December 2023

Peninsular Florida

Species Conservation and Consultation Guide

Sand Skink and Blue-tailed (Bluetail) Mole Skink

This guide for sand skink (*Plestiodon* [*Neoseps*] *reynoldsi)* and blue-tailed mole skink (*Plestiodon* [*Eumeces*] *egregius lividus*) conservation and Endangered Species Act (ESA) consultation is intended to assist project proponents to determine if or how a proposed action may affect sand skinks or blue-tailed mole skinks.

The sand skink and blue-tailed mole skink are listed as threatened pursuant to the ESA. The ESA prohibits the unauthorized "take"[a] of threatened and endangered species. Individuals and entities intending to conduct projects that may affect listed species may lawfully incidentally take those species after consulting with the U.S. Fish and Wildlife Service (Service) pursuant to section 7 or 10 of the ESA. When a project is conducted, funded, or authorized by a Federal agency, listed species consultation occurs through section 7 of the ESA. When there is no Federal nexus (*e.g.,* Federal authorization or funding), a non-Federal entity who wishes to conduct an activity may legally "take" listed species after obtaining an Incidental Take[b] Permit (ITP) from the Service in accordance with section 10 of the ESA.

In this guide, we first summarize sand skink and blue-tailed mole skink status, life history, distribution, habitat, and threats. Then we discuss the consultation steps, including: assessing the effects of the proposed action, making effect determinations, and incorporating conservation measures into proposed actions to maximize beneficial effects and to avoid or minimize negative effects to listed skinks and their habitat. Appendix A provides a recommended skink survey protocol, Appendix B provides a method for estimating skink habitat use based upon movement data and survey results, Appendix C provides a variety of possible Conservation Measures, including conservation, compensation, and mitigation guidance, and Appendix D provides a Habitat Equivalency Analysis calculator. The current guide will be updated as new information becomes available and will be posted on the Service's Florida website at https://www.fws.gov/office/florida-ecological-services.

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[a] "Take" is defined as harm, harass, pursue, hunt, shoot, wound, kill, trap, capture, collect, or to attempt to engage in any such conduct. The term "harm" includes any act which actually kills or injures fish or wildlife, and emphasizes that such acts may include significant habitat modification or degradation that significantly impairs essential behavioral patterns of fish and wildlife. The term "harass" is defined as any act that creates the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include but may not be limited to breeding, feeding, or sheltering.

[b] "Incidental Take" is defined as take that results from, but is not the purpose of, carrying out an otherwise lawful activity.

For more information on sand skink and blue-tailed mole skink biology, habitat needs, threats, taxonomy, and recovery criteria and goals, see the Bluetail Mole Skink and Sand Skink 5-Year Status Review (Service 2021 and Service 2023) and the South Florida Multi-Species Recovery Plan (Service 1999). Published literature as well as unpublished reports, information, and data referenced in the skink conservation and consultation guide are available at the Service's South Florida Ecological Services Office (SFESO) in Vero Beach, Florida (by phone at 772-562-3909 or by mail at 1339 20th Street, Vero Beach, Florida 32960-3559).

Status

The Service listed the sand skink and the blue-tailed mole skink as threatened under the ESA in 1987 primarily due to modification and destruction of xeric upland communities in central Florida. Habitat loss, habitat fragmentation, and changes in land use still threaten sand skinks and blue-tailed mole skinks. In addition, lack of habitat management, competition from non-native and invasive plant species, and loss of genetic diversity threaten sand skink and blue-tailed mole skink existence (Service 1999; 2021, 2023).

Life History

Little is known about sand skink and blue-tailed mole skink population or reproduction ecology. Both sand skinks and blue-tailed mole skinks are difficult to detect and study due to their small size and semi-fossorial to fossorial habits. Sand skinks and blue-tailed mole skinks generally partition rather than compete with one another for resources. Sand skinks are primarily fossorial; they move or "swim" below the surface of the ground in sandy soils and take prey below the surface. Blue-tailed mole skinks are semi-fossorial; they hunt at the soil surface and consume mostly terrestrial arthropods (Smith 1977).

No data are available on sand skink or blue-tailed mole skink home ranges, or blue-tailed mole skink dispersal. Information on sand skink dispersal and movement patterns is limited. Sand skink studies in the early 2000s documented several instances where movement distances exceeded 460 feet (ft) (140 meters [m]) (Mushinsky et al. 2001; Penney 2001; Penney et al. 2001) and one instance where an adult male moved over 780 ft (240 m) (Penney 2001). Other studies suggested that some individual sand skinks may move more than 3,280 ft (1 kilometer [km]) and up to 26,250 ft (8 km) where suitable soils are contiguous with no natural or manmade barriers to movement, but some data points in this dataset could not be verified (Mushinsky et al. 2011). Schrey et al. (2011) conducted a genetic analysis of sand skinks (n = 470) within 25 m of each other, and reported "the Florida sand skink occurs with higher genetic similarity than expected by chance within 25 m (82 ft)". Although dispersal data are not available for blue-tailed mole skinks, Schrey et al. (2012) found no genetic evidence of long-distance dispersal. Penney (2001) reported translocated sand skinks moved a median distance of 25.6 m (84 ft; n = 64). Perry and Garland (2002) reviewed literature and examined home range as a function of snout-vent length in lizards. Of the 489 data sets they examined, 108 met their criteria for their analysis. Lizards of the Autarchoglossa (the clade that contains all skink species) with snout-vent lengths ranging from 30 millimeters (mm) to 100 mm (i.e., the range representative of sand skinks) had home ranges of approximately 10 m^2 to approximately 1,700 m^2. A 1,700 m^2 area

has a radius of 23 m (75 ft). After reviewing this information, the Service has determined that sand skinks are reasonably certain to feed, breed, and shelter within 80 ft of a track when the habitat is suitable. Currently, a multi-year study on home range sizes and/or movement distance is being conducted. If additional scientific information is obtained, data will be evaluated and changes to these guidelines may be necessary at that time.

Distribution

Reptile research and incidental observations to date indicate blue-tailed mole skinks typically occur with sand skinks. Only sand skinks leave visible signs, or tracks, on sandy soil surfaces. Therefore, sand skink occurrence is used as an indicator of blue-tailed mole skink occurrence where the two species overlap in distribution. Blue-tailed mole skink genetic studies indicate that conservation actions for sand skinks will also likely benefit blue-tailed mole skinks (Schrey et al. 2012).

Both sand skinks and blue-tailed mole skinks are endemic to, which means they occur only on, the sandy ridges of central Florida. Skink distribution is defined by three factors: county, elevation, and soil types. Primary populations of sand skinks occur on the Lake Wales, Winter Haven, and Mt. Dora Ridges in Highlands, Lake, Marion, Orange, Osceola, Polk, and Putnam Counties. Blue-tailed mole skinks are restricted to the Lake Wales Ridge in Highlands, Polk, and Osceola Counties.

Skinks are generally found at elevations 82 ft above sea level and higher (Florida Natural Areas Inventory 2007). Recent skink occurrences documented at 70 ft above sea level indicate skinks occur at lower elevations where suitable soil conditions for skinks continue down slope (Service unpubl. data).

Skinks occur in excessively drained, well-drained, and moderately well-drained sandy soils that include Apopka, Arredondo, Archbold, Astatula, Candler, Daytona, Duette, Florahome, Gainesville, Hague, Kendrick, Lake, Millhopper, Orsino, Paola, Pomello, Satellite, St. Lucie, Tavares, and Zuber soil series, referred to as “skink soils” in this guide. Soil series maps are available online (https://sdmdataaccess.nrcs.usda.gov/and through county extension offices.

Habitat

Skink habitat identified in this guide includes skink soils at and above 80 ft above sea level. Skink searches or surveys following a standardized protocol (Appendix A) should be conducted in all skink soils above 80 ft elevation or in projects areas that are directly adjacent to suitable habitat. Additional skink surveys, monitoring, and observations will likely improve knowledge of skink occurrence and distribution, as well as understanding of skink habitat use.

Skink soils typically support scrub, sandhill, or xeric hammock natural ecological communities, such as oak-dominated scrub, turkey oak (*Quercus laevis*) barrens, high pine, and xeric hammocks. Typical upland habitat for both sand skinks and blue-tailed mole skinks consists of sand pine (*Pinus clausa*)-rosemary (*Ceratiola ericoides*) scrub or longleaf pine (*Pinus palustris*)-

turkey oak/sand live oak (*Quercus geminate*) association. Sand skinks have also been documented in skink soils where natural vegetative cover has been altered for human uses such as pine plantations, active or inactive citrus groves, pastures, and residential developments, as well as neglected vegetative cover like old fields and overgrown scrub, especially in areas with overgrown or remnant scrub adjacent (Pike et al. 2008). Blue-tailed mole skinks occur in habitat similar to that used by sand skinks. Habitat condition or vegetative cover alone cannot be used to exclude areas that might be used by sand skinks or blue-tailed mole skinks.

Both sand skinks and blue-tailed mole skinks typically occur in areas that contain a mosaic of open sandy patches interspersed with forbs, shrubs, and trees. Sand skink tracks are usually observed in open sandy areas, yet both skink species use a variety of micro-habitats within xeric vegetative communities. Sand skink tracks appear most abundant in the ecotone, or edges, between areas with abundant leaf litter and vegetative cover and adjacent open sands. Blue-tailed mole skinks are typically found under leaf litter, logs, palmetto fronds, and other ground debris (Christman 1992).

Specific physical structures of habitat that sustain sand skink populations, and likely blue-tailed mole skink populations as well, include a well-defined leaf litter layer on the ground surface and shade from either a tree canopy or a shrub layer, but not both. Leaf litter likely provides important skink foraging opportunities. Shade provided by a tree canopy or a shrub layer likely helps skinks regulate body temperature to prevent overheating. However, having both a tree canopy and a shrub layer appears to be detrimental to skinks (McCoy 2011, University of South Florida, pers. comm.).

Either natural fires started by lightning or prescribed burns are necessary to maintain habitat in natural scrub ecosystems. However, if fire occurs too frequently, leaf litter might not build up sufficiently to support skink populations. At Archbold Biological Station, sand skinks appear to be most abundant after 10 years of leaf litter development. The ideal fire frequency to maintain optimal leaf litter development for skinks likely varies by site and other environmental conditions (Mushinsky 2011, University of South Florida, pers. comm.).

Threats

Habitat loss, fragmentation, and changes in land use continue to threaten sand skinks and blue-tailed mole skinks. Development and agricultural conversion have resulted in the loss of approximately 85 percent of the scrub and sandhill habitats on the Lake Wales Ridge (Turner et al. 2006). Habitat degradation and fragmentation also continue to affect populations, even on protected lands. Active management is necessary to maintain suitable habitat for skinks. Much of the remaining habitat occurs in small, isolated patches surrounded by residential areas or citrus groves, making the suitable habitat patches and connections between patches difficult to protect and manage. Many habitat patches are overgrown and in need of restoration, but vegetation restoration and management programs are costly and depend upon availability of funding. Privately-owned sites remain at risk of being developed, and destruction or habitat modification due to improper or lack of management remains a concern. Conversion of rural lands to urban use in central Florida where skinks occur is projected to continue over the next 50

years. In addition, fire suppression, improper stand management, competition from invasive plant species, and loss of genetic diversity continue to threaten the existence of the sand skink and blue-tailed mole skink.

Critical Habitat

Critical habitat has not been designated for either sand skinks or blue-tailed mole skinks.

Consultation Area

The Service delineated a consultation area (Figure 1 and Figure 2) to assist project proponents to determine if a proposed action might affect sand skinks or blue-tailed mole skinks (skinks). The consultation area is intended to guide project proponents of both Federal and non-Federal actions. Some locations inside the consultation area may not contain appropriate soils and elevation to support skinks. The consultation area includes: (1) known skink locations, (2) skink soils at appropriate elevations defined as skink habitat, and (3) natural and developed ecosystems that are known to support skinks. Experts cannot determine the location of each skink throughout the year, or the exact areas that support skink feeding, breeding, and sheltering, even if extensive continuous year-long research is conducted in central Florida. Therefore, the consultation area outlines a geographic landscape with a higher likelihood of skink habitat use than the landscape outside of the consultation area.

In general, proposed actions inside the consultation area are more likely to affect skinks, and proposed actions outside the consultation area are less likely to affect skinks. Though the consultation area provides an initial analysis tool, users evaluating a proposed action should not consider the consultation area as the only factor in deciding whether or not consultation is required. The consultation area is based on best available information to date. We expect that more information will improve and refine our knowledge of skink occurrence in the future. Consultation is required if proposed actions outside the delineated consultation area may affect skinks. Similarly, consultation may not be required if proposed actions inside the consultation area will not affect skinks (*e.g.,* if the project location is not within the appropriate elevation or does not contain suitable skink soils).

Consultation

Federal and non-Federal project proponents have different responsibilities for conducting consultations to ensure compliance with the ESA. This section outlines a stepwise process to guide consultation for skinks. All project proponents should follow Steps 1 and 2 regardless of whether they are consulting on Federal actions through section 7 or seeking technical assistance through section 10. Federal project proponents should continue with Steps 3 and 4. Non-Federal project proponents seeking incidental take authorization through section 10 of the ESA should contact the Service at 772-562-3909 in South Florida or 904-731-3336 in North Florida for additional information.

Federal Action Agencies

In addition to this guide, the ESA section 7 Consultation Handbook (Services 1998) provides information on consultation for Federal actions. The Guide to a Complete Initiation Package (Service 2004b) and checklist provide details on how to prepare a complete consultation initiation package.

Non-Federal Entities

When an action, such as clearing vegetation, conducting development activities, or permitting of such activities, is proposed within the Skink Consultation Area and there is no Federal nexus, we recommend that non-Federal entities (*i.e.;* private land owners; businesses; state, county, or local municipalities) request technical assistance from the Service under section 10 of the ESA prior to initiating or authorizing the proposed activity. The Service will review the information provided to assess if the action has the potential to result in take of skinks or other listed animal or plant species. If the proposed action is likely to take listed species, the Service recommends that the non-Federal entity apply for an Incidental Take Permit (ITP) to ensure compliance with the ESA and to minimize the risk of third party lawsuits. As part of the ITP application, applicants develop a Habitat Conservation Plan (HCP). Among other things, the HCP describes the actions that the applicant will implement to minimize and mitigate negative effects to listed species, demonstrates that there will be no appreciable reduction in the survival of the species, and demonstrates that there is adequate funding and other assurances to ensure the plan will be fully implemented. For more information, contact the Service at (352) 448-9151. Additional information can also be found here Project Review Guidance and Resources of the Florida Ecological Services Office | U.S. Fish & Wildlife Service (fws.gov) and here https://www.fws.gov/media/florida-ecological-services-guidance-completing-esa-project-reviews.

Step 1: Describe the Proposed Action

Fully describe all features and activities related to the proposed action, such as: proposed project purpose; all aspects of proposed construction, including road access, staging areas, and any associated land clearing and filling; information on surveys and monitoring; and anticipated post-project operations, maintenance, and management. Describe the project location, habitat, soil types, and elevations affected. Develop and provide maps of all project locations, boundaries, county lines, soil types, elevation, and habitat. On the maps, delineate project boundaries, map suitable soils and elevations, and quantify the acreage of proposed impact. On the maps, also designate those areas that are not considered habitat (*e.g.*, existing paved surfaces, water bodies, existing structures, etc.).

Consequences of the action should be considered. Consequences are a result or effect of an action, and we apply the two-part test to determine whether a given consequence should be considered an effect of the proposed action that is under consultation. An example is

constructing a road to access a proposed action site. The access road would not be necessary but for the proposed action. Interdependent activities have no independent utility apart from the proposed action. An example is annual maintenance of the access road. Maintenance would not be necessary but for continued need for access to the proposed action.

More information on complete proposed action descriptions can be found in the Species Conservation Guidance Introduction of this document. Early coordination with the Service can reduce requests for additional information and reduce consultation time frames.

Step 2: Determine and Describe Species, Habitat, or Critical Habitat that May Be Affected. Note: Because no critical habitat has been designated for skinks, it will not be addressed further in this guidance.

2a: Species Location by County. Check to determine if the proposed action is in a county where skinks occur. Skink habitat typically supports federally listed plants and other species that should be consulted on, as well (See Figure 1 or the Service's website at http://ecos.fws.gov/ipac/).

2b: Consultation Area. If the proposed action is in a county where skinks generally occur, check the skink consultation area map (Figure 1 and Figure 2) to see if the proposed action is in or close to the delineated consultation area. Keep in mind that a proposed action may affect skinks whether or not it is within the consultation area boundary (*e.g.,* where skink soils are found or skinks or skink sign are detected outside of the boundary). Additional analysis may be needed.

2c: Species Occurrence by Habitat. If the proposed action is in the consultation area or otherwise might affect skinks, determine if skink habitat may be affected. Potential skink habitat includes all areas with skink soils (Refer to *Distribution*). We recommend verifying the soils present on the site in the field. Skink habitat consists of natural xeric vegetative cover and areas altered for human uses, including but not limited to: pine plantations, active or inactive citrus groves, pastures, residential developments, and neglected vegetative cover like old fields and overgrown scrub.

Check the natural community maps to determine if the proposed action is in or might affect natural ecological communities that traditionally indicated skink habitat. Because of the cumulative conversion of natural xeric communities for human uses, remaining natural xeric scrub is particularly important to maintain and support remaining skink populations.

This concludes the desktop analysis of the proposed action. However, site-specific assessments of parcels proposed for modification are necessary to determine if the proposed action may affect skink habitat.

2d: Early coordination. The Service highly recommends that applicants and their representatives contact the Service early in the planning process to determine if surveys

are recommended or if methodology is sufficient to detect presence. Early coordination will also assist in determining mitigation or minimization needs at the beginning of the consultation process.

In situations where projects meet soil, elevation, and habitat criteria, the Service recommends surveying the project site to indicate whether skinks occur within the project area, or if present, what extent of the project area they are utilizing. Prior to coverboard surveys, pedestrian surveys may be used to detect skink presence. However, pedestrian surveys may not be used to determine absence. See Appendix A for the Service's recommended survey protocol. Survey procedures should be followed closely and surveyors should have qualifications that include prior skink survey experience to increase the probability of detecting listed skinks where they occur. As stated in the protocol, the Service strongly recommends that project proponents contact us prior to initiating surveys.

If skinks are confirmed to occur within all or part of a proposed action area, whether inside or outside of the consultation area (Figure 1 and Figure 2), the site where skinks occur is considered occupied where habitat is suitable. The proposed action must be evaluated to determine if it may affect skinks.

The risk of a proposed action affecting occupied skink habitat does not depend solely on whether or not the action is located within known occupied skink habitat. Additional analysis (as described in Step 3a-b below) is needed to determine if project activities might affect skinks. A project may be so benign as to not affect skinks. If an analysis indicates a project presents only insignificant (small in size) or discountable (extremely unlikely to occur) negative risks to skinks, the applicant may consider incorporating conservation measures (see Step 3c and Appendix C), as appropriate, into the project design to further avoid or minimize direct or indirect negative effects to skinks. If a project will adversely affect skinks, it may be necessary to incorporate compensation or mitigation into the project design (Appendix C) to help offset anticipated incidental take.

Contact the Service or other sources early in the project planning and development process for more information on skinks and their habitat that may be affected by a proposed action.

Step 3: Evaluate Effects of the Proposed Action and Incorporate Conservation Measures.

3a: Describe potential effects of the proposed action, as well as consequences of the action, which may affect skinks. Proposed actions that would alter sites occupied by skinks that contain preferred soil types above 82 ft elevation in the consultation area could potentially affect skinks (*e.g.,* ground-disturbing or soil-compacting activities; clearing; construction, access, and staging activities; operation and maintenance activities; chemical applications; etc.)(Figure 1 and Figure 2).

3b: Describe potential cumulative effects which are the effects of future State or private activities, not involving Federal activities, which are reasonably certain to occur within the action area of the Federal action subject to consultation. These include effects that result in abiotic disturbances like chemical, radiation, or temperature changes and biotic disturbances like water quality, soil condition, vegetation cover, or topographic changes.

3c: Describe conservation measures incorporated into the project plan to avoid or minimize negative effects, in particular avoidance or minimization of adverse effects to skinks or their habitat. Describe conservation measures applied to compensate for anticipated incidental take. See more on Conservation Measures in Appendix C.

Contact the Service early in the consultation process for assistance in evaluating effects of the proposed action on skinks.

Step 4: Document methods, evidence, analyses, and reasoning and make a determination; prepare and submit a complete consultation initiation package that includes:

4a. A complete description of the proposed action.

4b. A complete description of federally listed resources (listed species and, if applicable, designated critical habitats) that may be affected.

4c. A complete description of potential direct (caused by the action, likely to affect listed resources, reasonably certain to occur), indirect (similar to direct effects but occur later in time), and cumulative (non-Federal actions reasonably certain to occur in the action area) effects and conservation measures incorporated to avoid, minimize, or compensate for adverse effects. Provide a complete description of conservation measures applied to avoid, minimize, or compensate for adverse effects anticipated to result in incidental take. Adverse effects may be either permanent or temporary in nature. See Appendix C for guidance on how to determine the nature of the adverse effects and calculate compensation for each.

4d. Reasoning or logic statements that connect the proposed action, affected listed resources, potential effects, and conservation measures; the reasoning should provide logical support and justification for the effect determinations.

4e. (An) effect determination(s), or a conclusion(s), and further coordination with the Service. Three effect determinations are possible:

i. “No effect” - If the proposed action is 1) outside the consultation area and contains no suitable habitat, or 2) inside the consultation area but contains no suitable habitat, then the action will not affect skinks, and the proposed action determination should be “no effect.”

ii. "May affect, not likely to adversely affect" - If the proposed action is in the consultation area and contains suitable habitat, elevation, and soils, the Service recommends proceeding with surveys within the project area (see Step 2). If skinks or their sign are detected and the proposed action will have only beneficial, insignificant, or discountable effects on skinks, the proposed action determination should be "may affect, not likely to adversely affect." The Service will concur with this determination unless survey protocols were not followed. Clearly document your survey methods and results, effects analyses, and reasoning so that we can evaluate your findings to prepare the Service's written concurrence, which is required for a "may affect, not likely to adversely affect" determination.

iii. "May affect, likely to adversely affect" – If sand skinks or their sign have been detected within the project area and if all avoidance and minimization measures have been incorporated into the design of your project and the remaining adverse effects to skinks are not insignificant or discountable, the determination for the proposed project should be "may affect, likely to adversely affect" skinks. This is true if skinks have been documented to occur, are detected, whether or not the proposed action is within or outside of the consultation area. Formal consultation with the Service is required. The Service may be contacted early for technical assistance to help identify additional conservation measures to minimize adverse effects to skinks. For guidance on when to seek an incidental take permit, see memo 067974.

Reinitiation of Consultation

While the issuance of the Service's biological opinion or concurrence letter concludes consultation, reinitiation of consultation is required if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals the action may affect listed species or critical habitat in a manner or to an extent not considered; (3) the action is modified which causes an effect not previously considered; or (4) a new species is listed or critical habitat designated that may be affected by the action. Any operation causing incidental take which exceeds the amount or extent anticipated must cease, and the Service must be contacted immediately.

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GIS Data

Sand_Skink_Consultation_Area_20200528 Consultation Area for sand skinks

Blue-Tail_Mole_Skink_Consultation Area_20200528 Consultation Area for blue-tailed mole skinks

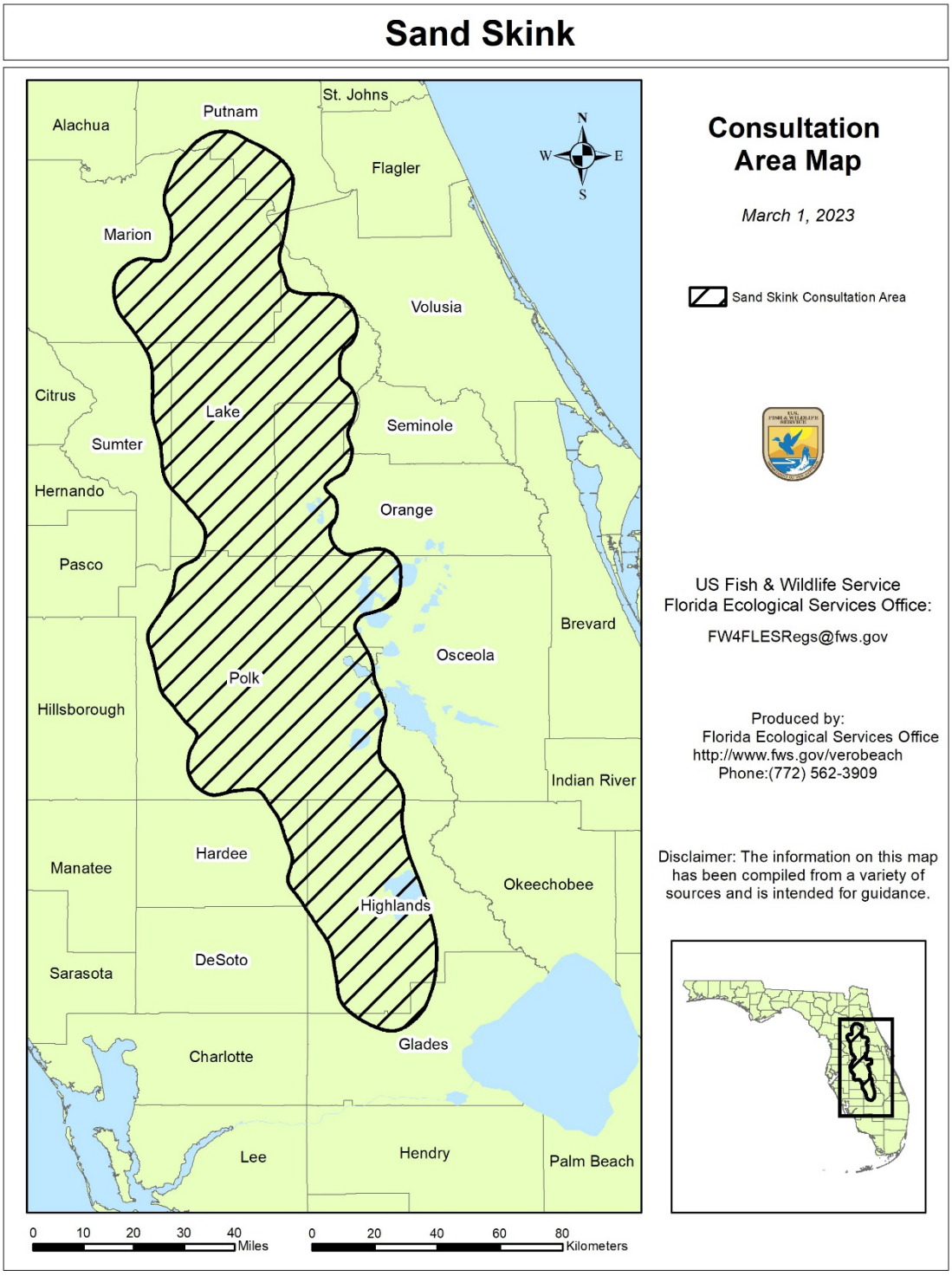

Figure 1. Sand skink consultation area. County names depicted in shadowed bold text indicate the counties where skinks are known to occur.

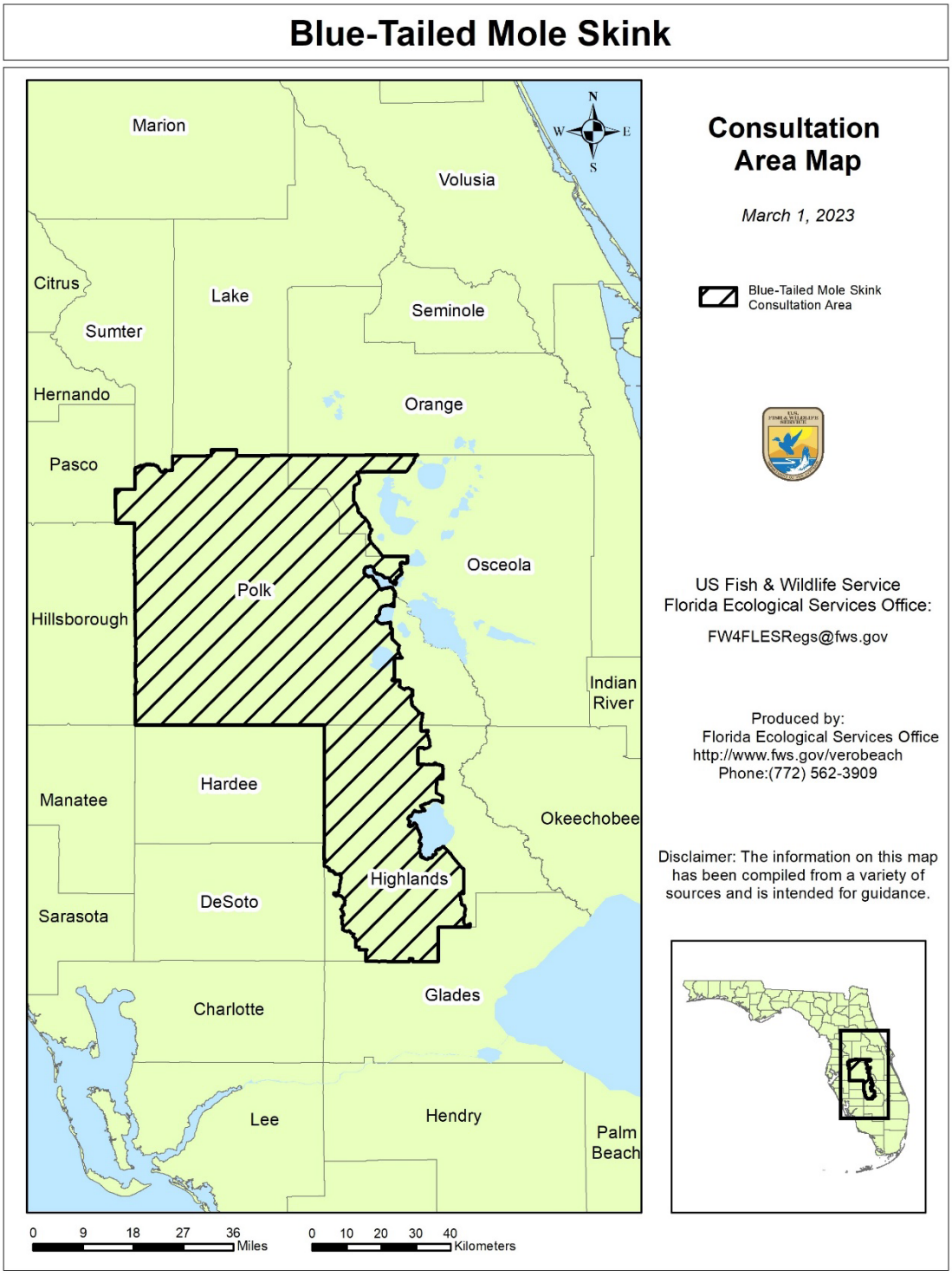

Figure 2. Blue-tailed mole skink consultation area. County names depicted in shadowed bold text indicate the counties where skinks are known to occur

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Appendix A

Sand Skinks and Blue-tailed Mole Skinks

Survey Protocol
Peninsular Florida

The U.S. Fish and Wildlife Service (Service) provides this revised skink survey protocol for all counties in Florida in which the sand skink (*Plestiodon* [*Neoseps*] *reynoldsi*) and blue-tailed (bluetail) mole skink (*Plestiodon* [*Eumeces*] *egregius lividus*) occur based on the 5-year status review of the two species (Service 2021 and Service 2023) and our assessment of skink surveys to date. The purpose of this recommended survey protocol is to standardize survey and data collection procedures among project proponents to ensure consistent and comparable information that may improve our knowledge of the species' occurrence and habitat use over space and time. The current guidance will be updated as new information becomes available.

The three most important factors in determining the likelihood of presence of skinks are location, elevation, and suitable soils. Sand skinks occur on sandy ridges of interior central Florida. The extant range of the sand skink includes Highlands, Lake, Marion, Orange, Osceola, Polk, and Putnam Counties (Christman 1988; Telford 1998). Principal populations occur on the Lake Wales Ridge, Winter Haven Ridge, and Mount Dora Ridge (Christman 1970; Christman 1992; Mushinsky and McCoy 1995). Blue-tailed mole skinks are only known to occur on the Lake Wales Ridge in Highlands, Osceola, and Polk Counties (Mount 1965; Christman 1978). Both skink species are found in this geographic area typically at elevations 82 feet (ft) (25 meters [m]) above sea level or higher (Florida Natural Areas Inventory 2007). Sand skinks are more numerous, broadly distributed, and easily detected than blue-tailed mole skinks. As such, sand skinks will be used as a proxy for both species in the counties in which they co-occur (See Skink Conservation and Consultation Guide for additional information).

Within appropriate geographic area and elevation, skinks are found in excessively drained, well-drained, and moderately well-drained sandy soils. Suitable soil types include: Apopka, Arredondo, Archbold, Astatula, Candler, Daytona, Duette, Florahome, Gainesville, Hague, Kendrick, Lake, Millhopper, Orsino, Paola, Pomello, Satellite, St. Lucie, Tavares, and Zuber soil series. We recommend that soil types be verified in the field by the surveyor. These soil types typically support scrub, sandhill, or xeric hammock natural communities, although they may be degraded by human impacts to overgrown scrub, pine plantation, citrus grove, old field, or pasture. Skinks have been found in all these degraded conditions where soil types are suitable regardless of vegetative cover (Pike et al. 2008a). Thus, habitat condition is of secondary importance in determining whether a site is occupied by skinks. If a site has suitable soils at the appropriate elevation, vegetation does not preclude coverboard placement, does not have a thick duff layer, and is within the counties where skinks are known to occur, there is a likelihood of presence, and potential effects to skinks should be considered.

When the location, elevation, and soil type are suitable and the proposed action may disturb the soils on-site, then a skink survey is necessary to determine if the site is occupied.

Surveys can be conducted in a two-tiered approach to determine presence of skinks. A visual pedestrian survey to detect skink tracks should be conducted first. This survey can be performed at any time of the year, but tracks are most detectable in the spring (March through May) and fall (October through January) (Ashton and Telford 2006; Pike et al. 2008b). We recommend a thorough pedestrian survey be completed during one of these periods prior to proceeding with a more intensive coverboard survey. Sand skinks leave a sinusoidal ("S"-shaped) track (Figure 1) at the surface that can be readily identified through a visual pedestrian survey. All open, exposed sandy areas on the property should be surveyed. The survey route (preferably global positioning system [GPS] based) should be recorded and depicted in map form with all locations of skink sign (skinks or skink tracks) marked. A photo documentation log of the skink signs should also be provided.

If the pedestrian survey is negative on some or all portions of the site, then a coverboard survey, with boards regularly dispersed across suitable soils in either the fall or spring, is necessary on those portions with negative pedestrian survey results. Prior to initiating coverboard surveys, we strongly encourage you to contact a Service biologist to confirm survey dates, obtain guidance on placement of the boards across the landscape, and determine if a site visit is needed to verify sampling protocol. Research has shown that sand skinks will take the path of least resistance through pastures. Edge habitat can be utilized by skinks especially if there is good quality habitat adjacent to grassy areas (McCoy et al. 2020). Surveys should try to focus on thoroughly surveying edges.

Coverboard surveys should be conducted from October 15th through December 15th (Ashton and Telford 2006, Pike et al. 2008b) or March 1st through May 15th (Gianopulos 2001, Mushinsky et al. 2001, Rizkalla et. al 2015). This time period was selected using the best available science and is intended to account for yearly temperature fluctuations. Negative results obtained outside this period of time are not considered adequate to presume absence of skinks. Surveys should be conducted a minimum of four times during four consecutive weeks within the survey time period to presume that skinks are not present. Coverboards must be lifted and checked for tracks a minimum of once per week over the four consecutive weeks. It is important to conduct surveys when survey conditions are suitable for detecting skinks (*i.e.,* the surrounding soil is not compacted as a result of rainfall or other events that may preclude skink movement, such as atypical weather conditions).

Coverboards should be placed within suitable soil types at a minimum density of 100 coverboards per hectare (40 per acre). Coverboards should be located in areas of bare sand or sparse vegetation adjacent to leaf litter or detritus. Carefully rake or grade the soil to ensure full contact of the coverboard with the soil surface. Removal of soil from surrounding areas and placement under coverboards may be necessary where stems or roots preclude full contact of the coverboard with the soil surface. The additional soil must be deep enough to allow skinks to

move through it and for tracks from their movements to be detectable (5 centimeters [cm]). Certain conditions (overgrown scrub, old fields, pastures) may require vegetation to be removed under specific coverboards to place a sufficient number of boards. Xeric scrub habitat where skinks occur may also be occupied by rare, State and federally listed plants. While setting up coverboard surveys, minimize effects to rare plant communities (For more information on plants, see (https://archbold-cms.payloadcms.app/media/Archbold%20Biological%20Station%20Plant%20List.pdf).

Coverboards should be 61 cm by 61 cm (2 ft by 2 ft) in dimension and may be constructed of 1.2 cm (0.5 in) or greater thick plywood, masonite, rigid insulation board (without metallic sheathing), carpet, or other rigid material of the same dimensions. Record the geographic coordinates of all coverboards. Coverboard surveys can take place in either our fall or spring survey season. Coverboards should be allowed to acclimate for 7 days before the first sampling event. Therefore, the latest date that one could deploy coverboards and complete the survey according to protocol is November 17 for fall season or April 17 for spring season.

Survey Season Begins	**Latest Date to Deploy Coverboards**	**Survey Season Ends**
March 1	April 17	May 15
October 15	November 17	December 15

Check for tracks upon lifting each coverboard. The use of gloves during sampling is highly recommended as coverboards often attract venomous insects and reptiles. We recommend lifting the coverboards from the edge farthest from you to keep the coverboard between you and any potential threats. After checking for tracks and skinks, carefully smooth the soil surface with the edge of the coverboard and replace the coverboard. During each site visit, look for and record tracks in sandy patches between coverboard locations.

A survey report that includes the following, as applicable, should then be forwarded to the Service. Survey results are valid for two years and older survey results will be evaluated on a case-by-case basis:

1. Project description of the action including site-specific habitat and vegetative descriptions, habitat structure (*i.e.,* the extent of canopy, understory, and ground cover, etc.), non-habitat structure (*i.e.*, the extent of existing paved surfaces, existing structures, and water bodies, etc.), and fire history, if available.

2. Soil map over a topographical map or aerial photograph of the project area including the path of the pedestrian surveys, coverboard locations, and locations of skinks and skink signs.

3. Photo documentation of tracks. All tracks resembling sand skink tracks should be submitted for review to ensure that Peninsular mole skink tracks are not mistakenly identified as sand skink tracks.

4. Field data sheets that include:
   A. Survey dates with starting and ending times of all surveys conducted and personnel conducting surveys;
   B. Weather conditions during all surveys, including average temperature, wind speed and direction, visibility, and precipitation;
   C. Total number of skink tracks observed; and
   D. All skink observations.

5. If the survey results are negative, please submit coordinates for a central location on the site. If the survey results are positive for skink presence submit all coordinates for skink locations.

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Figure 1. Typical “S”-shaped track of the sand skink (photographs courtesy of Randy Mejeur; Glatting Jackson Kercher Anglin Lopez Rinehart, Inc; 2000).

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Appendix B

Sand Skinks and Blue-tailed Mole Skinks

Estimating Skink Habitat Use on a Project Site
Peninsular Florida

The results of the surveys can be used to estimate how much of the total area is likely occupied by skinks. In the absence of data to estimate the average home range size of skinks, data on movement distances is being used to approximate usage of habitat around positive skink detections. It is the Service's opinion that any suitable habitat within 80 ft of a sand skink track is reasonably certain to be occupied, and any activities that occur within that radius which are reasonably certain to harm sand skinks would be considered incidental take as defined by the Endangered Species Act. The information that supports 80 ft as the radius includes: 1) Penney (2001), who reported translocated sand skinks moved a median distance of 25.6 m (84 ft; n = 64); 2) Schrey et al. (2011), who conducted a genetic analysis of sand skinks (n = 470) within 25 m of each other, and reported "the Florida sand skink occurs with higher genetic similarity than expected by chance within 25 m (82 ft)"; and 3) Perry and Garland (2002), who reviewed the literature and examined home range as a function of snout-vent length in lizards. Of the 489 data sets they examined, 108 met their criteria for their analysis. Lizards of the Autarchoglossa (the clade that contains all skink species) with snout-vent lengths ranging from 30 millimeters (mm) to 100 mm (i.e., the range representative of sand skinks) had home ranges of approximately 10 m^2 to approximately 1,700 m^2. A 1,700 m^2 area has a radius of 23 m (75 ft).

To estimate habitat use, the project proponent should follow the steps below:

Step 1. Using the results of fully-implemented coverboard surveys, pedestrian surveys, and any incidental observations of skinks or their sign, map the positive survey hits/tracks, etc. Note: Pedestrian surveys may not be used solely to estimate habitat use but still may be used prior to coverboard surveys to potentially narrow down the number of coverboards needing to be deployed.

Step 2. Using mapping software, generate a buffer with a radius of 80 feet (24.4 meters) around each positive survey hit/track from all coverboard and pedestrian surveys, as well as incidental observations, to estimate the area of habitat use. Although this may result in some buffers that come close to each other but do not overlap, the applicant will have the option (but not be required) to connect circles to better depict the total area of use by the skink population on site.

Step 3. When drawing the 80-foot radius around positive skink survey hits/tracks, the area of habitat use for compensation will be determined by calculating the total area of suitable soils within the circle(s). If areas within the circle(s) are unsuitable (i.e., paved road, not one of the suitable skink soils), then these specific portions may be subtracted from the total area of habitat use for compensation calculation. Note that evaluation of dense bahiagrass is on a case-by-case basis.

Step 4. If a portion of the circle(s) is outside of the project footprint, it will need to be evaluated for impacts from the project, as well, if it falls within the action area (all areas, whether inside or outside of the project footprint that will be affected by the proposed action). If the action area for the proposed project extends beyond the project boundary, then any portion of the circle(s) drawn outside of the project boundary but within the action area should be included in the compensation calculation. If the action area is fully contained within the project boundary, then portions of the circle(s) outside of the project boundary will require no compensation, and the area may be subtracted from that circle(s). If the buffers of multiple positive skink hits/tracks overlap, then the sum total of the areas of those circles will be used to determine the occupied area(s) (Figure 1).

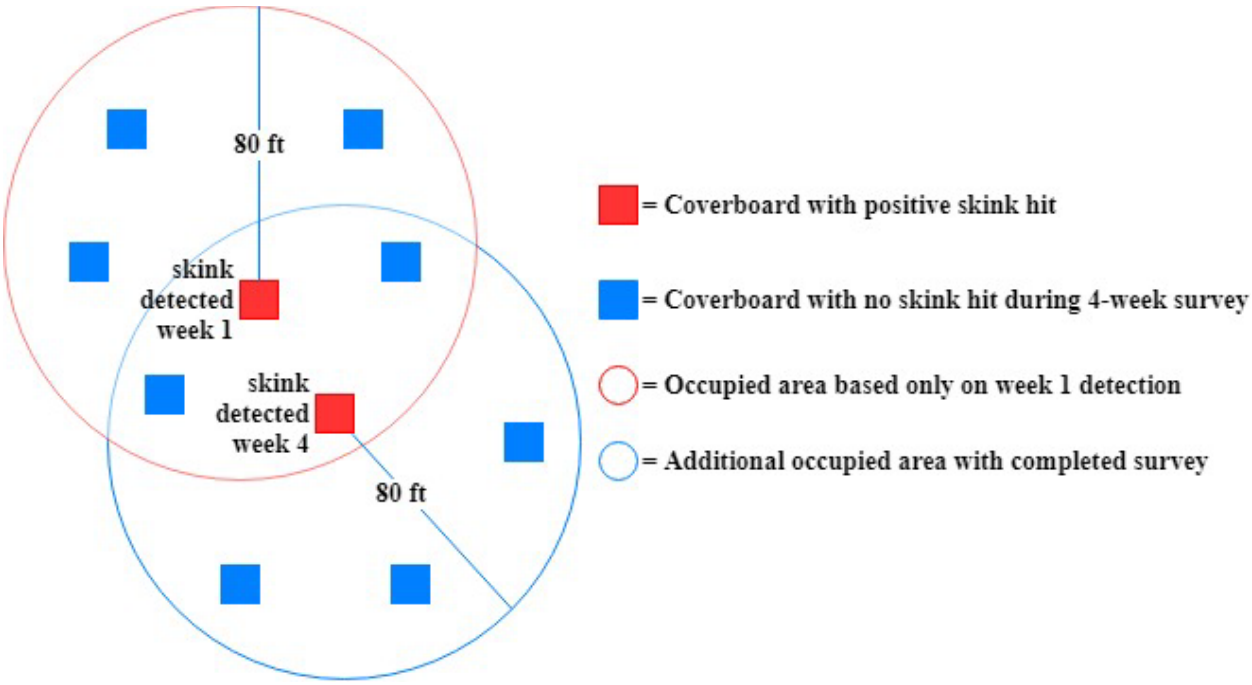

Figure 1. Diagram of habitat use estimation using buffered coverboard survey results with skink detections over 4-week survey period. Note: The number of coverboards represented within each 80-foot buffer is not to scale. Estimated skink habitat use = the entire area within the red circle + the area within the blue circle that falls outside of the red circle.

Step 5. To obtain the total area of habitat being used by skinks on the project site, add the area of all the circles drawn around positive skink survey hits/tracks and subtract the area of the footprint of any features (non-suitable soils, paved roads, buildings, water bodies, etc.) within the circles that are not considered by this guide to be skink habitat. This information should be mapped and provided to the Service to show how the final number of acres for compensation were derived.

Step 6. See Appendix C for potential conservation measures that project proponents may incorporate into their projects in order to avoid, minimize, compensate, and mitigate the effects of those projects on listed skinks.

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Appendix C

Sand Skinks and Blue-tailed Mole Skinks

Avoidance, Minimization, Conservation, and Mitigation Measures
Peninsular Florida

The purpose of this document is to provide a suite of potential conservation measures that project proponents may incorporate into their projects in order to avoid, minimize, compensate, and mitigate the effects of those projects on listed skinks. Federal project proponents are required to ensure proposed actions are not likely to jeopardize the continued existence of federally listed species by avoiding and minimizing the potential negative effects of their projects. Non-Federal project proponents developing a Habitat Conservation Plan (HCP) for an Incidental Take Permit for federally listed species are required to minimize and mitigate impacts to the maximum extent practicable. The best opportunity to avoid and minimize the potential impacts of a proposed project on listed species, including skinks, is during project planning and design. Project proponents should describe what conservation measures they are incorporating into their projects when preparing Biological Assessments or HCPs for submittal to the U.S. Fish and Wildlife Service (Service). Contact the Service early for additional assistance when planning or designing projects.

The most effective way to minimize the potential effects of a project on skinks is to avoid impacting occupied skink habitat. This includes avoiding both direct impacts to the habitat (*e.g.,* minimizing the project footprint), and indirect impacts to the habitat (*e.g.,* altering the hydrology of a site through modifications on- or off-site). Project proponents should consider limiting the impacts of all project components on skinks including, but not limited to, access and staging areas, land clearing and filling, construction, road building, landscaping, and anticipated project operations, maintenance and management.

In addition to avoiding skink habitat, the following avoidance and minimization measures should be considered:

- Limit roads, lanes, or other paths accessed by heavy equipment in and around skink habitat.

- Limit activities likely to disturb or compact soil in and around skink habitat (*e.g.,* disking, roller-chopping, use of heavy equipment, material storage, etc.).

- Limit black pavement that builds up heat during the day and increases air temperatures. Break up larger expanses of pavement to provide natural drainage and water filtration and to provide shade for paved areas.

- Incorporate green spaces using native vegetation and connectors into residential, residential-recreation, and other multi-use-residential developments.

- Set mower height at greater than 4 inches to avoid or minimize adverse effects to ground-dwelling wildlife.

    - Implement appropriate best management practices (*e.g.,* https://floridadep.gov/sites/default/files/npdes-pollution-prevention-2-4-16.pdf).

- Limit use of chemicals, if practicable, and follow all product labels when applying chemicals such as fertilizers, herbicides, and pesticides.

- Landscape with local and appropriate native plant species (for examples, see county extension websites).

- Designate any areas to be avoided as environmentally sensitive, delineate with temporary fencing or flagging to prevent accidental disturbance during project activities, and mark with signs (signs need to include information regarding the presence of listed skinks and any other federally protected species).

In some situations, it will not be possible to avoid taking skinks through the destruction or conversion of their habitat. In those cases, project proponents should propose appropriate compensation or mitigation to offset potential adverse impacts to skinks and their habitat. Compensation or mitigation will be determined based upon the nature of impacts from the proposed project (either permanent or temporary).

Temporary impacts refer to habitat damage and are the effects of actions which are short-term events and that result in the return of the habitat to suitable conditions for skinks within a reasonable amount of time (*e.g.*, powerline rights-of-way, pipeline projects). Temporary impacts to habitat include the following actions: trenching (if suitable soils are returned), pipe installation (if top of pipe ≥1 ft. below ground), soil piling/soil return (equipment vibrations, soil disruption, piling materials), foot traffic (if repetitive and/or destructive), vehicle traffic (if no fill is added, soil is not compacted, is repetitive and/or destructive), grading/site preparation (if horizon soils are saved and restored), mulching/vegetation removal (if discontinued after construction), maintenance mowing, radar surveys, and deep tillage (if used to restore construction-compacted soils).

Compensation or mitigation for temporary impacts to habitat will be determined using a Habitat Equivalency Analysis (HEA), which is a method for quantifying natural resource service losses and determining appropriate compensation for such losses. The skink HEA is based upon the time it will take the habitat to be restored to complete functionality for skinks. See Appendix D for HEA calculator. Impacts not defined as temporary by the above definition are considered to

be permanent impacts. Compensation or mitigation for permanent impacts will be calculated at a ratio of 2:1 (area of compensation or mitigation: area of impact).

An analysis of how the compensation or mitigation will offset the habitat loss as a result of the proposed action will be required. If compensation or mitigation is proposed off-site, the order of preference for location is: first, on the same ridge as the impact (preferably within the same genetic unit[a]); second, on the ridge adjacent to the impact; and third, elsewhere in the range of the listed skink being affected by the proposed action.

The following compensation or mitigation options may be available and are presented in priority order:

1. In the case of a project that is covered by a regional HCP, mitigate consistent with the HCP.

2. If credits are available at a Service-approved conservation bank whose service area covers the proposed project, mitigate or compensate by purchasing the appropriate number of credits from the bank.

3. Protect, restore, and perpetually manage occupied skink habitat that is off-site and adjacent to existing conservation lands acceptable to the Service. In some instances, a parcel that is shown occupied by skinks but is not adjacent to existing conservation lands could be a suitable option, if large enough and managed appropriately.

4. In rare cases, on-site compensation or mitigation may be acceptable to the Service. On-site conservation of occupied skink habitat may be appropriate when: none of the previous options are available, it is adjacent to existing conservation lands, it provides a connection among populations, or is otherwise desirable under the recovery plan. While skinks can persist on small parcels, on-site lands that are isolated by development have not been demonstrated to consistently support long-term viability of skink populations and are difficult to manage and maintain.

Requirements for compensation and mitigation areas (both on- and off-site)

If project compensation or mitigation involves skink habitat protection, restoration (if needed), and management, then the following are needed to ensure the habitat is protected and managed in perpetuity:

[a] Emerging research (e.g., Mushinsky et al. 2011) indicates that there are different sand skink genetic units that should be considered in conservation priorities. Project proponents should work with Service staff regarding genetic considerations for proposed compensation or mitigation.

- Permanent site protection: A conservation easement that is granted to a Service-approved non-profit entity (government or non-government) and allows the Service third-party rights of enforcement is the Service's preferred mechanism of permanent site protection. The non-profit entity should have experience in habitat conservation, be independent of the applicant, and be willing to monitor the easement annually and report its findings to the Service. The easement should be recorded in the county in which the protected property is located. Other site protection measures, such as deed restrictions and restrictive covenants, are considered on a case-by-case basis.

- Restoration: A detailed restoration plan, including a thorough budget, is required if the mitigation or compensation parcel requires restoration. The project proponent should describe how they will fund the restoration and provide funding assurances upfront. The preferred funding mechanism is the establishment of a Trust Fund to be held by a non-profit entity with experience in managing money for conservation purposes and to be drawn upon as restoration activities are conducted. Other funding mechanisms, such as a letter of credit or a bond, are considered on a case-by-case basis.

- Long-term management: A detailed Habitat Management Plan that includes a burn plan, invasive species management, skink monitoring, vegetation monitoring, and reporting of all results is required. In addition, an entity that is willing to manage the compensation or mitigation parcel and has demonstrated their ability to manage skink habitat should be identified. A management agreement with this entity is recommended when the applicant is not the manager. Additional information regarding Habitat Management Plans is provided below.

- Funding for management activities in perpetuity: A non-wasting Trust Fund (a fund in which only the interest generated is used to fund management activities) held by a non-profit entity with experience in managing money for conservation purposes is the Service's preferred method to secure permanent management funding. The non-profit entity should be independent of the applicant. The principal amount placed in the Trust Fund should take into account all costs associated with the compensation or mitigation parcel, the fee charged by the Trust Fund holder, and the interest and inflation that are expected to occur after the money is deposited. Other funding mechanisms, such as a letter of credit or a bond, are considered on a case-by-case basis.

Habitat Management Plans

A Habitat Management Plan should be created to support any on- or off-site compensation or mitigation. A Habitat Management Plan includes a detailed description of how the habitat will be managed; what steps will be taken to improve the habitat, how it will be maintained over time, and funding mechanisms to ensure beneficial management in perpetuity. The plan should

also include any survey reports and any land preservation covenants. If habitat improvements or restoration are proposed, the management plan needs to include a habitat monitoring component.

Research indicates overgrown scrub to be less suitable or unsuitable for skinks. Management practices beneficial to skinks may include, but are not limited to:

- Prescribed burns (not more than once every 10 years) or other activities that mimic natural disturbances in xeric scrub habitat,

- Non-native or invasive wildlife and vegetation removal, and

- Native vegetation restoration.

Structural characteristics of scrub habitat that can be managed to benefit skinks include a well-defined litter layer and shade in the form of a scattered shrub or tree overstory, but having both shrub and tree overstory can be detrimental to skinks. These structural characteristics are necessary for skinks to be able to regulate their body temperature. See the Habitat section in the main text of the *Skink Conservation and Consultation Guide* for more information on skink habitat characteristics.

Where monitoring is incorporated into the habitat management plan, a coverboard survey should be carried out once per year for 5 years during the appropriate period, then once every 5 years in perpetuity (see Appendix A for survey protocol). A survey report should be sent to the Skink Lead Biologist, South Florida Ecological Services Office, 1339 20th Street, Vero Beach, Florida 32960. Other observations of skinks, skink sign, and other listed species should be included in the survey report.

Additional items to consider for inclusion in a Habitat Management Plan for skinks include, but are not limited to:

- Implementing the avoidance and minimization measures beginning on page 1,

- Controlling overgrowth and managing overgrown scrub by thinning, burning, mowing, or other techniques to reduce vegetative density and create patchy, sandy open areas,

- Protecting habitat from detrimental off-road vehicle traffic and commercial forestry practices,

- Controlling domestic predators, such as cats, using traps or other deterrents,

- Developing and incorporating listed species conservation strategies, such as natural history kiosks and brochures, and

- Reporting land management activities and natural disturbances (*e.g.,* wildfire, controlled burns, etc.).

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APPENDIX D

Sand Skinks and Blue-tailed Mole Skinks

Habitat Equivalency Analysis (HEA)
Peninsular Florida

Appendix D. Injury parameters and calculation of skink services lost on X acres, recovering at a linear rate over 8 years (recovery time is equal to two skink generations). This tool is only for temporary impacts less than one year in duration, thus recovery begins in Year 1. If impacts are longer than one year in duration, contact the Service.
Habitat Equivalency Analysis model based on NOAA (2006).

Period	Project Status	%Service loss@begin	%Service loss@end	%lossMean	Service acre year lost	discount factor	discounted service acre years lost
2016	Year 1: Impact occurs / recovery begins	1	0.875	0.9375	0	1	0
2017	Y2: Recovery cont.	0.875	0.75	0.8125	0	0.970873786	0
2018	Y3: Recovery cont.	0.75	0.625	0.6875	0	0.942595909	0
2019	Y4 Recovery cont.	0.625	0.5	0.5625	0	0.915141659	0
2020	Y5: Recovery cont.	0.5	0.375	0.4375	0	0.888487048	0
2021	Y6: Recovery cont.	0.375	0.25	0.3125	0	0.862608784	0
2022	Y7: Recovery cont.	0.25	0.125	0.1875	0	0.837484257	0
2023	Y8: Recovery Complete	0.125	0	0.0625	0	0.813091511	0

Step 1. Insert total acres temporarily impacted into the box in cell A16 below to obtain acre-years lost (cell A18).

Result = Total acre-years lost (present discounted interim losses)
0.00

Step 2. Automated calculatation of the amount of credits (acres) that are needed to offset the temporary impacts following outline provided in NOAA 2006 paper. See compensation results highlighted in yellow below (cell D23).

Present discounted interim losses	0.00
Present discounted lifetime gains per acre of replacement pro-rated	34.33
Amount of needed skink conservation bank credits	**0.00**

National Oceanographic and Atmospheric Administration (NOAA). 2006. Habitat Equivalency Analysis: An Overview. Washington, D.C. NOAA.