized Tribes and Alaska Native Corporations (ANCs) on a government-to-government basis. In accordance with Secretary's Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly

with Tribes in developing programs for healthy ecosystems, to acknowledge that Tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to Tribes. We have determined that no Tribal lands fall within the boundaries of the current range of the Bethany Beach firefly, so no Tribal lands would be affected by the proposed listing of this species at this time.

References Cited

A complete list of references cited in this rulemaking is available on the internet at https://www.regulations.gov and upon request from the Chesapeake Bay Ecological Services Field Office (see FOR FURTHER INFORMATION CONTACT).

Authors

The primary authors of this proposed rule are the staff members of the Fish and Wildlife Service’s Species Assessment Team and the Chesapeake Bay Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Plants, Reporting and recordkeeping requirements, Transportation, Wildlife.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

2. In § 17.11, in paragraph (h), amend the List of Endangered and Threatened Wildlife by adding an entry for “Firefly, Bethany Beach” in alphabetical order under INSECTS to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *
(h) * * *

Table with 5 columns: Common name, Scientific name, Where listed, Status, Listing citations and applicable rules. Row 1: Firefly, Bethany Beach .. Photuris bethaniensis .. Wherever found T [Federal Register citation when published as a final rule]; 50 CFR 17.47(j).4d

3. Further amend § 17.47, as proposed to be amended August 6, 2024, at 89 FR 63888, by adding a paragraph (j) to read as follows:

§ 17.47 Species-specific rules—insects.

- (j) Bethany Beach firefly (Photuris bethaniensis)—(1) Prohibitions. The following prohibitions that apply to endangered wildlife also apply to the Bethany Beach firefly. Except as provided under paragraph (j)(2) of this section and §§ 17.4 and 17.5, it is unlawful for any person subject to the jurisdiction of the United States to commit, to attempt to commit, to solicit another to commit, or cause to be committed, any of the following acts in regard to this species:
(i) Import or export, as set forth at § 17.21(b) for endangered wildlife.
(ii) Take, as set forth at § 17.21(c)(1) for endangered wildlife.
(iii) Possession and other acts with unlawfully taken specimens, as set forth at § 17.21(d)(1) for endangered wildlife.
(iv) Interstate or foreign commerce in the course of a commercial activity, as set forth at § 17.21(e) for endangered wildlife.
(v) Sale or offer for sale, as set forth at § 17.21(f) for endangered wildlife.

- (2) Exceptions from prohibitions. In regard to this species, you may:
(i) Conduct activities as authorized by a permit under § 17.32.
(ii) Take, as set forth at § 17.21(c)(3) and (4) for endangered wildlife.
(iii) Take, as set forth at § 17.31(b).
(iv) Possess and engage in other acts with unlawfully taken wildlife, as set forth at § 17.21(d)(2) for endangered wildlife.
(v) Take incidental to an otherwise lawful activity caused by:
(A) Research and conservation activities to benefit Bethany Beach firefly conducted by an organization or individual, working cooperatively with a State conservation agency that is operating a conservation program pursuant to an approved cooperative agreement with the Service as set forth in § 17.31(b), when conducted by an organization or individual that has obtained a permit from the State conservation agency, and the research activity is carried out in compliance with all terms and conditions of the State permit. Research activities permitted by the State may include but are not limited to population monitoring (including surveys and handling fireflies to confirm identification); tissue

collection for genetic analysis (removal of a leg).
(B) Control of invasive plants and removal of native or invasive woody vegetation. These activities can be implemented in Bethany Beach firefly habitat at any time of the year, but they must be performed through mechanical removal using hand-operated machinery.
Martha Williams,
Director, U.S. Fish and Wildlife Service.
[FR Doc. 2024–22358 Filed 9–30–24; 8:45 am]
BILLING CODE 4333–15–P

DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R8–ES–2024–0107; FXES1111090FEDR–245–FF09E21000]

Endangered and Threatened Wildlife and Plants; 12-Month Not-Warranted Finding for the Las Vegas Bearpoppy

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Notification of finding.