Appendix D Biological Resources

BIOLOGICAL ASSESSMENT

for the

Falcon Operations at Space Launch Complex 40

Prepared by

United States Space Force

with assistance from

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1 INTRODUCTION

The Cape Canaveral Space Force Station (CCSFS) is located in Merritt Island, Brevard County, Florida, and is administered by the United States Space Force (USSF). Space Exploration Technologies Corporation (SpaceX) currently leases CCSFS's Space Launch Complex 40 (SLC-40) from the USSF for its Falcon 9 program (Figure 1). SpaceX launches Falcon 9 programs from SLC-40 under a license (LLO 18-105) issued by the Federal Aviation Administration (FAA). SpaceX proposes to expand infrastructure at SLC-40 to create and operate a new landing zone (to include a landing pad and associated structures) for Falcon 9 first stage boosters and to increase the number of annual Falcon 9 launches from SLC-40 (the Project). SpaceX proposes to increase the number of annual launches of Falcon 9 at SLC-40 from the current maximum of up to 50 launches per year to up to 120 launches per year, with up to 34 booster landings per year at SLC-40. Landings for the remaining launches would occur downrange on a droneship in the Atlantic Ocean.

1.1 Federal Action

The USSF's federal action is to expand the existing lease boundary for SLC-40 by approximately 10.08 acres from 40 acres to 50 acres. The existing lease boundary (approximately 40 acres) includes SLC-40 (approximately 37.82 acres) and the SLC-40 support facility (approximately 2.18 acres). The additional 10.08 acres (the Expansion Area) are located east of the current SLC-40 fence line and south of the existing SLC-40 support facility (Figure 2). The area encompassing SLC-40 and the Expansion Area (the Project Area; 47.9 acres) would provide the capacity for SpaceX to construct the new landing zone, which in turn will support an increase in the annual number of launches occurring at SLC-40. Additionally, the FAA would modify license LLO 18-105 to authorize SpaceX to conduct landings and increase launches at SLC-40.

1.2 Purpose and Need for the Biological Assessment

SpaceX's Project is related to the USSF's and FAA's federal actions (i.e., the Project would not occur but for the federal actions and the Project is reasonably certain to occur) and contributes to the effects of the action. The purpose of this Biological Assessment (BA) is to evaluate the effects of the action (e.g., the effects of the Project) on species and critical habitats protected by the Endangered Species Act (ESA) and certain other species and habitats that are proposed or under review for ESA protection. The USSF, as the lead federal action agency, has made effect determinations for each species and critical habitat considered in this BA.

Based on these determinations, the USSF submits this BA to the U.S. Fish and Wildlife Service (USFWS) to initiate federal interagency consultation and conference in accordance with Section 7(a)(2) and Section 7(a)(4) of the ESA. The USSF seeks concurrence with an effect determination of "may affect, not likely to adversely affect" for the West Indian manatee (*Trichechus manatus*), tricolored bat (*Perimyotis subflavus*), Audubon's crested caracara (*Polyborus* [Caracara] *plancus audubonii*), eastern black rail (*Laterallus jamaicensis* ssp. *jamaicensis)*, Everglade snail kite (*Rostrhamus sociabilis plumbeus*), piping plover (*Charadrius melodus)*, rufa red knot (*Calidris canutus rufa)*, wood stork (*Mycteria americana)*, black-capped petrel (*Pterodroma hasitata)*, roseate tern (*Sterna dougallii*), eastern indigo snake (*Drymarchon couperi)*, and monarch butterfly (*Danaus plexippus)*. The USSF determined that the Project is "likely to adversely affect" and seeks to initiate formal consultation with USFWS on the southeastern beach mouse (*Peromyscus polionotus niveiventris)*, Florida scrub-jay (A*phelocoma coerulescens*; FLSJ*)*, green sea turtle (*Chelonia mydas)*, hawksbill sea turtle (*Eretmochelys imbricata)*, Kemp's Ripley sea turtle (*Eretmochelys imbricata),* leatherback sea turtle (*Dermochelys coriacea)*, and loggerhead sea turtle (*Caretta caretta).*

Figure 1. Project location.

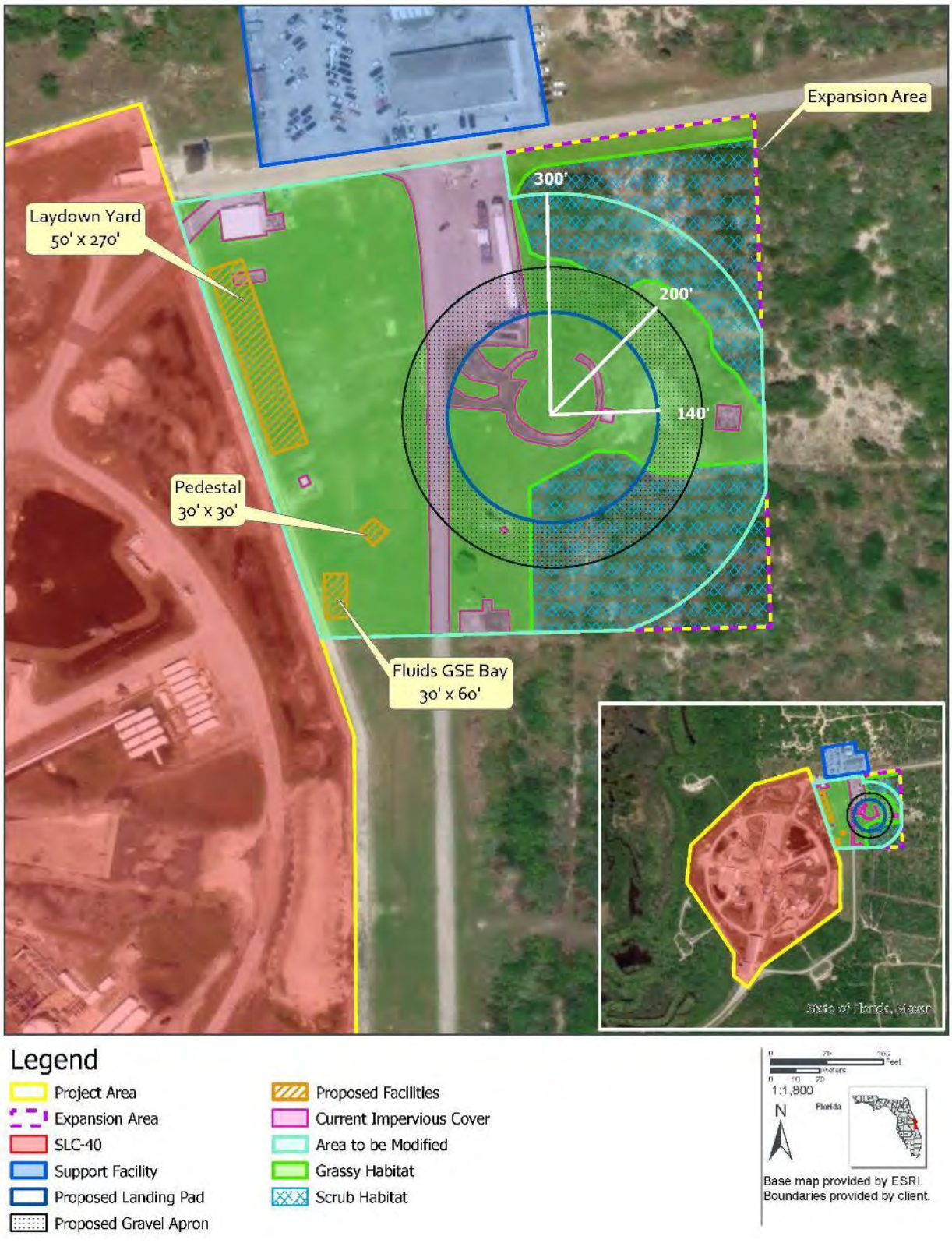

Figure 2. Proposed site plan.

2 PROJECT DESCRIPTION AND ACTION AREA

2.1 Expanded Landing Zone

SpaceX would construct a new landing zone adjacent to the existing boundary of SLC-40 within the Expansion Area. The new landing zone would allow SpaceX to land Falcon first stage boosters adjacent to its existing launch zone. The proximity of the new landing zone to the existing launch zone will support SpaceX's proposed increased number of annual launches from SLC-40.

2.1.1 Location

The CCSFS SLC-40 is located on lands owned and managed by the Space Launch Delta 45 (SLD-45), a unit of the USSF, in Brevard County, Florida, near the cities of Cape Canaveral and Titusville (see Figure 1). The proposed landing zone would be along the south side of Rocket Road east of SLC-40, within the Expansion Area.

2.1.2 Components and Activities

The proposed landing zone activities include construction and operations and maintenance of the new facility. Each of these is described further by tasks that are implemented with various methods, materials, and tools.

The Expansion Area (see Figure 2) is 10.08 acres. The western portion of the Expansion Area consists of an existing access road and a maintenance area, which is presently mowed grass. Rocket Road running along the north side of the Expansion Area would be utilized to access the proposed landing zone during construction, operation, and maintenance. The eastern portion of the Expansion Area contains native coastal scrub and xeric oak vegetation. Construction activities would occur over approximately 9.10 acres of the Expansion Area and would include the removal of approximately 2.03 acres of native scrub vegetation, with the remaining area of disturbance composed of mowed grassy areas, existing impervious cover, or existing structures. Approximately 0.97 acres of native scrub vegetation within the Expansion Area would not be disturbed during construction.

The landing zone includes the following facilities (shown in Figure 2):

- **Laydown Yard.** SpaceX proposes to utilize the grassy, presently modified area between the existing SLC-40 and Rocket Road as a laydown yard for equipment (e.g., crane) storage and maintenance, as well as storage of associated materials for the construction of the landing pad. All on-site fuel storage would have secondary containment. SpaceX would inspect fuel storage regularly and promptly remediate any containment failure in accordance with the Project's Spill Prevention, Control, and Countermeasures Plan (SPCC). No additional clearing for the laydown yard would be required, and no impervious surface would be installed.
- **Pedestal.** SpaceX proposes to construct a 30 x 30-foot pedestal located in the grassy, presently modified area between the proposed landing pad and the existing SLC-40. The pedestal would be designed to support the landing, storage, and maintenance of Falcon first stage boosters. The structure would be a platform made of concrete and steel and would be approximately 15 feet tall.
- **Fluids Ground Support Equipment (GSE) Bay.** As part of SpaceX's proposal to relocate existing operations from LZ-1/2 to SLC-40, SpaceX would construct a fluids GSE bay in the grassy, presently modified area between the proposed pedestal and the existing SLC-40. The

fluids GSE bay would be would either be a concrete or metal structure, similar to a cargo container. The fluids GSE bay would be 30 x 60 x 12 feet tall and would support the handling, processing, and storage of fluids required for post-landing processing. More specifically, the fluids GSE bay would primarily be used to distribute gaseous nitrogen to the vehicle's fluid circuits after landing. Isopar and isopropyl alcohol may also be stored at the fluids GSE bay and utilized at the landing zone for post-flight vehicle processing.

The paragraphs below describe the activities associated with construction of the landing zone, which will occur during daytime hours.

Surveying and Staking would occur within the Expansion Area prior to the start of construction. The limits of construction and locations of proposed facilities would be marked by stakes or other distinguishing markers.

Erosion and sediment controls would be installed prior to construction to minimize the impacts of soil erosion and sedimentation on the surrounding environment. Erosion controls such as silt fences and sediment barriers would be installed to stabilize exposed soil surfaces and prevent soil movement caused by wind, water, or other factors. Soil erosion can result in the transport of sediment, nutrients, and pollutants into nearby waterbodies. Sediment controls such as drain inlet protections can help prevent sediment-laden runoff before it reaches waterways.

Clearing and grading would remove 2.03 acres of native scrub vegetation using large, heavy tracked bulldozers. The removed vegetation would be placed in wheeled dump trucks and transferred to a suitable off-site area for disposal. The off-site disposal location would be determined by the contractor and would comply with all local, state, and federal regulations. It is anticipated that all excavated soil would remain onsite within the area of construction.

Site Preparation and Use would involve creating a suitable work area for construction equipment, vehicles, and personnel. This would include the removal of any potential hazards, such as rocks or debris, to ensure all construction areas within the Expansion Area are safe for construction activities to commence. The duration of proposed construction activities is expected to be approximately three months.

Landing Zone Construction would install a single, circular landing pad comprised of a 140-foot radius inner concrete ring and an outer gravel apron extending 60 feet beyond the concrete. The landing pad would provide a designated location for the safe recovery and landings of the Falcon 9 first stage booster.

Aboveground Nitrogen Gas Line Structures would be constructed to tie into the existing nitrogen gas line at SLC-40 and connect to the fluids GSE bay and pedestal for the maintenance and servicing of the booster after landing. It would provide a convenient and controlled means of supplying nitrogen to the fluids GSE bay and the pedestal and would be located in the southwest corner of the Expansion Area. The nitrogen gas line structures would be constructed above ground and would not require soil excavation or vegetation clearing.

Cleanup and Restoration would occur once construction is completed. These efforts would include removing construction debris and waste materials from the Project Area and restoring disturbed areas of the laydown yard with grassy vegetation**.**

Table 2.1-1 summarizes construction activities, tasks, materials, methods, and tools.

Table 2.1-1. Construction Activities, Tasks, Materials, Methods, and Tools

Construction Activity	Tasks, Materials, and Methods	Tools
Survey and Staking	Survey line sighting; boundary staking or flagging; underground utility surveys; geotechnical surveys	Work crews; passenger vehicles on existing roads/routes; light off-road vehicles; ground-penetrating radar; hand tools for vegetation trimming; survey stakes and flagging; rigs for geotechnical borings
Erosion and Sediment Control	Installing storm drain inlet protections, perimeter erosion, and sedimentation controls	Work crews; passenger vehicles and heavy equipment on existing roads/routes and at installation sites; light off-road vehicles; silt fences, straw bales, and/or other erosion control products
Clearing and Grading	Mechanical aboveground removal of shrubs and tall or dense vegetation; off-site disposal of cleared vegetative material; occasional belowground woody stems removal or surface grading at permanent sites (e.g., landing zone)	Work crews; passenger vehicles and heavy equipment on existing roads/routes and in temporary workspaces; light off-road vehicles; hand tools
Site Preparation and Use	Installation of temporary workspaces; erosion and sedimentation controls; security lighting as required; fuel storage, containment, and refueling; equipment and material staging and storage	Work crews; passenger vehicles and heavy equipment on existing roads/routes and in temporary workspaces; hand tools; generators; lighting
Landing Zone Construction	Pouring concrete to construct landing zone. Installation of gravel apron.	Work crews; passenger vehicles and heavy equipment on existing roads/routes and in temporary workspaces; hand tools; generators; lighting
Above Ground Nitrogen Gas Line Structures	Mat foundations; installing piping and tubing, valves and fittings, manifolds, and insulation.	Work crews; passenger vehicles and heavy equipment on existing roads, access routes, and in temporary workspaces (e.g., concrete trucks, drill rigs, cranes); hand tools
Cleanup and Restoration	Removing construction debris; removing stockpiles of materials and equipment; decompacting soil and smoothing ruts; hydroseeding disturbed soils with regionally appropriate species, where needed, for areas to re-vegetate naturally.	Work crews; passenger vehicles and heavy equipment on existing roads, access routes, and in temporary workspaces; hand tools

2.2 Increased Operations

The Project would include an increased number of annual launches of Falcon 9 rockets from SLC-40 and the new activity of Falcon 9 first stage booster landings at SLC-40. Table 2.2-1 summarizes the methods, tasks, and tools associated with each launch and landing activity and a description of the proposed changes to the number of launch and landing events at SLC-40. Safety closures associated with operations would generally be limited to the area immediately surrounding SLC-40 and would be expected to last three to four hours per operation. Access is typically restored within an hour of a successful operation. Operations could occur at any time of day.

Table 2.2-1. Operation and Maintenance Activities, Tasks, Methods, and Tools

Operations and Maintenance Activity	Tasks and Methods	Tools
Static Fire Testing	Performed no more than 40 times per year	Small work crews of technicians; crane and hoisting equipment; multimeters and telemetry equipment; power and hand tools

Operations and Maintenance Activity	Tasks and Methods	Tools
Launches	Launches occurring no more than 120 times per year	Small work crews of technicians; crane and hoisting equipment; multimeters and telemetry equipment; power and hand tools
Landings	Falcon first stage boosters landing no more than 34 times per year at SLC-40 and 120 times per year downrange, not to exceed a total of 120 landings per year.	Small work crews of technicians; crane and hoisting equipment; multimeters and telemetry equipment; power and hand tools; droneship for oceanic operations.
Post-flight processing	Secure the rocket; propellant safing; electrical system shutdown; cooling down; structural integrity check	Small work crews of technicians; personal protective equipment and gear for personnel; crane and hoisting equipment; power and hand tools
Inspections	Pre-launch inspections and checks of the rocket; annual ground inspections	Small inspection crews; multimeters and telemetry equipment; ground inspection by passenger vehicle on roads, light off-road vehicle, or on-foot
Vegetation Management	Occasional mechanical vegetation management (i.e., mowing) to reduce vegetation height and density within the Expansion Area excluding impervious surfaces and facilities (see Figure 2); removal of vegetative debris	Small work crews; passenger vehicles on existing roads; occasional heavy equipment in management areas; hand tools (e.g., chainsaws, weed trimmers, rakes, shovels, mowers, and brush hooks)
Damage Repairs/Maintenance	Equipment replacement and repair	Small work crews; passenger vehicles on existing roads; occasional heavy equipment at work sites (e.g., boom or line trucks, aerial trucks, assist trucks); hand tools

2.2.1 Launch Activities

Individual launches would continue to occur following standard methods used currently at SLC-40 (FAA 2020). The paragraphs below describe the activities associated with Falcon 9 program launches at SLC-40.

Static Fire Testing would be performed one to three days before a launch. Currently, each launch is preceded by this engine test, which lasts only up to 12 seconds. The need to conduct an engine static fire test depends on the individual mission and is determined on a case-by-case basis. With the proposed increased operations, SpaceX would conduct no more than 40 engine static fire tests per year at SLC-40.

Launches of Falcon 9 rockets at SLC-40 are proposed by SpaceX to increase to no more than 120 times per year. Launch operations could occur day or night at any time during the year. Falcon 9 launch trajectories would be specific to each mission. Each trajectory would be provided in SpaceX's Flight Safety Data Package and submitted to the FAA in advance of the launch. The launch schedule is based on SpaceX's anticipated need to support National Aeronautics and Space Administration (NASA) and Department of Defense (DoD) missions, as well as commercial customers.

2.2.2 Landing Activities

Following each launch from SLC-40, SpaceX would perform a boost-back and landing of the first stage booster. The paragraphs below describe the activities associated with Falcon 9 program landings at SLC-40.

Landings would occur downrange (i.e., on a droneship in the Atlantic Ocean) or at a CCSFS landing zone such as the one proposed herein. Final landing locations are not known because several real-time variables influence landing locations. For purposes of this BA, SpaceX assumes up to 34 landings could occur annually at SLC-40 and up to 120 landings could occur downrange, not to exceed 120 total landings annually.

Mission objectives may occasionally require the Falcon first stage booster to be expended into the Atlantic Ocean. If expended, the booster would break up upon atmospheric re-entry and there would be no residual propellant or explosion upon impact with the ocean's surface. The booster remnants would sink to the bottom of the ocean. Currently, Falcon first stage boosters returning to CCSFS land at Landing Zone 1 (LZ-1) or Landing Zone 2 (LZ-2). The Project would eliminate launches from SLC-40 landing at LZ-1 and LZ-2 and replace those with landings at the proposed SLC-40 landing zone.

For each landing, after the first-stage booster engine cutoff and separation from the second stage, three of the nine first stage booster engines are restarted to conduct a reentry burn. This reduces the velocity of the first stage booster and places it at the correct angle for descent. Once the first stage booster is in position and approaching the landing zone, the three engines are cut off to end the entry burn (FAA 2020). A final burn of one to three engines slows the booster to a velocity of zero for landing on the proposed landing zone.

Ideally, all Falcon first stage boosters would be capable of reuse; however, some payloads require additional propellant to reach desired orbits. SpaceX estimates that up to 34 Falcon first stage booster landings per year could occur at the SLC-40 landing zone and up to 120 landings could occur downrange, not to exceed 120 total landings per year.

2.2.3 Maintenance Activities

The proposed landing zone would support **Post-flight Processing** activities, which would begin upon completion of engine shutdown. The booster would be stabilized and vented, and all electrical systems would be powered down. Once a Falcon first stage booster has completed its post-flight processing, it is transported to a SpaceX facility for refurbishment (FAA 2020).

Inspections would be conducted prior to launches at SLC-40. These inspections would include a visual check by the engineers and technicians and checks of the Falcon 9 rocket components, the launch pad, and the ground support equipment. Functional and systems tests would be conducted to check the operation of electrical, communication, and other critical system components. Additionally, annual ground inspections would be conducted to check the structural integrity of the facilities at both launch and landing zones at SLC-40.

General Maintenance and Repairs would occur following an incident that may cause damage to SLC-40 or SLC-40 landing zone to ensure safety and functionality of the infrastructure. A damage assessment would be conducted, and engineers would develop a repair plan including an outline of the repairs, materials needed, and a timeline. Before repair work begins, precautions would be implemented to ensure the safety of personnel and equipment. Throughout the repair process, quality control measures would be implemented to ensure that the repairs are carried out to the necessary standards and upon completion, documentation would be provided to capture the work that was done.

Vegetation Management to include mowing and trimming would be conducted occasionally based on the season. Summer months would require more frequent mechanical vegetation management to reduce vegetation height and density. Herbicides would not be used as a means for vegetation management at the landing zone.

2.2.4 Environmental Protection Measures

As part of the Project, SpaceX would implement certain best management practices (BMPs) and conservation measures to minimize the likelihood or magnitude, or both, of adverse effects on species and critical habitats protected by the ESA and certain other species that are proposed or under review for ESA

protection (Table 2.2-2). The beneficial effects of these proposed measures are considered in the analyses of the effects.

Table 2.2-2. Best Management Practices and Proposed Conservation Measures

Best Management Practice or Conservation Measure	Anticipated Benefit
Tricolored Bat	
Seasonal restrictions: Vegetation clearing would not occur during tricolored bat maternity season (May 1 through July 15) or when ambient day time temperatures are 45 degrees Fahrenheit or below.	Seasonal restrictions on clearing reduce the potential for directly killing or wounding individual tricolored bats, particularly torpid adults or non-volant juveniles.
Florida Scrub-jay (FLSJ)	
Seasonal restrictions: Clearing activities are to be avoided within FLSJ breeding habitat during the FLSJ breeding season (March 1 through June 30).	Seasonal restrictions on clearing within FLSJ habitat avoid the potential for directly killing or wounding individual FLSJs, particularly viable eggs and non-mobile hatchlings or recent fledglings.
Prescribed burn coordination: Continued coordination with SpaceX and CCSFS to avoid or reduce burn day impacts due to launch.	Prescribed burns would continue to be conducted with sufficient frequency to maintain habitat.
Eastern Indigo Snake	
Preconstruction survey: A preconstruction survey for gopher tortoises would be conducted prior to the commencement of construction, following Florida Fish and Wildlife Conservation Commission guidelines.	Indigo snakes utilize a wide range of habitats for hunting and shelter. They are known to temporarily inhabit gopher tortoise burrows, particularly during fires and in the winter. A preconstruction survey would help identify eastern indigo snake presence or potential to be present if gopher tortoise burrows are present.
Standard protection measures: SpaceX would implement standard protection measures developed by USFWS for the eastern indigo snake (USFWS 2021a.)	The standard protection measures for eastern indigo snake include that if a live snake is found either on the property or while excavating a gopher tortoise burrow, construction or excavation activities are to temporarily cease to allow the snake sufficient time to move away from the site without interference. Implementation of standard protection measures would avoid the potential for direct mortality to the observed individual.
Sea Turtles	
Sea turtle lighting: USFWS-approved sea turtle lighting would be utilized at the construction site and installed at the newly proposed landing zone. The existing light management plan at SLC-40 would be updated to include new lighting and sent to USFWS for approval prior to the start of construction.	USFWS-approved sea turtle lighting would help minimize disorientation of adult sea turtles and hatchlings. Shielded and directional lighting focused downward and away from the beach would reduce the likelihood of hatchlings being attracted to the light and reduce potential for mortality due by allowing them to follow natural cues to crawl toward the ocean after hatching.
Construction Best Management Practices	
Storm Water Pollution Prevention Plan (SWPPP): SpaceX would prepare and implement soil and sediment control measures and waste management during construction activities within the Expansion Area. Erosion barriers and silt fencing would be installed to contain sediment runoff, inspected regularly, and maintained to ensure effectiveness.	Implementation of a SWPPP would help reduce the risk of soil erosion and sedimentation moving off-site, and ultimately from modifying habitat for fossorial or aquatic species, such as the southeastern beach mouse and West Indian manatee.
Spill Prevention, Control, and Countermeasures (SPCC) Plan: SpaceX would prepare and implement the SPCC, which will ensure that all on-site fuel storage will have secondary containment. SpaceX will inspect fuel storage regularly and promptly remediate any containment failure in accordance with the Project's SPCC plan.	Implementation of a SPCC would minimize the potential for spills to occur and would ensure prompt containment if a spill were to occur. This will help to ensure potential contaminants do not leave the Project Area and enter nearby habitat for species such as the southeastern beach mouse or the West Indian manatee.
Waste removal: Solid and liquid waste generated by maintenance and operations at SLC-40 and SLC-40 landing zone would be disposed of properly in designated locations.	Removing waste materials from the Project Area would help prevent attracting nuisance wildlife that may prey on or compete with ESA-protected species.

Best Management Practice or Conservation Measure	Anticipated Benefit
Speed limits: All personnel operating vehicles at SLC-40 and the landing zone would be informed of the potential presence of federally listed or proposed species and would adhere to posted speed limits.	Reduced speed limits within the construction area and within the SLC-40 and SLC-40 landing zone will be implemented to minimize the potential risk of direct mortality to species such as the monarch butterfly and the southeastern beach mouse as a result of collisions with vehicles.

2.3 Action Area

The Action Area means all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations (CFR) 402.02). In this BA, the Action Area represents the area wherein the Project causes a noticeable change to the physical environment. The Action Area establishes the geographic scope of the BA for the purposes of identifying the species and critical habitats that may be exposed to the effects of the action, describing the environmental baseline for the species and critical habitats considered in the BA, and identifying future non-federal activities contributing to cumulative effects.

2.3.1 Physical Consequences of the Action

Changes to the physical environment caused by the Project include the direct modification of vegetation and soil within a portion of the Expansion Area, the potential for soil migration (via water or wind) outside of direct construction footprint, and an increase in the occurrence and, in some cases, magnitude of noise and vibration, heat, light and anthropogenic activity, and sonic booms within and in the vicinity of the expanded SLC-40 site.

Direct Modification of Vegetation and Soil. The Project would directly modify approximately 9.10 acres of land within the Expansion Area, excepting the locations of existing structures. Continued use of the existing SLC-40 launch and support facilities would not cause substantial direct physical changes to vegetation or soil.

Soil Migration. Best management practices include implementation of a SWPPP which would prescribe the installation of silt fences and erosion barriers to contain soil within the constructed portion of the Expansion Area. Soil is not expected to migrate beyond the construction limits within the Expansion Area. Additionally, soil would be compacted and graded during construction to help minimize dust or particulate movement via wind.

Light and Anthropogenic Activity. During daylight hours, construction activities within the Expansion Area that involve large machinery such as cranes would be visible at a distance. Dense vegetation and other existing development would obstruct visibility of the construction activities. Construction activities may continue into non daylight hours and would require artificial lighting. The lighting required for construction would be limited to the immediate vicinity of the construction site within the Expansion Area. The landing of boosters would not need additional lighting than that already in use for the launch operations, however, additional lighting may be needed for post landing processing. USFWS-approved sea turtle lighting would be utilized at the construction site and installed at the newly proposed landing zone.

Heat Plume. The deluge system currently in use at SLC-40 would absorb the vast majority of the heat produced by Falcon 9 launches at SLC-40. In December 2019 and January 2020, SpaceX placed thermocouples in the direct path of the flame trench inside the SLC-40 fence line to measure temperatures during Falcon 9 launches. The highest reading was approximately 127 degrees Fahrenheit (Pownall pers. comm.). Additionally, an earthen berm exists within the SLC-40 fence line to reduce potential plume impacts. Landings involve burning fewer engines than launches, and the heat plume generated by a landing

is therefore expected to be lower than that associated with launches. Therefore, heat plumes generated by landings in the Expansion Area are not expected to result in temperatures beyond the boundary of the Expansion Area that are substantially above normal summer ambient temperatures.

Noise and Vibration. A-weighted sound levels between 60-90 dBA are considered "moderate" relative to commonly encountered sounds (Aerostar 2007). Falcon 9 launches at SLC-40 would produce sound levels of 111 dBA or higher across an area extending approximately 11.5 miles around the Project Area. This noise contour is primarily contained within CCSFS and KSC. Noise from static fire engine tests would precede a launch but produces less intense noise since the vehicle remains low to the ground. Landing noise follows a launch and associated launch engine noise by approximately 5 to 7 minutes and occurs slightly before the sonic boom impacts land. Landing noise is much less intense than launch, as fewer engines are ignited and for a much shorter duration.

Sonic Boom Overpressure. Boost-back landings create sonic booms that can be heard and felt many miles away, depending on atmospheric conditions and the individual mission trajectory. Modeled sonic boom overpressure levels of 1 pound per square foot (psf) or greater are generated during boost-back landings, which may be heard or felt up to approximately 15 miles away from the landing zone. This 15-mile radius is a conservative estimate intended to represent a likely maximum distance for the range of potential conditions and mission trajectories, bounding the extent of this physical consequence for all potential operations at SLC-40. Sonic boom contours are not circular and are driven by the landing trajectory. Thus, for landings at SLC-40, the western sections of this overpressure area are unlikely to experience sonic booms above 1 psf, as landing trajectories are generally east-to-west. A west-to-east landing trajectory at SLC-40, which would result in the western portion of the overpressure area to experience larger sonic booms, is unlikely as it would require overflight of populated areas. The circular overpressure area was utilized for simplicity of analysis.

2.3.2 Action Area Extent

The Action Area for this BA includes an assumed and conservative 15-mile-radius approximation of the sonic boom 1 psf overpressure contour centered on the proposed SLC-40 landing pad (Figure 3). Part of this overpressure area occurs over land and is the "On-shore Action Area." Parts of this overpressure area that occur over the Atlantic Ocean are included in the "Atlantic Ocean Action Area." The Action Area also includes the downrange booster and fairing recovery areas in the Atlantic Ocean (Figure 4), which are addressed here in as part of the Atlantic Ocean Action Area.

The FAA is conducting a separate consultation with NMFS for effects of the action that may occur to species under NMFS jurisdiction.

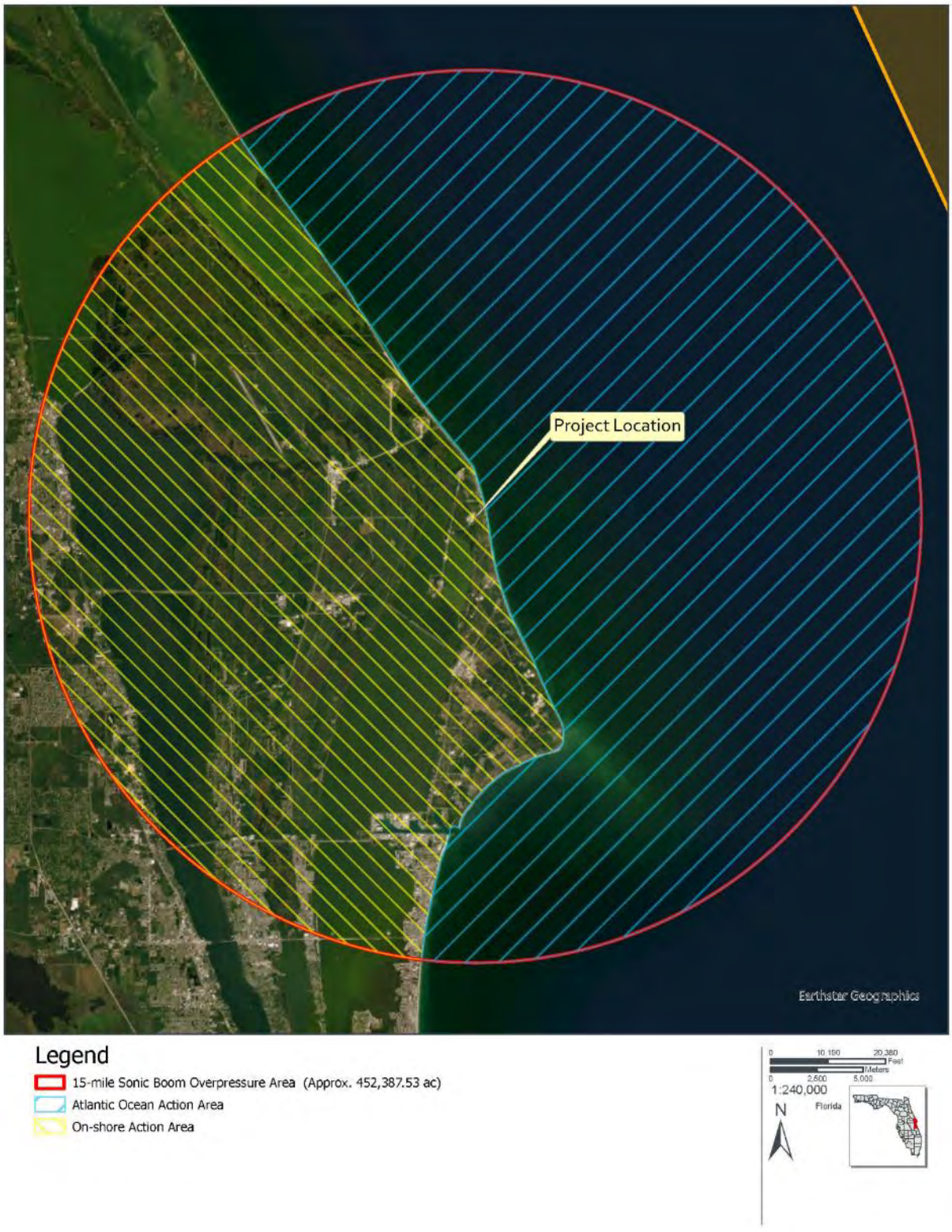

Figure 3. Sonic boom overpressure zone, the On-shore Action Area, and associated parts of the Atlantic Ocean Action Area.

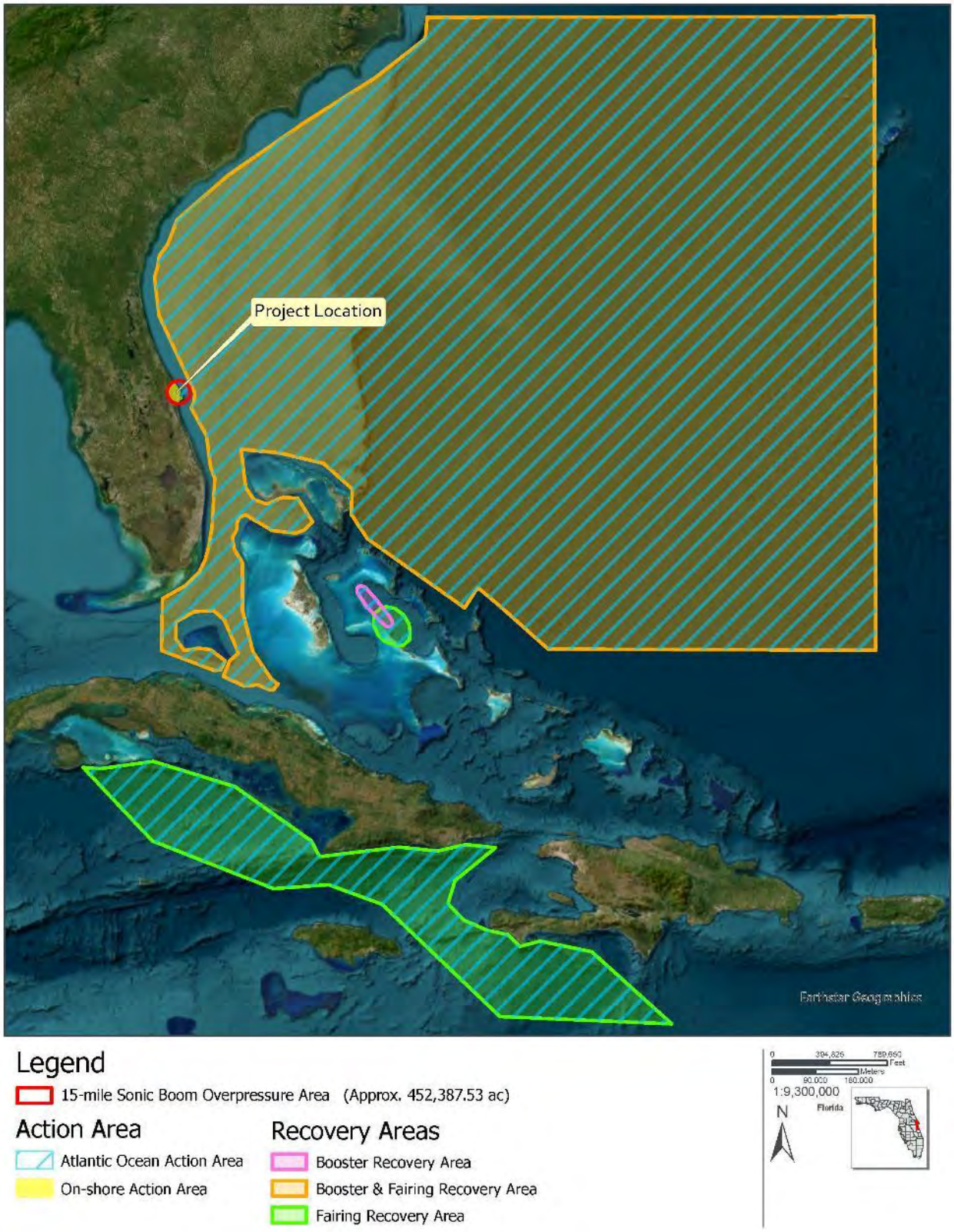

Figure 4. On-shore and Atlantic Ocean Action Areas.

3 SPECIES AND CRITICAL HABITATS CONSIDERED

3.1 Official Species List

The USFWS's Information for Planning and Consultation (IPaC) system was queried on April 2, 2024, for an official species list for the Project Area and the 15-mile sonic boom overpressure zone and queried on June 13, 2024, for an official species list for the downrange portions of the Atlantic Ocean Action Area. The USFWS Florida Ecological Services Field Office responded with automatically generated official species lists for each query (Appendix A, Appendix B, and Appendix C). Results of the IPaC queries are provided in Table 3.1-1.

Table 3.1-1. Official Species List and Critical Habitat for the Project Area and Action Area

Common Name (Scientific Name)	Federal Status	Noted in the Official Species List for the Project Area	Noted in the Official Species List for the 15-mile Sonic Boom Overpressure Zone	Noted in the Official Species List for the Downrange Areas
Mammals				
Southeastern Beach Mouse (*Peromyscus polionotus niveiventris*)	Threatened	X	X	-
West Indian Manatee (*Trichechus manatus*)	Threatened	X	X	X
Tricolored Bat (*Perimyotis subflavus*)	Proposed Endangered	X	X	X
Northern Long-eared Bat (*Myotis septentrionalis*)	Endangered	-	-	X
Birds				
Crested Caracara (Audubon's) [Florida Distinct Population Segment] (*Polyborus plancus audubonii*)	Threatened	X	X	-
Eastern Black Rail (*Laterallus jamaicensis* ssp. *jamaicensis*)	Threatened	X	X	-
Everglade Snail Kite (*Rostrhamus sociabilis plumbeus*)	Endangered	X	X	-
Florida Scrub-jay (*Aphelocoma coerulescens*)	Threatened	X	X	-
Piping Plover (*Charadrius melodus*)	Threatened	-	X	-
Rufa Red Knot (*Calidris canutus rufa*)	Threatened	X	X	-
Whooping Crane (*Grus americana*)	Experimental Population, Non-Essential	-	X	-
Wood Stork (*Mycteria americana*)	Threatened	-	X	-

Common Name (Scientific Name)	Federal Status	Noted in the Official Species List for the Project Area	Noted in the Official Species List for the 15-mile Sonic Boom Overpressure Zone	Noted in the Official Species List for the Downrange Areas
Roseate Tern (*Sterna dougallii dougallii*)	Endangered	-	-	X
Black-capped Petrel (*Pterodroma hasitata*)	Endangered	-	-	X
Reptiles				
Atlantic Salt Marsh Snake (*Nerodia clarkii taeniata*)	Threatened	-	X	-
Eastern Indigo Snake (*Drymarchon couperi*)	Threatened	X	X	-
Green Sea Turtle (*Chelonia mydas*)	Threatened	X	X	-
Hawksbill Sea Turtle (*Eretmochelys imbricata*)	Endangered	X	X	-
Leatherback Sea Turtle (*Dermochelys coriacea*)	Endangered	X	X	-
Loggerhead Sea Turtle (*Caretta caretta*)	Threatened	X	X	-
Insects				
Monarch Butterfly (*Danaus plexippus*)	Candidate	X	X	-
Plants				
Carter's Mustard (*Warea carteri*)	Endangered	X	X	-
Lewton's Polygala (*Polygala lewtonii*)	Endangered	X	X	-
Critical Habitats				
West Indian Manatee	Final and proposed	-	X (Final)	-
Rufa Red Knot	Proposed	-	X	-
Green Sea Turtle	Proposed	-	X	-
Loggerhead Sea Turtle	Final	-	X	-

The IPaC official species list did not include the Kemp's Ridley sea turtle (federally endangered). However, the species is known to nest on CCSFS and USSF has opted to include the species in this BA.

Of note, listed sea turtles are addressed in this BA when on the beach where they are under the jurisdiction of the USFWS. Listed sea turtles when in the marine environment are under the jurisdiction of NMFS and considered separately.

3.2 No Effect Determinations

The official species list includes certain species and critical habitats that, in consideration of the best available science, either do not or are not expected to occur in the Action Area. Others would not be exposed to effects of the action due to the type of habitat that they occupy. These species and critical habitats would not be affected by the action and are not considered further in this BA (Table 3.2-1).

Table 3.2-1. No Effect Determinations for Certain Species and Critical Habitats on the Official Species List

Common Name (Scientific Name)	Rationale for No Effect Determination
Species	
Northern Long-eared Bat (*Myotis septentrionalis*)	USFWS listed the northern long-eared bat as endangered effective March 31, 2023 (88 FR 4908). This wide-ranging bat species, is found in 37 states and 8 provinces in North America, typically overwinters in caves or mines and spends the remainder of the year in forested habitats (USFWS 2022). Non-migratory bats species are not typically thought to travel over the open ocean; however, some bat species may utilize temporary roost sites on lighthouses and other structures offshore. Some *Myotis* species were documented in acoustic surveys 2.8 to 11.5 km off the coasts of New Jersey and the mid-Atlantic states (Dowling et. al. 2017). According to the IPaC report (Appendix C), this species only needs to be considered if the project includes wind turbine operations. Because wind turbines are not proposed, the Project would have no effect on this species.
Whooping Crane (*Grus americana*)	USFWS listed the whooping crane as endangered on March 11, 1967 (48 FR 4001). The Aransas-Wood Buffalo population is the only wild and self-sustaining population of the species. These whooping cranes nest in Canada and winter along the central Texas coast. Individuals from the Aransas-Wood Buffalo population do not occur in Florida. On June 26, 2001, USFWS designated a nonessential experimental population of whooping cranes in the eastern United States, with a geographic boundary that includes Florida (66 FR 33903). A nonessential experimental population is one that has been established within a species' historical range to aid in recovery of the species. The USFWS has determined that nonessential experimental populations are not necessary for the continued existence of a species. Individuals within these populations are treated as threatened under the ESA only when occurring on a National Wildlife Refuge or on National Park land. Merrit Island National Wildlife Refuge is within the Action Area; however, whooping cranes are not known to occur on the Merritt Island National Wildlife Refuge (USFWS 2024a). Whooping cranes from the eastern migratory population are observed infrequently in Florida, with two individuals having been documented in the state (outside the Action Area) in winter 2022-2023 (International Crane Foundation 2023). Because whooping cranes are not expected to occur in the Action Area, the Project would have no effect on this species.
Atlantic Salt Marsh Snake (*Nerodia clarkii taeniata*)	The Atlantic salt marsh snake was listed as threatened by the USFWS in 1977 (42 FR 28165). Surveys for this species conducted between 2010 and 2012 discovered that the current distribution of the species appears limited to the coastal marshes of Volusia County, Florida (USFWS 2019b). Volusia County is not within the Action Area. Because this species is not believed to be present within the Action Area, the Project would have no effect on this species.
Carter's Mustard (*Warea carteri*)	This species occurs in both sandhill and scrubby flatwoods habitats, but populations are not densely or evenly distributed across the known range. The Florida Natural Areas Inventory (FNAI) database contains historic occurrence records within Brevard County, Florida, from 1987. However, the FNAI and USFWS presently consider Carter's mustard extirpated from Brevard County (FNAI 2000; USFWS 2021b). Because the species is considered extirpated from the Action Area, the Project would have no effect on this species.
Lewton's Polygala (*Polygala lewtonii*)	This species occurs primarily in sandhill habitats and may also be found in scrub areas that probably were former sandhill areas prior to logging and fire suppression activity (USFWS 2020a). There is one record for Lewton's polygala in Brevard County, Florida. However, the record was based on a misidentification (USFWS 2020a). Further, no plants of this taxon were observed during subsequent surveys on Merritt Island or mainland Brevard County (Schmalzer et al. 2003 as cited in USFWS 2020a). Because the species is unlikely to occur in the Action Area, the Project would have no effect on this plant.
Critical Habitats (Proposed and Final)	
Rufa Red Knot (*Calidris canutus rufa*) Proposed Critical Habitat	On July 15, 2021, USFWS published proposed non-breeding critical habitat for the rufa red knot that included a unit for FL-2 Ponce Inlet Complex in Volusia and Brevard Counties and FL-3 Merrit Island National Wildlife Refuge Impoundments in Brevard County (86 FR 37410). FL-2 occurs within the Action Area approximately 1.4 miles north of the Project Area, and FL-3 occurs within the Action Area approximately 12 miles northwest of the Project Area. Several specific physical and biological features are described for this critical habitat (86 FR 37410). Neither the construction activity, which will occur 1.4 and 12 miles away, nor the increase in operations is expected to affect the physical or biological characteristics of the proposed critical habitat. Therefore, the Project would have no effect on the critical habitat.

Common Name (Scientific Name)	Rationale for No Effect Determination
Loggerhead Sea Turtle (*Caretta caretta*) and Green Sea Turtle (*Chelonia mydas*) Proposed or Final Critical Habitats	Loggerhead sea turtle (designated) and green sea turtle (proposed) critical habitats are located approximately one-third mile east of the Project Area and outside CCSFS boundaries. These critical habitats may be exposed to the increased frequency of occurrences of activity, noise, light, and vibrations related to Project construction and operations activities. Construction activities will be temporary and short-lived and are not expected to affect the physical or biological characteristics of these designated and proposed critical habitats. Portions of these critical habitats are proximate to multiple SLCs and LZs and are currently exposed to the operational activities that occur there. Between 2015 and 2023, the number of Falcon 9 launches occurring at SLC-40 increased or stayed the same in all but three years. Overall, annual permitted launch activity during this time increased 587.5% from 8 launches in 2015 to 55 launches in 2023 (Table 4.2-1). Available radiance data indicate an increasing trend in radiance at the approximate center of the Project Area from 2012 – 2023 (12 years), with only one year-to-year decrease occurring from 2022 to 2023 (Falchi et al., 2016). Similarly, the FWC Fish and Wildlife Research Institute reports that between 2019 and 2023, the number of loggerhead sea turtle nests and nesting attempts reported in Brevard County generally trended toward an increase, from 27,814 nests in 2019 to 33,343 nests in 2023 (representing an overall increase of 19.9%) (Falchi et al., 2016). These nest data are for Brevard County at large, and not specific to the proposed and designated critical habitats. However, these data suggest that Brevard County beaches remain suitable (including sufficiently dark) to support increasing loggerhead sea turtle nesting activity, despite the proximity of onshore habitat to anthropogenic activity (e.g., lighting). The incremental increase in activity associated with Project operations at SLC-40 is not expected to affect the physical or biological characteristics of the critical habitats as the results (e.g., noise, light) of such activity 1) will represent a relatively minor addition to the level of activity to which the critical habitats are currently exposed, 2) will attenuate with distance from the Project Area, and 3) cannot be reliably parsed out from the other activities occurring as part of the baseline condition.
West Indian Manatee (*Trichechus manatus*) Critical Habitat	Currently, designated West Indian manatee critical habitat is located outside of the Project Area and within the Action Area. The nearest area of designated critical habitat includes three small marshes adjacent to the Banana River, located an average of approximately 583 feet west of the Project Area. The next nearest area of designated critical habitat is in the Atlantic Ocean, which is located approximately 1,535 feet east of the Project Area. Designated West Indian manatee critical habitat is aquatic. On September 24, 2024, the USFWS published a proposed rule to revise the existing designated critical habitat for the West Indian manatee based on physical or biological features essential to conservation of the species. The total area proposed for West Indian manatee critical habitat is 1,904,191 acres. In the proposed rule, the USFWS identifies the following physical or biological features as essential to species conservation: warm-water refuges with either reliable thermal quality throughout winter or established manatee use each year; foraging areas (i.e., areas that support submerged, emergent, or floating aquatic vegetation) within 18.6 mi of warm-water refuges; and foraging areas within 18.6 mi of other established winter manatee aggregations areas. The proposed revision of the spatial boundaries of designated critical habitat would remove previously designated areas along the Atlantic Coast and the east turning basin of Port Canaveral. The proposed rule would add new areas of critical habitat within the Canaveral barge canal at Port Canaveral and include the west and middle turning basins at the port. Based on the proposed revisions, the nearest area of critical habitat would be located approximately 4,110 feet west-northwest of the Project Area. Threats to manatee critical habitat identified in the proposed rule include the loss of warm water or aquatic vegetation, algal blooms, climate change, contaminants, and tropical storms and hurricanes. The Project does not include activities that would contribute to these proposed threats. Overpressures from sonic booms are not expected to travel through the water column and affect marine species. Acoustic energy from in-air noise does not effectively cross air-water interfaces; therefore, most of the noise is reflected off the water surface (FAA 2020). In addition, underwater sound pressure levels from in-air noise are not expected to reach or exceed threshold levels for injury to any marine species (FAA 2020). Additionally, sediment and erosion control measures implemented during construction (see Table 2.2-2) would prevent changes to water quality as a result of construction-related activities. Therefore, the Project will not affect designated or proposed West Indian manatee critical habitat.

4 ENVIRONMENTAL AND OPERATIONAL CONTEXT

4.1 Landscape Resources

The On-shore Action Area is completely contained within the Southern Coastal Plain Ecoregion. This ecoregion consists of mostly flat plains and also contains barrier islands, coastal lagoons, marshes, and swampy lowlands along the Gulf and Atlantic coasts (U.S. Environmental Protection Agency 2013).

Land cover is described following the Florida Land Use, Cover and Forms Classification System (FLCCS) (FDOT 1999). The FLCCS is a partnership venture between the Florida Fish and Wildlife Conservation Commission (FWC) and FNAI, and represents ecologically based, statewide land cover mapping using existing sources and expert aerial photography review.

The On-shore Action Area consists primarily of bays and estuarine (37.1%), shrub and brushland (11.8%), saltwater marshes (7%), mixed wetland hardwoods (3.8%), saltwater ponds (3.3%), and freshwater marshes (3%) (Table 4.1-1). Large areas of open water, including the Banana and Indian Rivers, are present in the On-shore Action Area. Together, developed areas (e.g., Medium Density, Governmental) comprise approximately 6.7% of the On-shore Action Area. Remaining land cover classifications each comprise $\leq$2.8% of the On-shore Action Area (Table 4.1-1).

Table 4.1-1. Florida Land Cover Classification for the On-shore Action Area

Site	Site Name	Acres	Percent of Total
5400	Bays and Estuaries	71,394.7	37.1%
3200	Shrub and Brushland	22,815.2	11.8%
6420	Saltwater Marshes	13,462.7	7.0%
6170	Mixed Wetland Hardwoods	7,402.9	3.8%
6460	Mixed Scrub-shrub Wetland	7,379.3	3.8%
1200	Medium Density, 2>5 dwelling units/acre	6,790.7	3.5%
5430	Saltwater Ponds	6,398.0	3.3%
1750	Governmental	6,311.5	3.3%
6410	Freshwater Marshes	5,773.1	3.0%
4210	Xeric Oak	5,364.5	2.8%
6120	Mangrove Swamps	3,992.5	2.1%
4340	Upland Mixed - Coniferous / Hardwood	3,985.6	2.1%
3300	Mixed Upland Nonforested	2,451.8	1.3%
3100	Herbaceous (Dry Prairie)	2,389.0	1.2%
6300	Wetland Forested Mixed	2,256.9	1.2%
2210	Citrus Groves	2,184.8	1.1%
6181	Cabbage Palm Hammock	2,067.6	1.1%
1400	Commercial and Services	1,743.0	0.9%
8140	Roads and Highways	1,690.9	0.9%
1100	Low Density, <2 dwelling units/acre	1,643.3	0.9%
1300	High Density, 6 or more dwelling units/acre	1,588.3	0.8%

Site	Site Name	Acres	Percent of Total
4200	Upland Hardwood Forests	1,580.6	0.8%
4110	Pine Flatwoods	1,218.9	0.6%
5300	Reservoirs	1,115.2	0.6%
5100	Streams and Waterways	1,020.3	0.5%
1700	Institutional	886.5	0.5%
6430	Wet Prairies	873.9	0.5%
1180	Residential, rural - one unit on 2 or more acres	656.1	0.3%
8150	Port Facilities	653.7	0.3%
8110	Airports	628.9	0.3%
6500	Non-Vegetated Wetlands	547.0	0.3%
6182	Cabbage Palm Savannah	534.2	0.3%
7100	Beaches other than Swimming Beaches	482.9	0.3%
1550	Other Light Industrial	397.8	0.2%
1810	Swimming Beach	296.1	0.2%
2240	Abandoned Tree Crops	287.5	0.1%
7430	Spoil Areas	280.5	0.1%
1900	Open Land (Urban)	269.7	0.1%
8320	Electrical Power Transmission Lines	252.0	0.1%
1820	Golf Courses	238.4	0.1%
1190	Low Density, Under Construction	232.8	0.1%
6210	Cypress	229.4	0.1%
2600	Other Open Lands (Rural)	221.8	0.1%
2110	Improved Pastures	213.5	0.1%
8310	Electric Power Facilities	197.0	0.1%
1860	Community Recreational Facilities	196.5	0.1%
Total	**-**	**192,597.2**	**100.0%**

The majority of the Project Area (Approximately 96.3%) is classified as Governmental land cover, reflecting the infrastructure and development at CCSFS (Table 4.1-2). Most of the remainder of the Project Area is Mixed Upland Nonforested (Figure 5), which is characterized as an intermixture of grassland and shrub-brushland range (FDOT 1999).

Table 4.1-2. Florida Land Cover Classification for the Project Area

Site	Site Name	Acres	Percent of Total
1750	Governmental	46.12	96.3%
3300	Mixed Upland Nonforested	1.65	3.4%
6500	Non-Vegetated Wetlands	0.09	0.2%
4200	Upland Hardwood Forests	0.05	0.1%
Total	**-**	**47.9**	**100%**

4.2 Existing Development and Ongoing Activities

SLC-40, historically named LC-40, is a launch pad for rockets located at the north end of CCSFS. LC-40 was used by the U.S. Air Force (USAF) for Titan rocket launches and was deactivated in 1998 as a result of the 45th Space Wing's (45th SW) decision to implement the National Security Space Launch program at the CCAFS. LC-40 underwent multiple upgrades including the design of towers with retractable and foldable platforms for vehicle assembly, instrumentation, and monitoring and the addition of a deluge system for sound and vibration suppression. In 2007, the 45th SW reactivated and leased LC-40 to SpaceX for its Falcon 9 launches. In December 2020, the USAF was redesignated as the USSF, and in May 2021, the 45th SW was redesignated as the Space Launch Delta 45 (SLD 45). In November 2023, construction was completed for an access tower to handle crewed missions from the LC-40 launch pad.

The number of Falcon 9 launches occurring at SLC-40 has increased since 2015 as capability has improved (Table 4.2-1). Current launch activities at SLC-40 remain consistent with those analyzed in the 2007 Environmental Assessment for the Operation and Launch of the Falcon 1 and Falcon 9 Space Vehicles at Cape Canaveral Air Force Station Florida (Aerostar 2007) and the 2020 Final Environmental Assessment and FONSI for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station (FAA 2020).

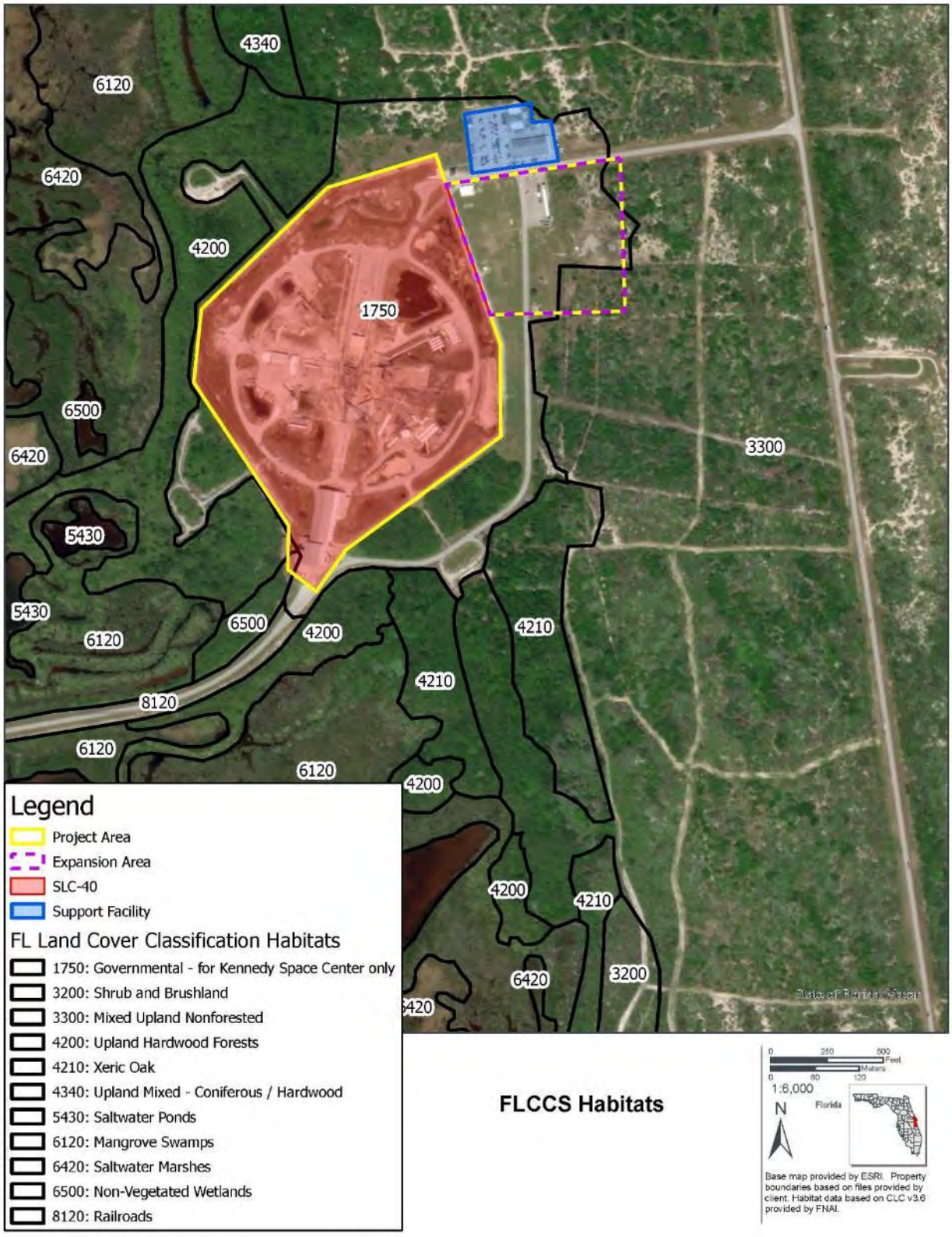

Figure 5. Florida Land Cover Classification System mapping units in the vicinity of the Project Area.

Table 4.2-1. Number of Past and Current Falcon 9 Launches at SLC-40

Year	Number of Launches
2015	8
2016	8
2017	1
2018	12
2019	8
2020	14
2021	16
2022	30
2023	55*

* FAA modified the current license to exceed 50 launches at SLC-40 for calendar year 2023.

4.3 Cumulative Activities

"Cumulative effects" under the ESA are those 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 (50 CFR 402.02). Approximately 7,156 acres within the On-shore Action Area are owned and operated by federal agencies. Projects on federal land do not, by definition, contribute to cumulative effects under the ESA. A thorough review of the non-federal lands within the Action Area was conducted to identify state or private activities that, when combined with the Project, may result in cumulative effects. An online search was conducted to identify state, local, and private projects planned to occur within non-federal lands of the Action Area. This information is compiled from a review of public meeting records for local governments mentioning approvals for specific projects involving new development projects, searches of local newspapers for activities related to development projects, and other publicly available databases and planning documents such as transportation project dashboards.

The following unrelated activities may contribute to cumulative effects in the Action Area:

1. Florida Department of Transportation—The Florida Department of Transportation (FDOT) website provides an interactive map with current and future projects by county. The map identifies multiple transportation improvement projects which consist of pavement rehabilitation and preventative maintenance activities. These types of projects are typically implemented within existing rights-of-way. Several road widening and causeway repair and enhancement projects are also planned to occur within the next several years (FDOT 2023).

2. City of Cape Canaveral—The Presidential Streets Master Plan identifies future street improvements, stormwater filtration systems, pedestrian and bicycle access, improved Americans with Disabilities Act accessibility, and traffic management features. This plan addresses the residential area south of Port Canaveral along the beach as part of several initiatives and projects over the next decade (City of Cape Canaveral 2022).

3. Canaveral Port Authority—Port Canaveral plans to expand its infrastructure to build a new cruise ship terminal. Additionally, parking expansion to accommodate 2,400 vehicles would be considered in the form of parking garages. The new terminal is estimated to open in 2026 (Jacksonville Business Journal 2023).

5 EFFECTS OF THE ACTION

5.1 Analysis Framework

The Project involves two major types of activities for which consequences are reasonably foreseeable: 1) construction and 2) operation and maintenance. Decommissioning of the Project is not expected for several decades, and the consequences of decommissioning are too tenuous at this time to be considered reasonably certain to occur, including whether Project facilities are decommissioned at all. Therefore, consequences to species and Critical Habitat are evaluated only for Project construction and operation and maintenance activities.

Generally, Project activities and tasks may cause the following types of impacts:

- **Habitat loss** – Vegetation clearing and other construction site preparation activities that remove habitat features (e.g., cover, forage, dens, roosts) temporarily or permanently reduce the amount of habitat available to be used by a species. Habitat loss changes the local distribution of a species (e.g., species are not expected to occur in places where habitat is not present). Habitat loss may also reduce the abundance of a species if individuals are killed or injured by the loss of habitat when essential life history behaviors (e.g., breeding, feeding, sheltering, movement) are significantly impaired.
- **Habitat degradation** – Project activities may temporarily or permanently reduce the functional quality of habitat without completely removing the habitat. For example, soil disturbance near water resources can generate sediment that makes aquatic habitat less suitable for species that prefer clear water or channel beds. When severe, habitat degradation can cause functional habitat loss. Like habitat loss, habitat degradation may change the local distribution of a species or reduce the abundance of a species through significant impairment of an essential life behavior. Specific types of habitat degradation follow.
    - **Heat Plumes** – The creation of heat plumes as a result of launches could cause habitat degradation. Studies on the effects to local vegetation from 14 Delta, 20 Atlas, and 8 Titan launches at CCSFS detected temporary near-field damage from fire and heat (FAA 2020). An increase in the annual number of launches would increase the number of heat plumes that are generated annually at SLC-40. There could be temporary damage of adjacent vegetation from fire and heat following a launch. However, the deluge system deployed during launch events would reduce the likelihood of fire and absorb a majority of heat (FAA 2020). Temperature measurements taken by SpaceX during past launch events found the highest reading was approximately 127 degrees Fahrenheit at the fence line surrounding the outer boundary of SLC-40, with temperature rapidly decreasing over the following seconds (Pownall pers. comm.). During launch, all nine engines are ignited. However, during boost-back landing, the first stage booster ignites up to three engines during the final burn just prior to landing. Because there are fewer engines ignited during landing and which burn for a shorter duration, the heat plume of a landing booster is anticipated to have no additional impact to vegetation and wildlife occupying the Project Area or adjacent habitats and, therefore, is not discussed further in this BA.

- **Noise and visual disturbance** – Noise and visual disturbance created by people, vehicles, equipment, and machinery are forms of wildlife habitat modification that can temporarily or permanently damage hearing in animals or cause physiological stress, interfere with animal communication or disrupt essential animal behaviors (like feeding, nesting, or roosting), or reduce the functional quantity or quality of wildlife habitat. Effects may influence individual animals, populations of a particular species, or entire wildlife communities. Researchers have noted that the effects of anthropogenic noise on wildlife is often conflated with other elements of the activity causing the noise, like visual disturbances or physical habitat modification, and do not often indicate a clear or discrete chain of causation between particular environmental consequences and observed changes (if any) in wildlife populations (Ortega 2012; Shannon et al. 2016).
    - **Noise** – The range of noise-wildlife impact studies in the published literature addresses a wide array of different species (e.g., birds, mammals, fish, entire wildlife communities), biological responses, acoustic metrics, environments, and other confounding variables (Ortega 2012; Shannon et al. 2016). Shannon et al. (2016) reports that a variety of studies on birds demonstrated responses to noise occurring at noise levels of at least 45 dBA (roughly the noise level of a quiet urban or rural setting), terrestrial mammals responded to noise levels between 52 and 68 dBA (roughly equivalent to the noise level of commercial area or busy highway), and gleaning bats responded to noise levels exceeding 80 dBA (roughly the noise level of a noisy urban area). The comparative noise level descriptors are consistent with the interpretation in FAA (2022).

      Shannon et al. (2016) suggests that the most consistent findings relating noise levels to wildlife responses (such as those contributing to the relatively low noise response thresholds in the prior paragraph) occur in the context of studies measuring average, ambient, or continuous noise levels – indicating a chronic noise environment. Ambient or continuous noise is not the type of noise produced by launch-related activity at SLC-40. The noise impact studies that identified wildlife responses at higher noise levels were more often associated with noise types and metrics that evaluated maximum noise produced during an event or represented the sound exposure level (a metric that represents the level and duration of a noise event in a single number; described by FAA [2022] as the equivalent of "squeezing all the noise energy from an event into one second"). Therefore, the acoustic metrics reported in noise impact studies (which are not consistent among studies as demonstrated in Figure 3 of Shannon et al. [2016]) are important to understanding how noise was quantified – different means of quantifying noise produce different noise level numbers that are not equivalent.

      The five studies evaluated by Shannon et al. (2016) that addressed sounds from activities most like those considered herein are classified as "military" and include noise-producing activities such as "gunfire, explosions, aircraft, naval sonar, and in some cases, entire military training operations." Among these studies, each of which evaluated noise using different types of metrics, biological responses were detected at levels summarized in Table 5.1-1.

Table 5.1-1. Summary of noise studies finding biological responses to wildlife from military activities (adapted from Shannon et al. 2016)

Taxon	Type of Biological Response	Response-inducing Sound Level and Metric	Sources
Birds	Increase in vigilance and alert behavior	63 dBA (equivalent continuous sound level; LAeq) 89 dBA (LAmax)	Conomy, J.T., J.A. Dubovsky, J.A. Collazo, and W.J. Fleming. 1998. Do black ducks and wood ducks habituate to aircraft disturbance? *The Journal of Wildlife Management* 62:1135–1142.

			Goudie, R. and I.L. Jones. 2004. Dose-response relationships of harlequin duck behaviour to noise from low-level military jet over-flights in central Labrador. *Environmental Conservation* 31:289–298.
Mammals	Short-term increase in heart rates and shifts in resting and movement behaviors of ungulates	85 dB (equivalent continuous sound level; Leq; uncertain frequency weighting, if any) 98 dBA (sound exposure level; SEL) 92 dB (max sound pressure level; Lmax; uncertain frequency weighting, if any)	Krausman, P.R., L.K. Harris, C.L. Blasch, K.K. Koenen, and J. Francine. 2004. Effects of military operations on behavior and hearing of endangered Sonoran pronghorn. *Wildlife Monographs* 157:1–41. Maier, J.A., S.M. Murphy, R.G. White, and M.D. Smith. 1998. Responses of caribou to overflights by low-altitude jet aircraft. *The Journal of Wildlife Management* 62:752–766. Weisenberger, M.E., P.R. Krausman, M.C. Wallace, D.W. De Young, and O.E. Maughan. 1996). Effects of simulated jet aircraft noise on heart rate and behavior of desert ungulates. *The Journal of Wildlife Management* 60:52–61.

For the studies reporting noise metrics of the type modeled for the Falcon 9 vehicles (i.e., LAmax or Lmax with uncertain frequency weighting), biological responses were detected at levels of 89 dBA and 92 dB. These studies support a wildlife noise impact threshold for this BA of approximately an Lmax of 90 dB; although, whether this noise level has adverse consequences on specific listed wildlife species is not certain.

Published reviews of the body of work on the impacts of noise on wildlife are careful to note that "synthesising [sic] a coherent understanding of the biological consequences of noise from this literature is challenging" (Shannon et al. 2016) and that "some species react more negatively to noise than others" (Ortega 2012). The collective findings of these studies demonstrate the likelihood of adverse effects from noise, which the authors note often occur in association with and are conflated by other forms of human disturbance. These studies also identify the means by which these noise impacts may manifest on an individual animal, a wildlife population, or a wildlife community. However, the variation in the context of these studies (e.g., different species or wildlife communities; different sources, frequencies, magnitudes, durations, and consistencies of noise; different environmental settings) makes the application of their generalized findings difficult to reliably apply to specific species and specific human activities. Shannon et al. (2016) offers that the combined body of work on noise impacts and wildlife has utility for predicting the outcomes of noise exposure and suggests that the studies identifying a significant response to noise at lower noise levels have the most utility for that purpose. But Shannon et al. (2016) does not apply or test the predictive power of their "cumulative weight-of-evidence curve."

Studies suggest that common animal responses to noise include the startle response and, ultimately, habituation (FAA 2020; Shannon et al. 2016; Schmalzer et al. 1998). It has been reported that the intensities and durations of the startle response decrease with the numbers and frequencies of exposures, suggesting no long-term adverse effects. Monitoring studies at CCSFS indicated that FLSJ continued to use the area within 1 km of launch sites post-launch, and that the behavior of FLSJ was normal following launch events (Schmalzer et al. 1998). Additionally, Schmalzer et al. observed no animal mortality that could be attributed to launches (1998).

- **Construction noise** – Potential noise-related impacts could occur from construction of the proposed landing zone. Noise levels near facilities at CCSFS and KSC currently proximate those of an urban industrial area, reaching levels of 60 to 80 dBA (FAA

2020). Noise related to Project construction activities may result in a temporary increase in noise levels near SLC-40 but are expected to be comparable to noise levels historically and currently occurring at the CCSFS and associated with SLC-40 launches.

- **Launch engine noise** – Noise resulting from a launch is short-lived and diminishes quickly as the vehicle ascends. Static fire testing would occur prior to some launches and would be included within launch activities. Additionally, the vehicle's deluge system assists in reducing the noise and vibrations produced during a launch. Noise impacts from launches are considered in the 2020 Final Environmental Assessment and FONSI for SpaceX Falcon Launches at KSC and Cape Canaveral Air Force Station (FAA 2020). Figure 6 illustrates the area exposed to maximum noise levels of at least 134 dBA, at least 120 dBA, and at least 111 dBA. Static fire engine tests produce maximum noise level contours that are less extensive than a launch event (Figure 7). Static fires produce lower maximum noise levels than launches. Both activities already occur at SLC-40 and the proposed increase in the number of launches and static fire tests would not change the maximum noise level contours from the baseline condition. Previous Falcon launches at CCSFS and KSC have not resulted in significant noise impacts (FAA 2020). The Project would result in an increase in frequency of noise occurrences at SLC-40, but no increase in the magnitude of this noise. In any case, the noise impact studies reviewed by Shannon et al. (2016) suggest that launches and static fires produce noise levels that are likely to affect wildlife within at least part of the Action Area around the Project Area.

- **Landing engine noise and sonic booms** – Noise resulting from a landing also is short-lived and follows very soon (i.e., minutes) after launch. Because only one-third of the engines used for launch are ignited during landing, the maximum noise level produced is less than that occurring during the launch. Figure 8 illustrates the maximum noise level contours for a first-stage booster landing at the proposed new launch pad. Sonic booms are generated by the first stage booster during the boost-back stage of landing. Modeled sonic boom overpressure levels of 1 pound per square foot (psf) or greater are generated during boost-back landings, which may be heard or felt up to approximately 15 miles away from the landing zone. An overpressure of 1 psf is similar to a clap of thunder. Overpressure events ranging from 5 to 10 psf may be experienced immediately adjacent to the landing zone, which are expected to startle wildlife but not physically injure wildlife or wildlife habitats. For example, NASA states that humans exposed to sonic boom overpressure events generating between 20 and 144 psf have been experienced by humans without injury (NASA 2003). A 1991 study funded by the U.S. Air Force found that chicken eggs, when exposed to sonic booms of 17 to 19 psf for a duration of 9 days, did not develop cracks or deviations (Bowles et al. 1991). Numerous other studies also cite sonic booms of varying intensity as having no detrimental effect on wildlife (Maglieri et al. 2014). Therefore, direct physical injury or death of wildlife from sonic booms generating approximately 5 to 10 psf of overpressure are not anticipated. The likely effects on listed wildlife are likely related to behavioral responses such as startling or flushing. Noise and sonic booms generated by a landing are a new source of impact not presently in the baseline condition associated with the current operation of SLC-40. However, SLC-40 and the surrounding areas have been experiencing noise and sonic booms from landing since 2015 from landing operations at LZ-1 and LZ-2 since 2015.

- **Visual** – Potential visual disturbances related to the Project include the following: the presence of people and equipment during construction; the addition of a new landing pad

and a new 30 x 60 x 12 feet tall fluid GSE bay to the Project Area landscape; the intermittent presence of people, vehicles, and vehicle components (e.g., first-stage boosters) during launch and landing activities; the potential for increased instances of visibility of rockets in the sky; and increased instances of nighttime lighting due to the increased number of nighttime launch events. All potential visual disturbances are consistent with current land use and activities at CCSFS.

As described above, researchers have noted that the effects of anthropogenic noise on wildlife is often conflated with other elements of the activity causing the noise, including visual disturbances. As such, it is difficult, if not often impossible, to indicate a clear or discrete chain of causation between particular environmental consequences and observed changes (if any) in wildlife populations (Ortega 2012; Shannon et al. 2016). As such, visual changes associated with Project activities for which there is also a potential noise impact (i.e., construction, launches, and landings) are considered together as potential impacts resulting from noise (i.e., impacts are assumed to be contributed to noise versus visual disturbance). Given the currently industrialized environment of CCSFS, and implementation of a Light Management Plan to minimize sky glow, impacts resulting from visual disturbances alone (e.g., the presence and movement of people at the site without the concurrent use of heavy equipment or machinery that might cause noise; the presence of the new fluid GSE bay) are expected to be minimal and/or intermittent. Therefore, the Project would result only in insignificant impacts resulting from visual disturbance.

- **Vehicular Traffic** – An increase in vehicle traffic during daily operations from construction and operational personnel could increase the potential for vehicle collisions with wildlife, including ESA-listed species. Increased traffic and human presence could cause wildlife to avoid the area, but no new transportation routes are proposed. Traffic would continue to utilize CCSFS roadways such as Phillips Parkway, which is a two-lane road with generally low traffic volumes. The Project is not expected to result in a significant increase in traffic on CCSFS roads. Most of the traffic from construction and operations would occur during daylight hours. Drivers would be expected to obey the posted speed limit and the potential for wildlife collision would be similar to other areas of CCSFS.

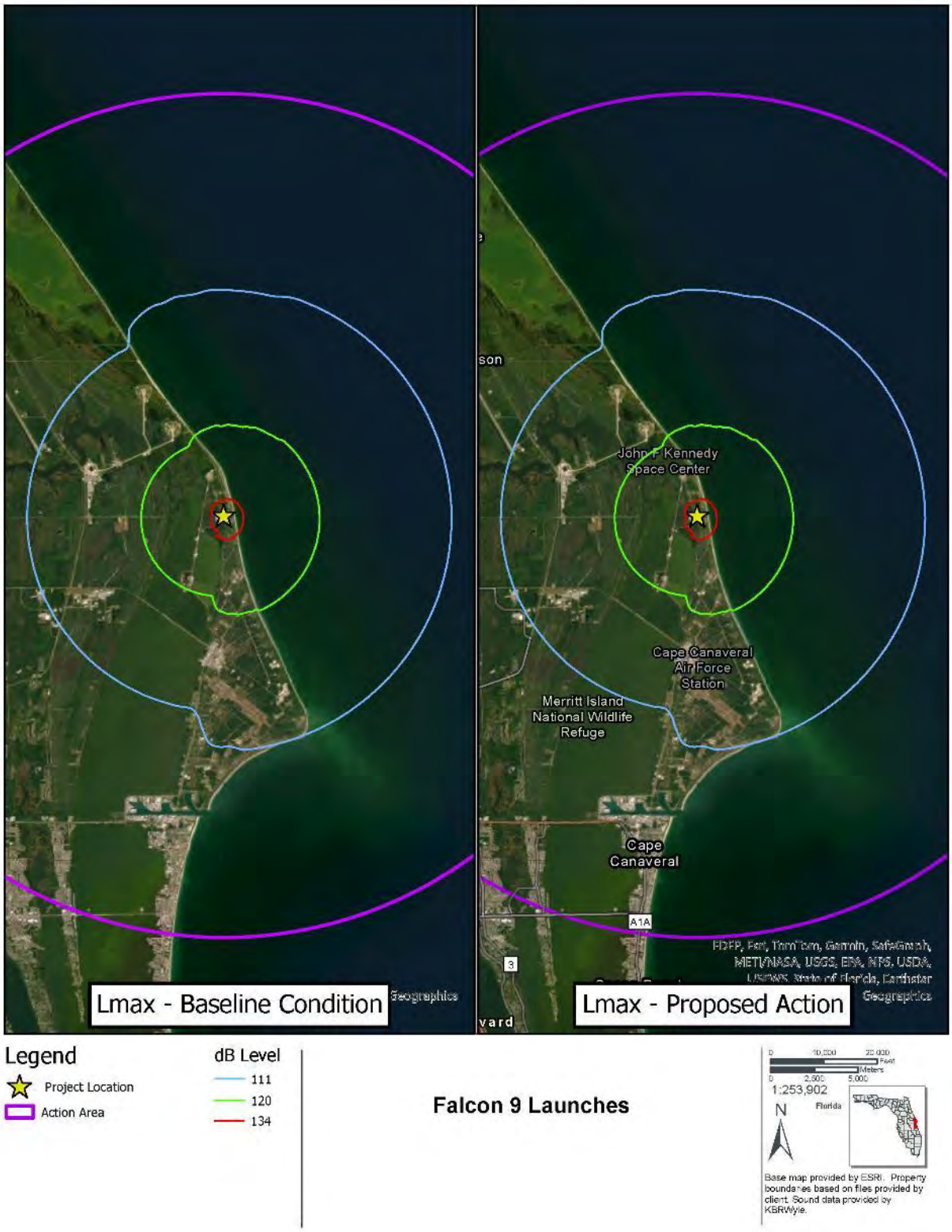

Figure 6. Comparison of Falcon 9 launch noise contours at baseline condition and for the Project.

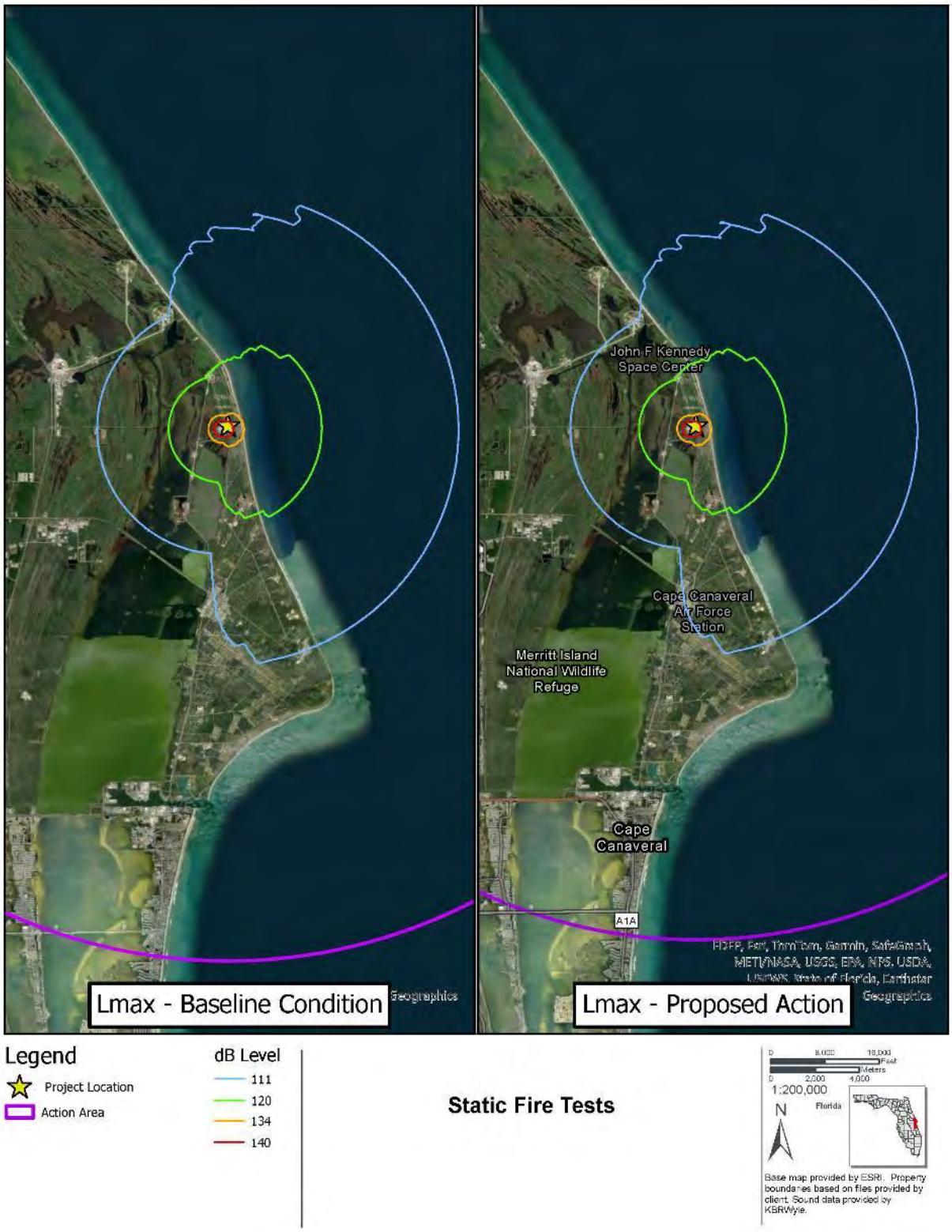

Figure 7. Comparison of static fire noise contours at baseline condition and for the Project.

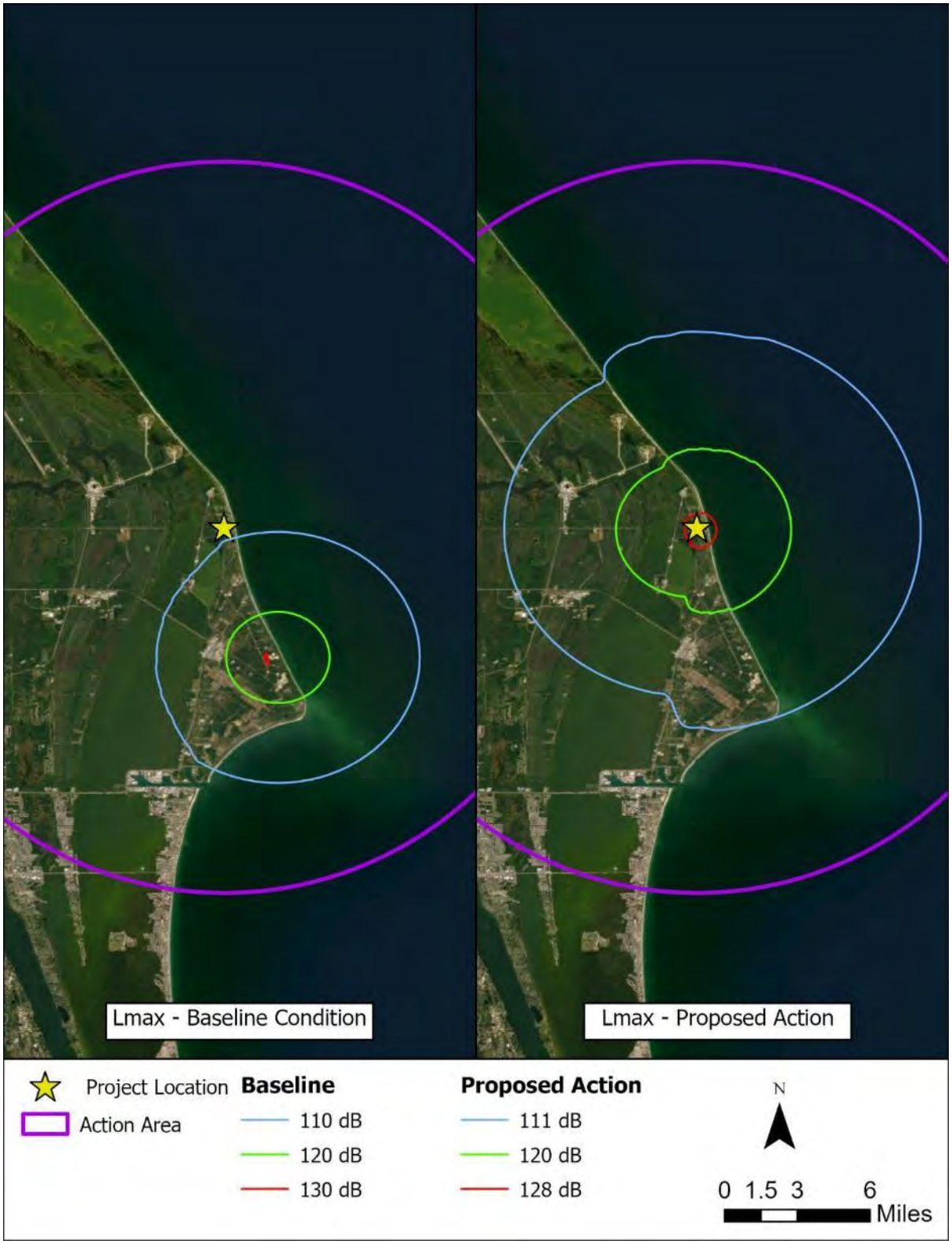

Figure 8. Comparison of booster landing noise contours at baseline condition and for the Project.

- **Collision** – Activities associated with increased human presence, vehicles, equipment, and machinery can create opportunities to physically encounter individuals of a species. Collisions

can occur under two types of circumstances: 1) when an individual of a species collides with facilities or 2) when vehicles, equipment, or machinery collide with an individual of a species. Collisions may kill or wound individuals of a species and reduce the abundance of local populations.

Three additional types of impacts were considered and considered unlikely to occur as a result of the Project.

- **Habitat fragmentation and edge effects** – A form of habitat degradation, fragmentation can exacerbate the consequences of habitat removal by altering the configuration of remaining habitats (e.g., reducing a patch size below the threshold of suitability). Habitat fragmentation increases edge effects (e.g., exposing previously forest interior habitat to light and temperature changes along a now-open edge) and may decrease the ability of a species to move across the landscape when the distance between habitat patches increases. Habitat fragmentation and edge effects may change the distribution of a species or reduce the abundance of a species through significant impairment of an essential life behavior. When dispersal behaviors are affected, the consequences of habitat fragmentation can influence species at a local or regional scale. The Project Area is currently comprised of a mosaic of land uses, including open, natural, and developed areas. Specifically, the area that is to be cleared of native vegetation is bounded by roadways to the west and north and is separated from the beach frontal dunes and scrub habitat by the Samuel C. Phillips Parkway, a moderately trafficked road. Because the Expansion Area lies in an area that is currently fragmented and comprised of a mosaic of land use, the Project is not anticipated to result in impacts related to fragmentation or edge effects.
- **Hazardous material exposure** – Fuels or other hazardous materials (e.g., isopar, isopropyl alcohol [see Section 2.1.2]) such as those used during Project activities have the potential to degrade habitat, particularly for species with relatively small home ranges, if an area is subject to unintentional exposure to such materials (e.g., leaks, spill events). Toxicity from hazardous materials may also directly impact individuals of a species that is susceptible to such exposure. Generally, where hazardous material exposure substantially degrades habitat or directly impacts individuals, the use of these materials may change the local distribution or reduce the local abundance of the species. SpaceX will implement best management practices to minimize the potential for spills and will implement a SPCC throughout Project construction and operation. All vehicles will be maintained in road-worthy conditions and will be used only on access routes. Therefore, the potential for any impacts to occur as a result of exposure to hazardous materials is considered unlikely.
- **Ecological community changes** – Some projects may change the landscape in ways that may promote the introduction or abundance of some species (e.g., invasive/noxious species) and demote others, changing the dynamics of the predator, competitor, and prey relationships. Altering these relationships may influence individuals and populations of species in complex ways that may be adverse in some respects but beneficial in others. The Project is not expected to have ecological community change impacts because 1) the Project will result in minimal native vegetation removal, 2) the removal will occur within a landscape mosaic of open, natural, and developed areas; and 3) operations and maintenance will represent an increase in frequency of activities currently conducted at, and near, the Project Area.

Table 5.1-2 describes what types of impacts may occur as a result of the Project activities and tasks.

Table 5.1-2. Relationship of Project Activities and Tasks to Potential Impact Types

Project Activities and Tasks	Methods and Materials	Tools	Habitat Loss	Habitat Degradation	Noise and Visual Activity Disturbance	Collision
Construction Activity						
Survey and staking	Survey line sighting; boundary staking or flagging; underground utility surveys	Work crews; passenger vehicles on existing roads or routes; light off-road vehicles; ground-penetrating radar; hand tools for vegetation trimming; survey stakes and flagging		X	X	X
Erosion and sediment control	Installing and maintaining various erosion and sedimentation controls	Work crews; passenger vehicles and heavy equipment on existing roads or routes and at work sites; light off-road vehicles; silt fences, filter logs, straw bales, and rolled erosion control products		X	X	X
Clearing and grading	Mechanical aboveground removal of shrubs and tall or dense vegetation; off-site disposal of cleared vegetative material; surface grading at permanent facility locations	Work crews; passenger vehicles and heavy equipment on existing roads or routes and at work sites; light off-road vehicles; hand tools; chemical spot applicators	X	X	X	X
Site preparation and use	Occasional clearing and grading; addition and compaction of road base (geotextile fabric and crushed rock); installation of work site erosion and sedimentation controls; installation of site fencing and security lighting; equipment and material staging and storage;	Work crews; passenger vehicles and heavy equipment on existing roads or routes and at work sites; hand tools; generators; lighting		X	X	X
Landing zone construction	Fencing; soil compaction and gravel surfacing; pedestal installation; gravel apron installation; lighting	Work crews; passenger vehicles and heavy equipment on existing roads, access routes, and at work sites (e.g., concrete trucks, drill rigs, hydraulic pulling and tensioning machines, semi-trucks, cranes); hand tools		X	X	X
Construction of Above Ground Nitrogen Gas Line Structures	Mat foundations; installing piping and tubing, valves and fittings, manifolds, and insulation.	Work crews; passenger vehicles and heavy equipment on existing roads, access routes, and in temporary workspaces (e.g., concrete trucks, drill rigs, cranes); hand tools		X	X	X
Cleanup and restoration	Removing construction debris; removing stockpiles of materials and equipment; decompacting soil and smoothing ruts; seeding disturbed soils	Work crews; passenger vehicles and heavy equipment on existing roads, access routes, and at work sites; hand tools			X	X
Operations and maintenance activity						

Project Activities and Tasks	Methods and Materials	Tools	Habitat Loss	Habitat Degradation	Noise and Visual Activity Disturbance	Collision
Inspections	Routine inspections	Small inspection crews; ground inspection by passenger vehicle on roads, light off-road vehicle, or on foot			X	X
Vegetation management	Occasional mowing	Small work crews; passenger vehicles on existing roads; hand tools (e.g., chainsaws, weed trimmers, rakes, shovels, mowers, and brush hooks)			X	X
Damage repairs	Equipment replacement and repair	Small work crews; passenger vehicles on existing roads; occasional heavy equipment at work sites (e.g., boom or line trucks, aerial trucks, assist trucks); hand tools			X	X
Launches	Launches occurring no more than 120 times per year.	Small work crews of technicians; crane and hoisting equipment; multimeters and telemetry equipment; power and hand tools			X	X
Landings	Falcon first stage boosters landing at SLC-40 no more than 34 times per year.	Small work crews of technicians; crane and hoisting equipment; multimeters and telemetry equipment; power and hand tools			X	X

5.2 Southeastern Beach Mouse

5.2.1 Biology and Habitat

The southeastern beach mouse (*Peromyscus polionotus niveiventris*; SEBM) occupies primary and secondary habitats. Primary habitat is characterized by foredunes, transitional dunes, and coastal scrub dunes typically vegetated by sea oats and other salt-tolerant vine and grass species. Secondary habitats are interior scrub and other natural and human-altered landscapes landward of dunes that provide refugia habitat and may support species resource needs, movement corridors, and/or population extensions (Johnson and Barbour 1990). SEBM utilizes the scrub adjacent to these dunes for digging burrows, which are generally found on the sloping side of a dune at the base of vegetation and are used for refuge, nesting, and food storage (USFWS 2019b).

Breeding by the SEBM generally peaks in the winter season, with gestation lasting 23 days, and litters typically consisting of 3 to 4 individuals. The weening period typically lasts 18 days, and SEBM reaches sexual maturity at 30 days old (FWC 2024a).

5.2.2 Environmental Baseline

The SEBM was listed as threatened on May 12, 1989 (54 FR 20598). The SEBM is known to occur on CCSFS, where a metapopulation exists with at least four subpopulations identified (FAA 2020). This metapopulation of SEBM occurs in federally protected lands along the beaches of Merritt Island National Wildlife Refuge and the CCSFS (USFWS 2019c). At CCSFS, SEBM typically occurs from the coastal dunes inland to west of Samuel C. Phillips Parkway and occurs where sand is suitable for burrows, coastal scrub is present, and the water table is not near the surface (USFWS 2020b). The USSF reports that small mammal burrows are present in the mowed grassy areas along roads within CCSFS, including within the Expansion Area, which are likely used by SEBM (Megan Nicely, USSF, pers. comm.).

Approximately 8.68 acres of SEBM habitat occur within the Expansion Area, including 3.00 acres of native scrub vegetation and 5.6.8 acres of mowed grassy areas (Figure 9).

SEBM faces many threats, which include habitat loss due to development and hurricanes, and predation by native and non-native species, such as cats (FWC 2024a).

5.2.3 Effects of the Action

The Project would result in the direct modification of approximately 7.48 acres of SEBM habitat in the Expansion Area, including 2.03 acres of habitat associated with native scrub vegetation and 5.45 acres associated with mowed grassy areas (see Figure 9). Of this modified SEBM habitat, approximately 2.40 acres would be permanently removed and replaced by impervious cover (i.e., the landing pad, gravel apron, fluids GSE bay, and pedestal). The other 5.09 acres of modified habitat would be temporarily disturbed by active construction (e.g., is within the laydown yard, the clearing zone around the launch pad, or in the mowed grassy areas that would be subject to the operation of construction equipment and vehicles) but is expected to remain usable by SEBM following construction.

The modified SEBM habitats are located approximately 0.4 miles west of the beach frontal dune and would not affect primary habitat at the beach frontal dune.

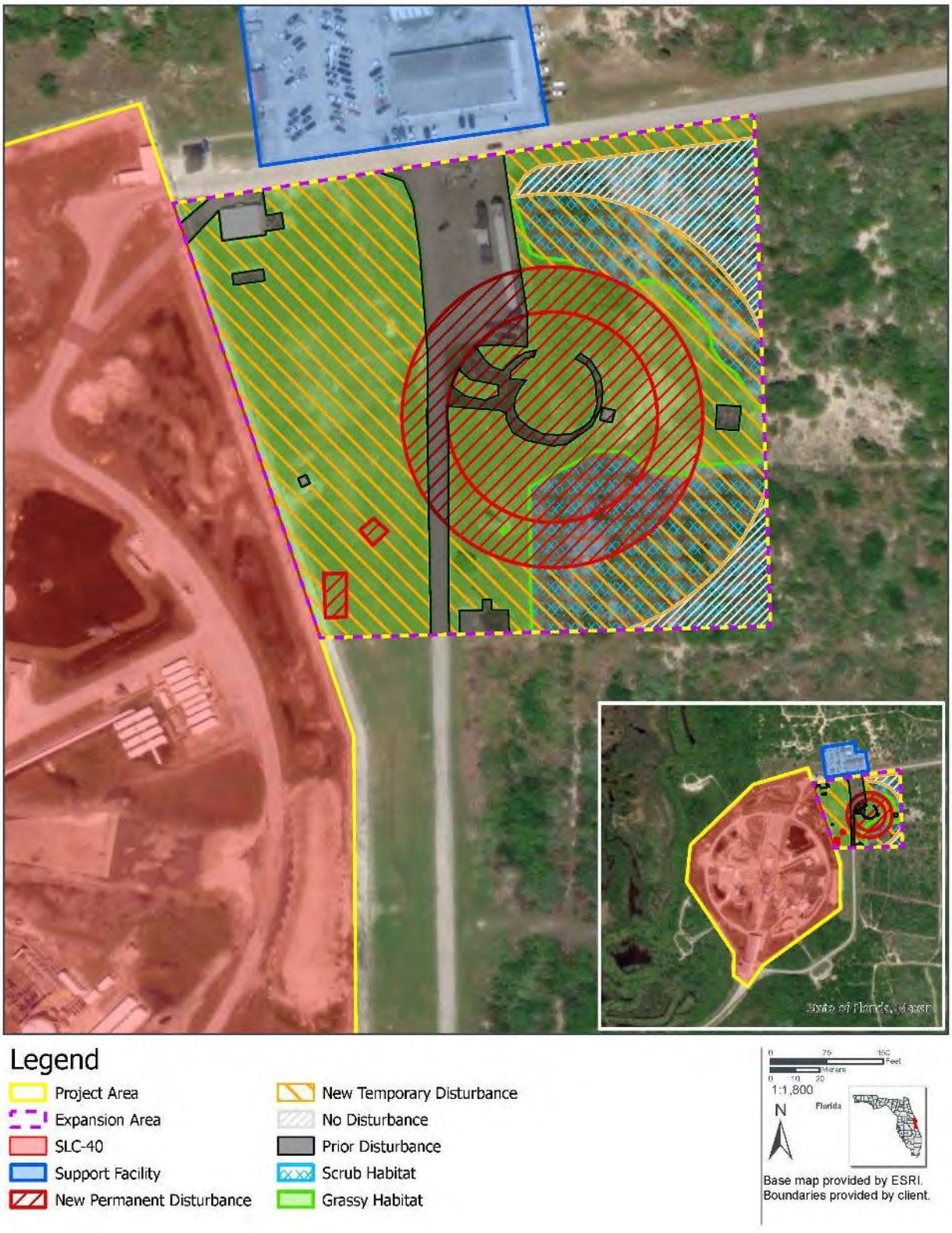

Figure 9. Impacts to southeastern beach mouse habitat and Florida scrub-jay habitat.

The Project is directly adjacent to SLC-40, which is the most active launch complex at CCSFS and currently experiences frequent human activity and related disturbance. Previous studies at CCSFS indicate that SEBM continues to exist in areas adjacent to launch pads indicating the species tolerates some level of disturbance (including noise, lighting, and vibrations) (NASA 2014). Further, Oddy et al. (1999) observed no direct impacts to SEBM as a result of normal launch operations of the Titan, Atlas, or Delta launch complexes. Direct impacts to SEBM habitat as a result of the explosion of the Delta rocket in January 1997 were documented and the alteration of habitat resulted in a shift in use with SEBM moving to newly burned areas (Oddy et al. 1999). These studies were conducted when launch frequency was lower than that proposed herein.

The proposed increase in annual number of launches and addition of landings would increase the frequency of occurrence of noise, lighting, activity, and vibrations in the Project Area. Bednarz (2021) reviewed previously published studies of the impacts of traffic noise on rodents and found that responses by species were varied (ranging from adverse to beneficial), but many studies documented changes in vigilance and foraging behaviors at noise levels between 26 and 87 dB. The findings of adverse effects were biased towards rodent species that are social and rely on alarm calls for protection (e.g., prairie dogs). SEBM, in contrast, are not a social species.

Increased launch frequency might generate more intense or longer-term adverse impacts to SEMB, as compared to the findings of Oddy et al. (1999), or increased launch frequency may continue to have no measurable adverse effect on how SEBM use habitat adjacent to these types of activities. There have been no studies to measure impacts related to more frequent launch activity.

During construction within the Expansion Area, SEBM (if present) could be impacted by vegetation and ground disturbing activities during clearing and site preparation. It is possible that SEBM would be trapped underground in burrows or crushed by equipment and vehicles and suffer death or physical injury. It is also possible that SEBM would flee from the construction activity or from the noise, light, and vibration caused by launch and landing activities into adjacent suitable habitats. Construction and O&M personnel would observe a reduced speed limit of 25 miles per hour while driving in the Project Area. Due to reduced speeds in the Project Area, SEBM are expected to be able to avoid collisions with vehicles on roads and constructed areas. In total, due to the potential for habitat loss and direct mortality, the Project may affect and is likely to adversely affect SEBM.

5.2.4 Cumulative Effects

As identified in Section 5.2.2, main threats to SEBM include habitat loss due to development and hurricanes; and predation by native and non-native species, such as cats. The projects identified in Section 4.3 – if they occur in or adjacent to SEBM habitat – may create the same types of threats to the species and could result in adverse cumulative effects to the species when combined with the Project.

The Service is continually working with private and state entities to review proposed projects, offer technical assistance, and provide recommendations on avoidance and minimization measures to protect SEBM. By continued cooperative efforts to protect the species and its habitat, the USSF does not believe that the potential cumulative effects are likely to jeopardize the continued existence of SEBM.

5.2.5 Population-level Biological Consequences

Because this species is known to continue using secondary habitat on CCSFS that is proximate to areas where activity, including rocket launches at SLC-40, currently occur, the Project is expected to have a minimal overall impact on the population of SEBM in the vicinity of SLC-40.

5.3 Tricolored Bat

5.3.1 Biology and Habitat

The tricolored bat roosts singly or in small groups in caves, tree foliage and cavities, and occasionally buildings and other human-made structures (e.g., culverts, bridges) (FWC 2024b) (USFWS 2021b). In Florida, female tricolored bats give birth to 2 pups in May or June (FWC 2024b).

Tricolored bats prefer wooded riparian areas for foraging, often flying along streams or ponds. Tricolored bats may prefer landscapes with a mosaic of relatively open and closed canopy areas, with forest edges and tree lines used for foraging and closed canopy woodland used for travel (USFWS 2021c). Tricolored bats are known to use small forest patches and linear tree lines, with no known minimum patch size threshold (USFWS 2024b). During winter, tricolored bats hibernate in caves and mines; however, in the southern U.S. where caves are sparse, the species often hibernates in road-associated culverts, and sometimes in tree cavities and abandoned water wells (USFWS 2021c).

The year-round active range for tricolored bats includes the entire state of Florida (USFWS 2024c). The range of the tricolored bat in the United States is organized into three Representation Units (RPU): Northern, Eastern, and Southern (USFWS 2021c). Tricolored bats found within the Southern RPU, which includes all of Florida, exhibit shorter hibernation lengths, increased winter activity, and utilization of culverts as hibernacula (USFWS 2021c).

5.3.2 Environmental Baseline

The tricolored bat was proposed endangered by USFWS on September 14, 2022 (87 FR 177). The species is known to occur in most areas of Florida, including Brevard County, and is considered uncommon because it is rarely encountered within the state (Evans et al. 2017). Main threats to the species include white nose syndrome, wind energy development-related mortality, climate change, and habitat loss (USFWS 2021c).

The Project Area contains limited natural vegetation including saw palmetto (*Serenoa repens*), sand live oak (*Quercus geminata*), and salt myrtle (*Baccharis halimifolia*) (Jones Edmunds 2023). Tricolored bats may roost in Spanish moss (*Tillandsia usneoides*) and the foliage of live or recently dead deciduous hardwood trees; however, the species prefers landscapes with tree corridors or other largely forested areas and is less abundant in developed, urban areas (USFWS 2021c) such as those present in and adjacent to the Project Area. The species may utilize culverts or tree cavities in the Action Area as winter hibernacula.

Tricolored bats have been detected on CCSFS during 2019 acoustic surveys (USFWS 2020b). No tricolored bat roosts have been identified on CCSFS and no deceased tricolored bats have been observed on CCSFS (USFWS 2020b).

5.3.3 Effects of the Action

The proposed increase in annual number of launches and addition of landings would increase the frequency of occurrence of noise, lighting, activity, and vibrations in the Project Area to which tricolored bats inhabiting the Action Area are currently exposed. These occurrences would be intermittent and short-lived.

Studies of noise impacts to bats have detected changes in some species in how they use habitat adjacent to highways with traffic noise, suggesting that bats may not use noisy environments as often as quiet environments (Shannon et al. 2016; Bednarz 2021). However, as discussed in Section 5.8.3, the body of research on noise impacts to wildlife does not predict with reasonable certainty how individual species will respond to specific kinds of noise in specific environmental settings. Further, as described in Section 5.1,

researchers have noted that the effects of anthropogenic noise on wildlife is often conflated with other elements of the activity causing the noise, like visual disturbances or physical habitat modification, and do not often indicate a clear or discrete chain of causation between particular environmental consequences and observed changes (if any) in wildlife populations (Ortega 2012; Shannon et al. 2016).

Roosting and foraging habitat for tricolored bats is not a limiting factor for the species across the landscape, particularly in the context of dramatically reduced bat abundance following the introduction of white-nose syndrome. Therefore, mobile individuals, if disturbed, are expected to move to adjacent or nearby suitable habitats. Nonvolant individuals may be exposed to the increase in short-lived, intermittent disturbances related to the proposed Action. However, there are no data available to indicate that this increase in exposure to such occurrences would result in an adverse effect to any bat.

As such, the Project may affect, but is not likely to adversely affect, the tricolored bat.

5.3.4 Cumulative Effects

The Project is not likely to adversely affect the tricolored bat. Therefore, cumulative effects are not considered.

5.3.5 Population-level Biological Consequences

The Project is not likely to adversely affect the tricolored bat. Therefore, no population-level biological consequences will occur.

5.4 West Indian Manatee

5.4.1 Biology and Habitat

The West Indian manatee inhabits rivers, bays, canals, estuaries, and coastal areas where it moves between fresh, saline, and brackish waters. Florida's estuaries, freshwater lakes, springs, and rivers provide seagrass and freshwater aquatic vegetation, which are the species' primary food sources (FWC 2024c).

Manatees require warm water for survival and cannot survive prolonged exposure to very cold water (FWC 2024c).

5.4.2 Environmental Baseline

The USFWS lists the West Indian manatee as threatened (32 FR 4001). Main threats to the species are collisions with boats and loss of warm water habitat (FWC 2024c). The species does not occur in the Project Area but may occur in suitable habitat within the On-shore Action Area.

5.4.3 Effects of the Action

The Project will generate vibration and noise associated with construction activities and launches/landings that may affect the West Indian manatee. Acoustic energy from in-air noise does not effectively cross the air-water interface and the majority of noise is reflected off the water surface. In addition, underwater sound pressure levels from in-air noise are not expected to reach or exceed threshold levels for injury to any marine species. Noise impact from operations is expected to be minimal, based on previous launch programs, and its effects are expected to be insignificant (USFWS 2020b).

During operations, overpressures from sonic booms are not expected to travel through the water column and affect marine species underwater. Thus, the potential for overpressure resulting from sonic booms – and related sound and vibration – to impact manatees is insignificant.

Marine landings such as booster expenditure in the Atlantic Ocean would not directly affect the manatees which inhabit freshwater lagoons and rivers. Furthermore, the drone ships associated with retrieval of Falcon 9 boosters launched from SLC-40 operate in Port Canaveral and do not enter the Banana River. Therefore, vessel strikes from transportation of Falcon 9 boosters associated with the Project would not result in impacts to manatees.

West Indian manatees that surface to breathe at the same time construction activity or launch/landing activity occurs may be temporarily exposed to related noise, lighting, or vibration. This exposure will be intermittent, occasional, and short-lived. Therefore, related effects (e.g., startling resulting in returning underwater prematurely) are expected to be minimal and insignificant. The Project may affect but is not likely to adversely affect the West Indian manatee.

5.4.4 Cumulative Effects

The Project is not likely to adversely affect the West Indian manatee. Therefore, cumulative effects are not considered.

5.4.5 Population-level Biological Consequences

The Project is not likely to adversely affect the West Indian manatee. Therefore, no population-level biological consequences will occur.

5.5 Audubon's Crested Caracara

5.5.1 Biology and Habitat

Crested caracaras are found in wet prairies associated with cabbage palms (*Sabal palmetto*) and wooded areas associated with palmetto, cypress, scrub oaks, and pastures throughout south-central Florida. They prefer open areas with thin ground cover to allow them to get a running start before flight (Cornell Lab of Ornithology 2024a). Caracaras typically build nests in cabbage palms, the tallest vegetation, or tree-like structures with a wide view in generally open prairie or pasture with low density scattered brush (Morrison and Dwyer 2023). The species' global distribution includes Texas, Arkansas, Mexico, Cuba, and Panama (FWC 2024d).

The crested caracara is a non-migratory resident across its range, building nests in trees, cacti, shrubs, and taller, human-made structures. Breeding has been observed from September to April but appears to peak from January to March. Clutch size is typically 2-3 eggs, rarely 4. The incubation period is 30-33 days, and nestling period is 42-56 days, and young may remain with parents for several weeks after fledging. The species keeps a strict territory, are monogamous for several years, and returns to its initial nesting site for several breeding cycles (National Audubon Society 2024a).

5.5.2 Environmental Baseline

Audubon's crested caracara (*Polyborus plancus audubonii*) is synonymous with the Northern Crested Caracara (*Caracara cheriway*). Although *Polyborus plancus audubonii* is not currently recognized as a valid subspecies, the name Audubon's crested caracara is retained in the Federal Register and Florida

Statutes for the Florida population as that was the name at the time of that population's federal listing as threatened (52 FR 25229; July 6, 1987). Main threats to the species include habitat loss due to urban development and agriculture, vehicle strikes, and illegal take (FWC 2024d). Caracaras are present in Florida in relatively small, isolated populations and are year-round residents throughout their range, which includes areas of Brevard County within the Action Area. Their primary habitat in Florida consists of improved pasture, dry prairies interspersed with marshes, mixed upland hardwoods, shrub swamp, grasslands, and pinelands (USFWS 2009). In Florida, up to 80% of nesting pairs of crested caracaras are found on private cattle ranches, likely due to shorter grass that increases visibility, allowing less vulnerability to predators (Rose and Boughton 2019). Caracaras have been observed within approximately 1 mile of the Project Area (Chambers pers. comm).

5.5.3 Effects of the Action

The Project Area does not contain any rural pastureland preferred by Audubon's crested caracara. Habitat is present for the crested caracara to forage and nest within the Action Area and noise disturbance from launch and sonic booms may startle or flush individuals. The proposed increase in annual number of launches would create more frequent occurrences of related activity, noise, lighting, and vibrations at SLC-40, however, due to the lack of habitat present within the Project Area and the minimal impacts the small, isolated populations may experience from launch noise and sonic booms, the Project may affect, but is not likely to adversely affect, the crested caracara.

5.5.4 Cumulative Effects

The Project is not likely to adversely affect the Audubon's crested caracara. Therefore, cumulative effects are not considered.

5.5.5 Population-level Biological Consequences

The Project is not likely to adversely affect the Audubon's crested caracara. Therefore, no population-level biological consequences will occur.

5.6 Eastern Black Rail

5.6.1 Biology and Habitat

Eastern black rails (*Laterallus jamaicensis jamaicensis*) live in marshes of all kinds, including riparian, coastal, saltmarshes, and impounded wetlands. Plant structure, vegetation height, and vegetation density (versus plant species composition) may most accurately predict habitat suitability, and potentially, species presence, as the species requires dense vegetative cover for movement below the canopy (USFWS 2024d).

Eastern black rails prefer habitat along the Atlantic Ocean and Gulf of Mexico coastlines where they defend up to 10 acres of territory. The species flies very little during breeding and wintering periods. Flushed individuals typically move only a short distance and remain on the ground, using rodent and rabbit runways to travel through dense vegetation (USFWS 2019d).

Due to their relatively small size, habitat preferences, and secretive nature, little is known about the species' breeding behavior. However, the species is known to build nests on taller vegetation a few inches off the ground. Clutch size may be anywhere from 4-13 eggs, with females laying 1-2 clutches per year (Cornell Lab of Ornithology 2024b).

5.6.2 Environmental Baseline

The USFWS listed the eastern black rail as threatened on November 9, 2020 (85 FR 63764). Main stressors impacting the species include habitat degradation, loss, and fragmentation due to climate change; ground- and surface water withdrawals; incompatible land management techniques (e.g., poorly timed prescribed burns, intense grazing or haying); and natural events such as floods and hurricanes (USFWS 2019d).

There are no recent (2011–2016) records of confirmed eastern black rail breeding in Brevard County, but the species may occur in the Action Area year-round (USFWS 2019d). Suitable eastern black rail habitat is not present within the Project Area; however, suitable habitat exists within the On-shore Action Area as intertidal marshes and emergent wetlands present west of SLC-40 (approximately 0.35 miles from the Project Area).

5.6.3 Effects of the Action

The increased annual number of launches and addition of landings related to the Project would result in more frequent occurrences of related activity, noise, lighting, and vibrations as compared to baseline operations. Eastern black rails are not presently known to occur in the On-shore Action Area. However, suitable habitat is present and could be occupied. Therefore, the increase in launch-related activity at the Project area has the potential to result in an increase in exposure of eastern black rails to such events, which could in turn disturb (e.g., elicit a startle response or flush) individuals that may be present within the On-shore Action Area during a launch event. These disturbances are part of the baseline conditions of the On-shore Action Area, and eastern black rails occurring in the On-shore Action Area during a launch or landing are expected to respond similarly (e.g., startle, flush) as they do under current operations. The threshold at which the frequency of such short-term and intermittent disturbances results in a measurable impact to the species is unknown, but there are no data to indicate that the increase in frequency of these disturbances would result in measurable effects to eastern black rails.

The effects of the Project represent an increase in the frequency of occurrence of, and not the introduction of new, potential disturbances to eastern black rails that may occur in the On-shore Action Area; the potential disturbances will be intermittent and short-term; and eastern black rails have potential for exposure only if occurring in the Action Area during a launch or landing event. Further, eastern black rails occur in suitable habitats containing dense vegetation, where they spend the majority of time under vegetative cover. This cover may act to limit or minimize exposure of eastern black rails to potential disturbances, such as lighting or noise. For these reasons, effects to the species are expected to be insignificant and the Project may affect, but is not likely to adversely affect, the eastern black rail.

5.6.4 Cumulative Effects

The Project is not likely to adversely affect the eastern black rail. Therefore, cumulative effects are not considered.

5.6.5 Population-level Biological Consequences

The Project is not likely to adversely affect the eastern black rail. Therefore, no population-level biological consequences will occur.

5.7 Everglade Snail Kite

5.7.1 Biology and Habitat

The everglade snail kite ranges from southern Mexico to northern Argentina and resides in the United States only in peninsular Florida (Reichert et al. 2020). This medium-sized raptor feeds almost exclusively on freshwater apple snails which are found in their preferred habitat of large inland freshwater marshes, edges of shallow lakes, and open freshwater wetland areas (Reichert et al. 2020). The everglade snail kite nests in trees usually less than 30 feet tall and on shrubbery or emergent vegetation such as sawgrass or cattails (Cornel Lab of Ornithology 2024c).

5.7.2 Environmental Baseline

USFWS listed the Everglade snail kite as endangered on March 11, 1967 (32 FR 4001). The current distribution of the Everglade snail kite in Florida is limited to six large freshwater ecosystems (Upper St. Johns marshes, Kissimmee River Basin, Lake Okeechobee, Loxahatchee Slough, the Everglades [i.e., areas south of Lake Okeechobee], and the Big Cypress basin) within the central and southern portions of the state (USFWS 2019a). The Upper St. Johns River and adjoining marshes do not include the Indian River Lagoon and Banana River (St. Johns River Water Management District 2024) which are the estuarine systems encompassed within the Action Area.

The Project Area lacks suitable habitat for the everglade snail kite, and it has never been observed CCSFS (Chambers pers. comm.). However, the species may range across water conservation areas within the On-shore Action Area (USFWS 2019a).

5.7.3 Effects of the Action

The Project Area does not contain freshwater lakes or marshes that are habitat for the Everglade snail kite. The range of the Everglade snail kite extends into Brevard County within the Action Area where the species may utilize suitable habitat for breeding and foraging. Noise disturbance from launch and sonic booms may startle or flush individuals, if present. However, while it is possible for Everglade snail kites to occur in the On-shore Action Area, no Everglade snail kites are known to regularly use potential habitat in the On-shore Action Area and have not been detected at CCSFS. Therefore, it is not reasonably certain that any Everglade snail kites will be exposed to the physical consequences of the Project. Since Everglade snail kites have never been detected within CCSFS, where the effects of the action would presumably the most intense, it is also highly unlikely that any Everglade snail kites that do happen to occur in the broader extent of the On-shore Action Area would be adversely affected by the proposed increase in annual number of launches and related activity, noise, lighting, and vibrations at SLC-40. The severity of these impacts attenuates with distance. Therefore, the Project may affect, but is not likely to adversely affect, the Everglade snail kite.

5.7.4 Cumulative Effects

The Project is not likely to adversely affect the Everglade snail kite. Therefore, cumulative effects are not considered.

5.7.5 Population-level Biological Consequences

The Project is not likely to adversely affect the Everglade snail kite. Therefore, no population-level biological consequences will occur.

5.8 Florida Scrub-jay

5.8.1 Biology and Habitat

The FLSJ, the only bird species endemic to Florida, inhabits sand pine and xeric oak scrub, and scrubby flatwoods where it feeds on small invertebrates, amphibians, reptiles, mice, bird eggs, and acorns (FWC 2024e). The species occupies year-round territories in family groups averaging 22 acres in size. Nesting occurs from March 1 through June 30 (USFWS 2019e). While FLSJ s may use the same territory and nest site in consecutive years, they may also build a new nest or modify the existing one from year to year based on factors such as the condition of the previous nest, changes in vegetation, and other environmental considerations. FLSJs are non-migratory, extremely sedentary, and permanently territorial. Most juveniles remain in their natal territory for at least one year, and males may remain as helpers in their natal territory for up to seven years before dispersing to become breeders (Woolfenden and Fitzpatrick 1996).

5.8.2 Environmental Baseline

The FLSJ was listed by the USFWS as threatened on June 3, 1987 (52 FR 20719). Primary threats to the species include range-wide population declines attributed to habitat loss and habitat degradation. KSC supports one of the largest remaining populations of FLSJ. Scrub-jay habitat is intensively managed on KSC and CCSFS property, primarily by controlled burning and mechanical treatment (FAA 2020).

The USSF conducts annual FLSJ census surveys. Family groups documented in surveys conducted between 2016 and 2023 are shown in Figure 10. There are several family groups in the vicinity of the Project Area that have been documented as recently as 2023. FLSJ are mobile and thus family groups may move throughout the territory, but the nearest family-group count identified in the 2023 census was approximately 650 feet from the Project Area. The area contains coastal scrub habitat that is considered moderate to high quality by professional wetland scientists at Jones Edmunds. The SLC-40 North Site Review Technical Memorandum stated that the habitat appeared to have been managed recently as the vegetation was of suitable height for scrub-jays compared to adjacent habitat. Numerous FLSJs were observed during the assessment (Jones Edmunds 2023).

The Expansion Area contains approximately 3.00 acres of native scrub vegetation that is habitat for FLSJ.

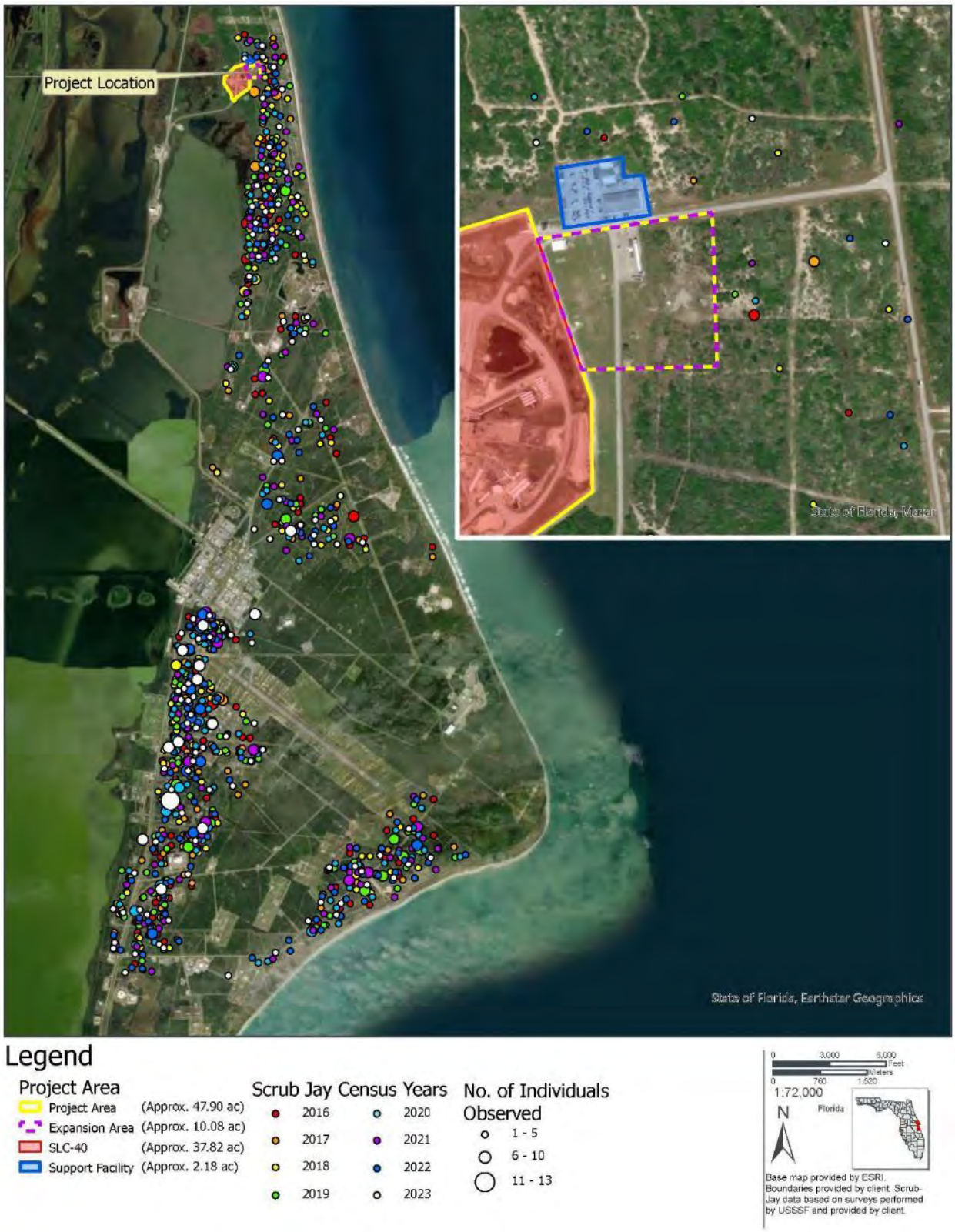

Figure 10. Florida scrub-jay survey data 2016-2023 in the On-shore Action Area.

5.8.3 Effects of the Action

The Project would result in a permanent loss of approximately 2.03 acres of occupied FLSJ habitat (Figure 10). This habitat loss is expected to disrupt the breeding, feeding, and sheltering activities of at least one FLSJ family group in ways that are likely to reduce the reproductive success or fitness of the individuals using that territory.

SpaceX originally proposed constructing the landing zone with two landing pads that would have resulted in the direct modification of approximately 19 acres of FLSJ habitat. To minimize the extent of adverse impacts to FLSJ s, SpaceX revised the site plan to include only one landing pad which reduced the area of construction and habitat loss. The proposed Project site plans retain a corridor of FLSJ habitat approximately 725 feet wide between Cape Road and the eastern boundary of the Expansion Area and ensures new development remains as close as possible to already developed areas (Figure 11Figure 11. Proposed site plan prior to minimization (top) and after minimization (bottom).

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The Project proposes to increase the annual number of launches, which would create more frequent occurrence of related activity, noise, lighting, and vibrations at SLC-40. While the body of research on noise impacts to wildlife indicate that even relatively low-level noise can elicit a change in wildlife behavior or habitat use (Shannon et al. 2016), this body of work does not predict with reasonable certainty how individual species will respond to specific kinds of noise in specific environmental settings.

Morgan et al. (2012) tested the potential for roads and traffic to cause physiological stress and reduce reproductive success of FLSJ. The authors found that roadside environments (with regular noise and movement disturbances and the presence of modified edge habitat) were not stressful for FLSC and did not reduce FLSC reproductive success compared to environments with non-road habitat edges and natural interior scrub habitat.

One noise impact study on western scrub-jays in a wooded New Mexico habitat management area with operating oil and gas compressor stations (Francis et al. 2009) measured noise levels using C-weighted values (a conversion that considers more low frequency sound that A-weighted values that are commonly used to express noise levels relevant to humans) and reported overall mean sound pressure levels (representing an overall measure of ambient noise) at sample locations. This study reported the amplitude of noise (C-weighted) at compressor station sites as between approximately 90 to 100 dB, attenuating to levels approaching consistency with control sites after approximately 400 meters (0.25 mile). In this study the researchers found that western scrub-jay occupancy at quiet control sites was 32% higher than at the noisy compressor station sites, although western scrub-jays did not avoid noisy sites completely. Western (Woodhouse's) scrub-jays in New Mexico are now classified as *Aphelocoma woodhouseii*, recently split from the closely related California scrub-jay (*A. californica*). Differences in how these two closely related species relate to noisy environments (represented by their occurrence in residential areas) highlight how their responses to noise and related human disturbances may differ. California scrub-jays are known to frequent residential areas, while Woodhouse's scrub-jays are not typically associated with such areas (Curry et al. 2020). FLSJ s, while habitat specialists, are also known to be exceptionally tolerant of human activity (Woolfenden and Fitzpatrick 2020). These differences illustrate that even among closely related species, response to noise and human activity may be different and the findings of Francis et al. (2009) may not be representative of how FLSJ s in the Action Area respond to noise and activity that is not novel on this landscape.

Noise impact studies of Florida scrub jays and rocket programs are not available. However, these activities have been ongoing at the CCSFS and KSC for decades. Species that occur year-round within the CCSFS

and KSC, such as the FLSJ, are likely habituated to rocket launch and landing operations. No behavior anomalies were observed in FLSJ after Delta, Atlas, and Titan launches at CCSFS and similar studies during the Space Shuttle program, implying no measurable, noise-related impacts to the scrub-jay (Schmalzer 1998). Figure 12, Figure 13, and Figure 14 show the distribution of FLSJ groups at CCSFS over several years and within the maximum noise level contours that represent baseline and proposed conditions for launch and static fire noise events and proposed conditions for landing noise events. Across CCSFS, FLSJ s occur in close proximity to launch pads and other concentrations of human activity. These data do not suggest that FLSJ avoid areas with recurring and loud noise events.

Prescribed burns conducted at CCSFS, KSC, and the Merritt Island National Wildlife Refuge are crucial to providing adequate habitat for fire-dependent species including the FLSJ. Prescribed burns currently are conducted in accordance with the *Memorandum of Understanding between the 45th Space Wing, the United States Fish and Wildlife Service, and John F. Kennedy Space Center for Prescribed Burning on the Merritt Island National Wildlife Refuge, John F. Kennedy Space Center, and Cape Canaveral Air Force Station, Florida*. Research by KSC noted a sustainable population depends most on increasing the amount of open medium habitat, and that population decline will continue until a suitable amount of this habitat is created through prescribed fire and other mechanical treatments (KSC 2024). This study also found that the loss of a Merritt Island National Wildlife Refuge fire crew and reduced burning opportunities due to operational restraints led to fewer, but more extensive fires. Outside of burn restrictions, such as operational smoke buffers or smoke sensitive activities/payloads, the decision on whether a burn is conducted is also influenced by the availability of burn crews, agency funding, and day-of weather. SpaceX would continue to coordinate with CCSFS to avoid or reduce burn day impacts due to launch so that burns could continue to be conducted with sufficient frequency to maintain habitat.

SpaceX will not put undue stress on the SLD 45 Prescribed Burn Program. Prescribed burning shall be supported unless SpaceX communicates there is a specific impact to operations on a launch day or day of associated launch support activities including payload movement, static fires, or dress rehearsals. SpaceX acknowledges that potential exists to have to alter the timing of launch operations or associated launch support activities to allow for prescribed burning operations to be completed. SpaceX understands it is their responsibility to protect payloads/space flight hardware from smoke associated with prescribed burning or wildfires, and will properly maintain and operate clean rooms and/or processing facilities in accordance with established industry clean room standards to allow for prescribed burns to be conducted.

As shown in Table 2.2-2, conservation measures included in the Project for the FLSJ include seasonal restrictions and a preconstruction survey. Clearing and construction activities are to be avoided during breeding season from March 1 through June 30. Seasonal restrictions would avoid or minimize the potential for directly killing or wounding individuals and disrupting the nesting activity of adults that may have used or currently use potential breeding habitat within or adjacent to the Project Area. Additionally, a preconstruction survey would be conducted prior to the start of construction.

The permanent loss of approximately 2.03 areas of FLSJ habitat in a known territory may disrupt the essential breeding, feeding, and sheltering behaviors of scrub-jays within the affected territory. Affected individuals may suffer reduced fitness from the reduction in territory resources that could lead to an increased risk of death or injury, such as reduced reproductive output. Habitat reduction due to the land clearing causes direct harm to individual birds by removing potential nesting sites and foraging opportunities within that area. The adjacent territories may also be affected by the encroachment of other individuals mobilizing to obtain the needed space to maintain their territory. Due to the permanent loss of FLSJ habitat within the Expansion Area, the Project is likely to adversely affect the FLSJ.

Figure 11. Proposed site plan prior to minimization (top) and after minimization (bottom).

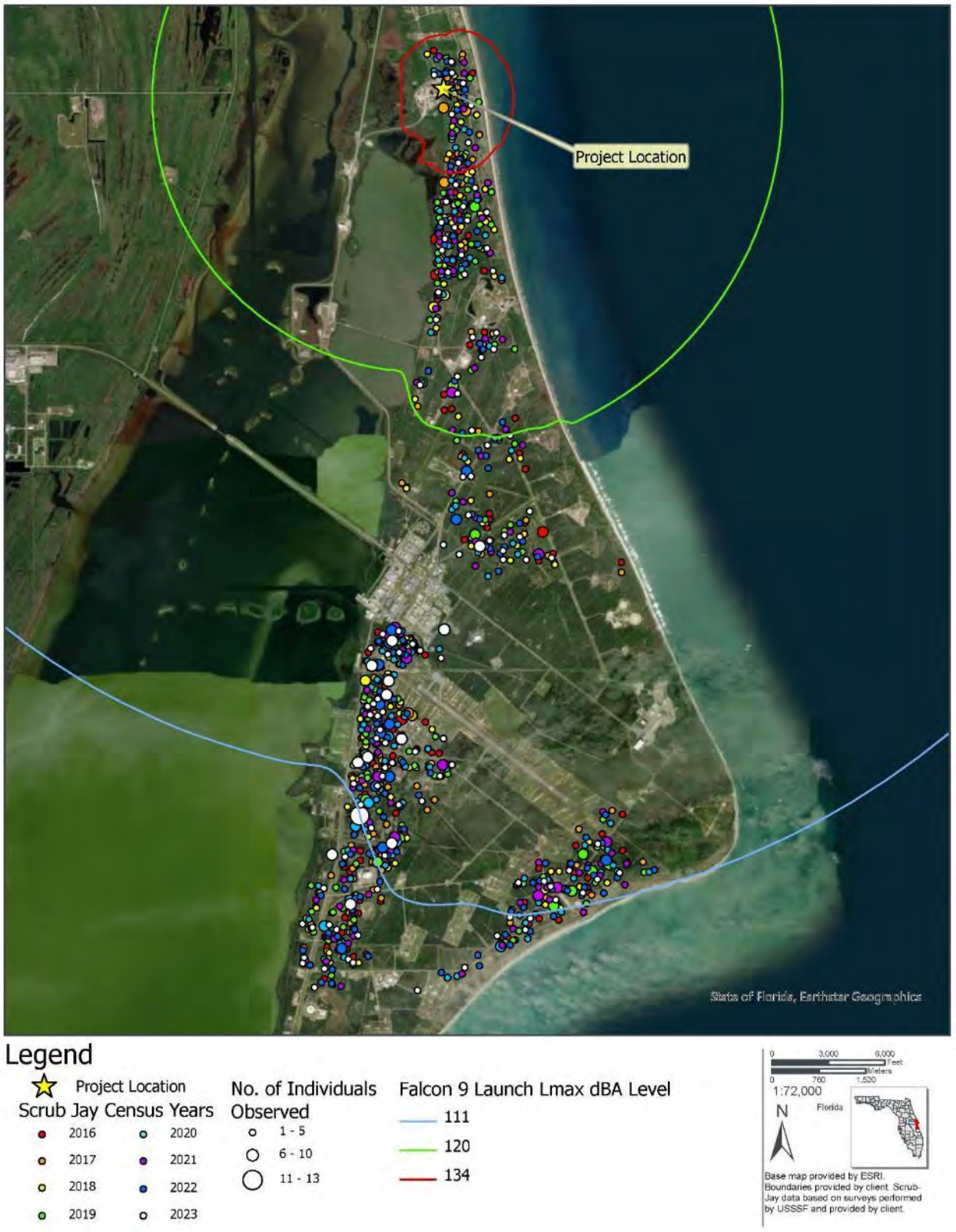

Figure 12. Florida scrub-jay groups and launch noise contours.

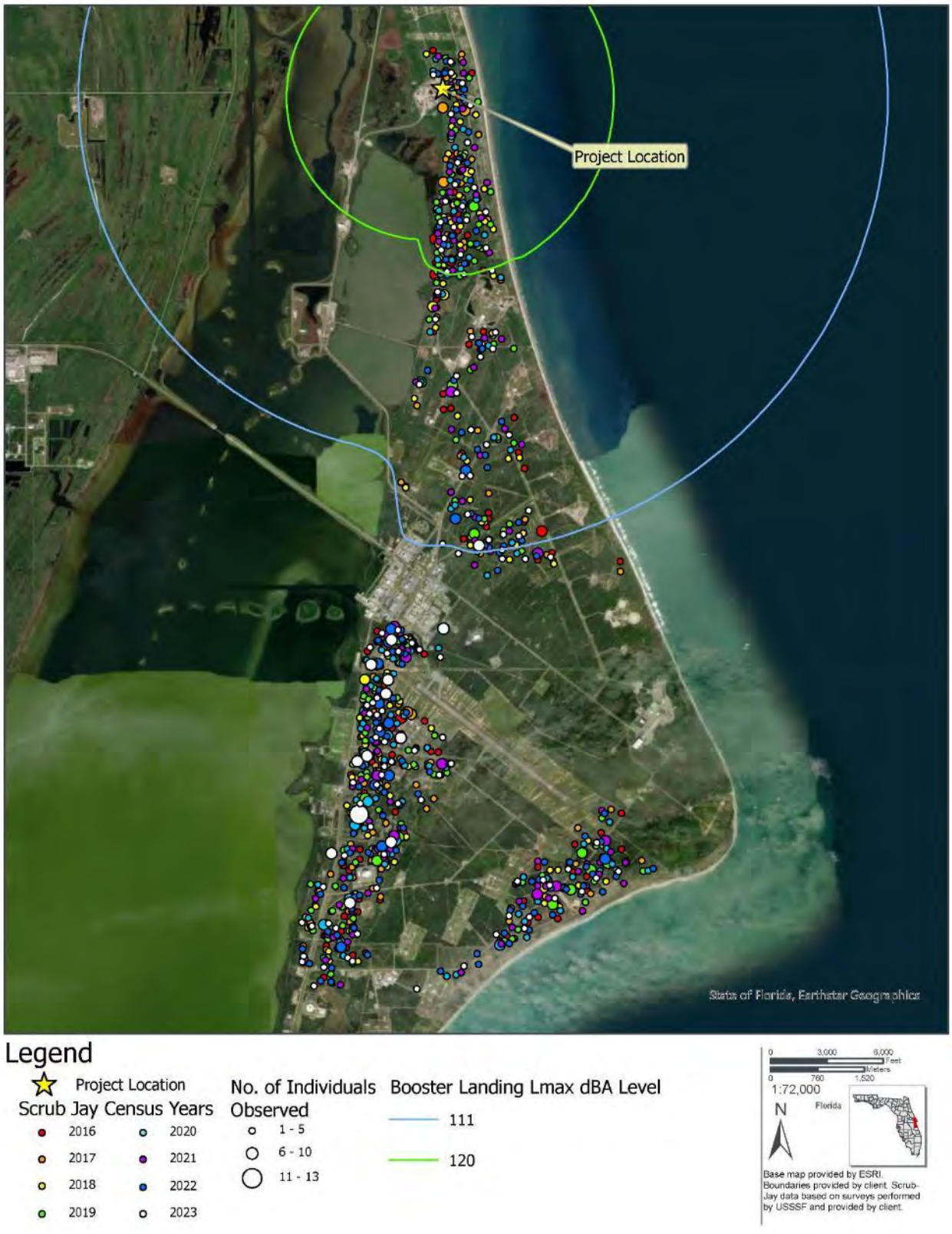

Figure 13. Florida scrub-jay groups and booster landing noise contours.

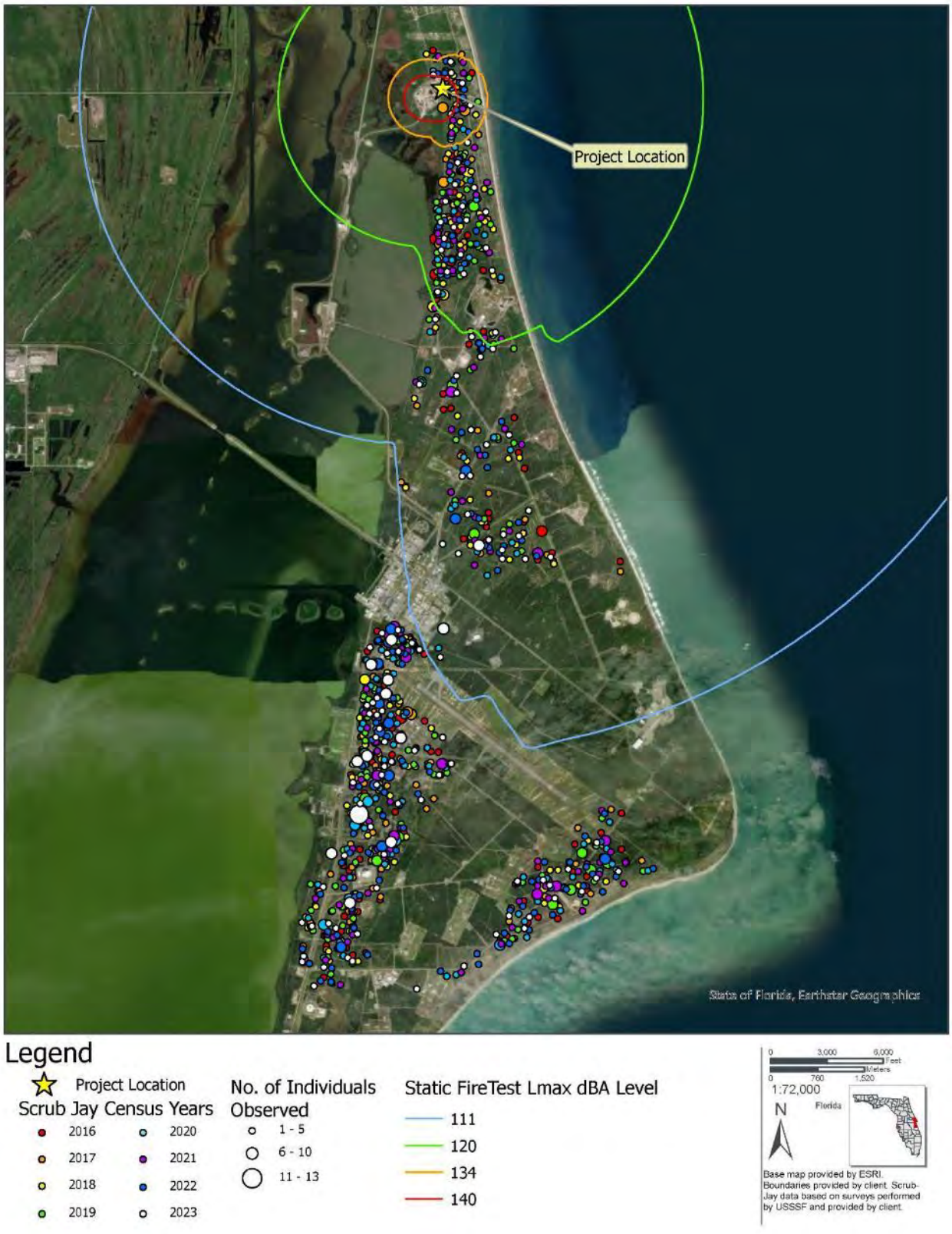

Figure 14. Florida scrub-jay groups and static fire noise contours.

5.8.4 Cumulative Effects

There are four impacts analyzed in this BA that are associated with proposed construction and operational activities: habitat loss, habitat degradation, noise and visual disturbance, and collision (Section 5.1). Section 4.3 identifies additional non-federal projects within the Action Area that are primarily road maintenance and residential improvements in previously developed lands. These activities would have comparable effects related to construction and operational activities related to these types of land development. It is unlikely the projects identified in Section 4.3 would result in FLSJ habitat loss and would not be expected to have an adverse effect on the FLSJ.

5.8.5 Population-level Biological Consequences

Because this species is adapted to a habitat that shifts in suitability depending mostly on the frequency and severity of fire and because the proposed 2.03 acres of habitat loss is a small fraction of a typical FLSJ territory size of about 22 acres, the Project is expected to have a minimal overall impact on the population of FLSJs in the vicinity of SLC-40. In addition, the 2023 *Annual Update Using Florida Scrub-Jay Habitat Quality and Demography to Inform Management Decisions* (KSC 2024) did not identify noise or launch frequency as an impact or population-level risk to FLSJs.

5.9 Piping Plover

5.9.1 Biology and Habitat

The piping plover is a migratory bird species with a breeding distribution in the Great Lakes region and Atlantic Coast and along central North America from Alberta, Canada, to Colorado and Oklahoma (USFWS 2020c). There are two recognized subspecies. The nominate piping plover nests on the Atlantic Coast, whereas *C. m. circumcinctus* breeds around the Great Lakes and on the Northern Great Plains (Elliott-Smith and Haig 2020).

The species uses habitats such as lakeshores, sandy beaches, sandy islands, sand bars, sand flats, mud bars in major rivers, playas, and mudflats contained within lagoons at water treatment plants (USFWS 2020c). The Florida population is not known to breed in the state, but they do spend a large portion of winter months foraging along the Atlantic and Gulf coasts. Migration to breeding grounds occurs from late March through April, with migration to wintering grounds occurring between late July and September. Migrating piping plovers likely use stopover sites opportunistically (USFWS 2020c). Haig and Plissner (1993) suggest that birds may fly nonstop between breeding and wintering grounds based on the scarceness of inland records during migration periods. However, records of occurrence of migrants at inland sites do exist, suggesting at least some birds make stops between nesting and wintering grounds. The diet of the Atlantic coast piping plover population consists of insects, crustaceans, and marine worms (FWC 2024f).

5.9.2 Environmental Baseline

The USFWS listed the piping plover as threatened on December 11, 1985 (USFWS 2020c). Main threats to the Atlantic coast population include habitat loss due to human development on beaches, increased human disturbance, and predation from raccoons, skunks, foxes, and domestic animals (FWC 2024f).

The species range overlaps the Action Area (Gratto-Trevor et al. 2012; USFWS 2020c). The species is an uncommon winter resident along the Gulf and Atlantic coasts and does not breed in Florida. Winter habitat is not present in the Project Area but is present in the On-shore Action Area. According to the 1991 International Winter Census, of 582 piping plovers sighted in Florida, 88% were recorded on the Gulf coast

and far fewer (i.e., only 20 - 30 birds) were sighted along the Atlantic coast from Duval County south to Brevard, St. Lucie, and Miami-Dade counties (FNAI 2023). FWC does not include Brevard County in the piping plover distribution, and the species is not known to occur regularly in the county (FWC 2024f). No piping plover critical habitat occurs in the Action Area.

5.9.3 Effects of the Action

The increased annual number of launches and addition of landings related to the Project would result in more frequent occurrences of related activity, noise, lighting, and vibrations as compared to baseline operations. This increase in occurrence has the potential to result in an increase in exposure of piping plovers to such events, which could in turn disturb (e.g., elicit a startle response) individual piping plovers in the Action Area if they occur concurrently with a launch or landing event. Piping plovers occurring in the Action Area during a launch or landing event are expected to respond similarly (e.g., startle) as they do to current operations. Due to the lack of suitable habitat within the Project Area, and the relatively low occurrence of the species within the Action Area, effects to piping plovers are expected to be insignificant. Therefore, the Project may affect, but is not likely to adversely affect, the piping plover.

5.9.4 Cumulative Effects

The Project is not likely to adversely affect the piping plover. Therefore, cumulative effects are not considered.

5.9.5 Population-level Biological Consequences

The Project is not likely to adversely affect the species. Therefore, no population-level biological consequences will occur.

5.10 Rufa Red Knot

5.10.1 Biology and Habitat

The rufa red knot is one of six subspecies of *Calidris canutus*, each with distinctive migration routes and annual cycles (USFWS 2020d). Rufa red knots (*Calidris canutus rufa*) are medium-sized shorebirds that migrate annually between their breeding grounds in the central Canadian Arctic and several wintering grounds, including Florida, where the southeast coast serves as a wintering ground for adult and hatch-year populations (USFWS 2024d).

During both the northbound (spring) and southbound (fall) migrations, rufa red knots use staging and stopover areas to rest and feed. Stopover areas along the Atlantic coast include Florida through the Carolinas. Stopover habitat is similar to wintering and breeding habitat and consists of muddy/sandy coastal areas, tidal flats, unimproved tidal inlets, ocean/bayfront areas, and sheltered bays/lagoons (USFWS 2024e).

This monogamous bird produces one clutch of around four eggs per year in the summer, typically in June or July. Parents stay in summer breeding/foraging areas with fledglings until mid-August, with the females often leaving first around mid-July (USFWS 2024e).

5.10.2 Environmental Baseline

The USFWS listed the rufa red knot as threatened in 2014 (79 FR 73705). Primary threats to the species were loss of habitat; disruption of predator cycles in breeding areas; reduced prey availability in the nonbreeding range; and the increasing frequency and "severity of asynchronies (mismatches) in the timing of the birds' annual migratory cycle relative to favorable food and weather conditions" (USFWS 2020d). The USFWS indicates that human disturbance is a moderate, secondary threat (threats not expected to have effects at the level of a listed taxon) to the rufa red knot during migration and wintering life stages (USFWS 2020d). Specifically, the USFWS describes that coastal development accompanied by increased levels of recreation and other human activities can result in disturbance to red knots, and that "excessive disturbance can impact red knot energy budgets and weight gain and can also preclude red knot use of otherwise preferred foraging and roosting habitat" (USFWS 2020d).

The rufa red knot winters in Florida, where it feeds along the shoreline of sandy beaches and occasionally in salt marshes, brackish lagoons, tidal mudflats, and mangroves (Baker et al. 2020). Florida serves as an important wintering area for adult and hatch-year populations (USFWS 2024d). Red knots have been observed on CCSFS during the winter, fall, and spring months (Chambers pers. comm.). Observations of the species on CCSFS are uncommon and the species is typically observed in small numbers. Designated critical habitat for the rufa red knot occurs within the Action Area, and the species has potential to occur there and in other areas of suitable habitat within the Action Area. Suitable habitat is not present in the Project Area.

5.10.3 Effects of the Action

The increased annual number of launches and addition of landings related to the Project would result in more frequent occurrences of related activity, noise, lighting, and vibrations as compared to baseline operations. This increase in occurrence has the potential to result in an increase in exposure of rufa red knots to such events, which could in turn disturb (e.g., elicit a startle response) individuals in the Action Area if they occur concurrently with a launch or landing event. These disturbances are part of the baseline conditions of the Project and Action areas, and rufa red knots occurring in the Action Area during a launch or landing event are expected to respond similarly (e.g., startle) as they do to current operations. The threshold at which the frequency of such short-term and intermittent disturbances results in a measurable impact to rufa red knots is unknown, but there are no data to indicate that the increase in frequency of these disturbances would result in measurable effects to individual rufa red knots.

Because the effects of the Project represent an increase in the frequency of occurrence of, and not the introduction of new, potential disturbances to rufa red knots in the Action Area; the potential disturbances will be intermittent and short-term; and rufa red knots have potential for exposure only if occurring in the Action Area during a launch or landing event, effects to rufa red knots are expected to be insignificant. Therefore, the Project may affect, but is not likely to adversely affect, the rufa red knot.

5.10.4 Cumulative Effects

The Project is not likely to adversely affect the rufa red knot. Therefore, cumulative effects are not considered.

5.10.5 Population-level Biological Consequences

The Project is not likely to adversely affect the species. Therefore, no population-level biological consequences will occur.

5.11 Wood Stork

5.11.1 Biology and Habitat

The wood stork is a large, white, wading bird with a dark, featherless head and neck and long, dark bill. The species is a year-round resident of Florida that breeds in large colonies of 100 to 500 nests primarily in mixed hardwood swamps, sloughs, mangroves, and cypress domes (FWC 2024g). Wood storks eat primarily fish and aquatic invertebrates but will also eat seeds, small amphibians, small reptiles, and nestlings of other bird species (Cornell Lab of Ornithology 2024d). In Florida, wood storks are capable of laying eggs from October to June (Rodgers 1990). They will have one clutch of 1-5 eggs per year, with an average incubation period of 30 days and a nesting period of about 2 months. Fledging occurs approximately 10-12 weeks after hatching (FWC 2024g).

5.11.2 Environmental Baseline

The USFWS listed the wood stork (*Mycteria americana*) as endangered in 1984 (49 FR 7332). It was then downlisted to threatened on June 30, 2014 (79 FR 37077). On February 15, 2023, the USFWS published a proposed rule to remove the Southeast U.S. distinct population segment (DPS), which includes those found in Florida, from the Federal List of Endangered and Threatened Wildlife due to recovery (88 FR 9830). Previously identified threats to the species include agricultural development on wetlands and cypress stands, and predation from raccoons (FWC 2024g).

According to the most recent wood stork nesting colonies data published by the Florida Department of Environmental Protection (FDEP), last updated on November 20, 2018, there were no colonies on Cape Canaveral (FDEP 2018). The closest three are locations in Cocoa and Orlando Wetlands Park, Florida, but are not encompassed within the Action Area. FDEP also published wood stork foraging areas data last updated on August 22, 2023, based on a 15-mile radius from known nests (FDEP 2023). These foraging areas associated with the three closest colonies extend approximately 4, 10, and 11 miles respectively into the Action Area however, they do not extend to the Project Area. The 15-mile radius extent of the three wood stork foraging areas is approximately 4, 5, and 10 miles respectively from the Project Area. The total wood stork foraging area overlaps with approximately 63% of the Action Area.

5.11.3 Effects of the Action

There are no wood stork colonies known to be located within the Action Area. The foraging areas associated with the three closest documented nests are within the Action Area but do not extend to the Project Area. The Project proposes to increase the annual number of launches and add landings, which would create more frequent occurrence of related activity, noise, lighting, and vibrations at SLC-40. This increase has the potential to disturb wood storks foraging in the Action Area during a launch or landing event, and individuals would be expected to experience a similar effect as they do to current operations, but they would experience that more frequently. However, wood storks are known to establish and maintain colonies in areas close to human activities and observations of wood storks feeding in urban environments are not uncommon (88 FR 9830). The species uses foraging habitat opportunistically and USFWS has indicated that suitable breeding and foraging habitat is widely available across the species' current range (88 FR 9830).

Due to the absence of known nest colonies within either the Project Area or the Action Area, the apparent tolerance of wood storks to human activity, and the abundance of suitable habitat available for the species across its range, the Project may affect, but is not likely to adversely affect, the wood stork.

5.11.4 Cumulative Effects

The Project is not likely to adversely affect the wood stork. Therefore, cumulative effects are not considered.

5.11.5 Population-level Biological Consequences

The Project is not likely to adversely affect the species. Therefore, no population-level biological consequences will occur.

5.12 Roseate Tern

5.12.1 Biology and Habitat

The roseate tern (*Sterna dougallii dougallii*) is a medium-sized tern that is exclusively marine and is a specialized plunge-diver. Roseate terns feed mainly on small schooling fish, focusing on reefs, sandbars, and riptides to locate their prey. They will also use the presence of larger predatory fish to drive schooling fish to the surface (Gochfeld and Burger 2020). In North America, there are two distinct breeding populations that rarely mix, even during migration. The Northeast population can be found in eastern Canada, Nova Scotia, and Quebec, south to New York. The Caribbean population is located in the Caribbean Sea, from the Florida Keys to the Lesser Antilles (USFWS 2024f). Both populations migrate to South America from August-October, migrating mainly over the open ocean. Most of the Northeast population then leaves their wintering sites in Brazil towards the end of April and arrives at their breeding locations in Massachusetts towards the end of May and into June (Gochfeld and Burger 2020).

In the Northeast population, roseate terns nest under dense vegetation or rocks but will also nest in specialized nest boxes. The terns of the Caribbean population nest in much more open habitats, including on the Florida Keys, intermingling with other species such as least and bridled terns (Gochfeld and Burger 2020).

5.12.2 Environmental Baseline

The USFWS listed the northeastern population of the roseate tern as endangered, and the Caribbean population as threatened on December 2, 1987 (52 FR 42064). Main threats to this species include habitat loss due to sea level rise, predation, and human development at nesting areas (USFWS 2010).

Roseate terns nest in the Florida Keys but are not known to nest on mainland Florida and are not known to use the On-shore Action Area (the official species list for the Project Area and the 15-mile sonic boom overpressure zone did not include this species). The Caribbean population is most likely to occur in the Atlantic Ocean Action Area during the breeding season; some Caribbean populations may overwinter within the typical breeding season range. Individuals from either population may migrate across the open ocean through the Atlantic Ocean Action Area.

5.12.3 Effects of the Action

Foraging individuals could be exposed and subsequently startled by engine noise and/or sonic booms associated with ascent, or by noise associated with downrange booster and fairing recovery. USFWS (2010) does not identify noise or activity over the ocean where roseate terns may be foraging as threats to the species. If noise or sonic booms were to occur near nesting colonies, then those individuals may be exposed to brief impacts. However, it is unlikely that such a brief and infrequent exposure to noise or

sonic boom overpressure event would substantially disrupt nesting activities because these nesting colonies continue to persist in areas with much greater levels of human disturbance (USFWS 2010). For example, the species has also been known to nest on rooftops (USFWS 2010).

Given the abundance and distribution of roseate terns across their breeding range and the large size of the Atlantic Ocean Action Area, it is highly unlikely that a landing rocket or debris from an expended rocket would directly collide with any individual terns. This potential effect pathway is discountable.

It is not expected that landings in the Atlantic Ocean or vehicles expended into the Atlantic Ocean would retain residual propellent upon contact with the ocean. In the unlikely event that residual fuel was released from a rocket it could potentially impact this species as it is foraging. Exposure to residual fuel could lead to mortality or sub-lethal effects (USFWS 2023). Because of the large size of the Atlantic Ocean Action Area, the limited retention of propellant in rockets that land or are expended into the Atlantic Ocean, and the unlikely occurrence of one or more roseate terns occurring at the same time and place as a rocket landing or expenditure, the likelihood of adverse effects occurring via this pathway is discountable.

In consideration of the above, the proposed action is not likely to adversely affect the roseate tern.

5.12.4 Cumulative Effects

The Project is not likely to adversely affect the roseate tern. Therefore, cumulative effects are not considered.

5.12.5 Population-level Biological Consequences

The Project is not likely to adversely affect the roseate tern. Therefore, no population-level biological consequences will occur.

5.13 Black-capped Petrel

5.13.1 Biology and Habitat

Black-capped petrels are pelagic seabirds that breed only in the highest elevations on the island of Hispaniola in the Caribbean. The species nests in Haiti and the Dominican Republic (88 FR 89611). Black-capped petrels produce one egg; incubation period is not known (Audubon 2024b). The species is widely distributed and forages in loose, small flocks associated with other seabirds (Audubon 2024b). Black-capped petrels forage in high concentrations off the coast of North Carolina and in warm, deep waters far off the southeastern coast of North America, including Florida.

As a pelagic species, black-capped petrels inhabit the open ocean during the non-breeding season. The abundance of petrels are lower near the shore and increase across the deeper parts of the ocean (Northeast Regional Ocean Council (NROC) 2009).

5.13.2 Environmental Baseline

The USFWS listed the black-capped petrel as endangered on December 28, 2023 (88 FR 89611). Main threats to the species include habitat loss due to deforestation and forest fires and predation by nonnative mammals. The species does not occur on CCSFS but is known to forage off the coast of Florida, including

several miles off the coast of CCSFS within the Atlantic Ocean Action Area, where the species has occasionally been observed (Satgé et al. 2024).

5.13.3 Effects of the Action

Foraging individuals could be exposed and subsequently startled by engine noise and/or sonic booms associated with ascent, or by noise associated with downrange booster and fairing recovery. The final listing rule for the black-capped petrel does not identify noise, sonic booms (or vibrations), movement of people or vehicles, or similar types of activity disturbances as a threat to the species; nor does the USFWS identify these kinds of impacts as among those that may potentially result in incidental take of individual petrels (noting, however, that this is not a comprehensive list) (88 FR 89611). The Species Status Assessment for the black-capped petrel discusses adverse effects from artificial lighting installed on communication towers, wind turbines, and similar structures located near petrel breeding areas (USFWS 2023). However, black-capped petrels do not nest in Florida and the proposed action does not involve the installation of tower lighting in the Atlantic Ocean Action Area where petrels may forage.

Additionally, because the species that spends most of its life at sea, the potential exists, although unlikely, for rocket fallback to directly collide with individual black-capped petrels. However, foraging flocks of black-capped petrels are generally no larger than 65 birds USFWS 2023), making the likelihood of a rocket or debris directly colliding with a black-capped petrel across an area the size of the Atlantic Ocean Action Area exceedingly unlikely and therefore discountable.

It is not expected that landings in the Atlantic Ocean or vehicles expended into the Atlantic Ocean would retain residual propellent upon contact with the ocean. In the unlikely event that residual fuel was released from a rocket it could potentially affect this species, as foraging in areas after a fuel spill could lead to mortality or sub-lethal effects (USFWS 2023). Because of the large size of the Atlantic Ocean Action Area, the limited retention of propellant in rockets that land or are expended into the Atlantic Ocean, and the unlikely occurrence of one or more black-capped petrels occurring at the same time and place as a rocket landing or expenditure, the likelihood of adverse effects occurring via this pathway is discountable.

USFWS describes the black-capped petrel as being efficient open-ocean foragers, with the ability to glide easily to cover long distances over water and to detect feeding opportunities at great distances (USFWS 2023. Therefore, it is unlikely that occasional and short duration introduction of noise, sonic booms, or engine fire; fall back of rockets or debris; or release of unspent fuel or hazardous material to the vast Atlantic Ocean Action Area would be reasonably certain to adversely affect the life, foraging behavior, or fitness of black-capped petrels.

In consideration of the above, the proposed action is not likely to adversely affect the black-capped petrel.

5.13.4 Cumulative Effects

The Project is not likely to adversely affect the black-capped petrel. Therefore, cumulative effects are not considered.

5.13.5 Population-level Biological Consequences

The Project is not likely to adversely affect the black-capped petrel. Therefore, no population-level biological consequences will occur.

5.14 Eastern Indigo Snake

5.14.1 Biology and Habitat

The eastern indigo snake (*Drymarchon couperi*) occurs throughout Florida in a variety of habitats, including pine flatwoods, prairies, coastal plains, moist hammocks, and the edges of cypress swamps (University of Florida Museum 2024). The species' diet consists of small mammals, birds, reptiles, and amphibians. Breeding season is between fall (November) and spring (April). Females can have one to two clutches per year consisting of 4-12 eggs. The eastern indigo snake is a known commensal species of the gopher tortoise, as it is known to inhabit and lay eggs in tortoise burrows (FWC 2024h). Habitat use often varies seasonally between upland and lowland areas, especially where the snakes habitually overwinter in gopher tortoise burrows in xeric sandhill habitats.

5.14.2 Environmental Baseline

The USFWS listed the eastern indigo snake as a threatened species on March 3, 1978 (43 FR 4026). Main threats to the species include habitat loss, degradation, and/or fragmentation as a result of urban development, pollution, vehicle strikes, captures for domestication, and intentional killings (FWC 2024h).

Suitable rural and scrub habitat for eastern indigo snakes is present in the Project Area. Additionally, gopher tortoise burrows occur within the Project Area (Jones Edmunds 2023). Therefore, SpaceX assumes the eastern indigo snake may be present in the Project Area. However, the last confirmed observation of an eastern indigo on CCSFS was in 2023, with the next most recent detection (a vehicle strike) in 2004. A herpetological survey completed in 2018 did not result in any observations of the species (Chambers, A., pers. comm.).

5.14.3 Effects of the Action

The Project would result in the permanent removal of approximately 2.03 acres of scrub habitat. The clearing of 2.03 acres would minimally change the existing mosaic of open, developed, and natural land cover types present in the Project Area.

Construction and operations and maintenance activities have potential to result in disturbance, direct injury, or mortality to eastern indigo snakes via the following pathways:

- Crushing or burying, if a snake were occupying a burrow at the same time that burrow is collapsed,
- Collision during construction, if a snake were occupying the same space at the same time as overland use of heavy equipment and vehicles in the Project Area occurs,
- Crushing or burying, if a snake were occupying artificial refugia at the same time that refugia is removed or destroyed (following construction),
- Collision with traffic on proximate roads, and
- Disturbance (e.g., noise, vibrations).

Prior to the start of clearing, and as described in the USFWS's standard protection measures, a qualified biologist will survey previously discovered gopher tortoise burrows (2021a). Snakes inhabiting a burrow will be allowed to vacate the burrow prior to collapsing the burrow. This measure will ensure no eastern indigo snakes are crushed or buried as a result of burrow collapse during construction activities. Similarly,

if artificial refugia (e.g., piles of construction debris) are produced during construction, a qualified biologist will carefully inspect such areas for the presence of eastern indigo snakes prior to the debris being removed or destroyed. Observed snakes will be allowed to vacate the refugia prior to further activity, ensuring no eastern indigo snakes are crushed or buried during removal. Therefore, the likelihood of eastern indigo snakes being impacted due to burrow collapse is discountable.

To minimize the likelihood of collisions between construction equipment and vehicles during overland use, standard protection measures will be implemented (USFWS 2021a). These measures include placing posters in the work area alerting construction personnel to the potential presence of eastern indigo snakes, and conducting meetings with construction personnel to inform them about the potential presence of the species and processes to follow in the event the species is observed. Additionally, all construction and O&M personnel would observe a reduced speed limit of 25 miles per hour while driving in the Project Area. Because construction personnel will be aware of the potential presence of the species and will follow processes (including to stop activity until a snake has moved out of the work area), the likelihood of eastern indigo snakes being impacted due to collisions with equipment and vehicles during construction is discountable.

SLC-40 is the most active launch complex at CCSFS and currently experiences frequent human activity and related disturbance, including traffic, noise, lighting, and vibrations. Operation of the Project will result in an increase in the annual number of launches and add landings at SLC-40, which is likely to result in more frequent occurrences of related traffic, activity, noise, lighting, and vibrations. The Species Status Assessment for the eastern indigo snake does not identify noise, light, or vibration as stressors on this species (USFWS 2019f). Many wildlife species, including reptiles and amphibians, display a startle response when exposed to such disturbances. Such impacts would be short-term and intermittent and, in consideration of the baseline conditions within the Project and Action areas to which individuals inhabiting the area are currently exposed, are considered insignificant.

Construction and operation and maintenance activities may result in an increase in traffic on roadways proximate to SLC-40 as personnel access and leave the Project Area. Enge and Wood (2002) found no correlation between traffic volume and snake mortality (on roads) rates during a study involving 1,022 daily searches to document all observed snake mortality on roads in a central Florida study area between June 1998 and December 2001. During this study, searches occurred on 79% of available days during the study period and one juvenile eastern indigo snake was found dead on a road. The study also found that eastern indigo snakes were one of four large snake species proportionally trapped three times more frequently within intact habitats on public lands than they were found on roads in fragmented areas (Enge and Wood 2002).

Overall, the Project may affect, and is likely to adversely affect the eastern indigo snake due to engine noise and potential vehicle strikes.

5.14.4 Cumulative Effects

There are four impacts analyzed in this BA that are associated with proposed construction and operational activities: habitat loss, habitat degradation, noise and visual disturbance, and collision (Section 5.1). Section 4.3 identifies additional non-federal projects within the Action Area that are primarily road maintenance and residential improvements in previously developed lands. These activities would have comparable effects related to construction and operational activities related to these types of land development. It is unlikely the projects identified in Section 4.3 would not be expected to have an adverse effect on the eastern indigo snake.

5.14.5 Population-level Biological Consequences

Because this species is known to continue using habitat on CCSFS that is proximate to areas where activity, including rocket launches at SLC-40 and neighboring launch complexes, currently occur, the Project is expected to have a minimal overall impact on the population of eastern indigo snake at CCSFS and KSC.

5.15 Sea Turtles

5.15.1 Biology and Habitat

There are four species of sea turtles known to nest on Brevard County beaches within the On-shore Action Area: green sea turtle (*Chelonia mydas),* Kemp's ridley sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Eretmochelys imbricata*), and loggerhead sea turtle (*Caretta caretta*). Additionally, the USFWS indicates hawksbill sea turtle (*Eretmochelys imbricata*) has potential to occur in the On-shore Action Area. All of these species are highly migratory and travel hundreds to thousands of miles between nesting, breeding, and feeding sites.

The green sea turtle occurs throughout the subtropical and temperate regions of the Atlantic Ocean and the Gulf of Mexico. Important feeding areas in Florida include the Indian River Lagoon, the Florida Keys, Florida Bay, the Dry Tortugas, Homosassa, Crystal River, Cedar Key, and St. Joseph Bay. Green turtles are mostly herbivorous, feeding on algae and seagrasses; however, the species will also consume sponges, invertebrates, and discarded fish. Every 2 to 5 years, green sea turtles will return to their hatchling beach to lay eggs, producing a clutch of around 110 eggs every two weeks in late spring. Eggs incubate for approximately 2 months (NOAA 2024a).

The Kemp's ridley sea turtle occurs in the Gulf of Mexico. Juveniles may occur in the Atlantic Ocean as far north as Nova Scotia, and occasionally may occur in the eastern North Atlantic (NOAA 2024b). The species feeds on small animals and plants. Most nesting occurs on beaches along the western Gulf of Mexico and 95% of worldwide Kemp's ridley nesting occurs in Mexico (NOAA 2024b). Occasional nesting has been documented in Alabama, Georgia, Florida, North Carolina, South Carolina, and Texas. The species nests on CCSFS (Chambers pers. comm.). Nesting occurs during daylight hours from April to July. Females lay an average of 2 to 3 clutches of approximately 100 eggs per season and return to the beach to nest every 1 to 3 years. Average incubation time is 50 to 60 days (NOAA 2024b).

The leatherback sea turtle has the widest global distribution of any sea turtle or reptile, with major U.S. nesting sites in Florida, Puerto Rico, and the Virgin Islands. The species tends to be present in tropical latitudes globally for nesting and feeding on mainly open-ocean species, including jellyfish and salps. However, leatherback sea turtles have occurred as far north as Nova Scotia, Canada, and the Netherlands. The typical breeding period for the U.S. population is from March to July. Leatherback sea turtles will lay a brood of around 100 eggs at several nesting sites every 2-4 years, returning to the same nesting beaches each time. Average incubation time is around two months (NOAA 2024c).

The loggerhead sea turtle occurs primarily in subtropical and temperate regions of the Atlantic and Pacific oceans. The species is carnivorous, feeding on floating items in open waters and on bottom-dwelling invertebrates in coastal waters. Loggerhead sea turtles rarely consume plant material. Breeding season is from March to September. During this time, the species will lay three to five clutches of around 100 eggs. Incubation time is approximately two months (NOAA 2024d).

The hawksbill sea turtle occurs in tropical and sub-tropical ocean waters across the globe. This species persists on a diet of sea sponges, marine algae, coral, mollusks, crustaceans, sea urchins, small fish, and jellyfish. The species uses healthy coral reefs for feeding grounds, but have been observed in mangrove

estuaries, rock formations, high energy shoals, and estuaries that provide good habitat for sponge growth. Hawkbill sea turtles, like many other sea turtles, return to their hatchling beaches to lay clutches of 130 to 160 eggs. Breeding season can vary but is typically between April and November. Eggs will hatch after two months of incubation (NOAA 2024e).

5.15.2 Environmental Baseline

The USFWS listed the hawksbill, leatherback, and Kemp's ridley sea turtles under a precursor to the ESA in 1970 (35 FR 18319), and the green and loggerhead sea turtles in 1978 (43 FR 32800). Main threats to these species include climate change, loss or degradation of nesting habitat, disorientation of hatchlings by beachfront lighting, ocean pollution, direct harvesting, and bycatching in fishing gear (NOAA 2024a-e).

The combined sea turtle nesting season in Florida is March (NOAA 2024c) through October (USFWS 2020b). During the nesting season, sea turtles are very active along the beaches at CCSFS and KSC. Within the On-shore Action Area, from March through October, adult females come on shore at night, dig a hole, and lay a clutch of eggs, ranging from 100-200 eggs (number is dependent upon species). A female choosing to nest within the On-shore Action Area may lay multiple clutches in a season, and this frequency is species-dependent. After approximately two months, during the night, the hatchlings emerge from the sand and make their way towards the ocean (NOAA 2022). Ambient light can disorient hatchlings, occasionally luring them away from the ocean, and can cause adult females to make "false crawls" (i.e., when a female comes ashore but returns to the water without digging a nest). The Atlantic Ocean Action Area encompasses the offshore area that sea turtles utilize for foraging, mating, and migration.

5.15.3 Effects of the Action

The Project Area is approximately 0.4 mile from the beach. Construction is expected to occur during the day and occasionally at nighttime over approximately 3 months. Minimal construction lighting will be needed, and only during nighttime construction activity. Furthermore, USFWS-approved sea turtle lighting would be implemented during construction to minimize the potential to impact sea turtles in the On-shore Action Area. Because construction will not occur at the beach, will be intermittent and temporary, will use USFWS-approved lighting, and is not expected to materially increase the levels of activity, noise, and lighting to which turtles are currently exposed in the On-shore Action Area, potential construction impacts to sea turtles is expected to be discountable.

The Project will increase the annual number of launches and add landings to SLC-40, which will result in more frequent occurrences of related activity, noise, lighting, and vibrations. The deluge system would reduce the intensity of noise and vibrations during launch. The levels (i.e., intensity) of activity, noise, lighting, and vibrations per event are expected to be the same or similar to those that occur currently at SLC-40. It is the frequency of these occurrences, and not the intensity or duration of discrete events, which will increase.

The impacts to nesting sea turtles from vibration is unknown. It is known that movement of eggs during early developmental stages can be lethal. However, studies have illustrated that mid-incubation relocation of sea turtle nests is in fact successful in promoting embryonic survival (Ahles and Milton 2015). These studies indicate that some amount of movement (i.e., vibration) can be and is tolerated by sea turtle eggs. Vibrations also have potential to collapse nests, and possibly solidify sand around nests, potentially impacting hatchling emergence. However, sea turtle nests occurring in the On-shore Action Area during Project operations would be exposed to levels of vibration to which many historic and successful, and current, nests are exposed, but the exposure to these vibrations may be more frequent. The impacts of vibrations associated with the Project are unlikely to be greater than that of wash-overs from fluctuating tides, which is a common occurrence particularly during the hurricane season, which overlaps substantially

with the combined nesting season. Vibrations could potentially increase rates of nest erosion, accretion, or solidification; however, these rates as a result of the project are unlikely to increase materially or beyond those attributed to the impact of tidal wash-overs or significant rain events.
Lighting at night can disorient or disrupt the nesting activities of sea turtles that nest at night[1]. Sky glow resulting from nighttime lighting at the expanded SLC-40 site has potential to cause female turtles to avoid using beaches in the On-Shore Action Area (particularly those closer to the Project Area) for nesting or to false crawl if they attempt to nest and could cause emerging hatchlings to become disoriented and crawl in the wrong direction (i.e., away from the ocean) (Witherington et al. 2014). The factors contributing to false crawls are not well studied; however, some researchers have found that lower sand surface temperature and physical barriers are correlated with increased incidents of false crawls by loggerhead sea turtles in Georgia, whereas anthropogenic light pollution had no effect on nesting activity by this species (Byrd 2022). Hatchlings that become disoriented may die from exhaustion, dehydration, predation, or other causes (Witherington et al. 2014).

Nighttime launches, including artificial lighting, from SLC-40 are considered in the 2020 BA and currently occur in the Project Area (FAA 2020). During Project operation, the increased launch cadence will result in an increase in the number of discrete, and temporary, lighting events that occur in the Project Area. No additional lighting to that needed for launch operations would be needed for landings; however, artificial lighting may be needed for post-landing inspections. SpaceX would minimize potential effects from lighting on sea turtles by installing sea turtle lighting described in a Lighting Management Plan that is shared with the USFWS for review and approval and implementing the plan during post-landing inspections to minimize the potential to impact sea turtles in the On-shore Action Area.

The increase in frequency in light events is considered an adverse effect to sea turtles, with potential to cause adult females to avoid nesting on On-shore Action Area beaches or to false crawl, or cause hatchlings to become disoriented. Therefore, the Project is likely to adversely affect sea turtles.

5.15.4 Cumulative Effects

As identified in Section 5.1.12.1, main threats to sea turtles include climate change, loss or degradation of nesting habitat, disorientation of hatchlings by beachfront lighting, ocean pollution, direct harvesting, and bycatching in fishing gear. The projects identified in Section 4.3 – if they occur in or adjacent to nesting habitat – may create the same types of threats to the listed sea turtle species addressed in this BA and could result in adverse cumulative effects to the species when combined with the Project.

The Service is continually working with private and state entities to review proposed projects, offer technical assistance, and provide recommendations on avoidance and minimization measures to protect listed sea turtles addressed in this BA. By continued cooperative efforts to protect these species and their nesting habitats, the USSF does not believe that the potential cumulative effects are likely to jeopardize the continued existence of the listed sea turtles addressed in this BA.

5.15.5 Population-level Biological Consequences

With the lighting-related conservation measures enacted, which minimize effects to sea turtles, it can be reasonably anticipated there will be no population-level effects to sea turtle species.

[1] Kemp's ridley sea turtles nest during the day and adult turtles would not be affected by lighting.

5.16 Monarch Butterfly

5.16.1 Biology and Habitat

The monarch butterfly (*Danaus plexippus*) is a predominantly migratory insect with four life stages: egg, larvae, pupae, and adult (Midwest Association of Fish and Wildlife Agencies 2018). The annual migration cycle begins in the fall when individuals from the eastern population migrate south to overwintering areas in central Mexico (USFWS 2020e). Adults live for an extended period in overwintering areas until they break reproductive diapause in the early spring and begin to migrate to their breeding ranges (USFWS 2020e). Four to five generations are produced annually to complete the migration, ending with the last generation migrating back to overwintering areas (Midwest Association of Fish and Wildlife Agencies 2018).

There are three monarch butterfly populations within continental North America. Two migratory populations are located east and west of the Rocky Mountains, and a third population is a non-migratory population located in southern Florida, where the climate supports year-round breeding (USFWS 2020e). Monarch butterflies occurring in the Action Area are part of this non-migratory population.

Breeding habitat is present where milkweed (*Asclepias* spp.) plants are found. Milkweed plants, which regularly grow in disturbed soils, are the sole host plant for monarch eggs and larvae (USFWS 2020e), and the presence of milkweed plants is vital to the species throughout its breeding and migratory range (Thogmartin et al. 2017). Monarch butterflies forage on a variety of blooming nectar resources throughout their range (USFWS 2020e).

5.16.2 Environmental Baseline

USFWS designated the monarch butterfly as a candidate for listing as threatened or endangered (85 FR 81813 [December 17, 2020]). USFWS has determined that the species is warranted for listing, but that listing is precluded by higher priority actions. USFWS anticipates publishing a proposal to list in 2024 (Midwest Association of Fish and Wildlife Agencies 2018). Main threats to the species include loss and degradation of habitat from conversion of grasslands to agriculture, widespread use of herbicides, logging/thinning at overwintering sites in Mexico, urban development, and drought (85 FR 81813).

Monarch butterflies may occur throughout the Action Area year-round in suitable habitats including scrub, open fields, and roadsides (USFWS 2020e) The monarch butterfly may use suitable habitat in the Action Area.

5.16.3 Effects of the Action

The Project would permanently or temporarily modify potentially suitable for use by flying and foraging monarchs. Monarch butterflies often inhabit disturbed areas exposed to human activity (USFWS 2020e) does not identify noise or visual disturbances as a threat to monarch butterflies. Therefore, noise and visual disturbance associated with implementation of Project activities is unlikely to have measurable impacts on monarch butterflies, and SpaceX anticipates that monarch butterflies would continue to use habitat exposed to temporary disturbances related to Project construction and operation or would move to and utilize adjacent habitat.

Construction and O&M personnel would observe a reduced speed limit of 25 miles per hour while driving in the Project Area. Due to reduced speeds in the Project Area, adult monarch butterflies are expected to be able to avoid collisions with vehicles in most instances. Targeted vegetation surveys have not been conducted in the Expansion Area. However, milkweed was not documented during recent natural resources

surveys (Jones Edmunds 2023) in the area. Because no milkweed has been documented in the Expansion Area, it is considered unlikely that monarch butterfly eggs, larvae, or pupae would be present.

The USFWS issued a Conference Opinion (USFWS Reference: 2025-0024332) for the Department of Defense's 7(a)(1) Conservation Strategy for the monarch butterfly for Mission and Sustainment Operations within the continental United States. This opinion concluded that installations operating under an Installation Natural Resources Management Plan, which CCSFS does, would not jeopardize the continued existence of the monarch butterfly.

Therefore, the Project may affect, but is not likely to adversely affect monarch butterflies.

5.16.4 Cumulative Effects

The Project is not likely to adversely affect the monarch butterfly. Therefore, cumulative effects are not considered.

5.16.5 Population-level Biological Consequences

The Project is not likely to adversely affect the species. Therefore, no population-level biological consequences will occur.

6 SUMMARY AND CONCLUSIONS

The Project would increase the annual number of Falcon rocket launches at SLC-40 to up to 120 per year and result in a newly constructed landing zone for Falcon first stage boosters by SpaceX. The USSF proposes to expand the existing SLC-40 lease boundary to accommodate the construction and operation of the landing zone. The Action Area includes the area within 15 miles of the Project Area, based on the 1 psf sonic boom overpressure zone, and other areas in the Atlantic Ocean where booster landings may occur.

The IPaC indicated the portion of the Action Area within 15 miles of the Project Area overlaps with the ranges of 23 listed, proposed, and candidate species and 3 designated or proposed critical habitats. This BA considered the effects of the Project on these species and critical habitats. This BA also considered the effects of the Project on three additional listed species and one additional proposed critical habitat not included on the official species list from USFWS.

The Project would have no effect on four of the species considered (i.e., Whooping crane, Atlantic salt marsh snake, Carter's Mustard, and Lewton's Polygala) and would have no effect on any designated or proposed critical habitat.

For each of the 19 species that may be affected by the Project, Table 6-1 summarizes the effect determinations.

Table 6-1. Effect Determinations for Species Protected by the Endangered Species Act and Species Proposed or Under Review for ESA Protection

Species or Critical Habitat	Status	Effect Determination
Southeastern Beach Mouse	Threatened	May Affect, Likely to Adversely Affect
Tricolored Bat	Proposed	May Affect, Not Likely to Adversely Affect
West Indian Manatee	Threatened	May Affect, Not Likely to Adversely Affect

Audubon's Crested Caracara	Threatened	May Affect, Not Likely to Adversely Affect
Eastern Black Rail	Threatened	May Affect, Not Likely to Adversely Affect
Everglade Snail Kite	Endangered	May Affect, Not Likely to Adversely Affect
Florida Scrub-jay	Threatened	May Affect, Likely to Adversely Affect
Piping Plover	Threatened	May Affect, Not Likely to Adversely Affect
Rufa Red Knot	Threatened	May Affect, Not Likely to Adversely Affect
Wood Stork	Threatened	May Affect, Not Likely to Adversely Affect
Roseate Tern	Endangered	May Affect, Not Likely to Adversely Affect
Black-capped Petrel	Endangered	May Affect, Not Likely to Adversely Affect
Eastern Indigo Snake	Threatened	May Affect, Likely to Adversely Affect
Green Sea Turtle	Threatened	May Affect, Likely to Adversely Affect
Hawksbill Sea Turtle	Endangered	May Affect, Likely to Adversely Affect
Kemp's Ridley Sea Turtle	Endangered	May Affect, Likely to Adversely Affect
Leatherback Sea Turtle	Endangered	May Affect, Likely to Adversely Affect
Loggerhead Sea Turtle	Threatened	May Affect, Likely to Adversely Affect
Monarch butterfly	Candidate	May Affect, Not Likely to Adversely Affect

*Candidate species are not protected by the ESA and do not trigger ESA Section 7 interagency consultation. However, USSF has evaluated the effects of the action on the monarch butterfly and seeks USFWS concurrence with this determination through a voluntary informal conference process. If this species becomes listed in the future, reinitiation of consultation may be required.

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Appendix A

USFWS IPaC Report for 15-mile Sonic Boom Overpressure Zone

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Florida Ecological Services Field Office
777 37th St
Suite D-101
Vero Beach, FL 32960-3559
Phone: (352) 448-9151 Fax: (772) 562-4288
Email Address: fw4flesregs@fws.gov
https://www.fws.gov/office/florida-ecological-services

In Reply Refer To: 04/02/2024 17:34:32 UTC
Project Code: 2024-0016317
Project Name: Falcon Operations at Space Launch Complex 40

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. **Please include your Project Code, listed at the top of this letter, in all subsequent correspondence regarding this project.** Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered

species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- Migratory Birds
- Marine Mammals
- Coastal Barriers
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

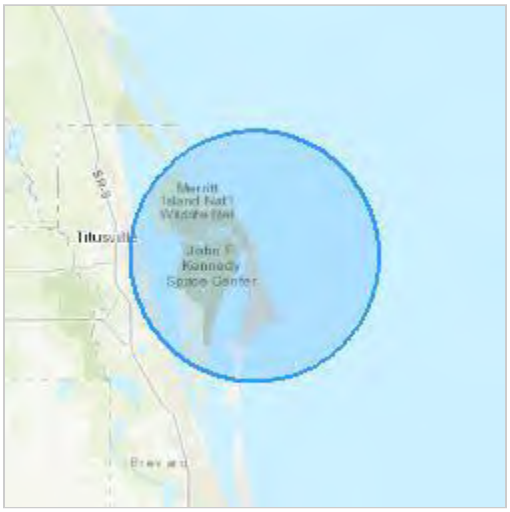
Florida Ecological Services Field Office
777 37th St
Suite D-101
Vero Beach, FL 32960-3559
(352) 448-9151

PROJECT SUMMARY

Project Code: 2024-0016317
Project Name: Falcon Operations at Space Launch Complex 40
Project Type: New Constr - Above Ground
Project Description: SpaceX proposes to expand its infrastructure at the Cape Canaveral Air Force Station's Space Launch Complex 40 (SLC-40) by constructing a new landing zone for the Falcon boosters and increase the annual Falcon 9 launches at SLC-40. The 15-mile radius area encompasses the estimated reach of the sonic boom.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@28.563217549999997,-80.57435362881762,14z



Counties: Brevard County, Florida

ENDANGERED SPECIES ACT SPECIES

There is a total of 20 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Southeastern Beach Mouse *Peromyscus polionotus niveiventris* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3951	Threatened
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered
West Indian Manatee *Trichechus manatus* There is **final** critical habitat for this species. Your location overlaps the critical habitat. ***This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.*** Species profile: https://ecos.fws.gov/ecp/species/4469	Threatened

BIRDS

NAME	STATUS
Crested Caracara (audubon""s) [fl Dps] *Caracara plancus audubonii* Population: FL DPS No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8250	Threatened
Eastern Black Rail *Laterallus jamaicensis ssp. jamaicensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10477	Threatened
Everglade Snail Kite *Rostrhamus sociabilis plumbeus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7713	Endangered
Florida Scrub-jay *Aphelocoma coerulescens* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6174	Threatened
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Rufa Red Knot *Calidris canutus rufa* There is **proposed** critical habitat for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Whooping Crane *Grus americana* Population: U.S.A. (AL, AR, CO, FL, GA, ID, IL, IN, IA, KY, LA, MI, MN, MS, MO, NC, NM, OH, SC, TN, UT, VA, WI, WV, western half of WY) No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/758	Experimental Population, Non-Essential

NAME	STATUS
Wood Stork *Mycteria americana* Population: AL, FL, GA, MS, NC, SC No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8477 General project design guidelines: https://ipac.ecosphere.fws.gov/project/YHG5ZJD2YVHFRHA7CJDBD7VMTQ/documents/generated/6954.pdf	Threatened

REPTILES

NAME	STATUS
Atlantic Salt Marsh Snake *Nerodia clarkii taeniata* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7729	Threatened
Eastern Indigo Snake *Drymarchon couperi* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/646	Threatened
Green Sea Turtle *Chelonia mydas* Population: North Atlantic DPS There is **proposed** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6199	Threatened
Hawksbill Sea Turtle *Eretmochelys imbricata* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3656	Endangered
Leatherback Sea Turtle *Dermochelys coriacea* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1493	Endangered
Loggerhead Sea Turtle *Caretta caretta* Population: Northwest Atlantic Ocean DPS There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/1110	Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

FLOWERING PLANTS

NAME	STATUS
Carter's Mustard *Warea carteri* Population: No critical habitat has been designated for this species.	Endangered

NAME	STATUS
Species profile: https://ecos.fws.gov/ecp/species/5583	
Lewton's Polygala *Polygala lewtonii* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6688	Endangered

CRITICAL HABITATS

There are 3 critical habitats wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Green Sea Turtle *Chelonia mydas* https://ecos.fws.gov/ecp/species/6199#crithab	Proposed
Loggerhead Sea Turtle *Caretta caretta* https://ecos.fws.gov/ecp/species/1110#crithab	Final
West Indian Manatee *Trichechus manatus* https://ecos.fws.gov/ecp/species/4469#crithab	Final

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

The following FWS National Wildlife Refuge Lands and Fish Hatcheries lie fully or partially within your project area:

FACILITY NAME	ACRES
MERRITT ISLAND NATIONAL WILDLIFE REFUGE https://www.fws.gov/our-facilities?$keywords="%5C%22MERRITT+ISLAND+NATIONAL+WILDLIFE+REFUGE%5C%22"	129,277.022

BALD & GOLDEN EAGLES

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider

implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

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1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

There are likely bald eagles present in your project area. For additional information on bald eagles, refer to Bald Eagle Nesting and Sensitivity to Human Activity

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Jul 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

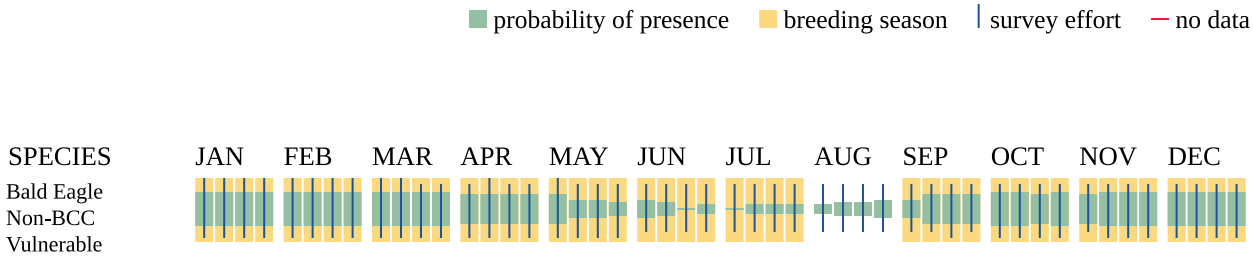
Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
American Oystercatcher *Haematopus palliatus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8935	Breeds Apr 15 to Aug 31
Audubon's Shearwater *Puffinus lherminieri* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9635	Breeds Mar 1 to Aug 5
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Sep 1 to Jul 31
Black Scoter *Melanitta nigra* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10413	Breeds elsewhere
Black Skimmer *Rynchops niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Black-capped Petrel *Pterodroma hasitata* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/4748	Breeds elsewhere
Black-legged Kittiwake *Rissa tridactyla* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10459	Breeds elsewhere
Brown Pelican *Pelecanus occidentalis* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/6034	Breeds Jan 15 to Sep 30
Chimney Swift *Chaetura pelagica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9406	Breeds Mar 15 to Aug 25

NAME	BREEDING SEASON
Common Eider *Somateria mollissima* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10457	Breeds Jun 1 to Sep 30
Common Loon *gavia immer* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/4464	Breeds Apr 15 to Oct 31
Cory's Shearwater *Calonectris diomedea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10452	Breeds elsewhere
Double-crested Cormorant *phalacrocorax auritus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/3478	Breeds Apr 20 to Aug 31
Dovekie *Alle alle* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/6041	Breeds elsewhere
Florida Burrowing Owl *Athene cunicularia floridana* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/11977	Breeds Mar 15 to Aug 31
Great Blue Heron *Ardea herodias occidentalis* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/10590	Breeds Jan 1 to Dec 31
Great Shearwater *Puffinus gravis* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/9634	Breeds elsewhere
Gull-billed Tern *Gelochelidon nilotica* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9501	Breeds May 1 to Jul 31

NAME	BREEDING SEASON
King Rail *Rallus elegans* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8936	Breeds May 1 to Sep 5
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Long-tailed Duck *Clangula hyemalis* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/7238	Breeds elsewhere
Magnificent Frigatebird *Fregata magnificens* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9588	Breeds Oct 1 to Apr 30
Manx Shearwater *Puffinus puffinus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10465	Breeds Apr 15 to Oct 31
Painted Bunting *Passerina ciris* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9511	Breeds Apr 25 to Aug 15
Pectoral Sandpiper *Calidris melanotos* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9561	Breeds elsewhere
Pomarine Jaeger *Stercorarius pomarinus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10458	Breeds elsewhere
Razorbill *Alca torda* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10461	Breeds Jun 15 to Sep 10

NAME	BREEDING SEASON
Red Phalarope *Phalaropus fulicarius* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10469	Breeds elsewhere
Red-breasted Merganser *Mergus serrator* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10693	Breeds elsewhere
Red-headed Woodpecker *Melanerpes erythrocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9398	Breeds May 10 to Sep 10
Red-necked Phalarope *Phalaropus lobatus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10467	Breeds elsewhere
Red-throated Loon *Gavia stellata* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/9589	Breeds elsewhere
Reddish Egret *Egretta rufescens* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/7617	Breeds Mar 1 to Sep 15
Ring-billed Gull *Larus delawarensis* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10468	Breeds elsewhere
Roseate Tern *Sterna dougallii* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10661	Breeds May 10 to Aug 31
Royal Tern *Thalasseus maximus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10471	Breeds Apr 15 to Aug 31

NAME	BREEDING SEASON
Ruddy Turnstone *Arenaria interpres morinella* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/10633	Breeds elsewhere
Short-billed Dowitcher *Limnodromus griseus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9480	Breeds elsewhere
Sooty Shearwater *Ardenna grisea* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10417	Breeds elsewhere
Sooty Tern *Onychoprion fuscatus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10695	Breeds Mar 10 to Jul 31
Southeastern American Kestrel *Falco sparverius paulus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/4076	Breeds Apr 1 to Aug 31
Surf Scoter *Melanitta perspicillata* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10463	Breeds elsewhere
Swallow-tailed Kite *Elanoides forficatus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8938	Breeds Mar 10 to Jun 30
Thick-billed Murre *Uria lomvia* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10700	Breeds Apr 15 to Aug 15
White-winged Scoter *Melanitta fusca* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10462	Breeds elsewhere

NAME	BREEDING SEASON
Willet *Tringa semipalmata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10669	Breeds Apr 20 to Aug 5
Wilson's Plover *Charadrius wilsonia* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9722	Breeds Apr 1 to Aug 20
Wilson's Storm-petrel *Oceanites oceanicus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10416	Breeds elsewhere
Worthington's Marsh Wren *Cistothorus palustris griseus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9560	Breeds Apr 10 to Aug 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (▪)

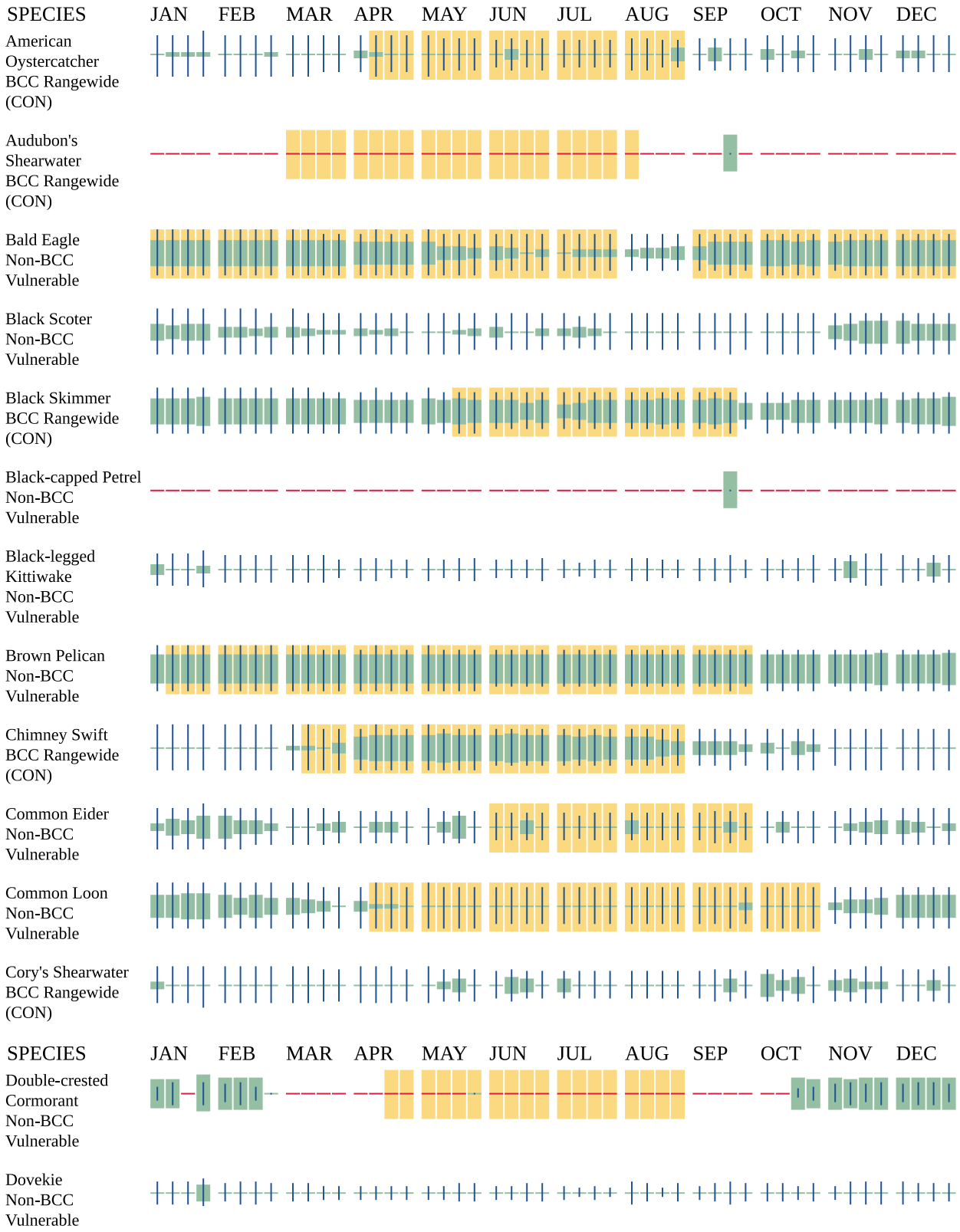
Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (▪)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

▪ probability of presence ▪ breeding season | survey effort – no data


SPECIES
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
American Oystercatcher BCC Rangewide (CON)
Audubon's Shearwater BCC Rangewide (CON)
Bald Eagle Non-BCC Vulnerable
Black Scoter Non-BCC Vulnerable
Black Skimmer BCC Rangewide (CON)
Black-capped Petrel Non-BCC Vulnerable
Black-legged Kittiwake Non-BCC Vulnerable
Brown Pelican Non-BCC Vulnerable
Chimney Swift BCC Rangewide (CON)
Common Eider Non-BCC Vulnerable
Common Loon Non-BCC Vulnerable
Cory's Shearwater BCC Rangewide (CON)
SPECIES
JAN
FEB
MAR
APR
MAY
JUN
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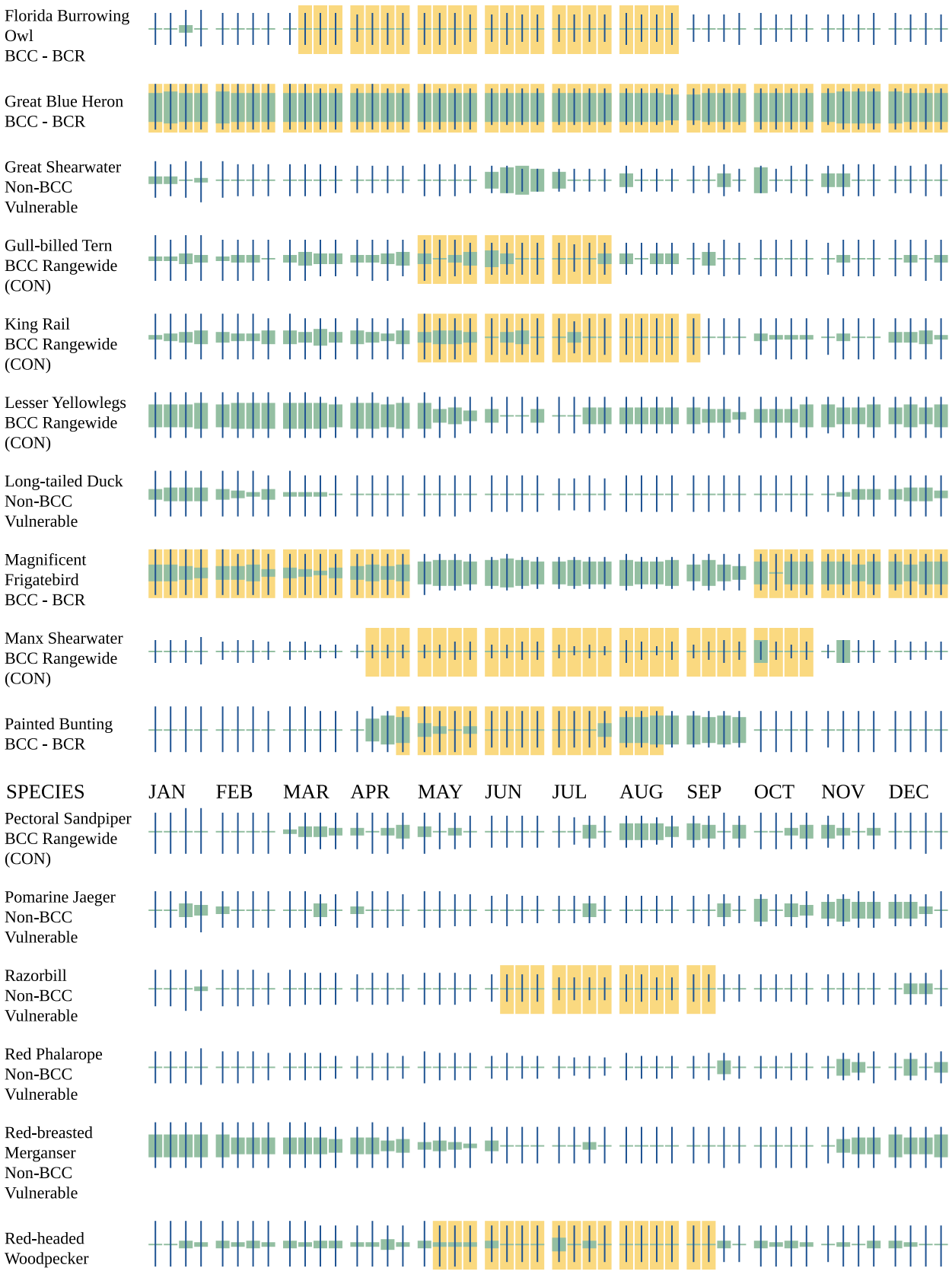
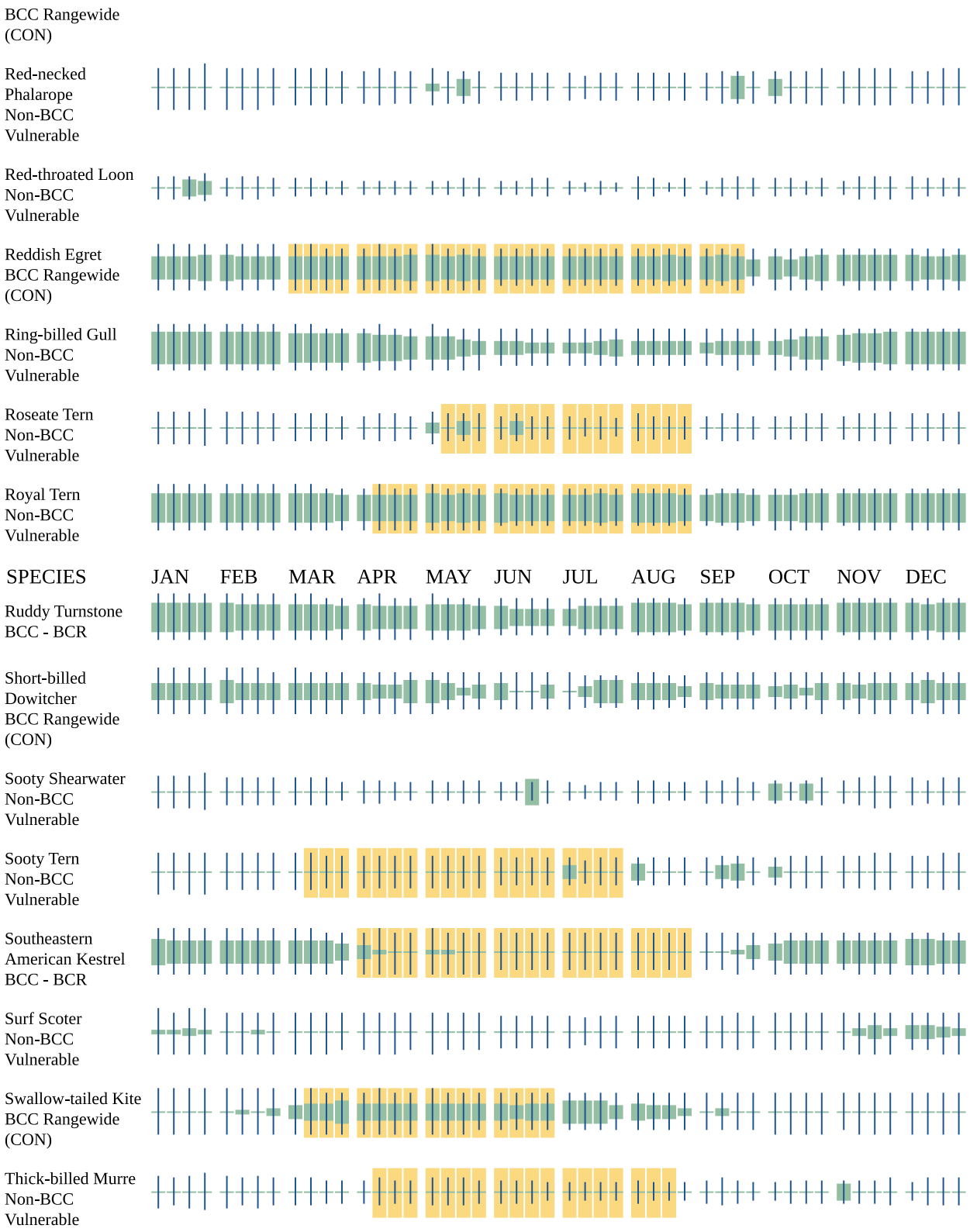
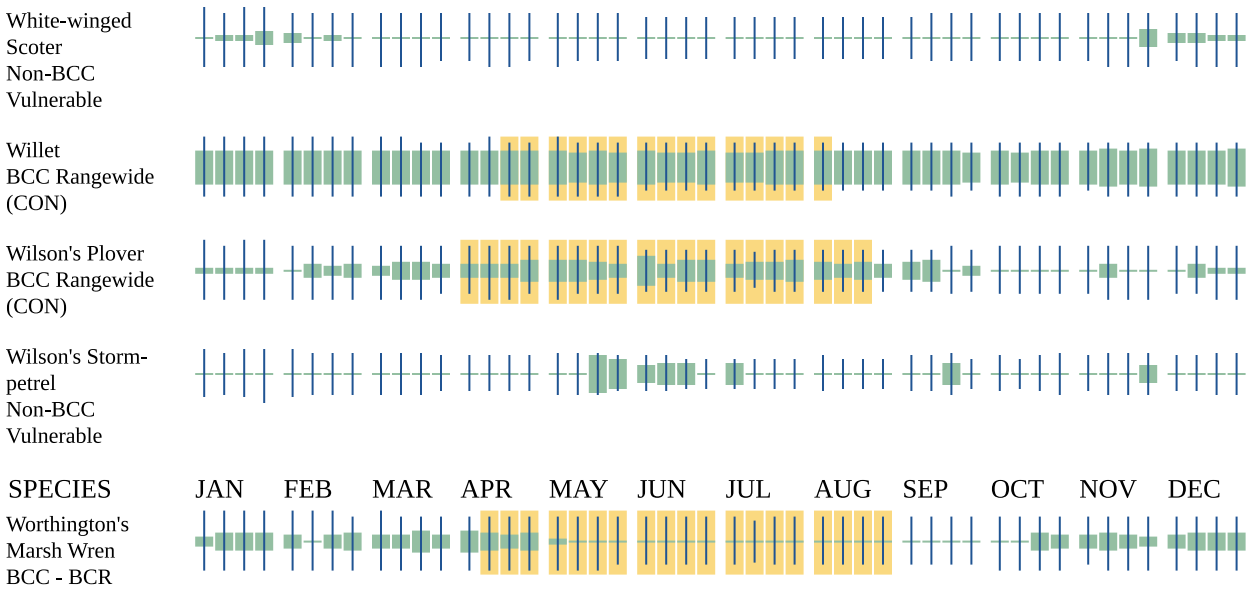
AUG
SEP
OCT
NOV
DEC
Double-crested Cormorant Non-BCC Vulnerable
Dovekie Non-BCC Vulnerable


Florida Burrowing Owl
BCC - BCR
Great Blue Heron
BCC - BCR
Great Shearwater
Non-BCC
Vulnerable
Gull-billed Tern
BCC Rangewide
(CON)
King Rail
BCC Rangewide
(CON)
Lesser Yellowlegs
BCC Rangewide
(CON)
Long-tailed Duck
Non-BCC
Vulnerable
Magnificent Frigatebird
BCC - BCR
Manx Shearwater
BCC Rangewide
(CON)
Painted Bunting
BCC - BCR
SPECIES
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Pectoral Sandpiper
BCC Rangewide
(CON)
Pomarine Jaeger
Non-BCC
Vulnerable
Razorbill
Non-BCC
Vulnerable
Red Phalarope
Non-BCC
Vulnerable
Red-breasted Merganser
Non-BCC
Vulnerable
Red-headed Woodpecker


BCC Rangewide (CON)
Red-necked Phalarope Non-BCC Vulnerable
Red-throated Loon Non-BCC Vulnerable
Reddish Egret BCC Rangewide (CON)
Ring-billed Gull Non-BCC Vulnerable
Roseate Tern Non-BCC Vulnerable
Royal Tern Non-BCC Vulnerable
SPECIES
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Ruddy Turnstone BCC - BCR
Short-billed Dowitcher BCC Rangewide (CON)
Sooty Shearwater Non-BCC Vulnerable
Sooty Tern Non-BCC Vulnerable
Southeastern American Kestrel BCC - BCR
Surf Scoter Non-BCC Vulnerable
Swallow-tailed Kite BCC Rangewide (CON)
Thick-billed Murre Non-BCC Vulnerable



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

COASTAL BARRIERS

Projects within the John H. Chafee Coastal Barrier Resources System (CBRS) may be subject to the restrictions on Federal expenditures and financial assistance and the consultation requirements of the Coastal Barrier Resources Act (CBRA) (16 U.S.C. 3501 et seq.). For more information, please contact the local Ecological Services Field Office or visit the CBRA Consultations website. The CBRA website provides tools such as a flow chart to help determine whether consultation is required and a template to facilitate the consultation process.

OTHERWISE PROTECTED AREA (OPA)

OPAs are denoted with a "P" at the end of the unit number. The only prohibition within OPAs is on Federal flood insurance. ***CBRA consultation is not required for projects within OPAs.*** *However, agencies providing disaster assistance that is contingent upon a requirement to purchase flood insurance after the fact are advised to disclose the OPA designation and*

information on the restrictions on Federal flood insurance to the recipient prior to the commitments of funds.

UNIT	NAME	TYPE	SYSTEM UNIT ESTABLISHMENT DATE	FLOOD INSURANCE PROHIBITION DATE
FL-07P	Canaveral	OPA	N/A	11/16/1991

MARINE MAMMALS

Marine mammals are protected under the Marine Mammal Protection Act. Some are also protected under the Endangered Species Act[1] and the Convention on International Trade in Endangered Species of Wild Fauna and Flora[2].

The responsibilities for the protection, conservation, and management of marine mammals are shared by the U.S. Fish and Wildlife Service [responsible for otters, walruses, polar bears, manatees, and dugongs] and NOAA Fisheries[3] [responsible for seals, sea lions, whales, dolphins, and porpoises]. Marine mammals under the responsibility of NOAA Fisheries are **not** shown on this list; for additional information on those species please visit the Marine Mammals page of the NOAA Fisheries website.

The Marine Mammal Protection Act prohibits the take of marine mammals and further coordination may be necessary for project evaluation. Please contact the U.S. Fish and Wildlife Service Field Office shown.

---

1. The Endangered Species Act (ESA) of 1973.
2. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a treaty to ensure that international trade in plants and animals does not threaten their survival in the wild.
3. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

NAME

West Indian Manatee *Trichechus manatus*
Species profile: https://ecos.fws.gov/ecp/species/4469

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

Due to your project's size, the list below may be incomplete, or the acreages reported may be inaccurate. For a full list, please contact the local U.S. Fish and Wildlife office or visit https://www.fws.gov/wetlands/data/mapper.HTML

ESTUARINE AND MARINE WETLAND

- E2ABM
- E2SS3Px
- E2FO3/1P
- E2SS3Pd
- E2SS1P
- E2USM
- E2EM1N
- E2FO1P
- E2AB3M
- E2EM1Nx6
- E2FO3P
- E2EM1P
- E2SS1/3P
- E2SS3P
- E2SS3N
- E2USP
- E2SS3Ph
- E2USPh
- E2USN
- E2EM1N6
- E2FO3N
- E2EM1P6
- E2EM1Nx
- E2SS3P6
- E2SS3/EM1P6
- E2USP6

ESTUARINE AND MARINE DEEPWATER

- E1UBL6
- E1UBLh

- E1UBLx
- E1UBLx6
- E1ABL
- E1UBL
- E1AB3L

LAKE

- L1UBHh
- L1ABV
- L1ABVh
- L1UBH
- L1ABHh

IPAC USER CONTACT INFORMATION

Agency: SWCA Environmental Consultants
Name: Jennifer Brinkworth
Address: 567 Bishop Gate Lane
City: Jacksonville
State: FL
Zip: 32204
Email jennifer.brinkworth@swca.com
Phone: 9043847020

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Space Force

Appendix B

USFWS IPaC Report for Project Area

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Florida Ecological Services Field Office
777 37th St
Suite D-101
Vero Beach, FL 32960-3559
Phone: (352) 448-9151 Fax: (772) 562-4288
Email Address: fw4flesregs@fws.gov
https://www.fws.gov/office/florida-ecological-services

In Reply Refer To: 04/02/2024 17:40:41 UTC
Project Code: 2024-0071555
Project Name: Falcon Operations at Space Launch Complex 40 (Project Area)

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. **Please include your Project Code, listed at the top of this letter, in all subsequent correspondence regarding this project.** Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered

species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- Migratory Birds
- Marine Mammals
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Florida Ecological Services Field Office
777 37th St
Suite D-101
Vero Beach, FL 32960-3559
(352) 448-9151

PROJECT SUMMARY

Project Code: 2024-0071555
Project Name: Falcon Operations at Space Launch Complex 40 (Project Area)
Project Type: New Constr - Above Ground
Project Description: SpaceX proposes to expand its infrastructure at the Cape Canaveral Space Force Station's Space Launch Complex 40 (SLC-40) by constructing a new landing zone for the Falcon boosters and increase the annual Falcon 9 launches at SLC-40. This area encompasses the extent of the Project Area.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@28.5620502,-80.57728327190091,14z

Counties: Brevard County, Florida

ENDANGERED SPECIES ACT SPECIES

There is a total of 16 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Southeastern Beach Mouse *Peromyscus polionotus niveiventris* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/3951	Threatened
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered
West Indian Manatee *Trichechus manatus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. ***This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.*** Species profile: https://ecos.fws.gov/ecp/species/4469	Threatened

BIRDS

NAME	STATUS
Crested Caracara (audubon""s) [fl Dps] *Caracara plancus audubonii* Population: FL DPS No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8250	Threatened
Eastern Black Rail *Laterallus jamaicensis ssp. jamaicensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10477	Threatened
Everglade Snail Kite *Rostrhamus sociabilis plumbeus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7713	Endangered
Florida Scrub-jay *Aphelocoma coerulescens* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6174	Threatened
Rufa Red Knot *Calidris canutus rufa* There is **proposed** critical habitat for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened

REPTILES

NAME	STATUS
Eastern Indigo Snake *Drymarchon couperi* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/646	Threatened
Green Sea Turtle *Chelonia mydas* Population: North Atlantic DPS	Threatened

NAME	STATUS

There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/6199

Hawksbill Sea Turtle *Eretmochelys imbricata* — Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/3656

Leatherback Sea Turtle *Dermochelys coriacea* — Endangered
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/1493

Loggerhead Sea Turtle *Caretta caretta* — Threatened
Population: Northwest Atlantic Ocean DPS
There is **final** critical habitat for this species. Your location does not overlap the critical habitat.
Species profile: https://ecos.fws.gov/ecp/species/1110

INSECTS

NAME	STATUS

Monarch Butterfly *Danaus plexippus* — Candidate
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/9743

FLOWERING PLANTS

NAME	STATUS

Carter's Mustard *Warea carteri* — Endangered
Population:
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/5583

Lewton's Polygala *Polygala lewtonii* — Endangered
Population:
No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/6688

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

BALD & GOLDEN EAGLES

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

---

1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

THERE ARE NO BALD AND GOLDEN EAGLES WITHIN THE VICINITY OF YOUR PROJECT AREA.

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE

SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Great Blue Heron *Ardea herodias occidentalis* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/10590	Breeds Jan 1 to Dec 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

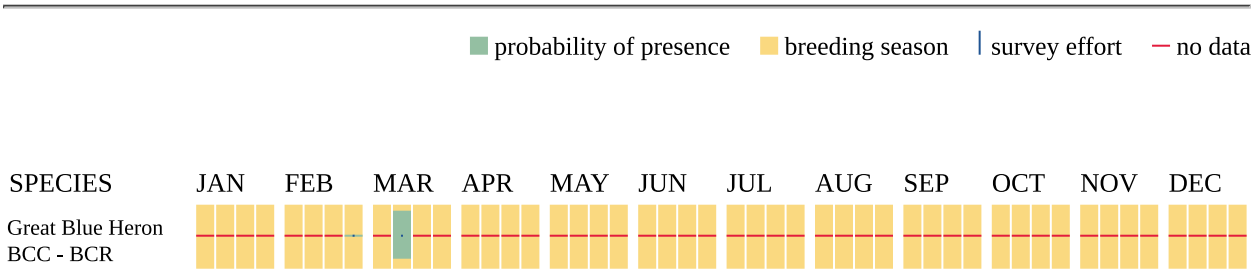
Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds

- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

MARINE MAMMALS

Marine mammals are protected under the Marine Mammal Protection Act. Some are also protected under the Endangered Species Act[1] and the Convention on International Trade in Endangered Species of Wild Fauna and Flora[2].

The responsibilities for the protection, conservation, and management of marine mammals are shared by the U.S. Fish and Wildlife Service [responsible for otters, walruses, polar bears, manatees, and dugongs] and NOAA Fisheries[3] [responsible for seals, sea lions, whales, dolphins, and porpoises]. Marine mammals under the responsibility of NOAA Fisheries are **not** shown on this list; for additional information on those species please visit the Marine Mammals page of the NOAA Fisheries website.

The Marine Mammal Protection Act prohibits the take of marine mammals and further coordination may be necessary for project evaluation. Please contact the U.S. Fish and Wildlife Service Field Office shown.

---

1. The Endangered Species Act (ESA) of 1973.
2. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a treaty to ensure that international trade in plants and animals does not threaten their survival in the wild.
3. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

NAME

West Indian Manatee *Trichechus manatus*
Species profile: https://ecos.fws.gov/ecp/species/4469

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

THERE ARE NO WETLANDS WITHIN YOUR PROJECT AREA.

IPAC USER CONTACT INFORMATION

Agency: SWCA Environmental Consultants
Name: Jennifer Brinkworth
Address: 567 Bishop Gate Lane
City: Jacksonville
State: FL
Zip: 32204
Email jennifer.brinkworth@swca.com
Phone: 9043847020

Appendix C

USFWS IPaC Report for Atlantic Ocean Action Area

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Ecological Services Field Office
3916 Sunset Ridge Rd
Raleigh, NC 27607
Phone: (919) 856-4520 Fax: (919) 856-4556

In Reply Refer To: 06/13/2024 20:18:17 UTC
Project Code: 2024-0103832
Project Name: Falcon Operations at Space Launch Complex 40 (Recovery Area)

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). If your project area contains suitable habitat for any of the federally-listed species on this species list, the proposed action has the potential to adversely affect those species. If suitable habitat is present, surveys should be conducted to determine the species' presence or absence within the project area. The use of this species list and/or North Carolina Natural Heritage program data should not be substituted for actual field surveys.

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered

species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Note: IPaC has provided all available attachments because this project is in multiple field office jurisdictions.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- Migratory Birds
- Marine Mammals
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Raleigh Ecological Services Field Office
3916 Sunset Ridge Rd
Raleigh, NC 27607
(919) 856-4520

This project's location is within the jurisdiction of multiple offices. However, only one species list document will be provided for all offices. The species and critical habitats in this document reflect the aggregation of those that fall in each of the affiliated office's jurisdiction. Other offices affiliated with the project:

Florida Ecological Services Field Office
777 37th St
Suite D-101
Vero Beach, FL 32960-3559
(352) 448-9151

Georgia Ecological Services Field Office
355 East Hancock Avenue
Room 320
Athens, GA 30601-2523
(706) 460-7161

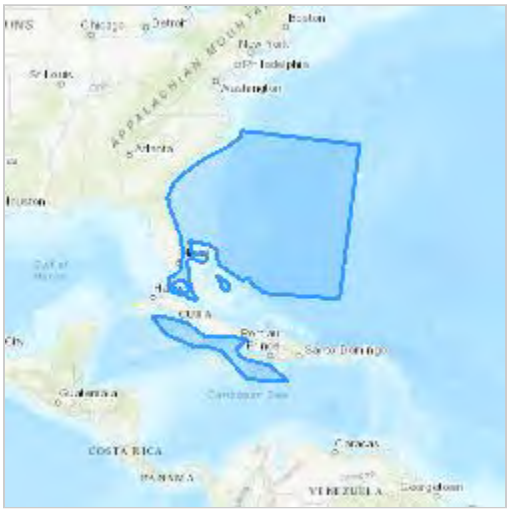
South Carolina Ecological Services
176 Croghan Spur Road, Suite 200
Charleston, SC 29407-7558
(843) 727-4707

PROJECT SUMMARY

Project Code: 2024-0103832
Project Name: Falcon Operations at Space Launch Complex 40 (Recovery Area)
Project Type: New Constr - Above Ground
Project Description: SpaceX proposes to expand its infrastructure at the Cape Canaveral Space Force Station's Space Launch Complex 40 (SLC-40) by constructing a new landing zone for the Falcon boosters and increase the annual Falcon 9 launches at SLC-40. The additional offshore action area encompassed here represent the fairing recovering areas in the Atlantic Ocean.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@29.2834175,-73.07577306701289,14z



Counties: Navassa County, US Minor Outlying Islands

ENDANGERED SPECIES ACT SPECIES

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Note that 2 of these species should be considered only under certain conditions.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ This species only needs to be considered if the project includes wind turbine operations. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. This species only needs to be considered under the following conditions: ▪ This species only needs to be considered if the project includes wind turbine operations. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered
West Indian Manatee *Trichechus manatus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. ***This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.*** Species profile: https://ecos.fws.gov/ecp/species/4469	Threatened

BIRDS

NAME	STATUS
Black-capped Petrel *Pterodroma hasitata* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4748	Endangered
Roseate Tern *Sterna dougallii dougallii* Population: Northeast U.S. nesting population No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2083	Endangered

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

The following FWS National Wildlife Refuge Lands and Fish Hatcheries lie fully or partially within your project area:

FACILITY NAME	ACRES
NAVASSA ISLAND NATIONAL WILDLIFE REFUGE https://www.fws.gov/our-facilities?$keywords="%5C%22NAVASSA+ISLAND+NATIONAL+WILDLIFE+REFUGE%5C%22"	384,029.807

BALD & GOLDEN EAGLES

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

THERE ARE NO BALD AND GOLDEN EAGLES WITHIN THE VICINITY OF YOUR PROJECT AREA.

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Audubon's Shearwater *Puffinus lherminieri* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9635	Breeds Mar 1 to Aug 5
Band-rumped Storm-petrel *Hydrobates castro* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/1226	Breeds elsewhere
Black Scoter *Melanitta nigra* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10413	Breeds elsewhere
Black-capped Petrel *Pterodroma hasitata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/4748	Breeds elsewhere
Brown Pelican *Pelecanus occidentalis* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/6034	Breeds Jan 15 to Sep 30
Common Loon *gavia immer* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/4464	Breeds Apr 15 to Oct 31
Cory's Shearwater *Calonectris diomedea* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10452	Breeds elsewhere
Double-crested Cormorant *phalacrocorax auritus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/3478	Breeds Apr 20 to Aug 31
Dovekie *Alle alle* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/6041	Breeds elsewhere

NAME	BREEDING SEASON
Great Shearwater *Puffinus gravis* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/9634	Breeds elsewhere
Great Skua *Stercorarius skua* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10697	Breeds elsewhere
Magnificent Frigatebird *Fregata magnificens* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9588	Breeds elsewhere
Manx Shearwater *Puffinus puffinus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10465	Breeds Apr 15 to Oct 31
Pomarine Jaeger *Stercorarius pomarinus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10458	Breeds elsewhere
Razorbill *Alca torda* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10461	Breeds Jun 15 to Sep 10
Red Phalarope *Phalaropus fulicarius* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10469	Breeds elsewhere
Red-breasted Merganser *Mergus serrator* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10693	Breeds elsewhere
Red-necked Phalarope *Phalaropus lobatus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10467	Breeds elsewhere

NAME	BREEDING SEASON
Ring-billed Gull *Larus delawarensis* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10468	Breeds elsewhere
Roseate Tern *Sterna dougallii* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10661	Breeds May 10 to Aug 31
Royal Tern *Thalasseus maximus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10471	Breeds Apr 15 to Aug 31
Sooty Shearwater *Ardenna grisea* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10417	Breeds elsewhere
Sooty Tern *Onychoprion fuscatus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10695	Breeds Mar 10 to Jul 31
South Polar Skua *Stercorarius maccormicki* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10699	Breeds elsewhere
White-winged Scoter *Melanitta fusca* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10462	Breeds elsewhere
Wilson's Storm-petrel *Oceanites oceanicus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/10416	Breeds elsewhere

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

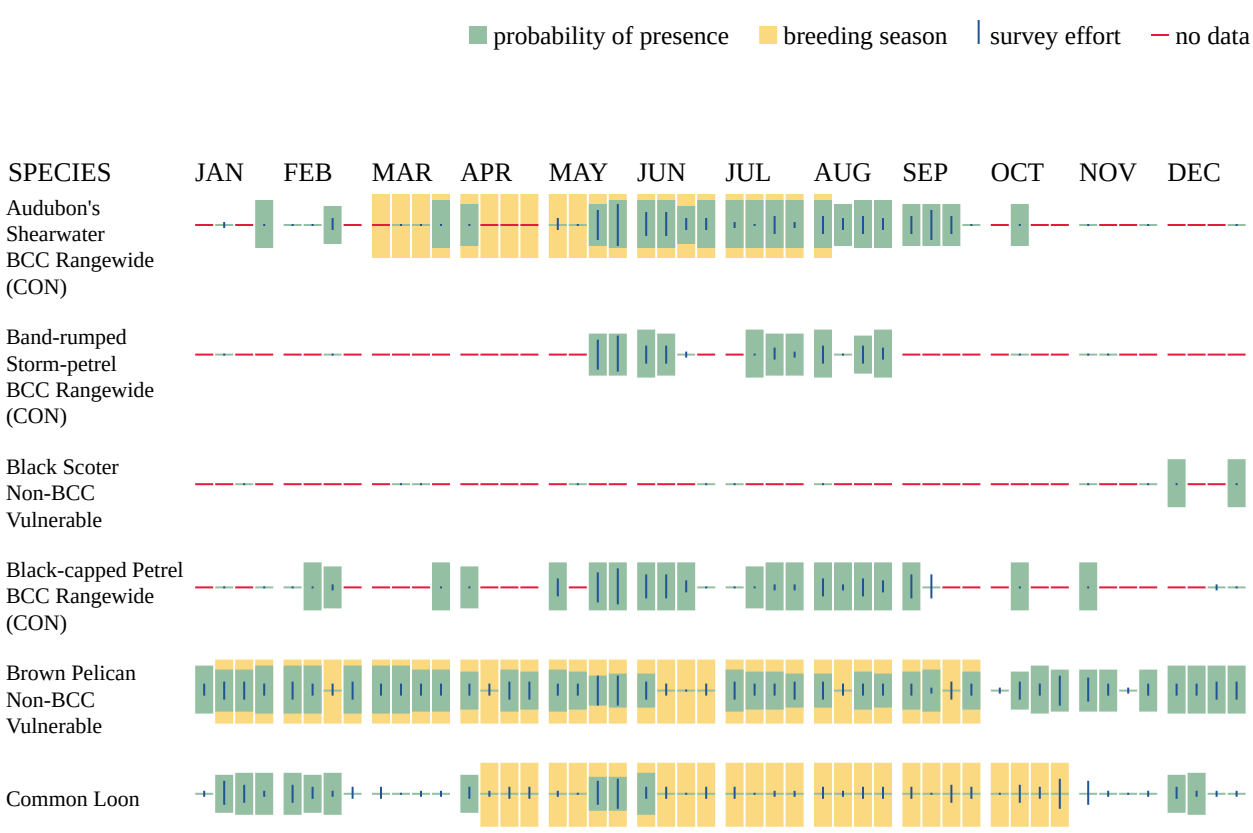
Probability of Presence (■)

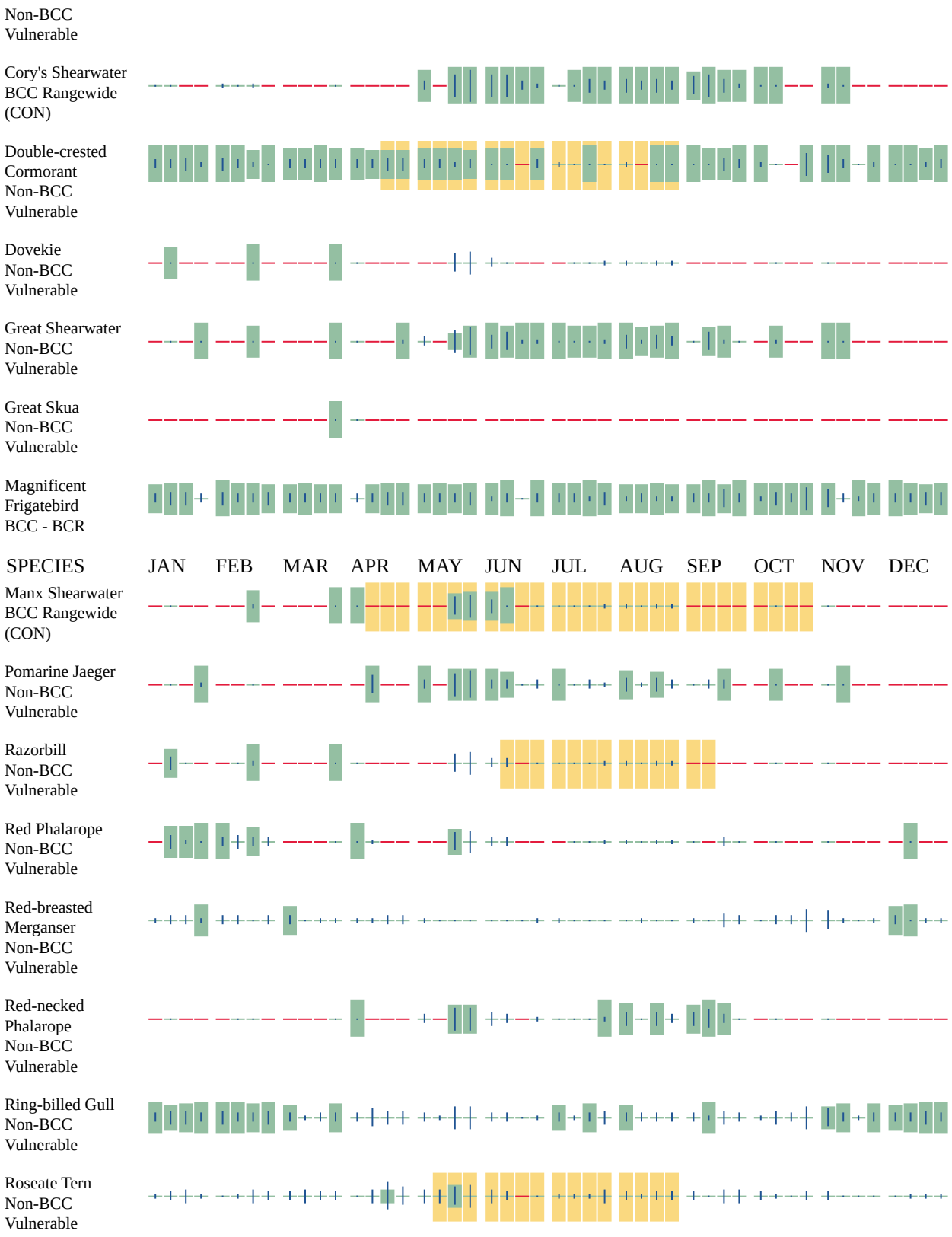
Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.




Non-BCC Vulnerable
Cory's Shearwater BCC Rangewide (CON)
Double-crested Cormorant Non-BCC Vulnerable
Dovekie Non-BCC Vulnerable
Great Shearwater Non-BCC Vulnerable
Great Skua Non-BCC Vulnerable
Magnificent Frigatebird BCC - BCR
SPECIES
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Manx Shearwater BCC Rangewide (CON)
Pomarine Jaeger Non-BCC Vulnerable
Razorbill Non-BCC Vulnerable
Red Phalarope Non-BCC Vulnerable
Red-breasted Merganser Non-BCC Vulnerable
Red-necked Phalarope Non-BCC Vulnerable
Ring-billed Gull Non-BCC Vulnerable
Roseate Tern Non-BCC Vulnerable

Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

MARINE MAMMALS

Marine mammals are protected under the Marine Mammal Protection Act. Some are also protected under the Endangered Species Act[1] and the Convention on International Trade in Endangered Species of Wild Fauna and Flora[2].

The responsibilities for the protection, conservation, and management of marine mammals are shared by the U.S. Fish and Wildlife Service [responsible for otters, walruses, polar bears, manatees, and dugongs] and NOAA Fisheries[3] [responsible for seals, sea lions, whales, dolphins, and porpoises]. Marine mammals under the responsibility of NOAA Fisheries are **not** shown on this list; for additional information on those species please visit the Marine Mammals page of the NOAA Fisheries website.

The Marine Mammal Protection Act prohibits the take of marine mammals and further coordination may be necessary for project evaluation. Please contact the U.S. Fish and Wildlife Service Field Office shown.

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1. The Endangered Species Act (ESA) of 1973.
2. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a treaty to ensure that international trade in plants and animals does not threaten their survival in the wild.
3. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

NAME

West Indian Manatee *Trichechus manatus*
Species profile: https://ecos.fws.gov/ecp/species/4469

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

WETLAND INFORMATION WAS NOT AVAILABLE WHEN THIS SPECIES LIST WAS GENERATED. PLEASE VISIT HTTPS://WWW.FWS.GOV/WETLANDS/DATA/MAPPER.HTML OR CONTACT THE FIELD OFFICE FOR FURTHER INFORMATION.

IPAC USER CONTACT INFORMATION

Agency: SWCA Environmental Consultants
Name: Jennifer Brinkworth
Address: 567 Bishop Gate Lane
City: Jacksonville
State: FL
Zip: 32204
Email jennifer.brinkworth@swca.com
Phone: 9043847020

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
Silver Spring, Maryland 20910

1/31/22

Refer to NMFS No: OPR-2021-02908

Michelle Murray
Manager, Operations Support Branch (A), ASA-140
FAA Office of Commercial Space Transportation
800 Independence Ave SW, Suite 325
Washington, DC 20591

RE: Programmatic Concurrence Letter for Launch and Reentry Vehicle Operations in the Marine Environment and Starship/Super Heavy Launch Vehicle Operations at SpaceX's Boca Chica Launch Site, Cameron County, TX

Dear Ms. Murray:

On August 25, 2021, the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) Endangered Species Act (ESA) Interagency Cooperation Division received a request for concurrence with the Federal Aviation Administration's (FAA) determination that launch and reentry vehicle operations in the marine environment may affect, but are not likely to adversely affect ESA-listed species or designated critical habitat under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.). On August 11, 2021, the FAA submitted a consultation request letter to the ESA Interagency Cooperation Division seeking concurrence on their determination that issuing experimental permits and/or a Vehicle Operator License that would allow SpaceX to launch the Starship/Super Heavy from the Boca Chica (Cameron County, TX) Launch Site may affect, but are not likely to adversely affect ESA-listed species or designated critical habitat. Because of the similarities in the two proposed actions, NMFS decided to batch the two consultations into a single programmatic letter of concurrence. This response to your consultation requests was prepared by NMFS pursuant to section 7(a)(2) of the ESA, implementing regulations at (50 CFR §402), and agency guidance for preparation of letters of concurrence.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with agency guidelines issued under section 515 of the Treasury and General Government Appropriations Act of 2001 (Data Quality Act; 44 U.S.C. 3504(d)(1) and 3516). A complete record of this informal consultation is on file at NMFS Office of Protected Resources in Silver Spring, Maryland.

CONSULTATION HISTORY

Because of the history of the FAA requesting individual consultations for different components of space launches and reentries, NMFS proposed a programmatic consultation focused on commercial space launches and reentries to the FAA in March 2018. The FAA agreed to a programmatic approach to combine space launches and reentries into a single consultation. The

National Aeronautics and Space Administration (NASA) and the U.S. Space Force (USSF) are included as federal action agencies in this programmatic consultation due to their involvement with commercial space launch operations that are part of the proposed action, such as leasing launch complexes and launch-related infrastructure to commercial launch operators.

The FAA submitted a consultation request letter to the ESA Interagency Cooperation Division on August 11, 2021, seeking concurrence on their effects determination for the proposed issuance of experimental permits and/or a Vehicle Operator License that would allow SpaceX to launch the Starship/Super Heavy from the Boca Chica (Cameron County, TX) Launch Site. NMFS ESA Interagency Cooperation Division decided to combine the two consultations into a single programmatic letter of concurrence. Programmatic ESA section 7 consultations allow the Services to consult on the effects of programmatic actions such as: (1) multiple similar, frequently occurring or routine actions expected to be implemented in particular geographic areas; and (2) a proposed program, plan, policy, or regulation providing a framework for future actions (50 C.F.R. §402.02).

The history of this consultation is as follows:

- During early coordination and technical assistance, the FAA submitted a draft Programmatic Biological Evaluation (BE) to NMFS on February 25, 2021, to solicit review and comments. The ESA Interagency Cooperation Division subsequently distributed the draft BE to NMFS regional offices for review. NMFS comments on the BE were combined and provided to the FAA on June 4, 2021.
- The FAA provided a revised BE to NMFS on August 25, 2021. The revised BE was reviewed by ESA Interagency Cooperation Division staff and sent to the NMFS regional offices. NMFS provided the FAA with questions following review of the revised BE on September 13, 2021. FAA provided responses on October 13, 2021. NMFS had additional questions regarding these responses, which were sent to the FAA on October 18, 2021, and the FAA responded on October 22, 2021.
- The SpaceX concurrence request letter was subsequently distributed to NMFS regional offices for review by the ESA Interagency Cooperation Division. NMFS comments on the letter were combined and provided to the FAA on September 15, 2021. The FAA provided responses on November 4, 2021, that included a revised letter and an expanded action area in the Gulf of Mexico for the consultation.
- On October 15, 2021, the ESA Interagency Cooperation Division staff requested a meeting with the FAA to discuss combing the Starship-Super Heavy proposed activities with the programmatic launch and reentry vehicle operations consultation. The meeting occurred on November 5, 2021, and, due to the significant overlap of proposed activities, action areas and effects analysis, NMFS and the FAA agreed to incorporate the Starship-Super Heavy consultation into the programmatic launch and reentry vehicle operations consultation.

The FAA, NASA, the USSF, and the U.S. Air Force (USAF) prior to the creation of USSF, have completed informal consultations with NMFS for the types of activities included in this programmatic consultation.

Previous consultations for the activities included in this programmatic consultation include:

- **SER-2016-17894:** On April 11, 2016, the FAA, USAF and NASA submitted a request for concurrence under ESA section 7 to NMFS's Southeast Regional Office (SERO) for SpaceX launch operations occurring from Cape Canaveral, Kennedy Space Center, and the SpaceX Texas Launch Site (now referred to as the SpaceX Boca Chica Launch Site), and launch recovery operations occurring in open waters in the Atlantic Ocean and Gulf of Mexico. On August 8, 2016, NMFS issued a Letter of Concurrence for those proposed activities.
- **FPR-2017-9231:** After concluding the 2016 consultation, SpaceX informed the FAA that parafoils and parachutes associated with the payload fairings that descend through the Earth's atmosphere and land in the Atlantic Ocean after a launch might not be fully recovered by SpaceX. The FAA also learned the parachutes associated with other spacecraft (e.g., Dragon) reentry were not always recovered. These aspects of the project were not considered in the 2016 consultation because it was assumed all parachutes and parafoils would be fully recovered. SpaceX also proposed to conduct Falcon 9 launch vehicle and Dragon spacecraft recovery operations in the Pacific Ocean, which were not addressed in the 2016 consultation. Actions in the Pacific Ocean include recovery of parafoils and parachutes associated with payload fairings and the Dragon spacecraft. On June 7, 2017, via conference call, staff from the FAA, USAF, NASA, and NMFS Protected Resources staff (from Headquarters and SERO) discussed ongoing operations and ESA coverage needs for future operations. The parties mutually agreed that NMFS ESA Interagency Cooperation Division would complete the ESA section 7 consultation for the expanded operations. On October 2, 2017, NMFS issued a Letter of Concurrence for SpaceX's proposed launch and recovery operations in the Atlantic Ocean, Gulf of Mexico, and Pacific Ocean.
- **SER-2018-19649 and FPR-2018-9287:** On October 15, 2018, the FAA reinitiated ESA consultation with NMFS (Headquarters and SERO) to consider the effects to the giant manta ray (*Manta birostris*) and the oceanic whitetip shark (*Carcharhinus lonigmanus*) because these species were federally listed subsequent to the 2016 and 2017 consultations. On November 21, 2018 and November 30, 2018, NMFS SERO and NMFS Headquarters, respectively, issued Letters of Concurrence.
- **OPR-2020-00268:** On October 7, 2019, the FAA reinitiated ESA consultation with NMFS (Headquarters) because SpaceX expanded their proposed launch trajectories to include a southern trajectory for payloads requiring polar orbits. The change expanded the action area for which Falcon first stage booster return and recovery operations in the Atlantic Ocean could occur. On February 26, 2020, NMFS Headquarters issued a Letter of Concurrence.

The purpose of this programmatic consultation is to streamline the FAA's, USSF's, and NASA's compliance with ESA section 7 for the actions as described in the *Proposed Action* section of this letter. This programmatic consultation includes all the project-specific activities evaluated in the above-mentioned consultations (including the environmental protection measures) and expands upon them to enable application to future launch projects or operations. Thus, this programmatic consultation supersedes the above-mentioned consultations.

Office of National Marine Sanctuaries

If a federal agency finds that a proposed action is likely to injure National Marine Sanctuary resources, the agency is required to consult with the NOAA Office of National Marine Sanctuaries (ONMS). The ESA Interagency Cooperation Division provided the Programmatic BE and the Starship Super Heavy concurrence request letter to ONMS on October 1, 2021, to determine if consultations would be needed for the proposed activities. The ONMS responded on October 12, 2021, stating that a permit might be needed if any material is expected to make its way into a sanctuary. The FAA determined none of the proposed activities are expected to occur within sanctuaries.

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) requires that an incidental take authorization be obtained for the unintentional "take" of marine mammals (e.g., by harassment) incidental to otherwise lawful activities. The action agencies and/or their commercial space partners are required to apply for an MMPA authorization from the NMFS Office of Protected Resources, Permits and Conservation Division, if their activities could subject marine mammals to "take" as defined by the MMPA.

PROPOSED ACTION AND ACTION AREA

Agency Action Overview

The FAA, USSF, and NASA prepared the Programmatic BE to address the potential effects of the following federal actions on ESA-listed species and designated critical habitat:

1) FAA's action of issuing licenses or permits to commercial space applicants in general practice, and specifically for SpaceX Starship-Super Heavy operations launched from Boca Chica;
2) USSF's (Space Launch Delta [SLD] 30 and 45) action of conducting launch operations from Cape Canaveral Space Force Station (CCSFS) and Vandenberg Space Force Base (VSFB)[1], including the action of leasing launch complexes to commercial launch operators; and
3) NASA's action of conducting launch, landing, and recovery operations from Kennedy Space Center (KSC) and Wallops Flight Facility (WFF), including the action of leasing launch complexes and launch-related infrastructure to commercial launch operators.

The following subsections provide an overview of the FAA's, USSF's, and NASA's missions pertaining to this consultation.

Federal Aviation Administration

The FAA Office of Commercial Space Transportation oversees, licenses, and regulates U.S. commercial launch and reentry activity, as well as the operation of non-federal launch and reentry sites, as authorized by the Commercial Space Launch Act of 1984, as amended and codified at 51 U.S.C. 50901–50923. An FAA license or permit is required for any commercial launch or reentry, or the operation of any commercial launch or reentry site, by U.S. citizens anywhere in the world, or by any individual or entity within the United States. An FAA license

[1] With the creation of the USSF, Cape Canaveral Air Force Station and Vandenberg Air Force Base were renamed Cape Canaveral Space Force Station and Vandenberg Space Force Base. The 30th and 45th Space Wings were renamed Space Launch Delta (SLD) 30 and 45.

or permit is not required for launch or reentry activities carried out by the federal government, such as NASA or Department of Defense (DoD) launches. The FAA licensing and permitting evaluation consists of five major components: 1) a policy review, 2) a payload review, 3) a safety review, 4) a determination of maximum probable loss for establishing financial responsibility requirements, and 5) an environmental review.
The FAA defines a 'launch vehicle' as a vehicle built to operate in, or place a payload in, outer space, or a suborbital rocket. The FAA defines a 'reentry vehicle' as a vehicle designed to return from Earth orbit or outer space to Earth substantially intact. The FAA issues licenses or permits to commercial launch vehicle operators (referred to as vehicle operators or launch operators) for operation of launch and reentry vehicles. The same vehicle operators may also conduct operations for NASA or DoD. Additionally, NASA and DoD may conduct launches and/or reentries of launch and reentry vehicles that were built by the federal government.

The FAA Office of Commercial Space Transportation issues the following types of licenses and permits, in accordance with Title 14, Code of Federal Regulations (CFR) parts 420, 437, and 450:

- **Launch Site Operator License** (14 CFR Part 420): A license to operate a launch site authorizes a licensee to offer its launch site to a launch operator (i.e., a person or company conducting the launch of a launch vehicle and any payload) for each launch point, launch vehicle type, and weight class identified in the license application and upon which the licensing determination is based. Examples of launch site operators include airports and state or local governments. Examples of launch operators include companies such as SpaceX, Blue Origin, Firefly, Rocket Lab, Northrop Grumman, Virgin Orbit, and United Launch Alliance. Issuance of a launch site operator license does not relieve a licensee of its obligation to comply with any other laws or regulations, nor does it confer any proprietary, property, or exclusive rights in the use of airspace or outer space. A launch site operator license remains in effect for 5 years from the date of issuance unless surrendered, suspended, or revoked before the expiration of the term and is renewable upon application by the licensee. Actual launches cannot occur from a launch site until a launch operator receives a vehicle operator license for the site.
- **Vehicle Operator License** (14 CFR Part 450):A vehicle operator license authorizes a licensee to conduct one or more launches or reentries using the same vehicle or family of vehicles. Launch includes the flight of a launch vehicle and pre- and post-flight ground operations. Reentry includes activities conducted in Earth orbit or outer space to determine reentry readiness and that are critical to ensuring public health and safety and the safety of property during reentry flight. Reentry also includes activities necessary to return the reentry vehicle, or vehicle component, to a safe condition on the ground after impact or landing.
- **Experimental Permits** (14 CFR Part 437): An experimental permit authorizes launch or reentry of a reusable suborbital rocket. The authorization includes pre- and post-flight ground operations. A suborbital rocket is a vehicle, rocket-propelled in whole or in part, intended for flight on a *suborbital* trajectory. A permit is an alternative to licensing and is valid for a one-year renewable term.
- **SpaceX Starship-Super Heavy, Boca Chica:** SpaceX must obtain an experimental permit or launch vehicle operator license from the FAA for Starship (spacecraft)-Super

Heavy (rocket booster) launch and reentry operations that originate from the Boca Chica Launch Site. SpaceX proposed launch operations include suborbital and orbital launches.

U.S. Space Force

The USSF is the lease or license holder for the real property and ranges where launches occur from CCSFS and VSFB. The USSF uses its own launch and reentry vehicles, as well as those of commercial launch operators, to launch USSF payloads into space.

- **Space Launch Delta 45:** SLD 45 is responsible for overseeing the preparation and launching of U.S. government, civil, and commercial satellites from CCSFS, Florida, and operates the Eastern Range for the USSF. SLD 45 also provides launch facilities and services to support NASA and commercial space operations. A directive of the USSF is to provide efficient means of executing national security and military policy goals. The Eastern Range operations provide the resources and activities for safe flight, range instrumentation, infrastructure, and schedule to support space and ballistic launches. The Eastern Range consists of tracking stations at CCSFS, mainland annexes, and downrange tracking stations on islands located in the Caribbean Sea and South Atlantic Ocean. SLD 45 is the primary missile and rocket launch organization for the USSF on the east coast of the United States.
- **Space Launch Delta 30:** SLD 30 at VSFB is the Air Force Space Command organization responsible for DoD space and missile launch activities on the west coast of the United States. The primary mission of VSFB is to launch and track satellites destined for polar or near-polar orbit, test and evaluate America's Intercontinental Ballistic Missile systems, and support aircraft operations. SLD 30 supports West Coast launch activities for the DoD (including USAF and Missile Defense Agency), NASA, foreign nations, and various private contractors.

National Aeronautics and Space Administration

The National Aeronautics and Space Act is the U.S. federal statute that created NASA. The Space Act gives NASA the responsibility for planning, directing, and conducting the nation's civilian space program, aeronautics and aerospace research activities. It also gives NASA the authorization to enter into cooperative agreements, leases, and contracts with public and private entities in the use of NASA's services, equipment, and facilities in support of scientific research and discovery.

- **Kennedy Space Center:** Established in 1962 as the NASA Launch Operations Center, KSC has carried out launch operations for the Apollo, Skylab, Space Shuttle, and cargo and crewed launches to the International Space Station. KSC is NASA's only launch site for human spaceflight. KSC's mission is to function as a multi-user spaceport for launch operations operated by NASA and a growing number of private partners. In addition to providing all aspects of launch, landing, and recover operations for both government and commercial launch providers, KSC also provides payload processing, testing, and integration for government and commercial partners at facilities across KSC. KSC is located adjacent to CCSFS and the two entities work closely together to execute their missions, sharing resources, facilities, and infrastructure.
  KSC's launch complexes consist of Launch Complex 39A and 39B, Launch Complex 48, and the Shuttle Landing Facility. KSC also has land identified for up to two additional launch complexes for potential future development. In anticipation of missions to the

moon and Mars, KSC will facilitate further research, development, and diverse partnerships to develop, integrate, and sustain space systems. Launch Complex 39A is designated as a multi-use complex that will support the NASA Space Launch System launch vehicle and the Orion crew capsule for manned missions beyond low Earth orbit. Launch Complex 39A is operated by SpaceX and supports Falcon vehicle launch operations with potential plans to support future SpaceX launch vehicle operations. Launch Complex 48 is a small class vehicle pad that is being developed to support commercial launches.

- **Wallops Flight Facility:** NASA Goddard Space Flight Center manages WFF, the oldest active launch range in the continental United States and the only rocket testing and launch range owned and operated by NASA. For over 70 years, WFF has flown thousands of research vehicles in the quest for information on the flight characteristics of launch vehicles and spacecraft, and to increase the knowledge of the Earth's upper atmosphere and the near space environment. The primary purpose of the WFF launch range is to provide the infrastructure, data services, logistics, and safety services necessary for flight projects supporting NASA science, technology, and exploration programs; DoD research and other government agency needs; and academic and commercial industry needs. WFF regularly provides launch support, range safety, and downrange tracking for the emerging commercial launch industry, either directly or through the Mid-Atlantic Regional Spaceport, which is a commercial launch site on Wallops Island licensed by the FAA and operated by the Virginia Commercial Space Flight Authority (Virginia Space). The Spaceport provides facilities and services for NASA, DoD, and commercial launches of payloads into space.

Launch Sites

USSF launches occur at CCSFS and VSFB. NASA launches occur at KSC and WFF. Commercial space launches are currently authorized to occur at several launch sites, including sites at CCSFS, VSFB, KSC, and WFF.[2] Existing launch sites that involve operations in the marine environment are listed in Table 1. The FAA, USSF, and/or NASA might receive proposals in the future for launch operations involving operations in the marine environment at other existing launch sites or new launch sites. Upon receipt of a new proposal that involves operations in the marine environment, the lead action agency will review the proposal and coordinate with NMFS to determine if the proposed launch operations fall within the scope of this consultation (see *Project Specific Review* for details).

Table 1. Launch Sites with Operations in the Marine Environment

Launch Site	FAA-License	Location	Site Operator	Type of Launch (Vertical or Horizontal)[a]
Cecil Airport	Yes	Jacksonville, FL	Jacksonville Aviation Authority	Horizontal
CCSFS (multiple launch and landing complexes)	No	Cape Canaveral, FL	U.S. Space Force	Vertical

[2] See the FAA's website for a current list of active licenses: https://www.faa.gov/data_research/commercial_space_data/licenses/.

Launch Site	FAA-License	Location	Site Operator	Type of Launch (Vertical or Horizontal)[a]
CCSFS Skid Strip	No	Cape Canaveral, FL	U.S. Space Force	Horizontal
CCSFS LC-46	Yes	Cape Canaveral, FL	Space Florida	Vertical
Ellington Airport	Yes	Houston, TX	Houston Airport System	Horizontal
Mojave Air and Space Port	Yes	Mojave, CA	Mojave Air & Space Port	Horizontal
NASA KSC (except SLF)	No	Merritt Island, FL	NASA	Vertical
NASA KSC SLF	Yes	Merritt Island, FL	Space Florida	Horizontal
NASA WFF (except LC-0)	No	Wallops Island, VA	NASA	Both
NASA WFF LC-0 (referred to as MARS)	Yes	Wallops Island, VA	Virginia Commercial Space Flight Authority	Vertical
NASA WFF Main Base	Yes	Wallops Island, VA	NASA	Horizontal
Pacific Spaceport Complex Alaska	Yes	Kodiak Island, AK	Alaska Aerospace Development Corporation	Vertical
Space Coast Regional Airport	Yes	Titusville, FL	Titusville-Cocoa Airport Authority	Horizontal
SpaceX Boca Chica Launch Site	No[b]	Brownsville, TX	SpaceX	Vertical
VSFB (multiple launch and landing complexes)	No	Vandenberg, CA	U.S. Space Force	Vertical

[a] Vertical = the launch vehicle takes off vertically from a launch pad (i.e., a traditional rocket launch); Horizontal = the launch vehicle takes off horizontally from a runway like an aircraft.
[b] SpaceX is the exclusive user of the Boca Chica Launch Site and therefore only need a vehicle operator license to launch.
AK = Alaska; CA = California; CCSFS = Cape Canaveral Space Force Station; FL = Florida; KSC = Kennedy Space Center; LC = Launch Complex; MARS = Mid-Atlantic Regional Spaceport; NASA = National Aeronautics and Space Administration; SLF = Shuttle Landing Facility; TX = Texas; VA = Virginia; VSFB = Vandenberg Space Force Base; WFF = Wallops Flight Facility

Launch Vehicles

A launch vehicle is a vehicle built to operate in, or place a payload in, outer space, or it is a suborbital rocket. Launch vehicles are commonly termed rockets. Launch vehicles take off either vertically from a launch pad or horizontally from a runway.

Currently, all of the vertical launch vehicles included in this consultation are expendable (i.e., individual stages are either disposed of in the ocean or in outer space), except for the first stages of SpaceX's Falcon 9, Falcon Heavy, and Super Heavy rockets, which are reusable (i.e., SpaceX recovers the first stages by either landing them at a launch site or on a barge in the ocean). In the

future, the FAA, USSF, and/or NASA expect to receive proposals from other operators (e.g., Blue Origin) for first stage booster landings at a launch site or on a barge in the ocean, similar to SpaceX.

In addition to vertically launched rockets, there are three main types (or concepts) of horizontal launch vehicles: Concepts X, Y, and Z (Table 2). Concepts X and Y vehicles are reusable (i.e., they are not expended during a launch mission). Concept Y vehicles are similar to Concept X vehicles, except they are powered solely by rocket engines. Propellants include liquid oxygen and either kerosene or alcohol. The Concept Y vehicle takes off from the runway under rocket power and flies a suborbital trajectory. Upon atmospheric reentry, the vehicle conducts an unpowered descent and landing at the spaceport. The Concept Z vehicle is a two-part launch system consisting of a carrier aircraft (reusable) and a rocket (expendable or reusable). The turbojet engines of the carrier aircraft use Jet-A fuel (kerosene) and the hybrid rocket engine uses nitrous oxide and hydroxyl-terminated polybutadiene. During a launch, the carrier aircraft takes off from the spaceport runway with the rocket attached and ascends to an altitude of approximately 50,000 feet (ft), where the rocket is released from the carrier aircraft. The rocket ignites its engines and flies a suborbital trajectory. Upon atmospheric reentry, a reusable rocket makes an unpowered descent and landing at the spaceport. Meanwhile, the carrier aircraft makes a normal powered landing after releasing the rocket. Use of an expendable rocket for the Concept Z launch vehicle involves expending a booster stage into the ocean.

Table 2. Types of Horizontal Launch Vehicles

Type	Takeoff Propulsion	Propulsion to Reach Orbit	Landing Propulsion	Reusable or Expendable
Concept X	Jet	Rocket	Jet	Reusable
Concept Y	Rocket	Rocket	Unpowered (glide)	Reusable
Concept Z[a]	Jet	Rocket	Jet (carrier aircraft); Unpowered (rocket)	Both

Notes:
[a] The Concept Z vehicle is a two-part launch system consisting of a carrier aircraft (reusable) and a rocket (expendable or reusable).

Examples of launch vehicles (vertical and horizontal) for which operations could affect ESA-listed species under NMFS jurisdiction are listed in Table 3.

Table 3. Examples of Launch Vehicles that could affect the Marine Environment

Launch Vehicle	Type	Operator(s)	Launch Site(s)
Alpha	Vertical	Firefly	VSFB
Antares Family	Vertical	Northrop Grumman	WFF
Astra Rocket 3	Vertical	Astra Space, Inc.	PSCA
Atlas V	Vertical	ULA, Lockheed Martin	CCSFS, VSFB
Delta IV	Vertical	ULA	CCSFS, VSFB
Electron	Vertical	Rocket Lab	WFF
Falcon 9	Vertical	SpaceX	CCSFS, KSC, VSFB

Launch Vehicle	Type	Operator(s)	Launch Site(s)
Falcon Heavy	Vertical	SpaceX	KSC
Minotaur Family	Vertical	Northrop Grumman	CCSFS, WFF, VSFB
New Glenn	Vertical	Blue Origin	CCSFS, VSFB
Pegasus	Horizontal – Concept Z (expendable)	Northrop Grumman	CCSFS, WFF, VSFB
LauncherOne	Horizontal – Concept Z (expendable)	Virgin Orbit	MASP
RS1	Vertical	ABL Space Systems	CCSFS, VSFB
Sounding Rockets	Vertical	NASA	WFF
Starship/Super Heavy	Vertical	SpaceX	KSC, SpaceX Boca Chica Launch Site
Terran 1	Vertical	Relativity Space, Inc.	CCSFS, VSFB
Vector-H, Vector-R	Vertical	Vector	CCSFS, WFF
Vulcan	Vertical	ULA	CCSFS, VSFB
X-60	Horizontal	Generation Orbit	Cecil Airport, WFF

AFB = Air Force Base; CCSFS = Cape Canaveral Space Force Station; KSC = Kennedy Space Center; MASP = Mojave Air & Space Port; PSCA = Pacific Spaceport Complex-Alaska; ULA = United Launch Alliance; VSFB = Vandenberg Space Force Base; WFF = Wallops Flight Facility

Starship-Super Heavy Launch Vehicle

The fully integrated launch vehicle is approximately 400 ft tall by 30 ft diameter and comprised of two stages: Super Heavy is the first stage (or booster) and Starship is the second stage. Both stages are designed to be reusable. Unlike the SpaceX Falcon launch vehicle, Starship-Super Heavy will not have separable fairings or parachutes. The Super Heavy is expected to be equipped with up to 37 Raptor engines, and the Starship will employ up to six Raptor engines. The Raptor engine is powered by liquid oxygen (LOX) and liquid methane (LCH_4). Super Heavy is expected to hold up to 3,700 metric tons (MT) of propellant and Starship will hold up to 1,500 MT of propellant.

Reentry Vehicles

Reentry means to return or attempt to return, purposefully, a vehicle and its payload or human being, if any, from Earth orbit or from outer space to Earth. A reentry vehicle is a vehicle designed to return from Earth orbit or outer space to Earth intact. Examples of reentry vehicles are SpaceX's Dragon and Starship spacecrafts, NASA's Orion spacecraft, Boeing's Starliner spacecraft, and Sierra Nevada's Dream Chaser spacecraft. SpaceX's Dragon spacecraft has reentered Earth and landed in the Pacific Ocean and the Gulf of Mexico. SpaceX is proposing to have Starship landings occur in the Gulf of Mexico and a location in the Pacific Ocean (offshore Kauai Island, Hawaii; see Figure 5 in the *Action Area*).

SpaceX is able to conduct landings of the first stage of the launch vehicle shortly after launch (takeoff). These first stage operations are suborbital and are not considered by the FAA to be a reentry vehicle because they have not completed one orbit around the Earth. These first stage landings are considered part of a launch and it is expected that additional launch operators will utilize this strategy in the future.

Vertical Launches

Vertical launches occur from launch pads located at a launch site. After liftoff, the rocket quickly gains altitude and flies over the ocean. At some point downrange, the rocket reaches supersonic speeds (which generates a sonic boom) and pitches over to attain its intended orbital trajectory. Depending on the rocket's orientation, it is possible for the sonic boom to intercept the Earth's surface. Given the altitude at which the rocket reaches supersonic speeds, most of the sonic boom footprint that reaches the Earth's surface is usually of small magnitude (1–2 pounds per square foot [psf]), but there could be areas that experience a sonic boom up to 8 psf. The area exposed to the higher overpressure (up to 8 psf) is much smaller than the areas that experience lower overpressures. Sonic boom intensity, in terms of psf, is greatest under the flight path and progressively weakens with greater horizontal distance away from the flight track.

Vertical rocket launches may involve expending one or more stages (or boosters) in the ocean. After stage separation during the rocket's flight, the booster(s) falls into the ocean and sinks to the ocean floor. This has been the normal practice for decades. The commercial aerospace company SpaceX has developed the ability to recover first stage boosters for subsequent reuse instead of expending boosters in the ocean. For missions involving booster recovery, the booster conducts fly back and landing on a platform barge in the ocean or on a pad at a launch site. The platform barge[3] has its own azimuth thrusters to maintain position needed for landings. After securing the vehicle, the barge is towed (by an approximately 80 ft long tugboat) with the booster to a port or wharf (e.g., Port of Cape Canaveral, a CCSFS-located wharf, Port of Long Beach, or Port of Los Angeles). During booster landing in the ocean, a sonic boom is produced, up to 8 psf directly underneath and directed towards the landing barge platform. Other launch companies will likely develop technology to recover boosters in the future.

In addition to expended boosters falling into the ocean, payload fairings also fall into the ocean and sink. The fairing consists of two halves that separate to facilitate the deployment of the payload. Like booster recovery, SpaceX has developed the ability to conduct fairing recovery. SpaceX's fairing recovery operations use a parachute system hundreds of miles offshore in deep water. The parachute system consists of one drogue parachute and one parafoil (see Appendix A for characteristics of parachutes and parafoils). Drogue parachutes are thinner and smaller (65-113 foot square[ft^2]) than the parafoils (1,782-3,000 ft^2), deployed to gain control of the fairing at speeds that would destroy the larger parafoil, and therefore deployed before the parafoil. Following re-entry of the fairing into Earth's atmosphere, the drogue parachute is deployed at a high altitude (approximately 50,000 ft) to begin the initial slow down and to extract the parafoil. The drogue parachute is then cut away following the successful deployment of the parafoil. A salvage ship (approximately 170 ft long, offshore supply vessel) that is stationed in a designated safety zone near the anticipated splashdown area facilitates the fairing and parafoil recovery

[3] A converted Marmac freight barge (~300 ft x 100 ft) that SpaceX refers to as an autonomous drone ship. *https://www.americaspace.com/2015/01/04/spacex-autonomous-spaceport-drone-ship-sets-sail-for-tuesdays-crs-5-rocket-landing-attempt/*

operation. Upon locating the fairing, rigid-hulled inflatable boats (RHIBs; approximately 12 ft long) recover the fairing. If sea or weather conditions are poor, recovery of the fairing and parafoil may be unsuccessful. The salvage ship transports the fairing to a port, wharf, (e.g., Port of Cape Canaveral, Port of Long Beach or Port of Los Angeles). The drogue parachute assembly is deployed at a high altitude, so it can be difficult to locate, but if the recovery team can get a visual fix, recovery of the drogue parachute is attempted. The drogue parachute becomes saturated with seawater quickly and begins to sink (see Appendix A for approximate sink rates), which also makes recovery of the drogue parachute difficult.

Boosters and fairings that are expended in the ocean are made of materials that sink, strong metal with heavy duty components designed to stand up to the stressful forces of launch, reentry, and extreme temperatures. A few internal parts that are lighter items (e.g., carbon composite-wrapped aluminum containers) could be released upon impact and may float, but are expected to become waterlogged and sink within a few days (10 days maximum).

SpaceX Starship-Super Heavy Launches

During the program's development, SpaceX is proposing to conduct up to 20 Starship suborbital launches annually (Table 4). As the program progresses, SpaceX is proposing to conduct up to five Starship suborbital launches annually (operational phase). During a Starship suborbital launch, the Starship would ascend to high altitudes and then its engines would throttle down or shut off to descend, landing back at the Boca Chica Launch Site or downrange (no closer than 19 miles from shore) either directly in the Gulf of Mexico or on a platform barge (as described above for the Falcon booster landings) in the Gulf of Mexico. A Super Heavy launch could be orbital or suborbital and could occur by itself or with Starship integrated as the second stage of the launch vehicle.

Table 4. Proposed SpaceX Starship-Super Heavy Annual Operations

Operation	Program Development Phase	Operational Phase
Starship Suborbital Launch	20	5
Super Heavy Launch	3	5

Each Starship-Super Heavy orbital launch would include an immediate boost-back and landing of the Super Heavy. During flight, the Super Heavy's engines would cut off at an altitude of approximately 40 miles and the booster would separate from Starship. Shortly thereafter, Starship's engines would start and burn to the desired orbit location. After separation, Super Heavy would rotate and ignite engines to place it in the correct angle to land. Once Super Heavy is in the correct position, the engines would be shut off. Super Heavy would then perform a controlled descent using atmospheric resistance to slow it down and guide it to the landing location (like current Falcon 9 booster landings at Cape Canaveral Space Force Station). Once near the landing location, Super Heavy would ignite its engines to conduct a controlled landing. Super Heavy could have approximately up to 5 metric tons of LCH_4 onboard following an orbital flight.

When Super Heavy landings occur on a platform barge downrange in the Gulf of Mexico, the Super Heavy would then be delivered on the towed barge to the Port of Brownsville and transported the remaining distance to the Boca Chica Launch Site over roadways. Super Heavy landings would generate a sonic boom(s). The maximum overpressure from a sonic boom

generated by a Super Heavy landing is predicted to be 15 psf. A maximum of five Super Heavy landings in the Gulf of Mexico could occur each year during the operational phase (Table 4).

It is SpaceX's goal to recover and reuse the Starship and Super Heavy boosters. However, during launches that are still early in the program development, SpaceX may require expending Super Heavy or Starship in the ocean (Gulf of Mexico or Pacific Ocean). When this occurs, SpaceX would not recover the Super Heavy or the Starship and expects they would breakup on impact with the ocean surface. Impact debris is expected to be contained within approximately one kilometer of the landing point. SpaceX expects debris to sink because the launch vehicle is made of steel, and if some lighter internal parts (e.g., carbon composite-wrapped aluminum containers as stated for other vertical launches) are released, they are expected to become waterlogged and sink within 10 days.

Horizontal Launches

Horizontal launches, including takeoff and landing, occur from a runway at the launch site. Concept X, Concept Y, and reusable Concept Z launch vehicle operations do not involve expending launch vehicle components in the marine environment. Horizontal launch vehicle operations can produce a sonic boom during flight over the marine environment that may affect the ocean's surface. The expendable Concept Z launch vehicle operations (e.g., Pegasus launches) involve expending a stage(s) into the ocean. The stage(s) is not recovered and rapidly sinks to the ocean floor.

Launch Failure Anomaly

An unintended launch failure (referred to as a launch anomaly) is possible during launch operations. Accidental failure could result in an explosion and/or breakup of a rocket booster and/or spacecraft on or near the launch pad or landing area. Anomalies could also occur later, during flight. Since 1989, there have been 415 commercial launches and 27 have resulted in mishaps that involved debris in the water.

Spacecraft Reentry and Recovery Operations

Some launch companies launch spacecraft as their payload into space (e.g., SpaceX Dragon spacecraft and Boeing Starliner spacecraft). After completing its mission in space, the spacecraft returns to Earth. Spacecraft reentry, splashdown, and recovery are the three elements of a spacecraft landing operation. After completing its mission in space, the spacecraft travels back to Earth where it completes a deorbit burn and reenters the atmosphere. During reentry, the spacecraft creates a sonic boom that may impact the ocean's surface. Spacecraft reentry would not be conducted in any type of stormy weather (i.e., weather that would compromise the success of the mission; e.g., a severe thunderstorm or hurricane) unless deemed necessary in an emergency (e.g., a medical emergency with an astronaut).

Spacecraft typically deploy two drogue parachutes and three to four main parachutes to assist in landing. The smaller drogue parachutes (19 ft^2 each) are deployed first to gain control of the spacecraft and then are released (and expected to land in the ocean within 0.5–1 mile from the spacecraft) before the larger main parachutes (116 ft^2 each) are deployed. The main parachutes slow the spacecraft enough to allow for a soft splashdown in the water (or on land). Drogue and main parachutes are typically made of Kevlar and nylon (see Appendix A).

During reentry, the spacecraft reenters Earth's atmosphere on a pre-planned trajectory and is tracked to a splashdown area in the ocean. Following splashdown, an electronic locator beacon on the spacecraft assists in locating and recovering the spacecraft by a pre-positioned 160 ft long recovery vessel equipped with up to six RHIBs.

Hypergolic fuels (e.g., nitrogen tetroxide [NTO] and monomethylhydrazine [MMH]) may be on the spacecraft during splashdown. A spacecraft's propellant storage is designed to retain residual propellant, so any propellant remaining in the spacecraft is not expected to be released into the ocean. In an unlikely event the propellant tank ruptures on impact, the propellant would evaporate or be quickly diluted and buffered by seawater.

The vehicle operator's personnel attempt to recover all parachutes deployed and load the spacecraft onto the recovery vessel. It is possible some or all the parachutes may not be recovered due to sea or weather conditions, and the drogue parachute may land well beyond sight of the spacecraft recovery area. For missions involving space crew (humans), the crew and any time-critical cargo may be transported via helicopter to the nearest airport. The recovery vessel transports the spacecraft to whatever port the launch operator uses (e.g., Port of Cape Canaveral, a CCSFS-located wharf, commercially available port or wharf on the Gulf Coast, Port of Long Beach, or Port of Los Angeles).

SpaceX Starship-Super Heavy Reentry and Recovery Operations

Each Starship-Super Heavy orbital launch would include a Starship reentry and landing after Starship completes its orbital mission. Starship landing could occur at the vertical launch area, downrange in the Gulf of Mexico (either on a floating platform or expended in the Gulf of Mexico), or expended in the Pacific Ocean approximately 62 nautical miles (NM) north of Kauai, Hawaiian Islands (Figure 5). Starship may have between 1 to 10 metric tons of LCH_4 onboard following an orbital flight. As Starship slows down during its landing approach, a sonic boom(s) with a maximum predicted overpressure of 2.2 psf will be generated. If a Starship landing occurs downrange in the Gulf of Mexico on a floating platform barge, it will be delivered on the barge to the Port of Brownsville, and transported the remaining distance to the Boca Chica Launch Site over roadways.

For missions involving the Starship landing in the Pacific Ocean, SpaceX will arrange an overflight to confirm that debris from the impact has sunk and attempt to locate the launch vehicle mission recording device (aka the 'black box') which has a global positioning system (GPS) tracking signal. If the tracking signal from the recording device is found, locally contracted scuba divers may be deployed to facilitate device retrieval. If there is floating debris found, a local contractor may be utilized to recover any floating debris that could drift into the Papahanaumokuakea Marine National Monument.

Launch Abort Tests

As part of research and development, launch operators may conduct launch abort tests that include waterborne landings. Abort tests may include pad abort tests and launch ascent abort tests. For both types of tests, operations may involve launching spacecraft on a low-altitude, non-orbit trajectory resulting in a waterborne landing in the Atlantic Ocean (see Atlantic Ocean in *Action Area*). Abort test operations typically involve a non-propulsive spacecraft landing using

drogue and main parachutes. Recovery of the spacecraft will be similar to recovering a reentry vehicle (i.e., use of a recovery vessel and RHIBs). During an abort test, the launch vehicle could break apart (explode) and land in the ocean. In such a case, the launch operator will be responsible for retrieving as many pieces of debris as feasible. SpaceX's January 19, 2020 in-flight abort test is an example of a launch abort test. During that test, the Falcon 9 launch vehicle exploded and landed in the Atlantic Ocean. SpaceX personnel retrieved as many pieces of debris as they could locate.

Weather Balloon Deployment

Launch operators and federal government personnel (e.g., the Weather Squadron at VSFB) release weather balloons, typically 5 but up to 15 if there are any launch delays, to measure wind speed prior to launches. The data are used to create wind profiles that help determine if it is safe to launch and land the vehicle. A radiosonde, typically the size of a half-gallon milk carton, is attached to the weather balloon to measure and transmit atmospheric data to the launch operator. The latex balloon rises to approximately 20-30 kilometers (km) above Earth's surface and bursts. The radiosonde and shredded balloon pieces fall back to Earth and are not recovered. The radiosonde does not have a parachute and is expected to sink to the ocean floor.

Spotter Aircraft and Surveillance Vessels

A number of spotter aircraft and surveillance vessels (watercraft) are used during launch activities to ensure that designated hazard areas are clear of non-participating crafts. Combinations of radar and visual spotter aircraft, and surface surveillance and law enforcement vessels (watercraft), may be deployed prior to launch. Most fixed wing aircraft operate at altitudes of 15,000 ft but may drop to 1,500 ft to visually obtain a call sign from a non-participating vessel.

Project Design Criteria

Project design criteria (PDCs) are identified as part of a programmatic consultation and are applicable to future projects implemented under the program. In the case of this consultation, PDCs include environmental protection measures developed by the FAA to limit the effects of launch operations. These environmental protection measures will lead to avoidance and minimization of effects to ESA-listed species and designated critical habitat in the action area to assist in the conservation of these resources.

General PDCs applicable to this consultation:

- Launch and reentry operations will be conducted by the USSF, NASA, or an FAA-licensed (or permitted) commercial operator from a launch site identified in Table 1. Launch preparations will occur in compliance with standard operating procedures and best management practices currently implemented at these existing launch vehicle facilities.
- Launch operations will utilize launch vehicles identified in Table 3.
- Launch activities, including suborbital landings and splashdowns, and orbital reentry activities will occur in the proposed action area at least 5 NM offshore the coast of the United States or islands. The only operations component that will occur near shore will be watercraft transiting to and from a port when recovering spacecraft or launch vehicle components, or possibly for surveillance.
    - No launch operator will site a landing area in coral reef areas.

- No activities will occur in or affect a National Marine Sanctuary unless the appropriate authorization has been obtained from the Sanctuary.

- Landing operations will not occur in the aquatic zone extending 20 NM (37 km) seaward from the baseline or basepoint of each major rookery and major haul-out of the Western Distinct Population Segment (DPS) Steller sea lion located west of 144° W.
- Launch abort testing will only occur in the Atlantic Ocean from CCAFS or KSC as previously analyzed (SER-2016-17894, FPR-2017-9231). In addition:
  - It will not occur in designated critical habitat for the North Atlantic right whale.
  - It will not occur during the North Atlantic right whale winter calving season from November to mid-March.
- Utilize all feasible alternatives and avoid landing in Rice's whale core habitat distribution area as much as possible. No more than one splashdown, reentry and recovery of the Dragon capsule, will occur in Rice's whale core habitat distribution area per year. No other operations, spacecraft, launch or reentry vehicle landings, or expended components will occur in Rice's whale core habitat distribution area. The Rice's whale core habitat distribution area map (Figure 1) and GIS boundary can be accessed here: https://www.fisheries.noaa.gov/resource/map/rices-whale-core-distribution-area-map-gis-data.

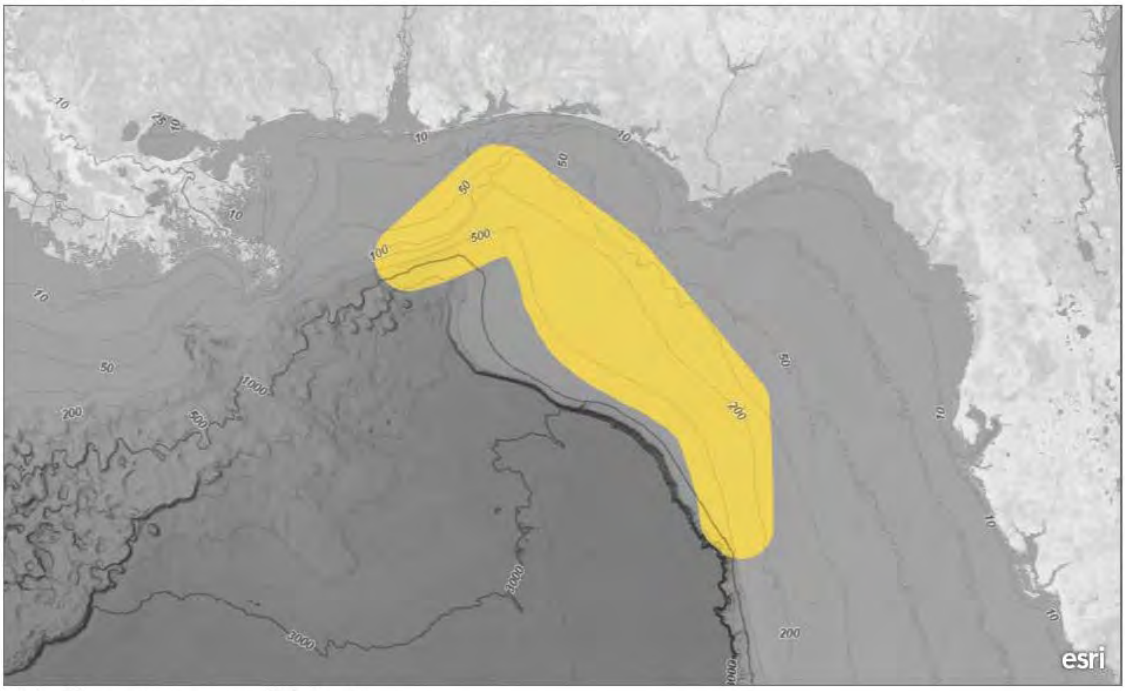

Figure 1. Rice's Whale Core Distribution Area in the Gulf of Mexico.

Education and Observation

- Each launch operator will instruct all personnel associated with launch operations about marine species and any critical habitat protected under the ESA, and species protected

under the MMPA that could be present in the operations area.[4] The launch operator will advise personnel of the civil and criminal penalties for harming, harassing, or killing ESA-listed and MMPA-protected species.

- Each launch operator will provide a dedicated observer(s) (e.g., biologist or person other than the watercraft operator that can recognize ESA-listed and MMPA-protected species) that is responsible for monitoring for ESA-listed and MMPA-protected species with the aid of binoculars during all in-water activities, including transiting marine waters for surveillance or to retrieve boosters, spacecraft, other launch-related equipment or debris.
  - When an ESA-listed or MMPA-protected species is sighted, the observer will alert vessel operators to apply the Vessel Operations protective measures.
  - Dedicated observers will record the date, time, location, species, number of animals, distance and bearing from the vessel, direction of travel, and other relevant information, for all sightings of ESA-listed or MMPA-protected species.
  - Dedicated observers will survey the launch recovery area for any injured or killed ESA-listed or MMPA-protected species and any discoveries will be reported as noted below.

Reporting Stranded, Injured, or Dead Animals

- Each launch operator will immediately report any collision(s), injuries or mortalities to, and any strandings of ESA-listed or MMPA-protected species to the appropriate NMFS contact listed below, and to Cathy Tortorici, Chief, ESA Interagency Cooperation Division by e-mail at cathy.tortorici@noaa.gov.
  - For operations in the Gulf of Mexico and Atlantic Ocean: 727-824-5312 or via email to takereport.nmfsser@noaa.gov, and a hotline 1-877-WHALE HELP (942-5343).
  - For operations on the west coast/Pacific Ocean: 562-506-4315 or via email to Justin.Viezbicke@noaa.gov, and a hotline for whales in distress 877-767-9245.
  - For operations near Alaska, statewide hotline: 877-925-7773.
  - Additional regionally organized contact information is here: https://www.fisheries.noaa.gov/report.
- In the Gulf of Mexico and Atlantic Ocean waters near Florida, each launch operator will report any smalltooth sawfish sightings to 941-255-7403 or via email Sawfish@MyFWC.com.
- Each launch operator will report any giant manta ray sightings via email to manta.ray@noaa.gov.
- In the Atlantic Ocean, each launch operator will report any injured, dead, or entangled North Atlantic right whales to the U.S. Coast Guard via VHF Channel 16.

Vessel Operations

All watercraft operators will be on the lookout for and attempt to avoid collision with ESA-listed and MMPA-protected species. A collision with an ESA-listed species will require reinitiation of consultation. Watercraft operators will ensure the vessel strike avoidance measures and reporting are implemented and will maintain a safe distance by following these protective measures:

- Maintain a minimum distance of 150 ft from sea turtles.

[4] The FAA is responsible for ensuring ESA compliance. The launch operator is responsible for MMPA compliance. Measures to protect all marine mammals are included here for animal conservation purposes.

- In the Atlantic Ocean, slow to 10 knots or less and maintain a minimum distance of 1,500 ft (500 yards) from North Atlantic right whales.
- In the Gulf of Mexico, slow to 10 knots or less and maintain a minimum distance of 1,500 ft (500 yards) from Rice's whale [formerly Gulf of Mexico Bryde's whale]. If a whale is observed but cannot be confirmed as a species other than a Rice's whale, the vessel operator must assume that it is a Rice's whale.
- Maintain a minimum distance of 300 ft (100 yards) from all other ESA-listed and MMPA-protected species. If the distance ever becomes less than 300 ft, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.
- Watercraft operators will reduce speed to 10 knots or less when mother/calf pairs or groups of marine mammals are observed.
- Watercraft 65 ft long or longer will comply with the Right Whale Ship Strike Reduction Rule (50 CFR §224.105)[5] including reducing speeds to 10 knots or less in Seasonal Management Areas or in Right Whale Slow Zones, which are dynamic management areas established where right whales have been recently seen or heard.
  - The Whale Alert app automatically notifies when entering one of these areas.
- Check various communication media for general information regarding avoiding ship strikes and specific information regarding North Atlantic right whale sightings in the area. These include NOAA weather radio, U.S. Coast Guard NAVTEX broadcasts, and Notices to Mariners.
  - There is also an online right whale sightings map available at https://apps-nefsc.fisheries.noaa.gov/psb/surveys/MapperiframeWithText.html.
- Attempt to remain parallel to an ESA-listed or MMPA-protected species' course when sighted while the watercraft is underway (e.g., bow-riding) and avoid excessive speed or abrupt changes in direction until the animal(s) has left the area.
- Avoid vessel transit in the Rice's whale core distribution area. If vessel transit in the area is unavoidable, stay out of the depth range of 100 m to 425 m (where the Rice's whale has been observed; Rosel et al. 2021) as much as possible and go as slow as practical, limiting vessel speed to 10 knots or less.
- No operations or transit will occur at night in Rice's whale core distribution area.

Aircraft Procedures

Spotter aircraft will maintain a minimum of 1,000 ft over ESA-listed or MMPA-protected species and 1,500 ft over North Atlantic right whales. Additionally, aircraft will avoid flying in circles if marine mammals or sea turtles are spotted to avoid any type of harassing behavior.

Hazardous Materials Emergency Response

In the event of a failed launch operation, launch operators will follow the emergency response and cleanup procedures outlined in their Hazardous Material Emergency Response Plan (or similar plan). Procedures may include containing the spill using disposable containment materials and cleaning the area with absorbents or other materials to reduce the magnitude and duration of any impacts. In most launch failure scenarios, at least a portion (if not most) of the

[5] See: http://www.fisheries.noaa.gov/pr/shipstrike/.

propellant will be consumed by the launch/failure, and any remaining propellant will evaporate or be diluted by seawater and biodegrade over time (timeframes are variable based on the type of propellant and environmental conditions, but generally hours to a few days).

Project-Specific Review

Project-specific reviews for this programmatic consultation for launch and reentry vehicle operations in the marine environment are not required as long as the activities are within the scope of the *Proposed Action*, within the action area, and comply with the PDCs. If operations are proposed that are not a part of the *Proposed Action* and/or are not in the *Action Area*, an individual consultation will be needed. If operations in the future include the use of a new launch site, a new launch vehicle, or other substantial changes in technology and operations, an individual consultation or reinitiation of this programmatic consultation may be required.
A project specific review is required when proposed operations do not fully comply with the applicable PDCs identified in this consultation. For example, if a reentry landing and recovery operation could possibly happen at night in the Rice's whale core habitat distribution area, a project specific review would be needed.

When projects do not fully meet the requirements, the action agency should submit a request for project-specific review to the NMFS Office of Protected Resources ESA Interagency Cooperation Division. The request should be sent by email to cathy.tortorici@noaa.gov with the subject line "Project Specific Review Request, OPR-2021-02908, Programmatic Concurrence for Launch Vehicle and Reentry Operations" and include the following information: a project description that details the operations, where and when they will occur, any criteria or measures that may not be fully implemented, and determination of effects to ESA-listed species and critical habitat that could result from the project.

NMFS will review the request to determine if the scope of the project is within this programmatic concurrence, if a supplemental effects analysis is needed, or if an individual consultation is required. Requests for project-specific review should be submitted at least six months in advance of the proposed activity to allow time for completion of a formal ESA section 7 consultation if one is required.

Annual Reporting to NMFS

The FAA, USSF, and NASA, in collaboration with launch operators, propose to prepare and submit reports to NMFS by December 31 beginning the calendar year this consultation is completed and continuing each year activities covered under this consultation occur. The reports will document the outcome of each launch mission that may affect the marine environment. The FAA will report on FAA-licensed launches (i.e., commercial launches) and USSF and NASA will report on their respective launches (i.e., government launches), including those involving commercial space vehicle operations.

Annual reports will include the following for all activities covered under this programmatic:

1) The dates and locations of all missions, including launch site, launch and reentry vehicles and any relevant license or permit that authorized the activities;
2) Contact information for the agencies and commercial entities involved in the events;
3) Details of launch and reentry operations that may affect the marine environment, such as booster stage landings at sea, and particularly those that involve entry of materials into

the marine environment, such as payload fairing recovery missions, spacecraft reentries, and abort tests;
4) Dates of reentry and recovery operations if different from launch date;
5) Approximate locations with GPS coordinates when available of all landing and splashdown areas, including fairing recoveries (and drogue parachute recoveries, if applicable) and spacecraft recoveries (including abort tests). Information should also be provided regarding support vessels used during operations and transit routes, as well as aircraft activity associated with an event;
6) Any available information on the location and fate of unrecovered parachutes, parafoils, expended components and debris;
7) Information regarding the implementation of the *Environmental Protection Measures* described above, including any issues identified by an observer or other crew member, divers or other personnel engaged in in-water activities;
8) Any information regarding effects to ESA-listed species due to the activities; and
9) Sighting logs with observations of ESA-listed species with date, time, location, species (if possible to identify), number of animals, distance and bearing from the vessel, direction of travel, and other relevant information.

Annual reports should be submitted electronically to cathy.tortorici@noaa.gov with the subject line "Annual Review, OPR-2021-02908, Programmatic Concurrence for Launch Vehicle and Reentry Operations Starship/Super Heavy Launch Vehicle Operations at SpaceX's Boca Chica Launch Site."

Basic information regarding events conducted in a given year can be provided in tabular form accompanied by a narrative summary organized by geography: Pacific, Atlantic, and Gulf of Mexico. Copies of the annual reports should also be submitted electronically to the appropriate NMFS regional offices for their review and comment dependent on where launch and reentry activities occur in a given year: SERO (nmfs.ser.esa.consultations@noaa.gov), PIRO (EFHESAconsult@noaa.gov), and WCR (see https://www.fisheries.noaa.gov/west-coast/consultations/esa-section-7-consultations-west-coast for information on contacts based on geographic area).

The summary of annual aggregate activities and associated effects will allow NMFS to evaluate, among other things, whether the scope of the activities are consistent with the description of the proposed action and action area, and whether the nature and scale of the effects predicted continue to be valid. Annual reviews help monitor development of the industry and the potential for increased frequency of activities that may indicate the effects to ESA resources could change, requiring new analysis and/or adjustments to implementing requirements under the programmatic.

Landing Failure Anomaly

It is possible that a stage booster landing could have a failure. The FAA indicated that, for the past several years, SpaceX has been successfully landing boosters on land and offshore on a barge. A failure on the barge would be very rare. SpaceX has adjusted mission operations to avoid explosions on the barge. During reentry/descent, if the launch vehicle indicates any failures, SpaceX would expend it into the open ocean, rather than attempt a barge landing to avoid an explosion on the barge. Therefore, this consultation does not include stage booster

landing failure. If a failure were to occur in the marine environment, reinitiation of this consultation may be required.

Action Area

The action area is defined in 50 CFR §402.02 as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." In general, the action area includes portions of the Atlantic Ocean, Gulf of Mexico, and the Pacific Ocean where launch and reentry activities are anticipated (see Figures 2, 3 and 4). SpaceX is proposing to land the Starship after an orbital mission in the Pacific Ocean, approximately 62 NM north of Kauai, Hawaii, as shown in Figure 5.

The launch and reentry activities occurring in the marine environment would occur in deep waters at least 5 NM offshore the coast of the United States or islands, with most activities occurring hundreds of miles offshore. The only component of the launch and reentry operations that occurs near (less than 5 NM offshore) the coast of the United States are the vessels (watercraft) transiting to and from a port during pre-launch surveillance or when recovering and transporting spacecraft or launch vehicle components in the ocean. These nearshore vessel transit areas in the action area include marine waters that lead to the Port of Brownsville, Texas; Port Canaveral, Florida; Port of Los Angeles, California; Port of Longview, California; Port of Kodiak, Alaska; and a port facility at Vandenberg Space Force Base, California.

Figure 2. Atlantic Ocean Action Area

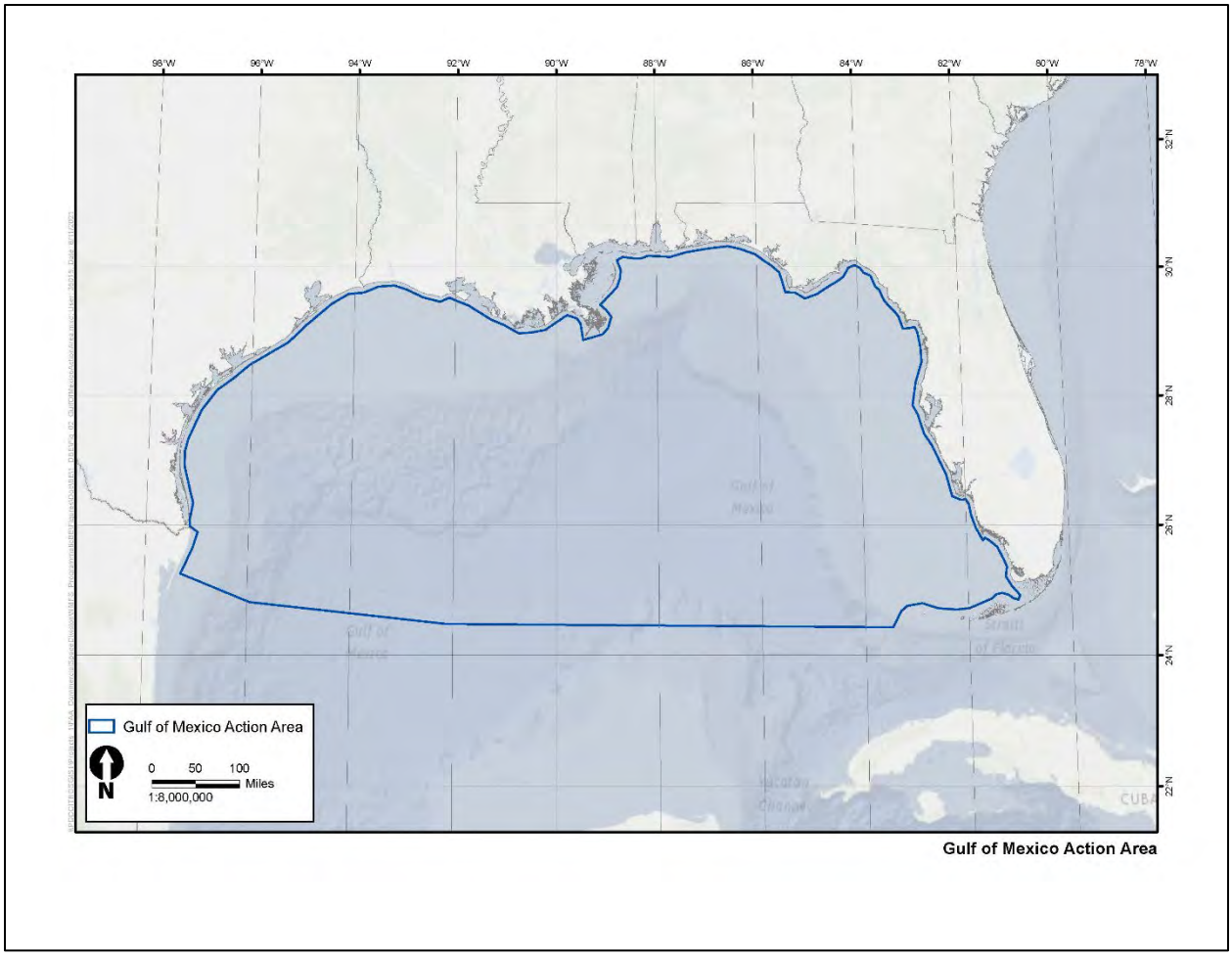

Figure 3. Gulf of Mexico Action Area

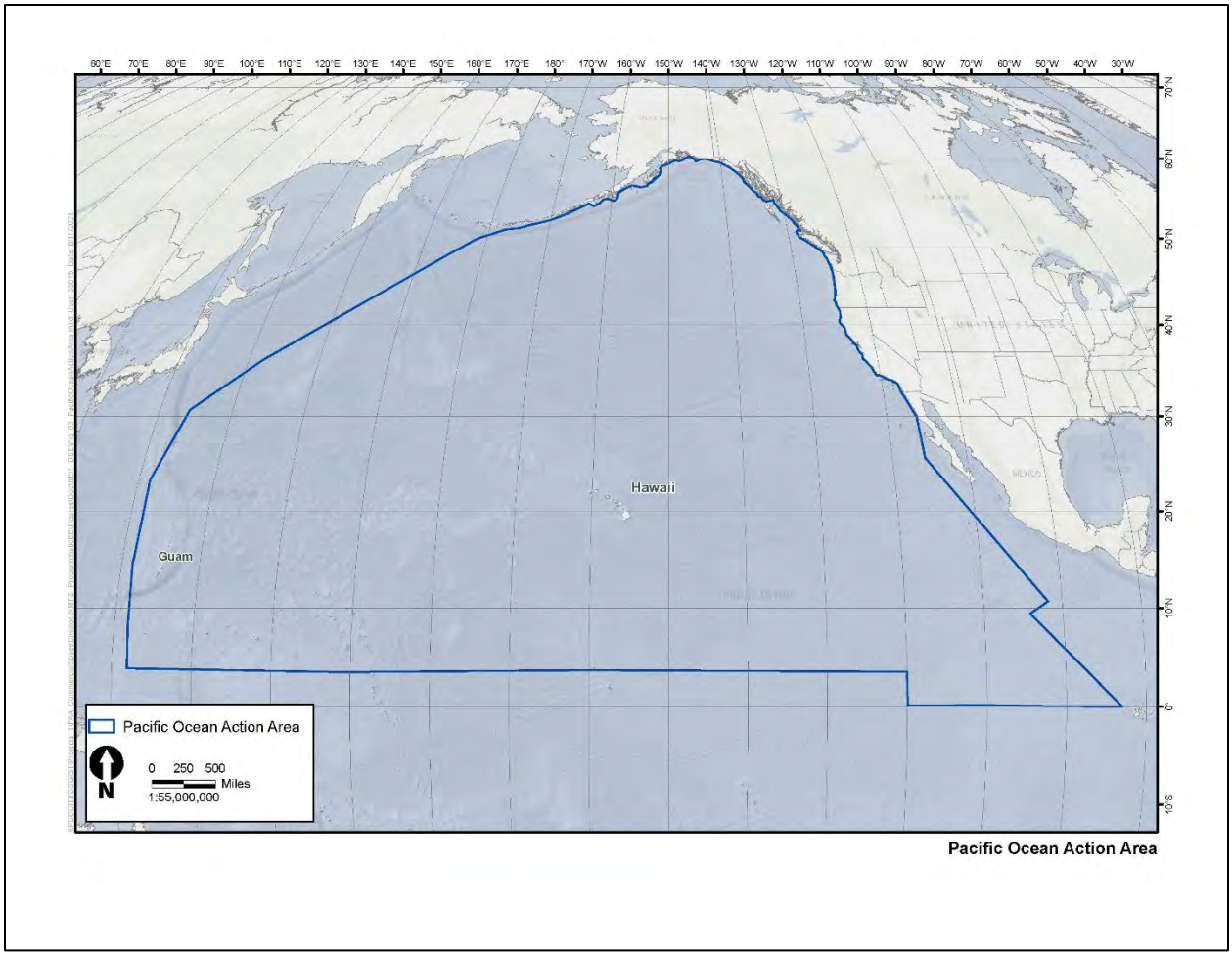

Figure 4. Pacific Ocean Action Area

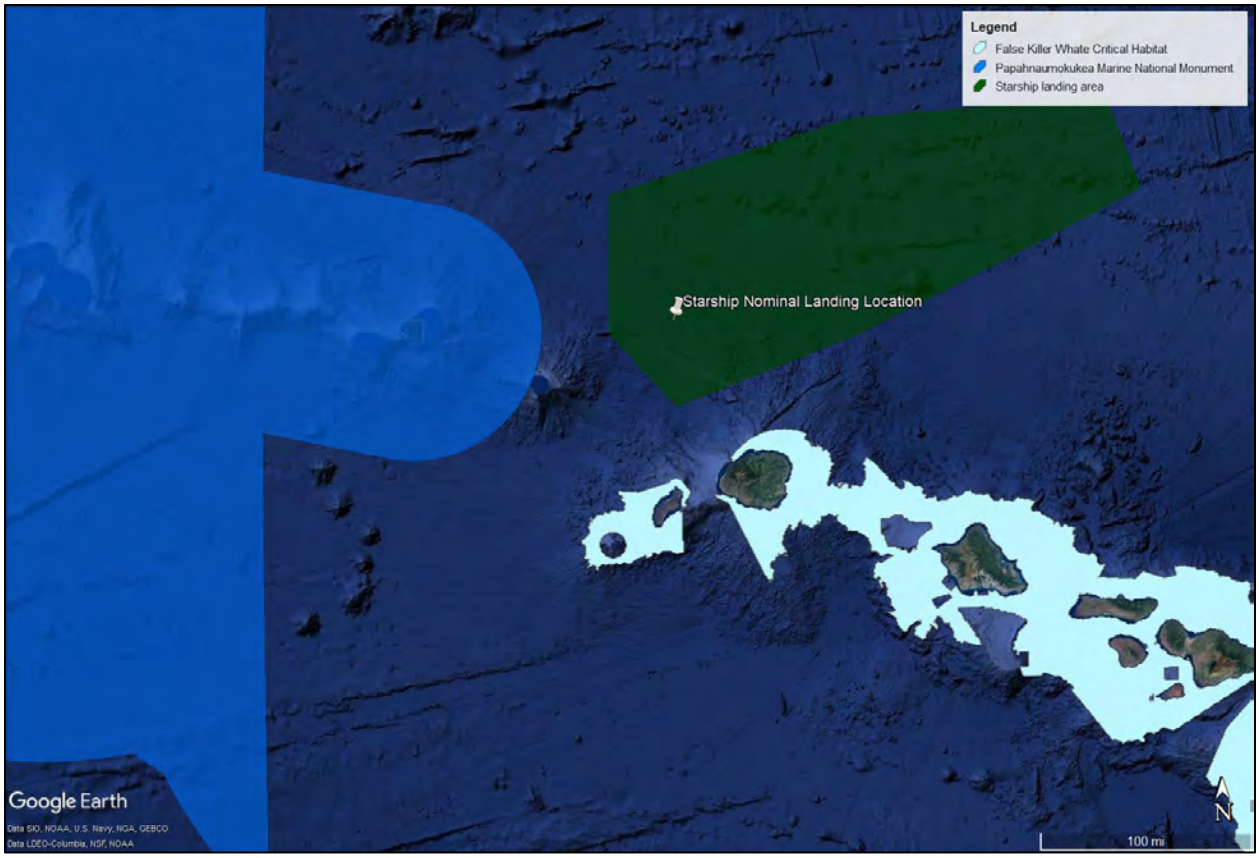

Figure 5. Proposed Landing Area in the Pacific Ocean for SpaceX Starship Orbital Missions.

Annual Operations per Ocean Area

Dependent on mission needs, the amount of annual launch and recovery operations can be variable. The table below outlines the maximum annual operations expected by the action agencies in the marine environment over the next five years (2022 through 2026) for the activities included in this consultation.

Table 5. Maximum Annual Operations

Type of Operation	Maximum # of Annual Operations
Atlantic Ocean Action Area	
Launches involving stages and fairings that are expended in the ocean (not recovered)	30
Launches involving attempted recovery of stages and fairings in the ocean	70
Spacecraft reentry and landing in the ocean	10
Launch abort test	1
Pacific Ocean Action Area	
Launches involving stages and fairings that are expended in the ocean (not recovered)	30
Launches involving attempted recovery of stages and fairings in the ocean	20
Spacecraft reentry and landing in the ocean	3
Gulf of Mexico Action Area	
Launches involving stages that are expended in the ocean (not recovered)	5

Type of Operation	Maximum # of Annual Operations
Launches involving attempted recovery of stages in the ocean	5
Spacecraft reentry and landing in the ocean	10

ESA-Listed Species and Critical Habitat in The Action Area

Several ESA-listed marine mammals (cetaceans and pinnipeds), sea turtles, fishes and designated critical habitats are known to occur or have the potential to occur in the action area (Table 6). The FAA, USSF, and NASA have determined that launch and reentry vehicle operations in the marine environment may affect, but are not likely to adversely affect any ESA-listed species or designated critical habitat.

The action area does not include nearshore areas where most ESA-listed coral species occur. There is proposed critical habitat for three coral species in the Gulf of Mexico farther offshore (i.e., > 5 NM). However, no launch operator would site a landing area in coral reef areas, and the location of the proposed critical habitat in the Gulf of Mexico is too far north of the launch trajectories from the Boca Chica Launch Site to be affected. Therefore, the FAA determined launch and reentry operations will have no effect on ESA-listed coral species or their proposed critical habitat in the action area.

Table 6. ESA-listed Species and Designated Critical Habitat Potentially Present in the Action Area

Species	ESA Status	Critical Habitat	Recovery Plan
Marine Mammals - Cetaceans			
Blue Whale (*Balaenoptera musculus*)	E – 35 FR 18319	-- --	07/1998 11/2020
False Killer Whale (*Pseudorca crassidens*) – Main Hawaiian Islands Insular DPS	E – 77 FR 70915	83 FR 35062	Draft – 85 FR 65791 9/2020
Fin Whale (*Balaenoptera physalus*)	E – 35 FR 18319	-- --	75 FR 47538 07/2010
Gray Whale (*Eschrichtius robustus*) – Western North Pacific Population	E – 35 FR 18319	-- --	-- --
Humpback Whale (*Megaptera novaeangliae*) – Central America DPS	E – 81 FR 62259	86 FR 21082	11/1991
Humpback Whale (*Megaptera novaeangliae*) – Mexico DPS	T – 81 FR 62259	86 FR 21082	11/1991

Humpback Whale (*Megaptera novaeangliae*) – Western North Pacific DPS	E – 81 FR 62259	86 FR 21082	11/1991
Killer Whale (*Orcinus orca*) – Southern Resident DPS	E – 70 FR 69903 Amendment 80 FR 7380	71 FR 69054 86 FR 41668	73 FR 4176 01/2008
North Atlantic Right Whale (*Eubalaena glacialis*)	E – 73 FR 12024	81 FR 4837	70 FR 32293 08/2004
North Pacific Right Whale (*Eubalaena japonica*)	E – 73 FR 12024	73 FR 19000	78 FR 34347 06/2013
Rice's Whale (*Balaenoptera ricei*)	E – 84 FR 15446 E – 86 FR 47022	-- --	-- --
Sei Whale (*Balaenoptera borealis*)	E – 35 FR 18319	-- --	12/2011
Sperm Whale (*Physeter macrocephalus*)	E – 35 FR 18319	-- --	75 FR 81584 12/2010
Marine Mammals - Pinnipeds			
Guadalupe Fur Seal (*Arctocephalus townsendi*)	T – 50 FR 51252	-- --	-- --
Hawaiian Monk Seal (*Neomonachaus schauinslandi*)	E – 41 FR 51611	80 FR 50925	72 FR 46966 2007
Steller Sea Lion (*Eumetopias jubatus*) – Western DPS	E – 55 FR 49204	58 FR 45269	73 FR 11872 2008
Marine Reptiles			
Green Turtle (*Chelonia mydas*) – North Atlantic DPS	T – 81 FR 20057	63 FR 46693	10/1991
Green Turtle (*Chelonia mydas*) – Central North Pacific DPS	T – 81 FR 20057	-- --	63 FR 28359 01/1998
Green Turtle (*Chelonia mydas*) – Central West Pacific DPS	E – 81 FR 20057	-- --	63 FR 28359 01/1998
Green Turtle (*Chelonia mydas*) – Central South Pacific DPS	E – 81 FR 20057	-- --	63 FR 28359 01/1998

Green Turtle (*Chelonia mydas*) – East Pacific DPS	T – 81 FR 20057	-- --	63 FR 28359 01/1998
Hawksbill Turtle (*Eretmochelys imbricata*)	E – 35 FR 8491	63 FR 46693	57 FR 38818 08/1992 – U.S. Caribbean, Atlantic, and Gulf of Mexico 63 FR 28359 05/1998 – U.S. Pacific
Kemp's Ridley Turtle (*Lepidochelys kempii*)	E – 35 FR 18319	-- --	09/2011
Leatherback Turtle (*Dermochelys coriacea*)	E – 35 FR 8491	44 FR 17710 and 77 FR 4170	10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 63 FR 28359 05/1998 – U.S. Pacific
Loggerhead Turtle (*Caretta caretta*) – Northwest Atlantic Ocean DPS	T – 76 FR 58868	79 FR 39855	74 FR 2995 10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 05/1998 – U.S. Pacific 01/2009 – Northwest Atlantic
Loggerhead Turtle (*Caretta caretta*) – North Pacific Ocean DPS	E – 76 FR 58868	-- --	63 FR 28359
Olive Ridley Turtle (*Lepidochelys olivacea*) – All Other Areas/Not Mexico's Pacific Coast Breeding Colonies	T – 43 FR 32800	-- --	-- --
Olive Ridley Turtle (*Lepidochelys olivacea*) – Mexico's Pacific Coast Breeding Colonies	E – 43 FR 32800	-- --	63 FR 28359
Fishes			
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – Carolina DPS	E – 77 FR 5913	82 FR 39160	-- --
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – Chesapeake DPS	E – 77 FR 5879	82 FR 39160	-- --
Atlantic Sturgeon (*Acipensar oxyrinchus*	T – 77 FR 5879	82 FR 39160	-- --

oxyrinchus) – Gulf of Maine DPS			
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – New York Bight DPS	E – 77 FR 5879	82 FR 39160	-- --
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – South Atlantic DPS	E – 77 FR 5913	82 FR 39160	-- --
Chinook Salmon (*Oncorhynchus tshawytscha)* – California Coastal ESU	T – 70 FR 37160	70 FR 52488	81 FR 70666
Chinook Salmon (*Oncorhynchus tshawytscha)* – Central Valley Spring-Run ESU	T – 70 FR 37160	70 FR 52488	79 FR 42504
Chinook Salmon (*Oncorhynchus tshawytscha)* – Lower Columbia River ESU	T – 70 FR 37160	70 FR 52629	78 FR 41911
Chinook Salmon (*Oncorhynchus tshawytscha)* – Puget Sound ESU	T – 70 FR 37160	70 FR 52629	72 FR 2493
Chinook Salmon (*Oncorhynchus tshawytscha)* – Sacramento River Winter-Run ESU	E – 70 FR 37160	58 FR 33212	79 FR 42504
Chinook Salmon (*Oncorhynchus tshawytscha)* – Snake River Fall-Run ESU	T – 70 FR 37160	58 FR 68543	80 FR 67386 (Draft)
Chinook Salmon (*Oncorhynchus tshawytscha)* – Snake River Spring/Summer Run ESU	T – 70 FR 37160	64 FR 57399	81 FR 74770 (Draft) 11-2017-Final
Chinook Salmon (*Oncorhynchus tshawytscha)* – Upper Columbia River Spring-Run ESU	E – 70 FR 37160	70 FR 52629	72 FR 57303
Chinook Salmon (*Oncorhynchus tshawytscha)* – Upper Willamette River ESU	T – 70 FR 37160	70 FR 52629	76 FR 52317

Chum Salmon (*Oncorhynchus keta*) – Columbia River ESU	T – 70 FR 37160	70 FR 52629	78 FR 41911
Chum Salmon (*Oncorhynchus keta*) – Hood Canal Summer-Run ESU	T – 70 FR 37160	70 FR 52629	72 FR 29121
Coho Salmon (*Oncorhynchus kisutch*) – Central California Coast ESU	E – 70 FR 37160	64 FR 24049	77 FR 54565
Coho Salmon (*Oncorhynchus kisutch*) – Lower Columbia River ESU	T – 70 FR 37160	81 FR 9251	78 FR 41911
Coho Salmon (*Oncorhynchus kisutch*) – Oregon Coast ESU	T – 73 FR 7816	73 FR 7816	81 FR 90780
Coho Salmon (*Oncorhynchus kisutch*) – Southern Oregon and Northern California Coasts ESU	T – 70 FR 37160	64 FR 24049	79 FR 58750
Eulachon (*Thaleichthys pacificus*) –Southern DPS	T – 75 FR 13012	76 FR 65323	9/2017
Giant Manta Ray (*Manta birostris*)	T – 83 FR 2916	-- --	-- --
Green Sturgeon (*Acipenser medirostris*) – Southern DPS	T – 71 FR 17757	74 FR 52300	2010 (Outline) 8/2018- Final
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	T – 56 FR 49653	68 FR 13370	09/1995
Nassau Grouper (*Epinephelus striatus*)	T – 81 FR 42268	-- --	8/2018- Outline
Oceanic Whitetip Shark (*Carcharhinus longimanus*)	T – 83 FR 4153	-- --	9/2018- Outline
Smalltooth Sawfish (*Pristis pectinata*) – U.S. portion of range DPS	E – 68 FR 15674	74 FR 45353	74 FR 3566 01/2009
Scalloped Hammerhead Shark (*Sphyrna lewini*) – Central and Southwest Atlantic DPS	T – 79 FR 38213	-- --	-- --

Scalloped Hammerhead Shark (*Sphyrna lewini*) – Eastern Pacific DPS	E – 79 FR 38213	-- --	-- --
Scalloped Hammerhead Shark (*Sphyrna lewini*) – Indo-West Pacific DPS	T – 79 FR 38213	-- --	-- --
Shortnose Sturgeon (*Acipenser brevirostrum*)	E – 32 FR 4001	-- --	63 FR 69613 12/1998
Sockeye Salmon (*Oncorhynchus nerka*) – Ozette Lake ESU	T – 70 FR 37160	70 FR 52630	74 FR 25706
Sockeye Salmon (*Oncorhynchus nerka*) – Snake River ESU	E – 70 FR 37160	58 FR 68543	80 FR 32365
Steelhead Trout (*Oncorhynchus mykiss*) – California Central Valley DPS	T – 71 FR 834	70 FR 52487	79 FR 42504
Steelhead Trout (*Oncorhynchus mykiss*) – Central California Coast DPS	T – 71 FR 834	70 FR 52487	81 FR 70666
Steelhead Trout (*Oncorhynchus mykiss*) – Lower Columbia River DPS	T – 71 FR 834	70 FR 52629	78 FR 41911
Steelhead Trout (*Oncorhynchus mykiss*) – Middle Columbia River DPS	T – 71 FR 834	70 FR 52629	74 FR 50165
Steelhead Trout (*Oncorhynchus mykiss*) – Northern California DPS	T – 71 FR 834	70 FR 52487	81 FR 70666
Steelhead Trout (*Oncorhynchus mykiss*) – Puget Sound DPS	T – 72 FR 26722	81 FR 9251	84 FR 71379
Steelhead Trout (*Oncorhynchus mykiss*) – Snake River Basin DPS	T – 71 FR 834	70 FR 52629	81 FR 74770 (Draft) 11-2017-Final
Steelhead Trout (*Oncorhynchus mykiss*) – South-Central California Coast DPS	T – 71 FR 834	70 FR 52487	78 FR 77430

Steelhead Trout (*Oncorhynchus mykiss*) – Southern California Coast DPS	E – 71 FR 834	70 FR 52487	77 FR 1669
Steelhead Trout (*Oncorhynchus mykiss*) – Upper Columbia River DPS	T – 71 FR 834	70 FR 52629	72 FR 57303
Steelhead Trout (*Oncorhynchus mykiss*) – Upper Willamette River DPS	T – 71 FR 834	70 FR 52629	76 FR 52317

DPS=distinct population segment; ESU=evolutionarily significant unit; E=endangered; T=threatened; FR=*Federal Register*

ESA-Listed Marine Mammals in the Action Area

Blue whales, fin whales, and sei whales are widely distributed across the globe in all major oceans. All of these species typically winter at low latitudes, where they mate, calve and nurse, and summer at high latitudes, where they feed. They are most common in offshore continental shelf and slope waters that support productive zooplankton blooms.

Humpback whales are also widely distributed and winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed. The Western North Pacific DPS of humpback whales breeds/winters in the area of Okinawa and the Philippines, which are not in the action area, and migrates to feeding grounds in the northern Pacific Ocean, primarily off the Russian coast outside of the action area, but also feeds near the Aleutian Islands and the Gulf of Alaska (81 FR 62259). The Mexico DPS of humpback whales breeds along the Pacific coast of mainland Mexico and the Revillagigedos Islands, and feeds in the action area across a broad geographic range from California to the Aleutian Islands (81 FR 62259). The Central America DPS of humpback whales breeds along the Pacific coast of Central America and feeds in the action area almost exclusively offshore of California and Oregon (81 FR 62259).

The Southern Resident DPS killer whale is found along the Pacific Coast of the United States and Canada. Southern Resident killer whales occur in the inland waterways (not in the action area) of Puget Sound, the Strait of Juan de Fuca, and the Southern Georgia Strait during the spring, summer and fall. During the winter, they move out into coastal waters primarily off Oregon, Washington, California, and British Columbia.

The Western North Pacific gray whales tend to feed near the bottom in productive waters closer to shore. Some Western North Pacific of gray whales winter in the action area on the west coast of North America, while most others migrate south to winter in waters off Japan and China and summer in the Okhotsk Sea off northeast Sakhalin Island, Russia, and off southeastern Kamchatka in the Bering Sea (Burdin et al. 2013).

The North Atlantic right whale is primarily found in the western North Atlantic Ocean from shallow coastal water breeding grounds in temperate latitudes off the coast of the southeastern

U.S. during the winter, and feeding in summer outside the action area on large concentrations of zooplankton in the sub-polar latitudes (Colligan et al. 2012) off the coast of Nova Scotia (Waring et al. 2016).

North Pacific right whales mostly inhabit coastal and continental shelf waters in the North Pacific Ocean. They have been observed in temperate latitudes during winter off Japan (outside the action area), California, and Mexico where they likely calve and nurse. In the summer, they feed on large concentrations of zooplankton in sub-polar waters around Alaska.

The range of Rice's whale is primarily in a relatively small biologically important area in the northeastern Gulf of Mexico near De Soto Canyon, in waters 100 to 400 meters (m) deep along the continental shelf break. It inhabits the Gulf of Mexico year round, but its distribution outside of this biologically important area is unknown. It should be noted that population estimates for Rice's whale are very low, in 2009 estimated at 33 individuals (Rosel et al. 2016). An estimate by Roberts et al. (2016) utilizing habitat-based density models that incorporate visual survey data from 1992 to 2009 is 44 individuals.

The sperm whale is widely distributed globally, found in all major oceans. Sperm whales mostly inhabit areas with a water depth of 600 m (1,968 ft) or more, and are uncommon in waters less than 300 m (984 ft) deep. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed primarily on squid and demersal fish.

False killer whales prefer waters more than 1,000 m (3,280.8 ft) deep, feeding on fishes and cephalopods. The Main Hawaiian Islands Insular DPS of false killer whale is considered resident within 40 km (21.6 NM) of the Main Hawaiian Islands.

Guadalupe fur seals breed mainly on Guadalupe Island with another smaller breeding colony in the San Benito Archipelago, Baja California, Mexico (Belcher and T.E. Lee 2002). Guadalupe fur seals feed mainly on squid species (Esperon-Rodriguez and Gallo-Reynoso 2013) with foraging trips that can last between four to 24 days (average of 14 days) and cover great distances, with sightings occurring thousands of kilometers away from the main breeding colonies (Aurioles-Gamboa et al. 1999). Guadalupe fur seals are infrequently observed in U.S. waters but they can be found on California's Channel Islands.

The entire range of the Hawaiian monk seal is located within U.S. waters. The main breeding subpopulations are in the Northwestern Hawaiian Islands, but there is also a small growing population found on the Main Hawaiian Islands. Hawaiian monk seals are considered foraging generalist that feed primarily on benthic and demersal prey such as fish, cephalopods, and crustaceans in subphotic zones (Parrish et al. 2000).

The Western DPS Steller sea lions reside in the central and western Gulf of Alaska, the Aleutian Islands, as well as coastal portions of Japan and Russia that are not in the action area. Western DPS Steller sea lions typically forage in coastal waters on the continental shelf, but they sometimes forage in deeper continental slope and pelagic waters, especially in the non-breeding season.

ESA-Listed Sea Turtles in the Action Area

The green turtle has a circumglobal distribution, occurring throughout nearshore tropical, subtropical and, to a lesser extent, temperate waters. After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage believed to last several years. Adult green turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Green turtles from the North Atlantic DPS range from south of the action area from the boundary of South and Central America throughout the Caribbean Sea (outside action area), into the Gulf of Mexico and the U.S. Atlantic coast (in the action area), and range north of the action area toward Canada (outside the action area). The range of the North Atlantic DPS of green turtle also extends east beyond the action area to the western coasts of Europe and Africa. The North Atlantic DPS of green turtle nesting occurs primarily outside the action area in Costa Rica, Mexico, and Cuba, but also in Florida. The Central North Pacific DPS of green turtle is found in the Pacific Ocean near the Hawaiian Archipelago and Johnston Atoll. The major nesting site for the Central North Pacific DPS of green turtle is at East Island, French Frigate Shoals, in the Northwestern Hawaiian Islands; lesser nesting sites are found throughout the Northwestern Hawaiian Islands and the Main Hawaiian Islands. Green turtles in the Central West Pacific DPS are found throughout the western Pacific Ocean, in Indonesia, the Philippines, the Marshall Islands, and Papua New Guinea. In the action area, Central West Pacific DPS green turtle nesting assemblages occur in the Federated States of Micronesia, and the Marshall Islands. Green turtles in the East Pacific DPS are found in the action area from the California/Oregon border to south of the action area, to central Chile. Nesting occurs outside the action area at major sites in Michoacán, Mexico, and the Galapagos Islands, Ecuador. Smaller nesting sites are found in the Revillagigedos Archipelago, Mexico, and along the Pacific Coast of Costa Rica, Columbia, Ecuador, Guatemala and Peru (Seminoff et al. 2015). The Central South Pacific DPS green turtle is found in the South Pacific Ocean extending north from northern New Zealand to Tuvalu and extending east over to Easter Island, Chile. The Central South Pacific DPS encompasses several island groups including American Samoa, French Polynesia, Cook Islands, Fiji, Kiribati, Tokelau, Tonga, and Tuvalu. Those island groups are south of the action area, except Kiribati breaches into the action area, the most northern island group. Central South Pacific DPS nesting occurs sporadically throughout the geographic distribution of the population, with isolated locations having relatively low to moderate nesting activity.

The hawksbill turtle has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical waters of the Atlantic, Indian, and Pacific Oceans. In their oceanic phase, juvenile hawksbill turtles can be found in *Sargassum* mats; post-oceanic hawksbills may occupy a range of habitats that include coral reefs or other hard-bottom habitats, seagrass, algal beds, mangrove bays and creeks (Bjorndal and Bolten 2010; Musick and Limpus 1997).

The Kemp's ridley turtle occurs from the Gulf of Mexico and up along the Atlantic coast of the U.S. (TEWG 2000). The majority of Kemp's ridley turtles nest at coastal Mexican beaches in the Gulf of Mexico. During spring and summer, juvenile Kemp’s ridleys occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida. In the fall, most Kemp’s ridleys migrate to deeper or more southern, warmer waters and remain there through the

winter (Schmid 1998). As adults, many Kemp's ridley turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS et al. 2010).

Globally, olive ridley sea turtles can be found in tropical and subtropical waters in the Atlantic, Indian, and Pacific Oceans. Major nesting beaches are found outside the action area in Nicaragua, Costa Rica, Panama, India and Suriname. Olive ridleys may forage across ocean basins, primarily in pelagic habitats, on crustaceans, fish, mollusks, and tunicates. The range of the endangered Pacific coast breeding population extends as far south as Peru and up to California. Olive ridley turtles of the Pacific coast breeding colonies nest outside the action area on arribada beaches at Mismaloya, Ixtapilla and La Escobilla, Mexico. Solitary nesting takes place all along the Pacific coast of Mexico.

Loggerhead turtles are circumglobal, and are found in the temperate and tropical regions of the Atlantic, Indian, and Pacific Oceans. The post-hatchling stage is in pelagic waters and juveniles are first in the oceanic zone and later in the neritic zone (i.e., coastal waters). While in their oceanic phase, loggerhead turtles undertake long migrations using ocean currents. Adults and sub-adults occupy nearshore habitat important for foraging and inter-nesting migration. The Northwest Atlantic Ocean DPS of loggerhead turtle hatchlings disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean. Genetic evidence demonstrates that juvenile loggerheads from southern Florida nesting beaches comprise the vast majority (71 to 88 percent) of individuals found in foraging grounds throughout the western and eastern Atlantic (Masuda 2010). North Pacific Ocean DPS of loggerhead turtles are found throughout the Pacific Ocean, north of the equator. Their range extends from the West Coast of North America to eastern Asia. Two major juvenile foraging areas have been identified in the North Pacific Basin: Central North Pacific and off Mexico's Baja California Peninsula. Hatchlings from Japanese nesting beaches outside the action area use the North Pacific Subtropical Gyre and the Kurishio Extension to migrate to those foraging grounds (Abecassis et al. 2013; Seminoff et al. 2014). The leatherback sea turtle is unique among sea turtles for its large size and ability to maintain internal warmth (due to thermoregulatory systems), which allows it to range worldwide from tropical into subpolar latitudes. Leatherbacks occur throughout marine waters, from nearshore habitats to oceanic environments (Shoop and Kenney 1992). Leatherback sea turtles migrate long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage, primarily on jellyfish and tunicates. Detailed population structure is unknown, but the leatherback distribution is assumed dependent upon nesting beach locations in the Pacific, Atlantic, and Indian Oceans. Movements are largely dependent upon reproductive and feeding cycles and the oceanographic features that concentrate prey, such as frontal systems, eddy features, current boundaries, and coastal retention areas (Benson et al. 2011).

ESA-Listed Fishes in the Action Area

Atlantic sturgeon spawn in freshwater, but spend most of their adult life in the marine environment. Atlantic sturgeon occupy ocean waters and associated bays, estuaries, and coastal river systems from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida (ASMFC 2006; Stein et al. 2004). Five DPS's of Atlantic sturgeon are listed under the ESA: Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic. Juveniles typically spend two to five years in freshwater before eventually becoming coastal residents as sub-adults (Boreman 1997; Schueller and Peterson 2010; Smith 1985). Atlantic sturgeon exhibit high

fidelity to their natal rivers but can undergo extensive mixing in coastal waters (Grunwald et al. 2008; King et al. 2001; Waldman et al. 2002).

The Pacific salmon (chinook, coho, chum and sockeye) and steelhead trout are anadromous fishes and the ESA-listed DPSs and ESUs spawn in their natal rivers in Washington, Oregon and California. Juvenile Chinook may reside in freshwater for 12 to 16 months, but some migrate to the ocean as young-of-the-year within eight months of hatching. Chinook salmon spend a few years feeding in the ocean, and sexually mature between the ages of two and seven but are typically three or four years old when they return to spawn, generally in summer or early fall. Coho salmon spend a year in freshwater and then migrate out to the ocean to spend about 1.5 years feeding before returning to spawn, generally in fall or early winter. Sockeye salmon rear in freshwater for one to three years, after which they reach the smolt stage and migrate to the ocean to feed and grow. They typically mature and return to freshwater to spawn in the summer or fall after two to three years at sea, but some return earlier or stay at sea longer, between four and five years. Steelhead trout typically migrate to open marine waters after spending two years in freshwater. They reside in marine waters for typically two or three years prior to returning to their natal stream as four- or five-year-olds to spawn shortly after river entry from December through April. Young chum salmon (fry) typically migrate directly to estuarine and marine waters soon after they are born and do not reside in freshwater for an extended period. As chum salmon grow larger, they migrate offshore and as they approach maturity, typically between the ages of three and six, they migrate back to spawn in late summer through March.
The eulachon is an anadromous fish, smaller than salmonids (8.5 inches, 21.5 centimeters), that can be found in the continental shelf waters of the eastern Pacific Ocean. Adult and juvenile Southern DPS eulachon typically occupy waters 50 to 200 m deep (Gustafson 2016), and up to depths of about 300 m, from California to the Bering Sea. Southern DPS eulachon are those that return to spawn in rivers south of the Nass River in British Columbia to the Mad River in California.

The giant manta ray occupies tropical, subtropical, and temperate oceanic waters and productive coastlines where they feed on zooplankton. Giant manta rays are commonly offshore in oceanic waters, but are sometimes found feeding in shallow waters (less than 10 m [32.8 ft]) during the day. Giant manta rays can dive to depths of over 1,000 m (3,280.8 ft), and also conduct night descents to between 200 and 450 m (656.2 to 1,476.4 ft) deep.

The green sturgeon is an anadromous fish that occurs in the nearshore coastal waters to a depth of 110 m from Baja California, Mexico to the Bering Sea, Alaska (Hightower 2007). Adult Southern DPS green sturgeon enter San Francisco Bay and migrate up the Sacramento River to spawn (Heublin et al. 2009).

The current range of the Gulf sturgeon extends from Lake Pontchartrain in Louisiana east to the Suwannee river system in Florida. Young-of-the-year slowly work their way downstream from where they hatched and arrive in estuaries and river mouths where they will spend their next six years developing (Sulak and Clugston 1999). After six years, Gulf sturgeon enter the marine environment to forage on benthic (bottom dwelling) invertebrates along the shallow nearshore (2-4 m depth), barrier island passes, and in unknown offshore locations in the Gulf of Mexico (Huff 1975, Carr et al. 1996, Fox et al. 2002, Ross et al. 2009).

The Nassau grouper is distributed from south Florida throughout the Caribbean, and Bermuda. Juveniles inhabit macroalgae, coral clumps, and seagrass beds, and are relatively solitary. As they grow, they occupy progressively deeper areas and offshore reefs, and can be in schools of up to forty individuals. When not spawning, adults are most common in waters less than 100 m deep.

The oceanic whitetip shark is a large pelagic shark distributed globally throughout open ocean waters, outer continental shelves, and around oceanic islands, primarily from 10 degrees North to 10 degrees South, but up to 30 degrees North and 35 degrees South (Young 2016). They occur from the surface to at least 152 m (498.7 ft) deep, and display a preference for water temperatures above 20 degrees Celsius (°C).

Shortnose sturgeon occur in estuaries, rivers, and the sea along the east coast of North America (Vladykov and Greeley 1963). Their northerly distribution extends north of the action area to the Saint John River, New Brunswick, Canada, and their southerly distribution historically extended to the Indian River, Florida (Evermann and Bean 1898, Scott and Scott 1988). Some populations rarely leave freshwater while others are known to migrate along the coast between river systems (Quattro et al. 2002, Wirgin et al. 2005, Dionne et al. 2013, Altenritter et al. 2015).

The scalloped hammerhead shark is found throughout the world and the Central and Southwest Atlantic DPS, Eastern Pacific DPS, and Indo-West Pacific DPSs live in coastal warm temperate and tropical seas. The species occurs over continental shelves and the shelves surrounding islands, as well as adjacent deep waters, but is seldom found in waters cooler than 22 (°C) (Compagno 1984; Schulze-Haugen and Kohler 2003). It ranges from the intertidal and surface to depths of up to 450 to 512 m (1,476.4 to 1,679.8 ft), with occasional dives to even deeper waters. It has also been documented entering enclosed bays and estuaries. The Central and Southwest Atlantic DPS of scalloped hammerhead shark's range extends from the southeast coast of Florida to outside the action area, down to Brazil, including the Caribbean Sea, but not the Gulf of Mexico. The Eastern Pacific DPS of scalloped hammerhead shark's range extends from the coast of southern California, down south past the action area, to Ecuador and possibly Peru, and waters off Tahiti. The Indo-West Pacific DPS of scalloped hammerhead shark ranges from Japan down to Australia, including tropical Pacific islands in the action area. The central Pacific Ocean waters near Hawaii are not included within the range of listed DPSs.

Historically within the United States, smalltooth sawfish have been captured in estuarine and coastal waters from New York southward through Texas, with the largest number of recorded captures in Florida (NMFS 2010). Recent capture and encounter data suggest that the current distribution is primarily south and southwest Florida from Charlotte Harbor through the Dry Tortugas (Seitz and Poulakis 2002, Poulakis and Seitz 2004). Water temperatures (no lower than 16-18°C) and the availability of appropriate coastal habitat (shallow, euryhaline waters and red mangroves) are the major environmental constraints limiting the distribution of smalltooth sawfish (Bigalow and Schroeder 1953). Juvenile sawfish spend the first 2-3 years of their lives in the shallow waters provided in the lower reaches of rivers, estuaries, and coastal bays (Simpfendorfer et al. 2008 and 2011). As smalltooth sawfish approach 250 centimeters (cm), they become less sensitive to salinity changes and begin to move out of the protected shallow

water embayments and into the shorelines of barrier islands (Poulakis et al. 2011). Adult sawfish typically occur in more open water, marine habitats (Poulakis and Seitz 2004).

Critical Habitat in the Action Area

This section discusses designated critical habitat that is either completely encompassed by the action area or is partially within the action area.

Green Sturgeon

The action area includes critical habitat for Southern DPS green sturgeon (Figure 6). In marine waters, the designated critical habitat is up to the 110 m depth isobath from Monterey Bay to the U.S.-Canada border.

The physical and biological features (PBFs) essential for the conservation of the Southern DPS green sturgeon are:

1. **Migratory corridor:** A migratory pathway necessary for the safe and timely passage within marine and between estuarine and marine habitats.
2. **Water quality:** Nearshore marine waters with adequate dissolved oxygen levels and acceptably low levels of contaminants (e.g., pesticides, organochlorines, elevated levels of heavy metals) that may disrupt the normal behavior, growth, and viability of subadults and adults.
3. **Food resources:** Abundant prey items for subadults and adults, which may include benthic invertebrates and fishes.

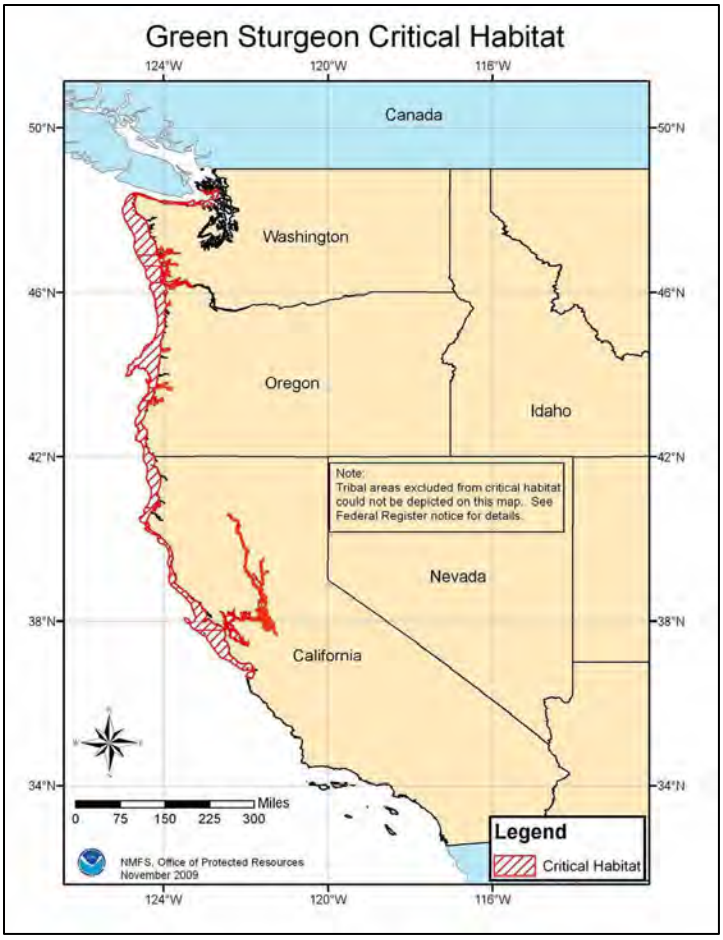

Figure 6. Green Sturgeon Critical Habitat

Gulf Sturgeon

Most of the Gulf sturgeon critical habitat is outside the action area, except for a boundary portion near Cedar Key, Florida, in the Gulf of Mexico (Figure 7). Most subadult and adult Gulf sturgeon spend cool months (October or November through March or April) in estuarine areas, bays, or in the Gulf of Mexico.

The PBFs relevant to the conservation of gulf sturgeon in estuarine and marine areas are:

1. Abundant prey items within estuarine and marine habitats and substrates for juvenile, subadult, and adult life stages;
2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages;
3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; and
4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., a river unobstructed by any permanent structure, or a dammed river that still allows for passage).

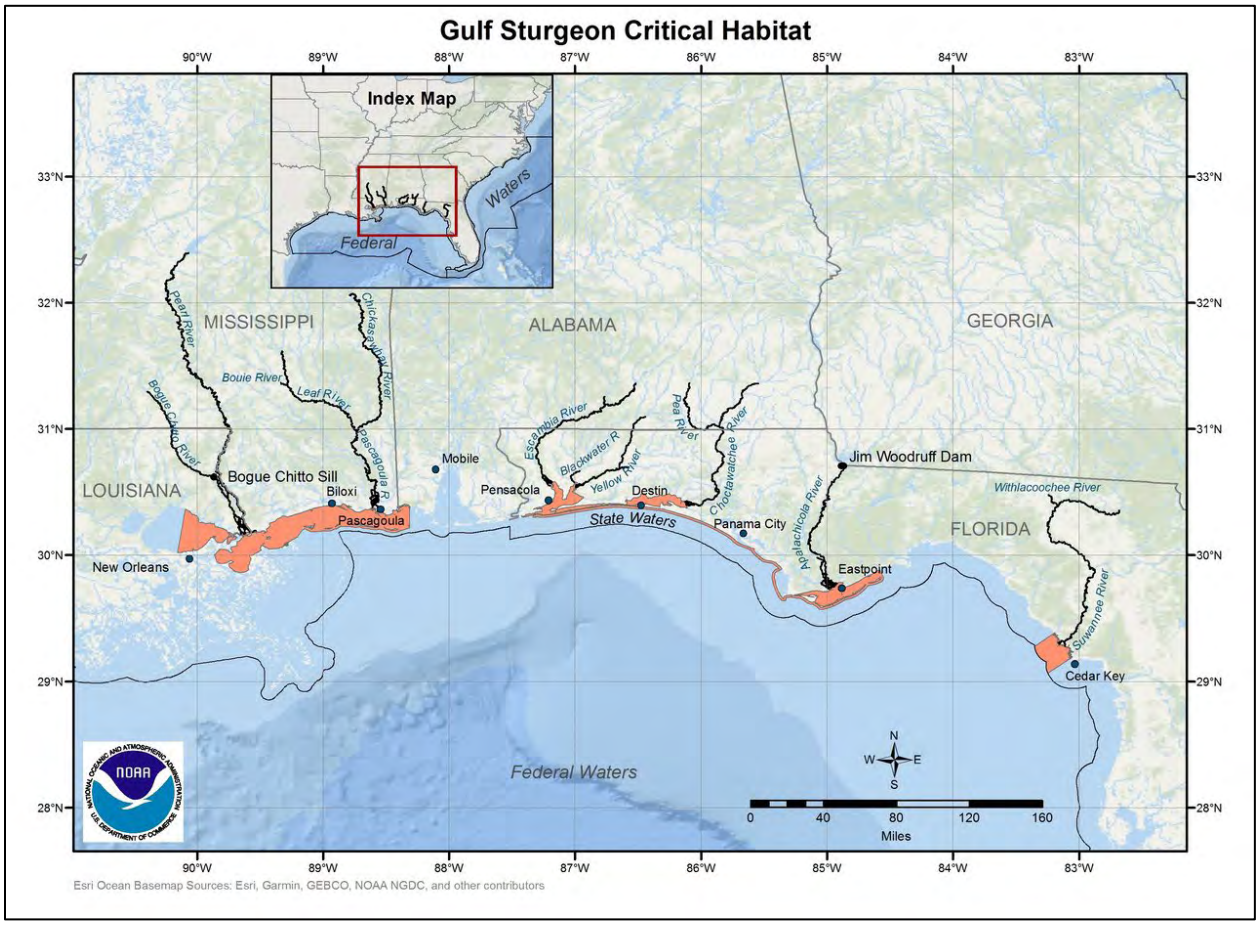

Figure 7. Gulf Sturgeon Critical Habitat

Pacific Leatherback Sea Turtle

The action area includes leatherback sea turtle critical habitat along the U.S. West Coast (Figure 8). This designation includes approximately 43,798 square kilometers stretching along the California coast from Point Arena to Point Arguello east of the 3000 m depth contour; and 64,760 square kilometers stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 m depth contour. The designation includes waters from the ocean surface down to a maximum depth of 80 m. These waters were designated specifically because of the occurrence of prey species, primarily Scyphomedusae of the order Semaeostomeae (i.e., jellyfish), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

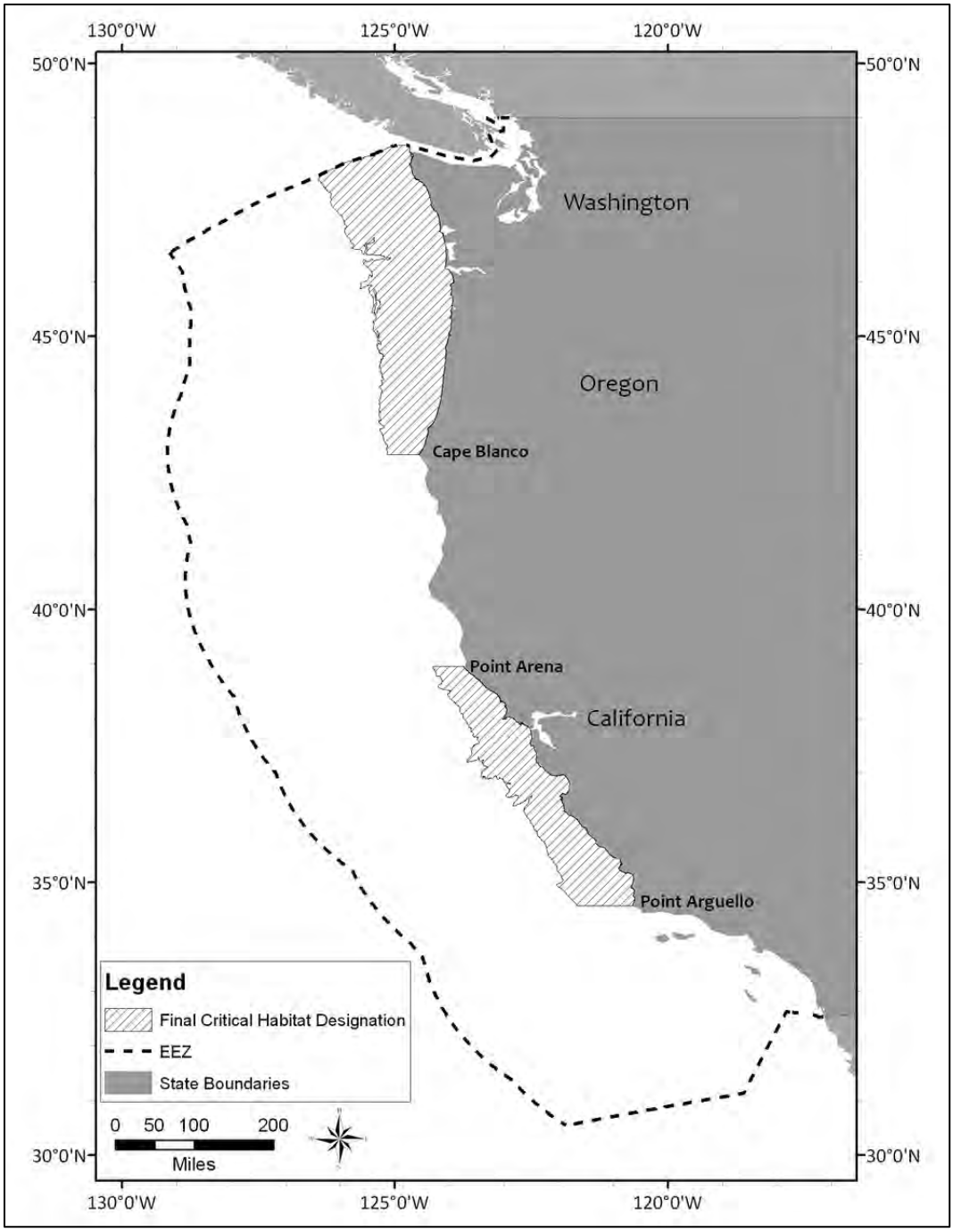

Figure 8. Pacific Leatherback Sea Turtle Critical Habitat

Loggerhead Sea Turtle

The action area includes Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitat in the Gulf of Mexico and Atlantic Ocean (Figure 9). The designated critical habitat includes overlapping areas of nearshore reproductive habitat, constricted migratory habitat, breeding habitat, and *Sargassum* habitat (descriptions below). The FAA determined that approximately 13 miles of nearshore reproductive habitat is within the action area around Cape Canaveral and Port

Canaveral, but the remaining nearshore reproductive habitat areas are outside the action area because the landing/splashdown area begins 5 NM offshore.

- **Nearshore reproductive habitat:** The PBFs of nearshore reproductive habitat as a portion of the nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season. The following primary constituent elements support this habitat: (i) nearshore waters directly off the highest density nesting beaches and their adjacent beaches, as identified in 50 CFR § 17.95(c), to 1.6 kilometers offshore; (ii) waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and (iii) waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents.
- **Constricted migratory habitat:** The PBFs of constricted migratory habitat as high use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side. Primary constituent elements that support this habitat are the following: (i) constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways; and (ii) passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas.
- **Breeding habitat:** The PBFs of concentrated breeding habitat as those sites with high densities of both male and female adult individuals during the breeding season. Primary constituent elements that support this habitat are the following: (i) high densities of reproductive male and female loggerheads; (ii) proximity to primary Florida migratory corridor; and (iii) proximity to Florida nesting grounds.
- ***Sargassum* habitat:** The PBFs of loggerhead *Sargassum* habitat as developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially *Sargassum*. Primary constituent elements that support this habitat are the following: (i) convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads; (ii) *Sargassum* in concentrations that support adequate prey abundance and cover; (iii) available prey and other material associated with *Sargassum* habitat including, but not limited to, plants and cyanobacteria and animals native to the *Sargassum* community such as hydroids and copepods; and (iv) sufficient water depth and proximity to available currents to ensure offshore transport (out of the surf zone), and foraging and cover requirements by *Sargassum* for post-hatchling loggerheads, i.e., >10 m in depth.

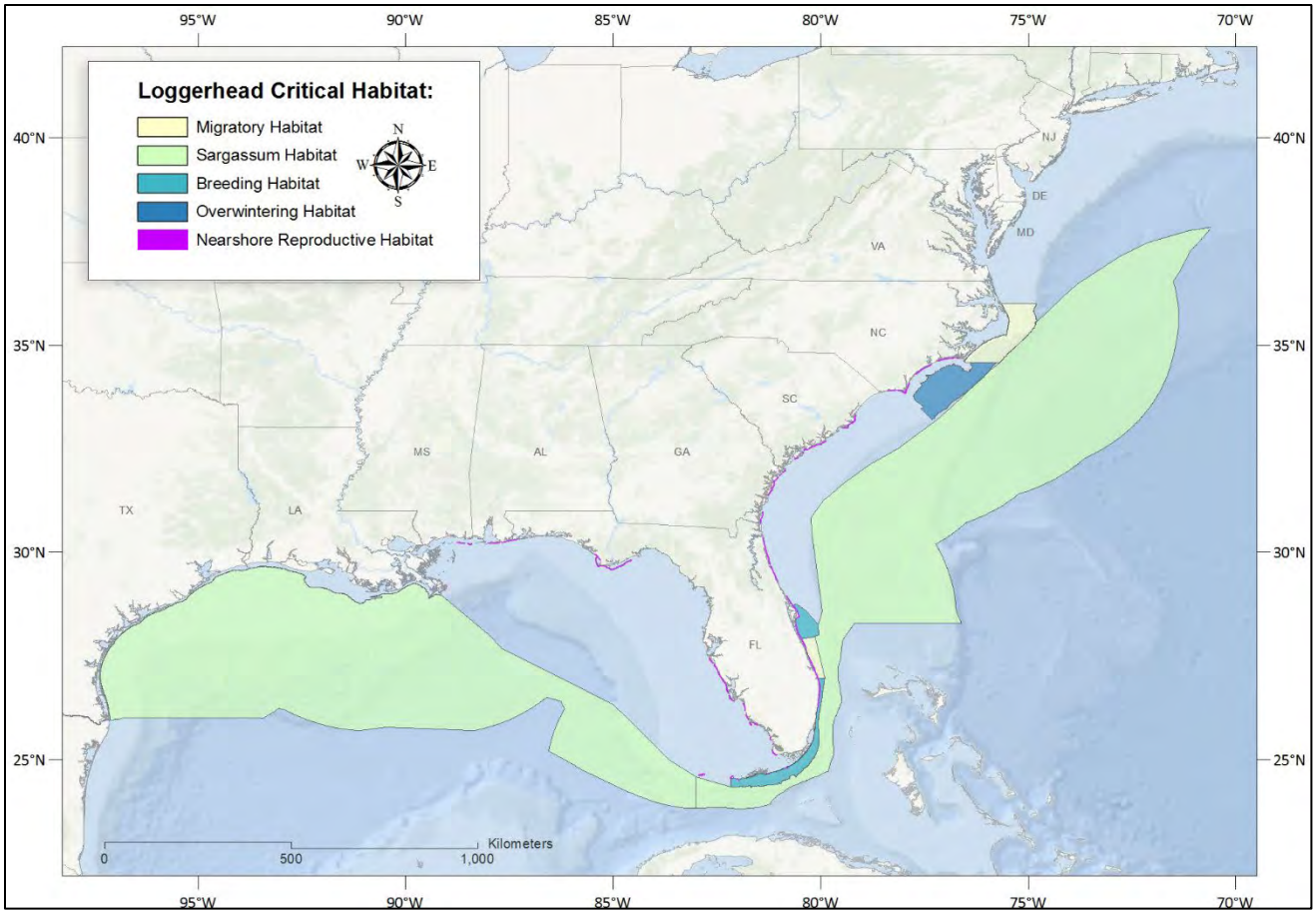

Figure 9. Loggerhead Sea Turtle Critical Habitat

North Atlantic Right Whale

NMFS designated two units of critical habitat for the North Atlantic right whale. Unit 1 is for foraging habitat in the Gulf of Maine and Georges Bank region, and is not in the action area. Unit 2 is for calving and is in the action area, consisting of all marine waters from Cape Fear, North Carolina, southward to approximately 27 NM below Cape Canaveral, Florida (Figure 10). Unit 2 occurs off the coast of CCSFS and extends seaward approximately 5 NM off the coast north of CCSFS. The following PBFs are present in Unit 2:

- Sea surface conditions associated with Force 4 or less on the Beaufort Scale.
- Sea surface temperatures of 7°C to 17°C.
- Water depths of 6-28 m, where these features simultaneously co-occur over contiguous areas of at least 231 square NM of ocean waters during the months of November through April. When these features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves.

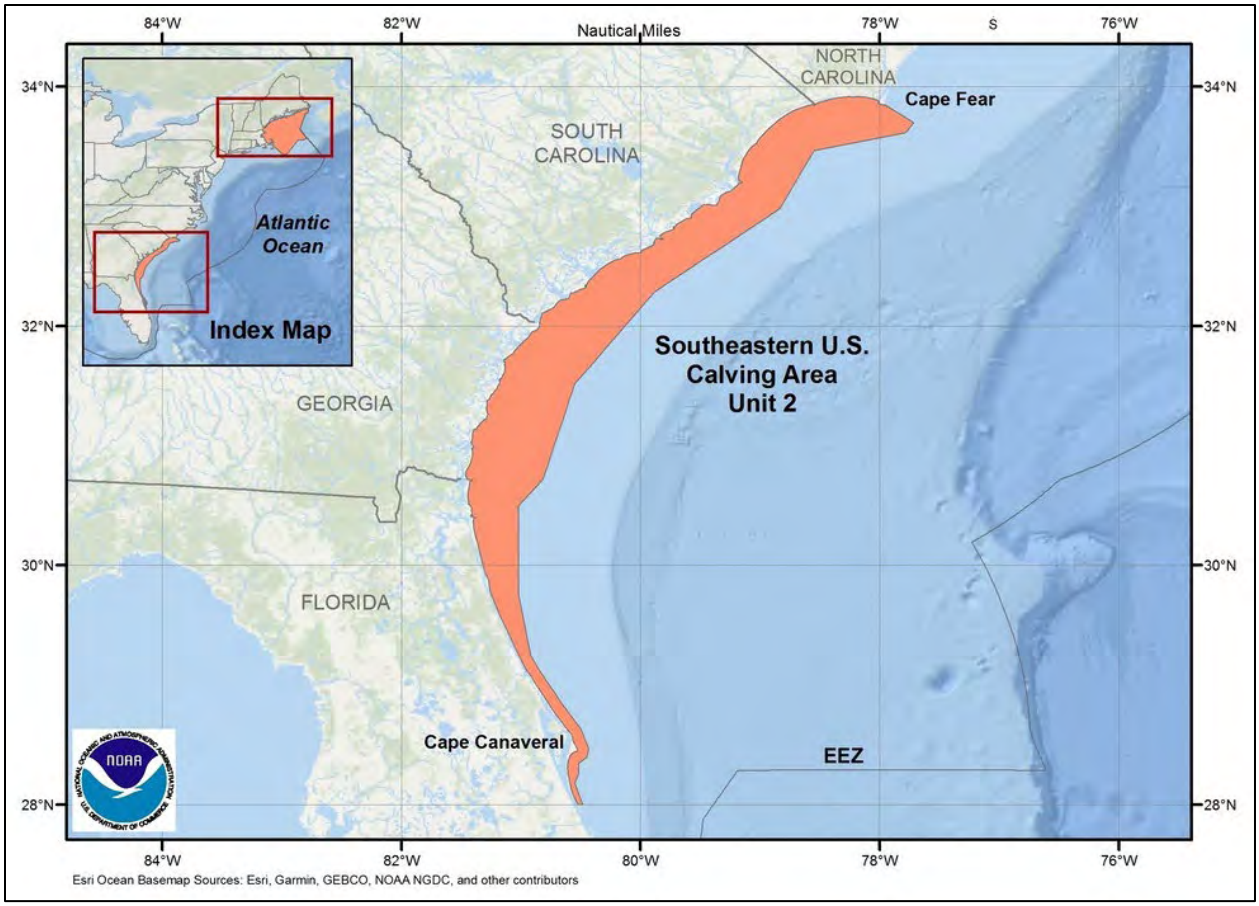

Figure 10. North Atlantic Right Whale Critical Habitat Unit 2

North Pacific Right Whale

Designated critical habitat for the North Pacific right whale includes an area in the Southeast Bering Sea, which is not in the action area, and an area south of Kodiak Island in the Gulf of Alaska (Figure 11), which is in the northern boundary of the action area in the Pacific. Both critical habitat areas support feeding by North Pacific right whales because they contain the designated PBFs, which include: nutrients, physical oceanographic processes, certain species of zooplankton (e.g. copepods *Calanus marshallae*, *Neocalanus cristatus*, and *N. plumchris*, and the euphausiid *Thysanoëssa raschii*), and a long photoperiod due to the high latitude (73 FR 19000).

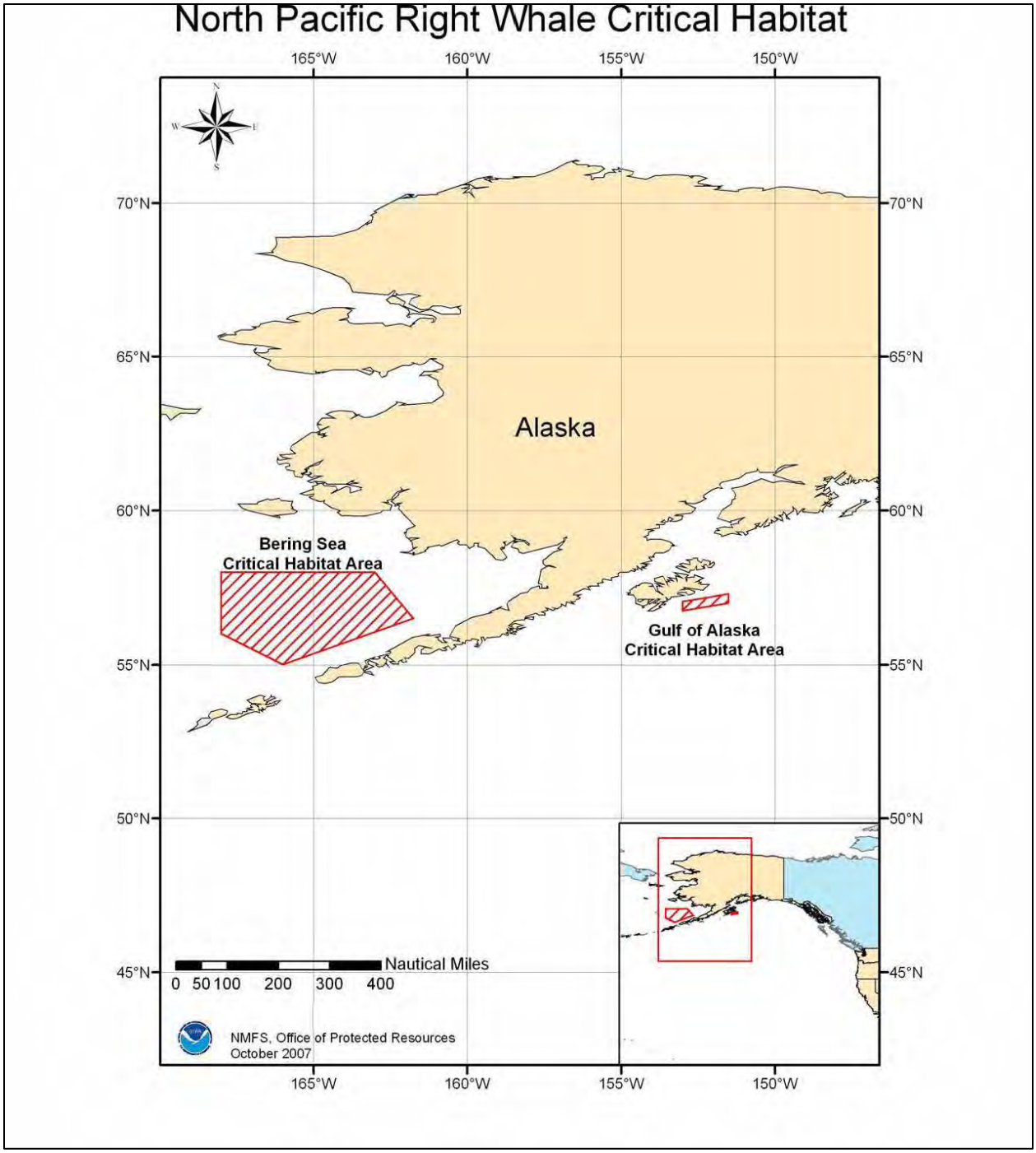

Figure 11. North Pacific Right Whale Critical Habitat

Humpback Whale

NOAA Fisheries designated critical habitat for the endangered Western North Pacific DPS, the endangered Central America DPS, and the threatened Mexico DPS of humpback whales on May 21, 2021 (86 FR 21082; Figures 12-14). The area designated as critical habitat for the Central America DPS contain approximately 48,521 square NM of marine habitat in the Pacific Ocean

within the portions of the California Current Ecosystem off the coasts of Washington, Oregon, and California (Figure 12). Areas designated as critical habitat for the Mexico DPS contain approximately 116,098 square NM of marine habitat in the North Pacific Ocean, including areas within portions of the eastern Bering Sea, Gulf of Alaska, and California Current Ecosystem (Figure 13). Areas designated as critical habitat for Western North Pacific DPS contain approximately 59, 411 square NM of marine habitat in the North Pacific Ocean, including areas within the eastern Bering Sea and Gulf of Alaska (Figure 14).

The following PBFs were identified as essential to the conservation of the DPSs as follows:

1. **Central American DPS:** prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific sardine, northern anchovy, and Pacific herring, of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.
2. **Mexico DPS:** prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific sardine, northern anchovy, Pacific herring, capelin, juvenile walleye pollock, and Pacific sand lance of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.
3. **Western North Pacific DPS:** prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific herring, capelin, juvenile walleye pollock, and Pacific sand lance of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.

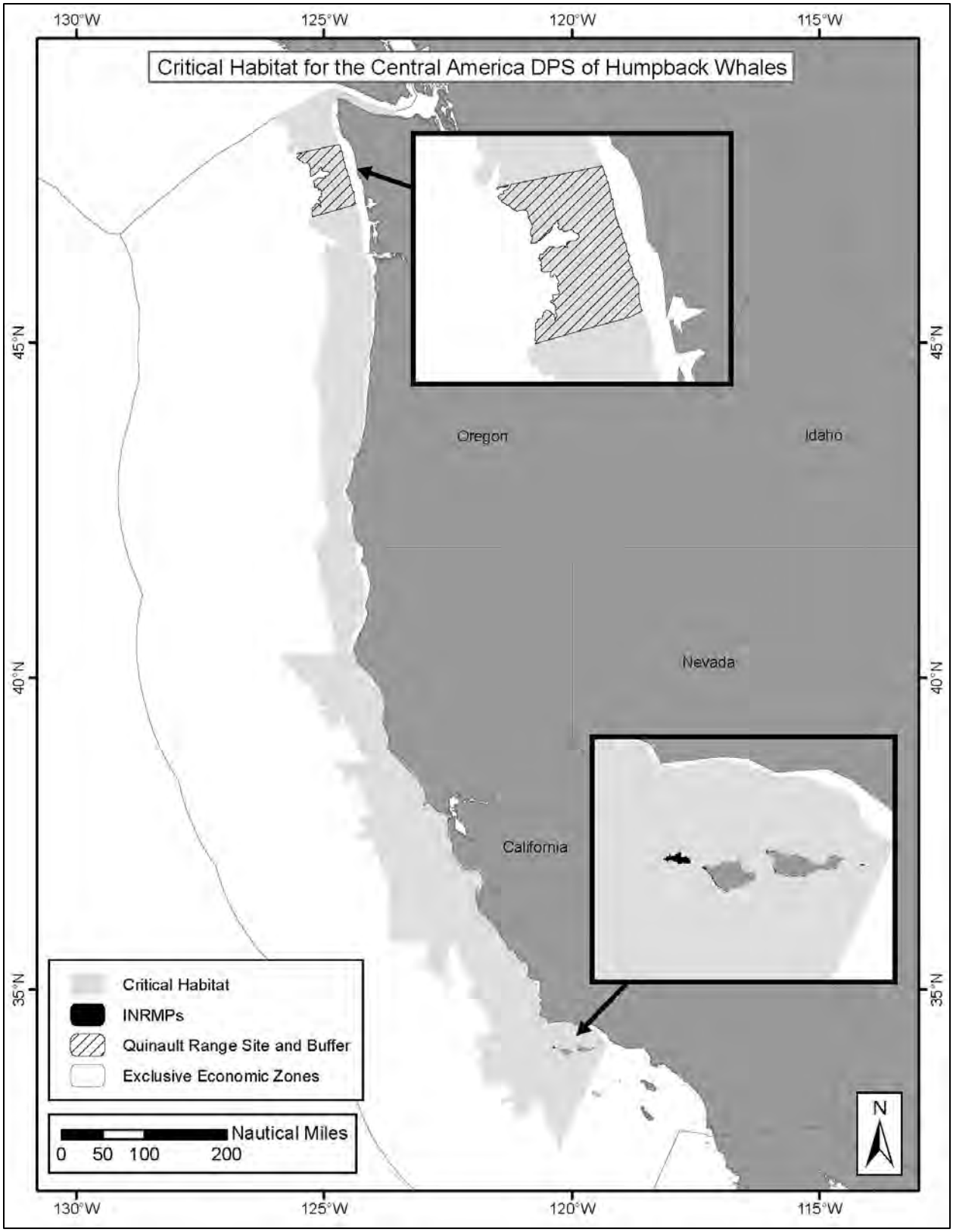

Figure 12. Critical Habitat for Central America DPS humpback whales

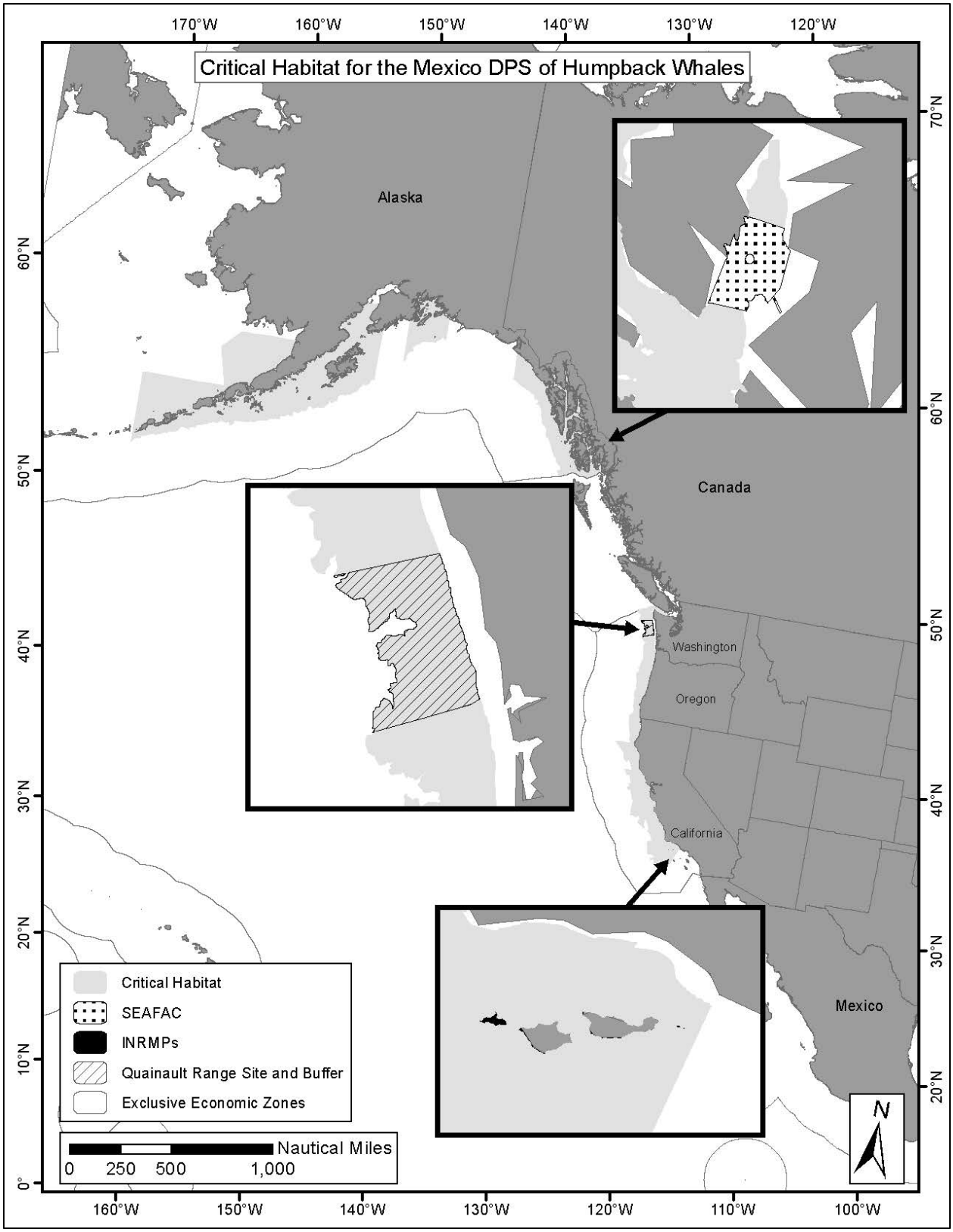

Figure 13. Critical Habitat for Mexico DPS humpback whales

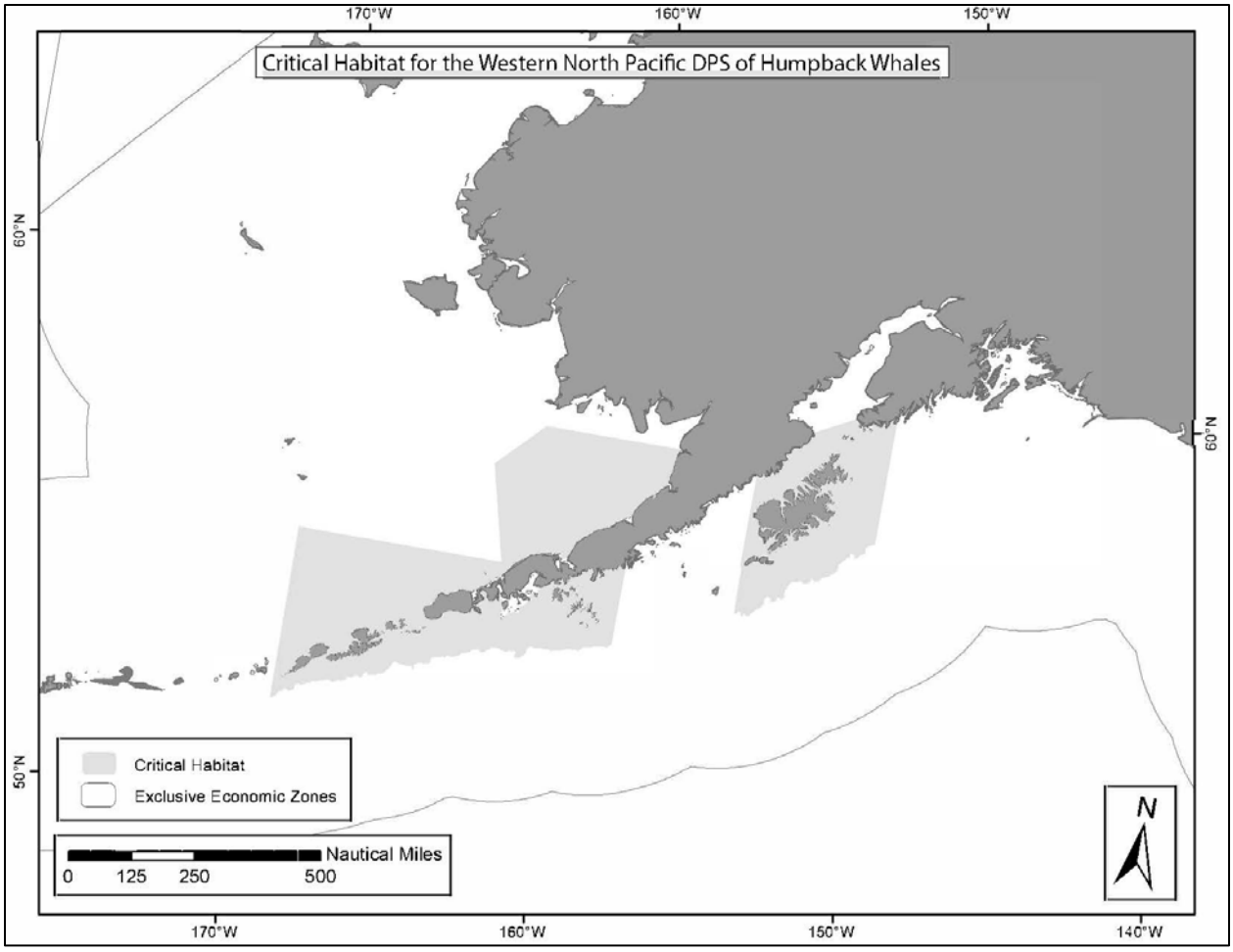

Figure 14. Critical Habitat for Western North Pacific DPS humpback whales

Killer Whale

In 2006, NMFS issued a final rule designating approximately 2,560 square miles of inland waters of Washington State as critical habitat for the Southern Resident DPS killer whale. In August of 2021, NMFS issued a revised rule to the critical habitat designation by expanding it to include six new areas along the U.S. West Coast, while maintaining the whales' currently designated critical habitat in inland waters of Washington (Figure 15). The expanded critical habitat includes marine waters between the 6.1 m depth contour and the 200 m depth contour from the U.S. international border with Canada south to Point Sur, California. Critical habitat within the action area contains PBFs associated with water quality to support growth and development, prey availability for growth, reproduction and development, and overall population growth; and passage conditions to allow for migration, resting, and foraging.

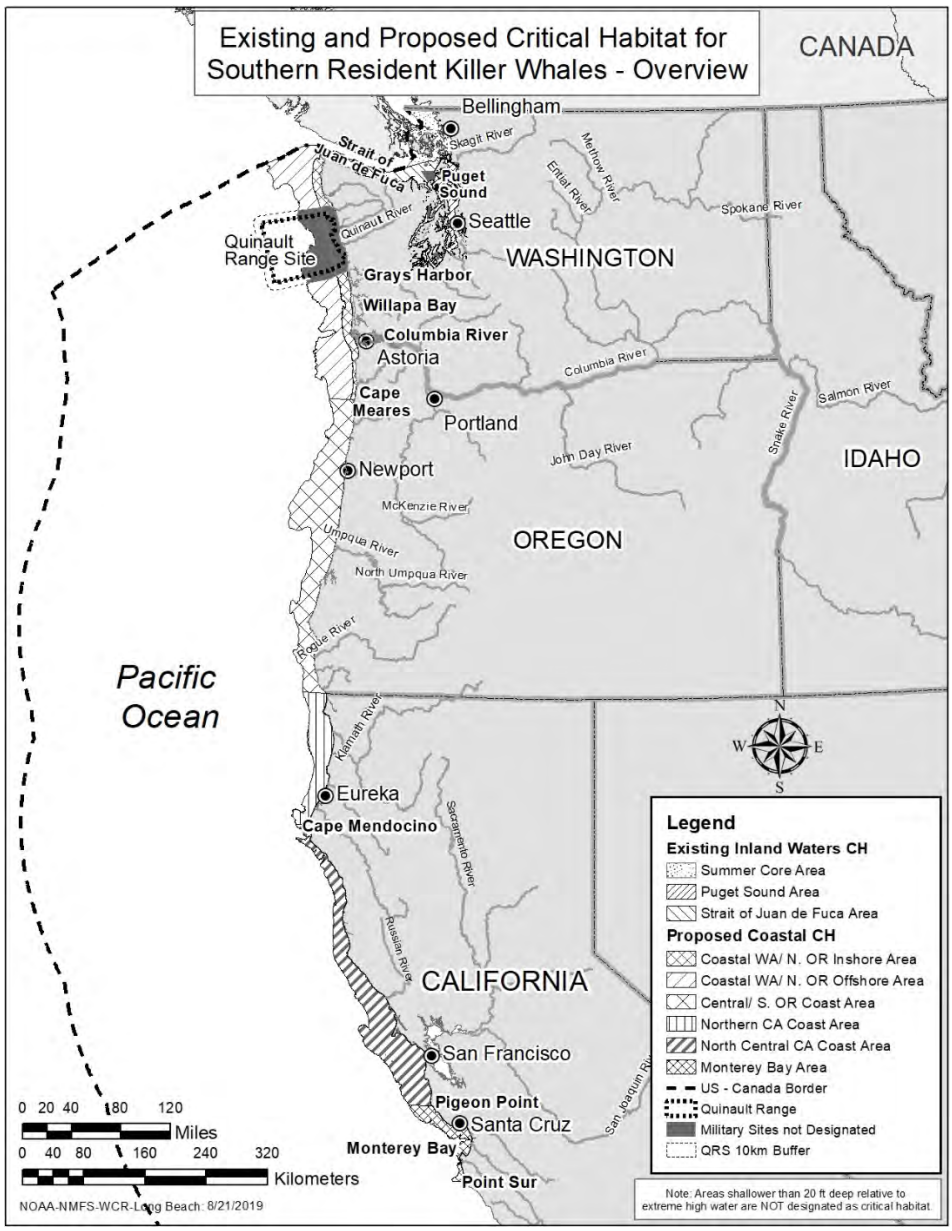

Figure 15. Southern Resident Killer Whale Critical Habitat

False Killer Whale

On July 24 2018, NOAA Fisheries designated critical habitat for the main Hawaiian Islands insular false killer whale DPS by designating waters from the 45-m depth contour to the 3,200-m depth contour around the main Hawaiian Islands from Ni'ihau east to Hawai'i (Figure 16). Island-associated marine habitat is an essential feature for the conservation of the main Hawaiian Islands insular false killer whale. Main Hawaiian Islands insular false killer whales are island-associated whales that rely entirely on the productive submerged habitat of the main Hawaiian Islands to support all of their life-history stages. The following characteristics of this habitat support insular false killer whales' ability to travel, forage, communicate, and move freely around and among the waters surrounding the main Hawaiian Islands:

1. Adequate space for movement and use within shelf and slope habitat;
2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth;
3. Waters free of pollutants of a type and amount harmful to main Hawaiian Islands insular false killer whales; and
4. Sound levels that would not significantly impair false killer whales' use or occupancy.

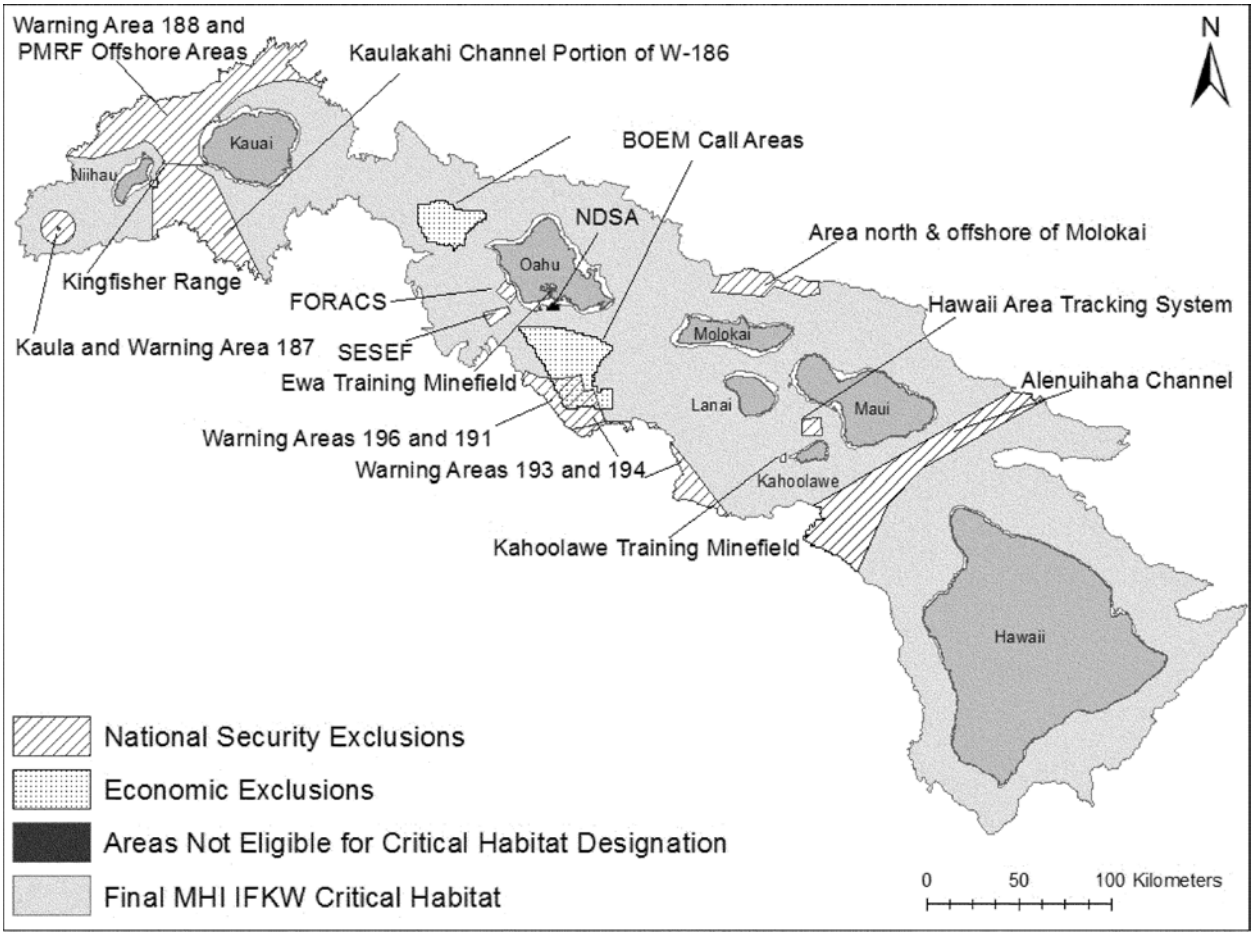

Figure 16. Main Hawaiian Islands insular DPS false killer whale critical habitat.

Hawaiian Monk Seal

NOAA Fisheries designated Critical Habitat for the Hawaiian monk seal in sixteen occupied areas within the range of the species (See series of Critical Habitat maps at: https://www.fisheries.noaa.gov/resource/map/hawaiian-monk-seal-critical-habitat-map), These areas contain one or more PBFs essential to Hawaiian monk seal conservation, including: preferred pupping and nursing areas, significant haul-out areas, and/or marine foraging areas out to 200 m in depth.

Northwestern Hawaiian Islands (Hawaiian names in parenthesis)

There are ten designated Hawaiian monk seal critical habitat areas in the Northwestern Hawaiian Islands that include all beach areas, sand spits, and islets, including all beach crest vegetation to its deepest extent inland, as well as the seafloor and marine habitat 10 m in height above the seafloor from the shoreline out to the 200 m depth contour around:

- Kure Atoll (Hōlanikū)
- Midway Atoll (Kuaihelani)
- Pearl and Hermes Reef (Manawai)
- Lisianski Island (Kapou)
- Laysan Island (Kamole)
- Maro Reef (Kamokuokamohoali‘i)
- Gardner Pinnacles (‘Ōnūnui)
- French Frigate Shoals (Lalo)
- Necker Island (Mokumanamana)
- Nihoa Island

Main Hawaiian Islands

There are six designated Hawaiian monk seal critical habitat areas in the main Hawaiian Islands that include the seafloor and marine habitat to 10 m above the seafloor from the 200-m depth contour through the shoreline and extending into terrestrial habitat 5 m inland from the shoreline between identified boundary points around the following islands:

- Kaula Island (includes marine habitat only)
- Ni‘ihau (includes marine habitat from 10 to 200 m in depth)
- Kaua‘i
- O‘ahu
- Maui Nui (including Kaho‘olawe, Lāna‘i, Maui, and Moloka‘i)
- Hawai‘i Island

Steller Sea Lion

Critical habitat for designated for the Steller sea lion includes specific rookeries, haul-outs, and associated areas, as well as three foraging areas that are considered to be essential for the health, continued survival, and recovery of the species. Critical habitat includes terrestrial, air and aquatic areas that support reproduction, foraging, resting, and refuge.

Critical habitat in Alaska includes a terrestrial zone extending 3,000 ft (0.9 km) landward from each major rookery and haul-out; it also includes air zones extending 3,000 ft (0.9 km) above these terrestrial zones and aquatic zones. Aquatic zones extend 3,000 ft (0.9 km) seaward from the major rookeries and haul-outs east of 144°W (Figure 17). West of 144° W, where the Western DPS is located, the aquatic zone extends 20 NM (37 km) seaward from the baseline or basepoint of each major rookery and major haul-out (Figure 18). In addition, NMFS designated special aquatic foraging areas as critical habitat for the Steller sea lion. These areas include the Shelikof Strait (in the Gulf of Alaska), Bogoslof Island, and Seguam Pass (the latter two are in the Aleutians). These sites are located near Steller sea lion abundance centers and include important foraging areas with large concentrations of prey.

Although within the range of the now delisted Eastern DPS, the designated critical habitat in California and Oregon remains in effect (Figure 19). In California and Oregon, major Steller sea lion rookeries and associated air and aquatic zones are designated as critical habitat. Critical habitat includes an air zone extending 3,000 ft (0.9 km) above rookery areas historically

occupied by sea lions. Critical habitat also includes an aquatic zone extending 3,000 ft (0.9 km) seaward.

Figure 17. Steller Sea Lion Critical Habitat – Southeast Alaska

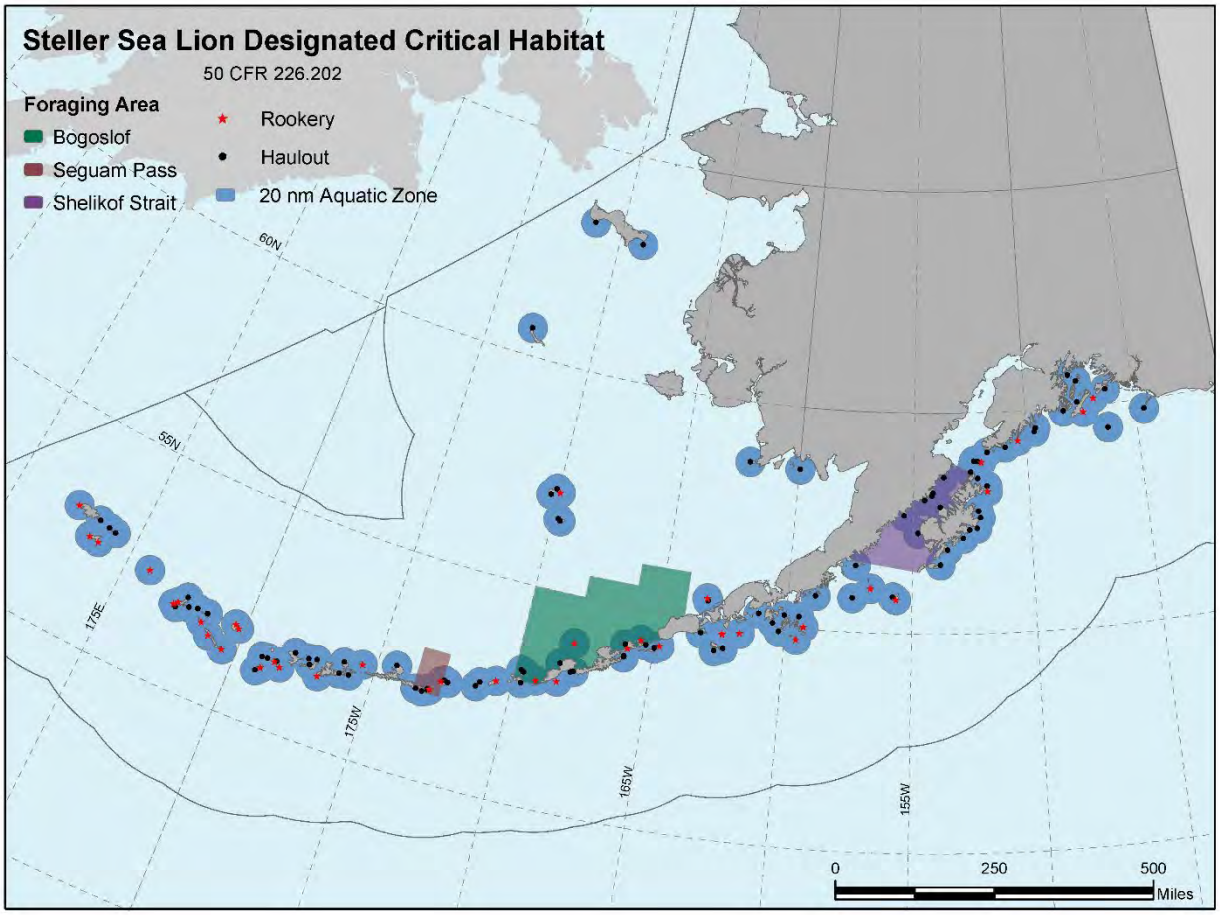

Figure 18. Steller Sea Lion Critical Habitat – Western Alaska

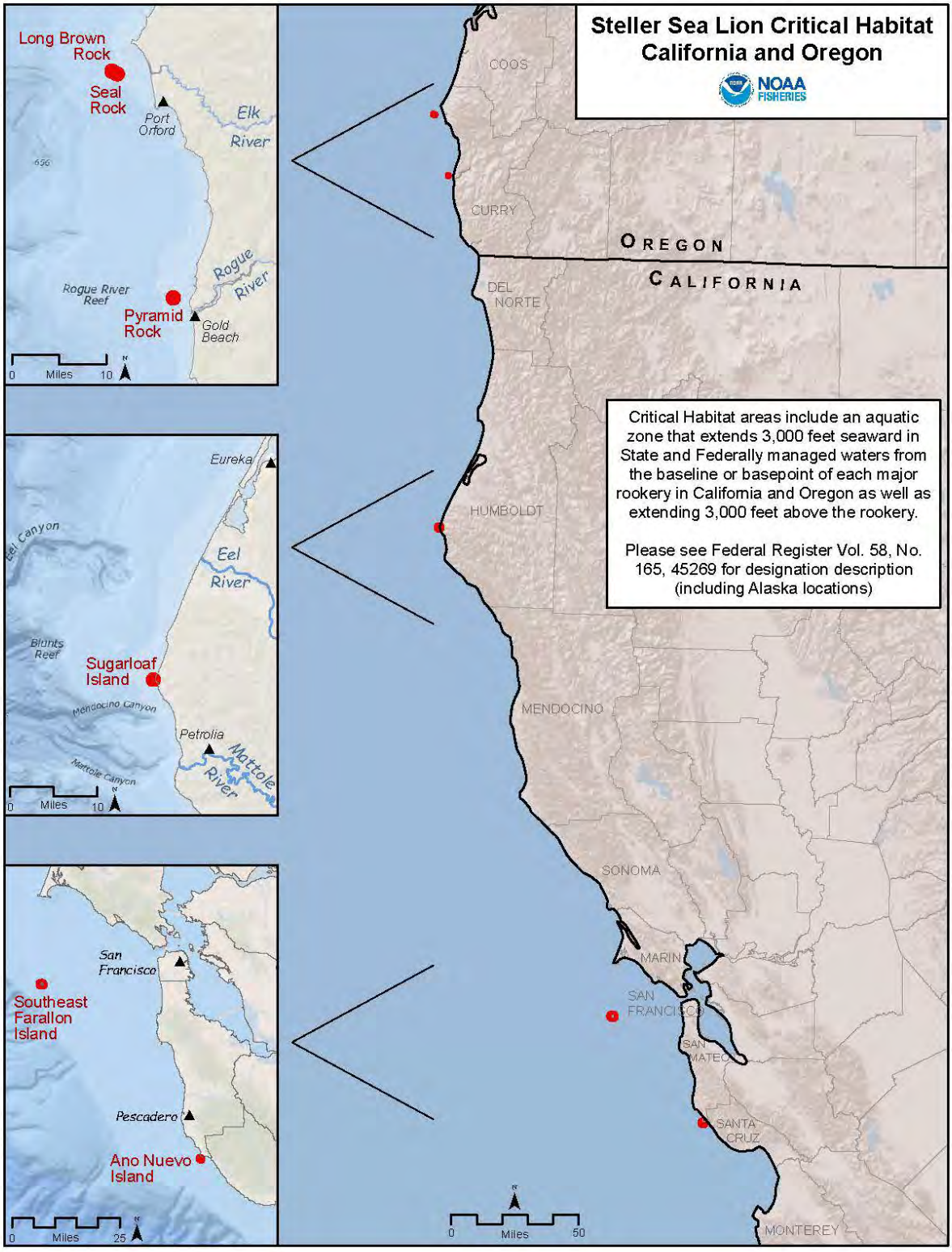

Figure 19. Steller Sea Lion Critical Habitat – Oregon and California

EFFECTS ANALYSIS

"Effects of the action" means all consequences to ESA-listed species or designated critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 C.F.R. §402.2).

The applicable standard to find that a proposed action is not likely to adversely affect ESA-listed species or designated critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or wholly beneficial. Beneficial effects have an immediate positive effect without any adverse effects to the species or habitat. Insignificant effects relate to the size or severity of the impact and include those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. Insignificant is the appropriate effect conclusion when plausible effects are going to happen, but will not rise to the level of constituting an adverse effect. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action that would be an adverse effect if it did affect an ESA-listed species), but it is very unlikely to occur.
The following subsections identify the potential stressors and analyze the potential effects of the proposed launch and reentry vehicle operations on the ESA-listed species and critical habitat in the action area.

Potential Stressors to ESA-Listed Species

Stressors are any physical, chemical, or biological agent, environmental condition, external stimulus, or event that may induce an adverse response in either an ESA-listed species or its designated critical habitat. Potential stressors to ESA-listed species from the proposed activities include the following:

- Impact by fallen objects: spacecraft, rocket parts, radiosonde;
- Entanglement in unrecovered parachutes and parafoils;
- Ingestion of material from unrecovered parachutes, parafoils, and weather balloon fragments;
- Exposure to hazardous materials;
- Exposure to sonic booms (overpressure) and impulse noise generated during spacecraft reentry or stage landings in the ocean;
- Ship strike; and
- Harassment by aircraft overflight.

Fallen objects, unrecovered parachutes/parafoils, and hazardous materials could also impact designated critical habitat. Potential effects to the ESA-listed species from these stressors are discussed in the following sections, followed by potential effects to the PBFs of designated critical habitat.

Impact by Fallen Objects

Boosters, fairings, spacecraft, and radiosondes from weather balloons falling through the atmosphere to Earth's surface have the potential to affect ESA-listed species marine species. Debris from a launch abort test or any launch failure anomalies could also have an effect. The

primary concern is a direct impact from an object landing on an ESA-listed marine mammal, sea turtle or fish.

The action area where objects could splashdown encompasses vast expanses of ocean. ESA-listed species are sparsely distributed across these ocean expanses, resulting in very low densities of species overall. The probability of a direct impact to an ESA-listed species is thus extremely unlikely.

The same conclusion was reached when analyzing the Joint Flight Campaign missile testing from some of the same launch sites and overlapping areas of the Atlantic and Pacific Oceans (OPR-2021-02470). The BE for the Joint Flight Campaign utilized the best available density data for ESA-listed marine mammals and sea turtles, which is from the U.S. Navy's Marine Species Density Databases for training and testing areas in the Pacific and Atlantic (U.S. Navy 2017a and b, U.S. Navy 2018). Species densities were averaged across study areas within a proposed drop zone and the highest estimated densities across seasons were used to represent animal densities in the entire drop zone. For a flight test from VSFB, the maximum number of estimated animal exposures for any ESA-listed species in the broad ocean area is for fin whales at 0.00002 individuals, corresponding to a one in 50,000 chance of contacting a fin whale during a single test from VSFB. For a flight test from WFF, the maximum number of estimated animal exposures for any ESA-listed species in the broad ocean area is 0.000008 individuals for marine mammals (fin whales) and 0.00005 for sea turtles (loggerheads). This corresponds to a one in 121,000 chance of contacting a fin whale and a one in 22,000 chance of contacting a loggerhead turtle during a single test from WFF.

The very low probabilities of direct contact further illustrate the likelihood of ESA-listed mammals or sea turtles being in the same spot where these materials happen to land in vast open ocean areas is very low. Similar density data for ESA-listed fish species is not available, but most of the fish species that may be present in the action area do not spend much time near the surface where direct strikes could occur and often prefer deeper waters (e.g., eulachon, grouper, sawfish, sturgeons, salmonids). Additionally, a physical strike affecting a fish depends on the relative size of the object potentially striking the fish and the location of the fish in the water column. Because fish are likely able to detect an object descending in the water column (e.g., sensing the pressure wave or displacement of water) and are highly mobile, fish would likely swim away from an oncoming object. The oceanic whitetip shark, scalloped hammerheads and giant manta ray are known to spend time near the surface, likely to utilize sunlight-warmed waters, but are also known to dive to greater depths. However, the chance of any ESA-listed fish species being in the same spot where launch materials happen to land is highly unlikely, and therefore, the risk of being directly hit by any falling objects from launch operations is extremely low.

It is worth noting that materials have been expended from rocket launches for decades with no known interactions with any of the ESA-listed species considered in this programmatic. In summary, because it would be extremely unlikely for an ESA-listed species to be directly struck by launch vehicle components, spacecraft, radiosondes, and any launching or landing-related debris, the potential for effects to ESA-listed species from a direct impact by those fallen objects are discountable. Therefore, we conclude that direct impacts from fallen objects to ESA-listed

marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Entanglement

Spacecraft reentry and recovery operations and fairing recovery involve the use of parachutes and/or parafoils, which introduces the possibility of marine species becoming entangled in the parachute/parafoil material and attached lines, particularly if the material is not recovered by the launch operator. Entanglement can impact a marine animal by limiting its ability to move through the water for feeding, reproductive, or migratory purposes (Laist 1997). Materials entangled tightly around a body part may cut into tissues, enable infection, and severely compromise an individual's health, and may lead to death. A compromised individual is also less likely to be able to escape predation.

Drogue parachutes are the smallest and are cut away at altitude, which separates it from the spacecraft or fairing before the point of splashdown and so are more likely not to be recovered than the other parachutes and parafoils. The drogue parachute's primary material (nylon) is in the family of high molecular weight polymers, which are not easily degraded by abiotic (physical or chemical) or biotic processes (Haines and Alexander 1974). Photooxidative degradation, the process of decomposition of the material by light (most effectively by near-ultraviolet [UV] and UV wavelengths) would be the most effective source of damage exerted on the nylon parachute. However, the drogue parachute assembly becomes saturated within approximately one minute of splashing down and begins to sink. The drogue parachutes are expected to sink at a rate of approximately 1,000 ft in 46 minutes (or approximately 22 ft per minute; see Appendix A), rapidly sinking below the depths to which UV radiation penetrates in the oceans, eventually resting on the ocean floor where exposure to UV light would not occur, making photo-oxidation improbable. Once on the ocean floor, the relatively constant temperatures and lower oxygen concentration (as compared to the atmosphere) would slow the degradation process (Andrady 1990).

If the larger main parachutes or parafoils are not recovered, they will take longer than the drogue parachutes to become saturated and will sink more slowly, but even the largest parafoil is expected to sink at a rate of approximately 1,000 ft in 145.5 minutes (or approximately 7 ft per minute; see Appendix A). This still is a relatively short amount of time to pass through the water column, likely reaching the ocean floor within a matter of hours.

All parachutes and parafoils are meant to be recovered and they have been recovered during the majority of operations. Even if the parachutes or a parafoil are not recovered, they sink rather quickly and spend a short time passing through the water column. Fairing recovery typically takes place between 300-500 NM offshore and if any drogue parachutes or parafoils are not recovered, they are expected to settle (> 3,000 m [9,800 ft]). None of the ESA-listed species considered in this programmatic forage that deep, and therefore are not expected to encounter the settled parachutes or parafoils. SpaceX's Dragon spacecraft parachutes (drogue and main) are the only spacecraft parachutes that have been deployed to date for spacecraft re-entries. Missions use the Dragon spacecraft during contract support for NASA, delivering cargo to the International Space Station. Recovery of Dragon spacecraft reentering from resupply missions occurs offshore over deep waters (> 3,000 m [9,800 ft]), similar to the fairings. SpaceX has typically recovered the Dragon spacecraft within one hour of splashdown and subsequently recover parachutes.

However, there have two instances where sea and weather conditions during Dragon cargo spacecraft recovery created complications and SpaceX did not recover the parachutes. In 2020, a crewed test flight of Dragon-2 was conducted and the recovery operation was not as far offshore (approximately 27 NM), for human crew safety logistics, and therefore occurred over shallower water. The crewed Dragon test flight recovered both drogue parachutes and 3 of the 4 main parachutes. As the crewed Dragon flights become operational, procedures should become more efficient, including parachute retrieval. Crewed Dragon spacecraft missions will be less frequent than cargo missions and only expected to happen once or twice a year.

Considering the low occurrence of parachutes or parafoils not being recovered, the limited time they would spend in the water column and settling typically in the deep ocean, exposure of ESA-listed mammals, sea turtles, or fishes to the parachutes or parafoils is extremely unlikely and therefore the risk of entanglement is discountable.

Ingestion

Foraging individuals of ESA-listed species could be exposed and therefore risk ingesting, pieces of weather balloons, parachutes or parafoils.

Latex weather balloons typically have a diameter at launch of approximately 4 ft, but then rise to approximately 20–30 km where the volume increases to the point where the elastic limit is reached and the balloon bursts. The temperature at this altitude range can reach negative 40 degrees Fahrenheit (°F) and even colder. Under these conditions of extreme elongation and low temperature, the balloon undergoes "brittle fracture" where the rubber actually shatters along grain boundaries of crystallized segments. The resultant pieces of rubber are small strands comparable to the size of a quarter (Burchette 1989). This was confirmed by researchers at the University of Colorado and NOAA (University of Colorado and NOAA 2017). The small shreds then make their way back to the surface of the Earth and are expected to land in the ocean. Along the way, the pieces can be subject to movements in atmospheric pressure and wind as they sink through the air. This can cause the fragments to become scattered and disperse before landing on the surface of the ocean where they are subject to movement of surface currents, which can cause additional dispersion.

The balloon fragments would be positively buoyant, float on the surface, and begin to photo-oxidize due to UV light exposure. Studies have shown latex in water will degrade, losing tensile strength and integrity, though this process can require multiple months of exposure time (Pegram and Andrady 1989; Andrady 1990; Irwin 2012). Field tests conducted by Burchette (1989) showed latex rubber balloons are very degradable in the environment under a broad range of exposure conditions, including exposure to sunlight and weathering and exposure to water. The balloon samples showed significant degradation after six weeks of exposure (Burchette 1989).

The floating latex balloon fragments would provide substrate for algae and eventually be weighed down with growth of heavier epifauna, such as tunicates (Foley 1990). The degree to which such colonization may occur will correspond to the amount of time the balloon remains at or near the ocean's surface. Additionally, an area's geographic latitude (and corresponding climatic conditions) has a marked effect on the degree of biofouling on marine debris. Fouling of the latex shreds could be confused with organic matter while ESA-listed species are foraging. Green sea turtles are herbivorous and a large study of green sea turtles that stranded in Texas

between 1987 and 2019, discovered 48% had ingested plastic, although there was no evidence of mortality related to the ingestion of the plastics (Choi et al. 2021). A study of latex balloon fragment ingestion by freshwater turtles and catfish found no significant impact on survival or blood measured indicators of stress response (Irwin 2012).

In addition to further degradation of the latex material, the embedded fouling organisms would cause the material to become negatively buoyant, making it slowly sink to the ocean floor. Studies in temperate waters have shown that fouling can result in positively buoyant materials (e.g., plastics) becoming neutrally buoyant, sinking below the surface into the water column after only several weeks of exposure (Ye and Andrady 1991; Lobelle and Cunliffe 2011), or descending farther to rest on the seafloor (Thompson et al. 2004).

Given the small balloon shreds are likely to be scattered and not concentrated, and they should only be available in the upper portions of the water column on the order of weeks, the potential for exposure of ESA-listed marine species to these shreds is extremely low and therefore discountable.

As stated previously, operators expect to recover parachutes/parafoils soon after splashdown and in the rare occasion they are not recovered (a few each year, see Appendix A), the parachutes/parafoils will sink to the seafloor within a matter of hours. As discussed previously, the degradation of parachute and parafoil materials will be a slow process that takes place after the materials have settled on the sea floor. It is possible that small fragments could temporarily resuspend in the water column, but the potential for this depends on local ocean floor conditions and the fragments are not expected to resuspend high in the water column where they would likely be encountered by ESA-listed species. As previously discussed recovery operations typically take place far offshore (e.g. 300-500 NM) and any drogue parachutes or parafoils not recovered are expected to settle (> 3,000 m [9,800 ft]). None of the ESA-listed species considered in this programmatic forage that deep, therefore, the likelihood of them encountering ingestible material once it has settled over the long-term is expected to be extremely unlikely to occur and thus discountable.

We conclude that the risk of ingesting pieces of weather balloons, parachutes or parafoils to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Exposure to Hazardous Materials

Hypergolic fuels (e.g., NTO and MMH) may be on the spacecraft during a splashdown. A spacecraft's propellant storage is designed to retain residual propellant, so any propellant remaining in the spacecraft is not expected to be released into the ocean. In an event the propellant tank actually ruptures on impact, the propellant would evaporate or be quickly diluted.

In the event of a failed launch operation, launch operators will follow the emergency response and cleanup procedures outlined in their Hazardous Material Emergency Response Plan (or similar plan). Procedures may include containing the spill using disposable containment materials and cleaning the area with absorbents or other materials to reduce the magnitude and duration of any impacts. In most launch failure scenarios, at least a portion of the propellant will be consumed by the launch/failure, and any remaining propellant will evaporate within hours or

be diluted by seawater and degrade over time (timeframes are variable based on environmental conditions, but generally hours to days).

Launch vehicles and spacecraft are designed to retain propellants and even if there is a rare launch failure (> 93% success rate over 30 years), propellants will evaporate and be diluted within hours. The chance for ESA-listed marine species to be exposed to the residual propellants from a splashdown or launch failure is extremely low and therefore discountable. Therefore, we conclude that hazardous material exposure to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Exposure to Sonic Booms and Impulse Noise

A sonic boom will be generated during spacecraft reentry and stage landings in the ocean. Due to the shape and size of existing spacecraft and spacecraft in development, as well as the altitude at which reentering spacecraft generate a sonic boom, the FAA, USSF, and NASA do not expect the overpressure from reentering spacecraft to exceed 1 psf. An overpressure of 1 psf is similar to a thunderclap. For boosters that can currently land on a barge in the ocean (e.g., SpaceX Falcon series), overpressures at the ocean's surface could be up to 8 psf. For the Super Heavy, which is currently in developmental stages and expected to be operational soon, overpressures at the ocean's surface could be up to 15 psf from ocean barge landings. Boom intensity, in terms of psf, is greatest under the flight path and progressively weakens with horizontal distance away from the flight track. Based on modeling for landings at the Boca Chica Launch Site, the area beneath the stage receiving the maximum overpressure (up to 15 psf) as it is landing could be up to 1.28 km in diameter.

Overpressure from sonic booms are not expected to affect marine species underwater. Acoustic energy in the air does not effectively cross the air/water interface and most of the noise is reflected off the water surface (Richardson et al. 1995). The landing platform barge will also act as a barrier to the most intense portion of overpressure from landings. In addition, underwater sound pressure levels from in-air noise are not expected to reach or exceed threshold levels for injury or harassment to ESA-listed species.

Previous research conducted by the USAF supports this conclusion with respect to sonic booms, indicating the lack of harassment risk for protected marine species in water (U.S. Air Force Research Laboratory 2000). The researchers were using a threshold for harassment of marine mammals and sea turtles by impulsive noise of 12 pound per square inch (psi) peak pressure and/or 182 decibels (dB) referenced (re) to the standard unit of acoustic pressure underwater, 1 micro Pascal (µPa), which is an older threshold used by NMFS and DoD at the time. The researchers pointed out that, to produce the 12 psi in the water, there needs to be nearly 900 psf at the water surface, assuming excellent coupling conditions. They also noted that it is very difficult to create sonic booms that even approach 50 psf. Current thresholds utilized by NMFS for behavioral disturbance from impulsive acoustic sources are lower (in water, re 1 µPa: 175 dB sea turtles, 160 dB marine mammals, 150 dB fishes) but these are root mean square (rms) values and not peak pressure values.. The rms is a square root of the average of sound signal pressures that have been squared over a given duration. Due to the squaring and averaging of sound pressure values (which tends to level out large values), the rms, results in a more conservative value than just a peak value. Still, what the USAF research report illustrates is that it would take

a tremendously greater sonic boom than what is generated by the booster stage landings to create an acoustic impact underwater that could approach disturbing ESA-listed marine mammals, sea turtles or fish. Therefore, any effect from the sonic booms on ESA-listed species while under water would be insignificant.

ESA-listed marine mammals and sea turtles could be exposed to the overpressures from sonic booms in the air when they are surfacing for air; however, the chances of both events happening at same time (i.e., species surfacing and a sonic boom occurring) is extremely unlikely, especially considering the length of a sonic boom is less than one second. The Guadalupe fur seal, Hawaiian monk seal, and Steller sea lion can spend time hauled out of the water and therefore may be affected by an in-air sonic boom. The potential for effect would only be present during spacecraft reentry missions occurring in the Pacific Ocean and rocket booster landing are not planned near areas where these species haul out. Spacecraft reentry in the Pacific Ocean would generate sonic booms at high altitudes (approximately 50,000 ft). The magnitude of the high altitude sonic boom overpressure that has the potential to impact land areas where Guadalupe fur seals, Hawaiian monk seals, and Steller sea lions may be present is low (1 psf or lower). Therefore, the effect of these sonic booms is unlikely to create any meaningful disturbance for these ESA-listed pinnipeds when they are out of the water.

The 2019 MMPA Letter of Authority for VSFB launch operations arrived at a similar conclusion (84 FR 14314). Over 20 years of monitoring data for species including harbor seals (*Phoca vitulina*), elephant seals (*Mirounga angustirostris*), and California sea lions (*Zalophus californianus*) at VSFB and the North Channel Islands (CA), show reactions to sonic booms tend to be insignificant when not above 1.0 psf. Observational data do not include the ESA-listed pinnipeds considered in this programmatic, but the long time series data for other species serve as a proxy indicating this category of sonic booms for marine mammals that haul out of water do not result in disturbance at low overpressures.

In summary, it is extremely unlikely that an ESA-listed sea turtle or marine mammal would surface close to a landing booster at the exact moment to be exposed to a sonic boom (greater than 1 psf) in the air, therefore the effects are discountable. Any ESA-listed sea turtles, marine mammals or fishes underwater are not expected to be exposed to measurable acoustic effects from a sonic boom therefore, the effects are insignificant. The low level sonic boom (not above 1 psf) resulting from spacecraft reentry at high altitude in the Pacific, is not expected to create any significant disturbance to hauled out ESA-listed pinnipeds and the effects are therefore insignificant.

Ship Strike

Ships and other watercraft vessels are used to recover launch vehicle stages that land on a platform in the ocean, as well as to recover spacecraft and payload fairings. Vessels may also be used for surveillance to ensure that designated hazard areas are clear of non-participating crafts. These watercraft operations have potential to result in a ship strike of ESA-listed species that spend time at or near the surface of the water (e.g., marine mammals, sea turtles, giant manta ray, oceanic whitetip shark, and scalloped hammerhead). ESA-listed marine mammals and sea turtles can spend time at the surface, but most of their time is spent submerged. Giant manta ray, oceanic whitetip and scalloped hammerhead sharks can also spend time at or near the ocean surface and be subject to potential ship strikes, but they also dive to great depths. All vessels

would be required to comply with the *Environmental Protection Measures* for vessel operations. All watercraft would have a dedicated observer on board, adhere to maintaining minimum safety distances between ESA-listed species and vessels, and reduce speed as required.

During the portion of time that ESA-listed marine mammals, sea turtles, and some elasmobranch fish species may spend near the ocean surface, ship strikes are considered extremely unlikely to occur and therefore discountable, due to the use of dedicated observation personnel and safety procedures for avoidance. Based on previous operation reports provided as part of ESA section 7 consultations for similar operations, there have not been reported vessel collisions with ESA-listed marine species.

Rice's whale requires additional consideration due to its very low population size (likely < 50) and its ecology. The Rice's whale dives deep during the day to forage but at night tends to stay just below the surface, increasing the chance of the animal being struck at night. The *Vessel Operations* measures in the PDCs for this programmatic consultation include the condition that recovery and vessel transit will not occur at night in the Rice's whale core distribution area. The PDCs for this programmatic consultation stipulate only one splashdown, a reentry and recovery of the Dragon capsule, may occur in Rice's whale core habitat distribution area per year. These restrictions will ensure the effects of vessel strike due to recovery vessel operations are discountable.

We conclude that the risk of ship strike to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Aircraft Overflight

Noise from aircraft overflight may enter the water, but, as stated in relation to sonic booms, very little of that sound is transmitted into water. Sound intensity produced at high altitudes is reduced when it reaches the water's surface. At lower altitudes, the perceived noise will be louder, but it will decrease rapidly as the aircraft moves away. Individual ESA-listed species that occur at or very near the surface (e.g., marine mammals, sea turtles, giant manta ray and sharks) at the time of an overflight could be exposed to some level of elevated sound. There could also be a visual stimulus from overflight that could potentially lead to a change in behavior. Both noise and visual stimulus impacts would be temporary and only occur if an individual is surfacing or very close to the surface and an aircraft happens to be flying over at the same time.

Studies in the Gulf of Mexico found that most sperm whales dive when overflown by fixed wing aircraft (Wursig et al. 1998). Richter et al. (2006) documented only minor behavioral effects (i.e., both longer surface time and time to first vocalization) of whale-watching aircraft on New Zealand sperm whales. However, details on flight altitude were not provided. Smultea et al. (2008) studied sperm whales in Hawai‘i, documenting that diving responses to fixed winged overflights occurred at approximately 820 ft above ground level (AGL).

Patenaude et al. (2002) observed bowhead whales, which are not a species considered in this consultation but serve as an example for mysticetes, during spring migration in Alaska and recorded short-term responses to fixed-wing aircraft activity. Few (approximately 2%) of the observed bowheads reacted to overflights (between 200 and 1,500 AGL), with the most common

behavioral responses being abrupt dives, short surfacing episodes, breaching, and tail slaps (Patenaude et al. 2002). Most of these responses occurred when the aircraft was below altitudes of 600 ft (Patenaude et al. 2002), which is below the altitude expected to be flown by fixed wing aircraft during project-related surveillance for the activities considered in this consultation.

Species-specific studies on the reaction of sea turtles to fixed wing aircraft overflight are lacking. Based on sea turtle sensory biology (Bartol and Musick 2003), sound from low-flying aircraft could likely be heard by a sea turtle at or near the ocean surface. Sea turtles might be able to detect low-flying aircraft via visual cues such as the aircraft's shadow, similar to the findings of Hazel et al. (2007) regarding watercraft, potentially eliciting a brief reaction such as a dive or lateral movement. However, considering that sea turtles spend a significant portion of their time below the sea surface (Lutcavage and Lutz 1997) and the low frequency and short duration of surveillance flights, the probability of exposing an individual to an acoustically or visually-induced stressor from aircraft momentarily flying overhead would be very low. The same is relevant for giant manta rays and the ESA-listed shark species in the action area, considering their limited time near the surface and brief aircraft overflight.

As stated in the *Environmental Protection Measures*, spotter aircraft will maintain a minimum of 1,000 ft over ESA-listed or MMPA-protected species and 1,500 ft over North Atlantic right whales. Additionally, aircraft will avoid flying in circles if marine mammals or sea turtles are spotted to avoid any type of harassing behavior. The chances of an individual ESA-listed species being exposed to the proposed aircraft overflights are extremely low. Given the limited and temporary behavioral responses documented in available research, it is expected that potential effects on ESA-listed species, should they even occur, would be insignificant. We conclude that effects from aircraft overflight to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Critical Habitat

A common element across several of the designated critical habitats in the action area that may be affected by the proposed action is water quality: green sturgeon, Gulf sturgeon, Southern Resident DPS killer whale, and Main Hawaiian Islands Insular DPS false killer whale critical habitat include PBFs for water quality. Water quality may be temporarily degraded as a result of a launch failure. Potential effects to water quality could result from debris and propellants. Recovery activities and any emergency response and cleanup procedures would reduce the magnitude and duration of any impacts. As previously discussed, propellants are expected to evaporate and quickly become diluted, limiting any impacts to a temporary duration. Given the unlikely scenario of a launch failure and the brief exposure of residual propellants from splashdowns, it is highly unlikely that water quality features would become degraded to the extent the conservation value of the critical habitats are impacted.

Most of the proposed operations would occur well offshore in deep waters. Landing and recovery operations would not occur within 5 NM of the coast where most of the critical habitat for green sturgeon is located. The same is true for Gulf sturgeon, except for Cedar Key, Florida, but it is far away from flight trajectories from the Boca Chica Launch Site. It is very unlikely that any launch or reentry operations would occur within that portion of Gulf sturgeon critical habitat. Unit 2 of the North Atlantic right whale critical habitat occurs off the coast of CCSFS and

extends seaward approximately 5 NM off the coast. Keeping operations out of the first 5 NM from shore helps avoid this critical calving area. Operations are not expected to have any impact on the oceanic features near the Unit 2 calving area such as sea temperature, sea state or depth. PBFs for Hawaiian monk seal conservation include significant haul-outs and preferred pupping/nursing areas. Operations will not occur in or near those areas. Critical habitat for Steller sea lions includes major rookeries, haul-outs, and associated zones extending 3,000 ft (0.9 km) landward, in the air above, or into the water from those major rookeries and haul-outs, that support reproduction, foraging, resting, and refuge. Operations will not occur in those zones. West of 144° W, where the Western DPS Steller sea lion is located, the critical habitat aquatic zone extends 20 NM (37 km) seaward from the baseline or basepoint of each major rookery and major haul-out. If operations cannot comply with the PDC that landings will not occur in those 20 NM aquatic zones, they will require a project-specific review.

Migratory passage and adequate space for movement are features common to Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, and Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitats. As stated previously, no operations will occur in the immediate nearshore environment (< 5 NM), resulting in a considerable amount of those critical habitats not being affected by the proposed action. Landing and reentry operations will typically be much farther out but, even if they were to occur close to the 5 NM limit, they are temporary with no long-term occupation or structures creating obstructions to movement, thus any potential effects are likely to be insignificant.

Prey and foraging areas are other common elements across several of the designated critical habitats in this consultation: leatherback, Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, North Pacific right whale; Western North Pacific, Central America, and Mexico DPSs of humpback whales; and Hawaiian monk seal and Steller sea lion foraging areas. As previously stated, sound from sonic booms is not expected to enter the water with enough intensity to create any significant disturbances to ESA-listed species and the effects of this sound is also expected to be insignificant for zooplankton or small pelagic schooling fishes that are the important prey species for these critical habitats. Pieces of weather balloons or parachutes/parafoils are not expected to be available to prey species in sufficient concentrations to measurably affect prey populations. Considering the rare occurrence of not recovering parachutes/parafoils, as the parachutes/parafoils begin to become saturated with seawater and begin to sink, prey fish species should be able to detect the object and move out of the way (as previously discussed for fishes) and the chance of entanglement is extremely unlikely to occur and thus discountable. Prey zooplankton species may have less of an ability to move out of the way and therefore some could get entrapped in the parachute/parafoil. The removal of a small amount of zooplankton is not expected to reduce the conservation value of that PBF in any designated critical habitats and therefore the effect will be insignificant.

A unique PBF for Main Hawaiian Islands Insular DPS false killer whale critical habitat is sound levels that would not significantly impair false killer whales' use or occupancy. As previously stated, sound of any intensity that would create meaningful disturbance underwater is not an expected effect from proposed operations.

Oceanographic conditions supporting *Sargassum* habitat having adequate abundance and cover for post hatchlings and prey is a PBF for Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitat. The scale of operations are not large enough to affect boundary currents or areas of convergence that promote the aggregation of *Sargassum*. Any potential impacts to these features are expected to be very small and temporary, and therefore insignificant.

In summary, the effects associated with stressors from launch and reentry operations that are part of the proposed action may affect, but are not expected to adversely affect any of the designated critical habitats in the action area.

Additive Effects

We have concluded the proposed launch and reentry vehicle operations in the marine environment, when in compliance with the requirements of this programmatic, are not likely to adversely affect ESA-listed marine mammals, sea turtles, and fishes or designated critical habitat for green sturgeon, Gulf sturgeon, leatherback sea turtle, Northwest Atlantic Ocean DPS loggerhead sea turtle, North Atlantic right whale, North Pacific right whale; Western North Pacific DPS, Central America DPS, and Mexico DPS of humpback whales; Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, Hawaiian monk seal, and the Western DPS Steller sea lion. Programmatic consultations often involve actions that may occur with some frequency over many years and possibly continue for an indefinite time. As a result, we evaluate the potential for the effects of the stressors to ESA-listed species and designated critical habitat over the lifetime of the proposed action to result in additive effects due to chronic stress or cumulative effects. Therefore, we determine if, when considered additively, the effects of stressors associated with the launch and reentry vehicle operations in the marine environment that are part of the proposed action are likely to adversely affect the aforementioned ESA-listed species and designated critical habitat.

The USSF (and previously USAF), NASA, and commercial space operations with authorization from the FAA have been conducting launch and reentry vehicle operations for decades with little documented impact to the marine environment as a whole, including a lack of reported incidences affecting ESA-listed species and designated critical habitats in the action area. The activities considered in this programmatic consultation will occur across large expanses of open water in the Atlantic and Pacific Oceans, and the Gulf of Mexico. Each of the stressor categories (see *Effects of the Action*) were determined to have effects that are extremely unlikely to occur and therefore discountable, or to result in effects that are so small as to be insignificant. The possibility of the discountable effects overlapping in time and space and having a cumulative effect to ESA-listed species and designated critical habitat in the action area does not seem plausible considering the limited time operations occur in a small portion of the vast action areas. Within the same reasoning, chronic stress from activities whose effects are considered insignificant also does not seem plausible. Therefore, additive effects from the activities considered in this consultation are extremely unlikely and thus discountable.

CONCLUSION

Based on this analysis, NMFS ESA Interagency Cooperation Division concurs with the FAA, NASA and the USSF, that the proposed action may affect, but is not likely to adversely affect ESA-listed species and designated critical habitat.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans or develop information (50 C.F.R. §402.02).

As previously stated, the Rice's whale population is likely less than 50 individuals and therefore at high risk from threats that could reduce their numbers. Vessel strike is one of those threats. As discussed in the *Effects Analysis*, spacecraft recovery vessel activities are not likely to adversely affect ESA-listed marine mammals such as the Rice's whale. Even though one Dragon capsule splashdown and recovery per year in the Rice's whale core distribution area is not considered a significant threat, we are using this opportunity within this programmatic consultation to emphasize the conservation priority of avoiding the area, especially depths greater than 100 m deep. We also want to take this opportunity to address debris that originates from space launch and reentry operations, even though it is mostly expected to sink and settle in deep water, any reduction of debris in the marine environment could benefit all marine wildlife, including ESA-listed species.

The following conservation recommendations are discretionary measures that NMFS believes are consistent with the Federal action agencies' obligation under section 7(a)(1) and therefore should be carried out where applicable:

- Every effort should be made to move spacecraft capsule splashdowns closer to shallow edges of the Rice's whale core distribution area boundaries. Moving out of the area altogether is preferred.
- No vessel transit should take place in the Rice's whale core distribution area unless to specifically to pick up the capsule and then immediately exit at the nearest boundary edge while staying out of the core habitat area with depths of 100 m to 425 m, where the Rice's whale has been observed (Rosel et al. 2021).
- The action agencies should coordinate with NMFS ESA Interagency Cooperation Division to foster collaboration with the NOAA Marine Debris Program (MDP), in order to evaluate how activities of the MDP may apply to debris that originates from space launch and reentry operations (e.g., expended vehicle components).

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their critical habitat, the FAA, NASA, and/or USSF (as applicable) should notify the ESA Interagency Cooperation Division and SERO of any conservation recommendations implemented as part of activities included in this programmatic consultation. This information can be included in annual reports.

REINITIATION OF CONSULTATION

Reinitiation of consultation is required and shall be requested by the federal agency, where discretionary federal involvement or control over the action has been retained or is authorized by law and:

1. New information reveals effects of the action that may affect an ESA-listed species or designated critical habitat in a manner or to an extent not previously considered;
2. The identified action is subsequently modified in a manner that causes an effect to the ESA-listed species or designated critical habitat that was not considered in this concurrence letter;
3. Take of an ESA-listed species occurs; or
4. A new species is listed or critical habitat designated that may be affected by the identified action (50 C.F.R. §402.16).

Please direct questions regarding this letter to Dr. Soren Dahl, Consulting Biologist, at (301) 427-8495 or soren.dahl@noaa.gov, or me at (301) 427-8495, or by email at cathy.tortorici@noaa.gov.

Sincerely,

Cathryn E. Tortorici
Chief, ESA Interagency Cooperation Division
Office of Protected Resources

Cc: USSF, NASA

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APPENDIX A – PARACHUTE INFORMATION PROVIDED TO NMFS BY THE FAA

A.1 Spacecraft Parachutes

Two sets of parachutes are typically used during spacecraft re-entry: drogue and main parachutes. The drogue parachutes are thin parachutes deployed during reentry to gain control of the spacecraft at speeds that would destroy larger parachutes and therefore are deployed before the larger and thicker main parachutes (see Figure A-1). Spacecraft can be rigged with two drogue parachutes. Each drogue parachute has a diameter of approximately 19 feet with 72 feet of risers/suspension and are made of variable porosity conical ribbon. The drogues typically land within 0.5–1 mile from the spacecraft.

Shortly after the drogue parachutes are deployed, they are released, and the main parachutes are deployed (see Figure A-1). The main parachutes slow the spacecraft to a speed of approximately 13 miles per hour allowing for a "soft" splashdown in the water. The main parachutes are made of Kevlar and nylon and have a diameter of approximately 116 feet with 147 feet of risers/suspension. Spacecraft may be rigged with up four main parachutes.

Figure A-1. Main Parachutes with Released Drogue Parachutes in the Background (SpaceX Dragon)

SpaceX's Dragon parachutes (drogue and main) are the only spacecraft parachutes that have been deployed to date for spacecraft re-entries. The parachutes remain floating on the surface enabling the recovery operations. However, due to sea and weather conditions, there have been two instances where SpaceX did not recover Dragon's main parachutes. Similarly, there have been four instances where SpaceX

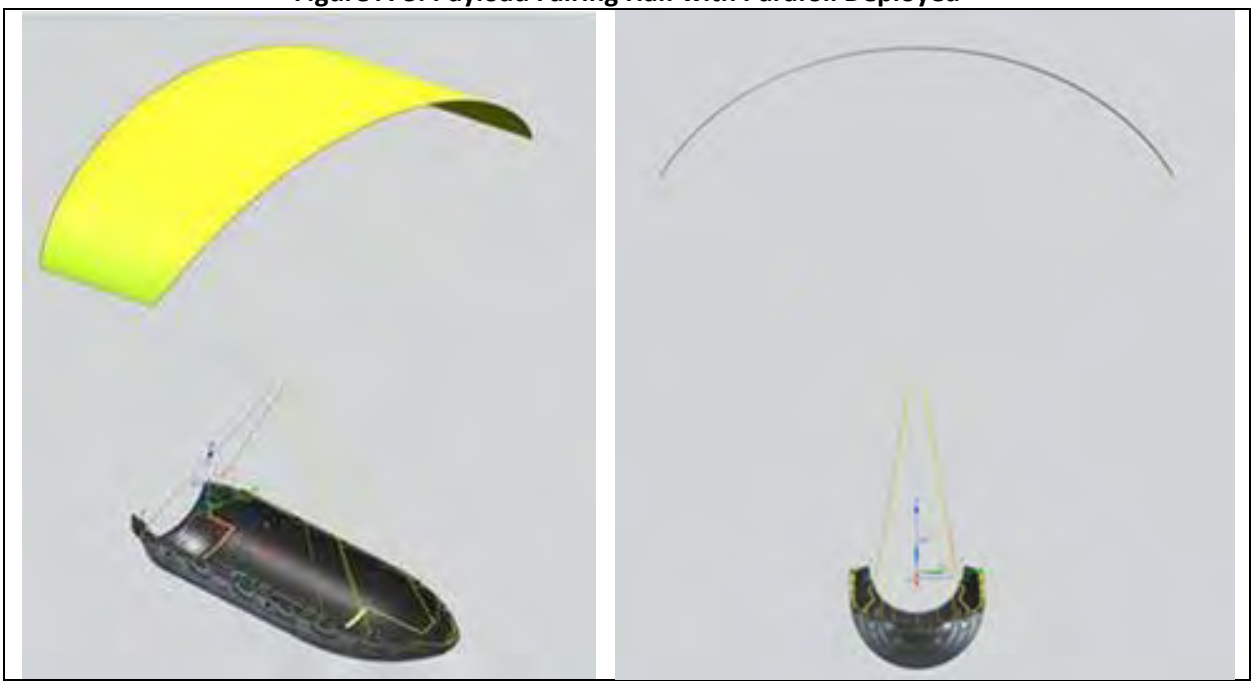
did not recover Dragon's drogue parachutes. Refer to the FAA's 2018–2020 annual reports sent to NMFS regarding SpaceX launch recovery efforts.

A.2 Payload Fairing Parachutes

SpaceX has designed a parachute system to enable recovering of payload fairings. Other launch operators may do the same in the future. SpaceX's parachute system consists of one drogue parachute and one parafoil (see Figures A-2 and A-3).

Figure A-2. Fairing Parafoil

Figure A-3. Payload Fairing Half with Parafoil Deployed



The parachute system slows the decent of the fairing to enable a soft splashdown such that the fairing remains intact. Following re-entry of the fairing into Earth's atmosphere, the drogue parachute is deployed at a high altitude (approximately 50,000 feet) to begin the initial slow down and to extract the parafoil. The drogue parachute is then cut away following the successful deployment of the parafoil. Refer to the FAA's 2018–2020 annual reports sent to NMFS regarding SpaceX launch recovery efforts.

Two parachute systems for the fairing may be used (Type 1 and Type 2). The specifications of each system are noted below (Tables A-1 and A-2). The Type 2 system has a similar drogue parachute as the Type 1 system but a larger and lighter parafoil than Type 1. Type 1 drogue parachute risers are made of Kevlar with nylon overwrap. Type 1 parafoil risers, for which there are four, are made of nylon with Kevlar overwrap. Type 2 drogue parachute risers are made of Kevlar. Type 2 parafoil risers, for which there are four, are made of nylon.

Table A-1. Specifications of Type 1 and Type 2 Fairing Drogue Parachutes

Drogue Type	Canopy Material	Area (ft^2)	Suspension Line Material	Deployment Bag (ft^2)[a]
Type 1	Nylon	63.59	Kevlar	28[b]
Type 2	Nylon	113	Kevlar	28[c]

[a] The deployment bag is part of the drogue parachute assembly; the two components are connected.
[b] Spectra cloth with Kevlar webbing.
[c] Nylon cloth.
ft^2 = square feet

Table A-2. Specifications of Type 1 and Type 2 Fairing Parafoils

Parafoil Type	Canopy Material	Area (ft^2)	Suspension Line Length (ft)
Type 1	Nylon	1,782	42.6
Type 2	Nylon	3,000	50

ft = feet; ft^2 = square feet

The projected sink rates for both types of drogue parachutes and parafoils are shown below (Tables A-3 to A-6 and Figures A-4 to A-7). As indicated in the figures, both types of drogue parachutes are expected to sink at a rate of approximately 1,000 feet in 46 minutes (or approximately 22 feet per minute). The Type 1 parafoil is expected to sink at a rate of approximately 1,000 feet in 63 minutes (or approximately 16 feet per minute). The Type 2 parafoil is expected to sink at a rate of approximately 1,000 feet in 145.5 minutes (or approximately 7 feet per minute). These estimated sink rates were calculated using a NASA method/spreadsheet for estimating sink rates of parachutes and balloons. The spreadsheet provides steady-state sink rates in water for parameters inputted by the user. There are conservative assumptions built in the spreadsheet, such as assuming the parachute remains open during the entire in-water descent, slowing the descent velocity, when, in actuality, the parachute could either collapse or become entangled in the other flight train components. The calculations present the most conservative (slowest) sink rates.

Table A-3. Projected Sink Rate for Type 1 Drogue Parachute

Properties	
Sum of masses:	18.2 pounds
Sum of buoyancy forces:	8.73 pounds
Sum of drag areas:	73 square feet
Sink Rate	
Terminal velocity of system in water:	0.36 feet/second
Sink time per 1,000 ft of depth:	46.2 minutes
Sink time per 100 m of depth:	15.17 minutes

Figure A-4. Sink Rate Chart for Type 1 Drogue Parachute

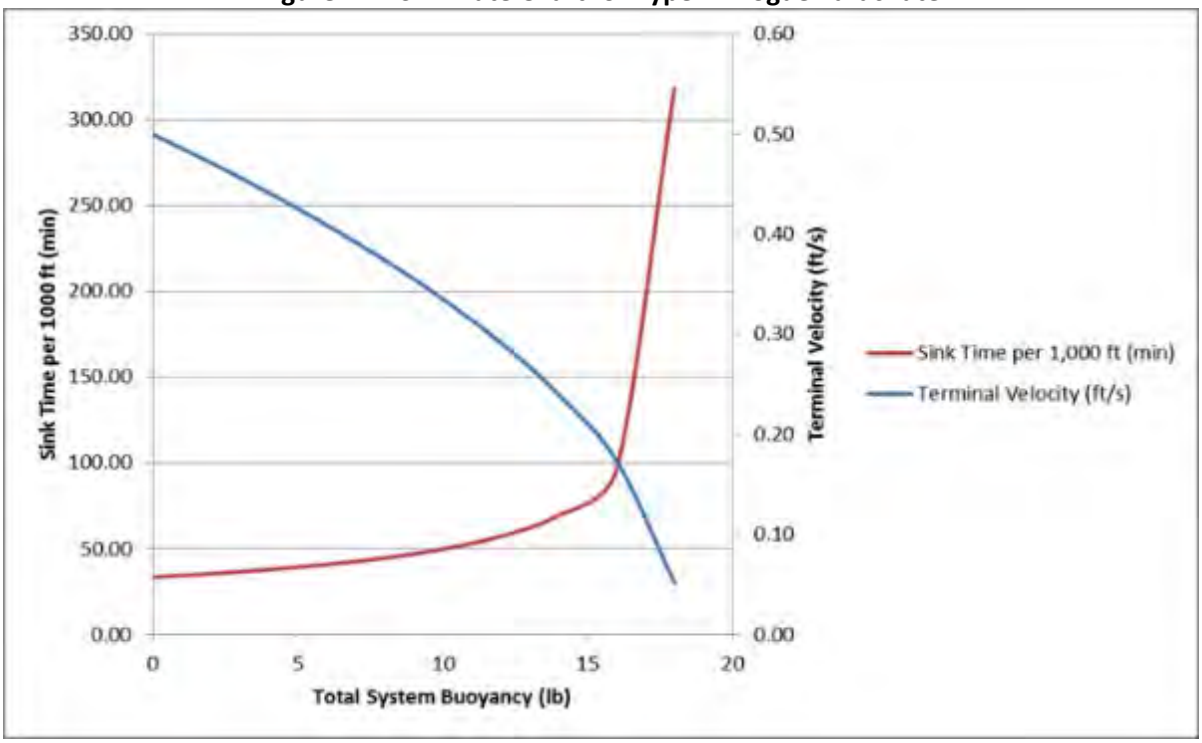


Table A-4. Projected Sink Rate for Type 1 Parafoil

Properties	
Sum of masses:	181 pounds
Sum of buoyancy forces:	84 pounds
Sum of drag areas:	1,426 square feet
Sink Rate	
Terminal velocity of system in water:	0.26 feet/second
Sink time per 1,000 ft of depth:	63.7 minutes
Sink time per 100 m of depth:	20.91 minutes

Figure A-5. Sink Rate Chart for Type 1 Parafoil

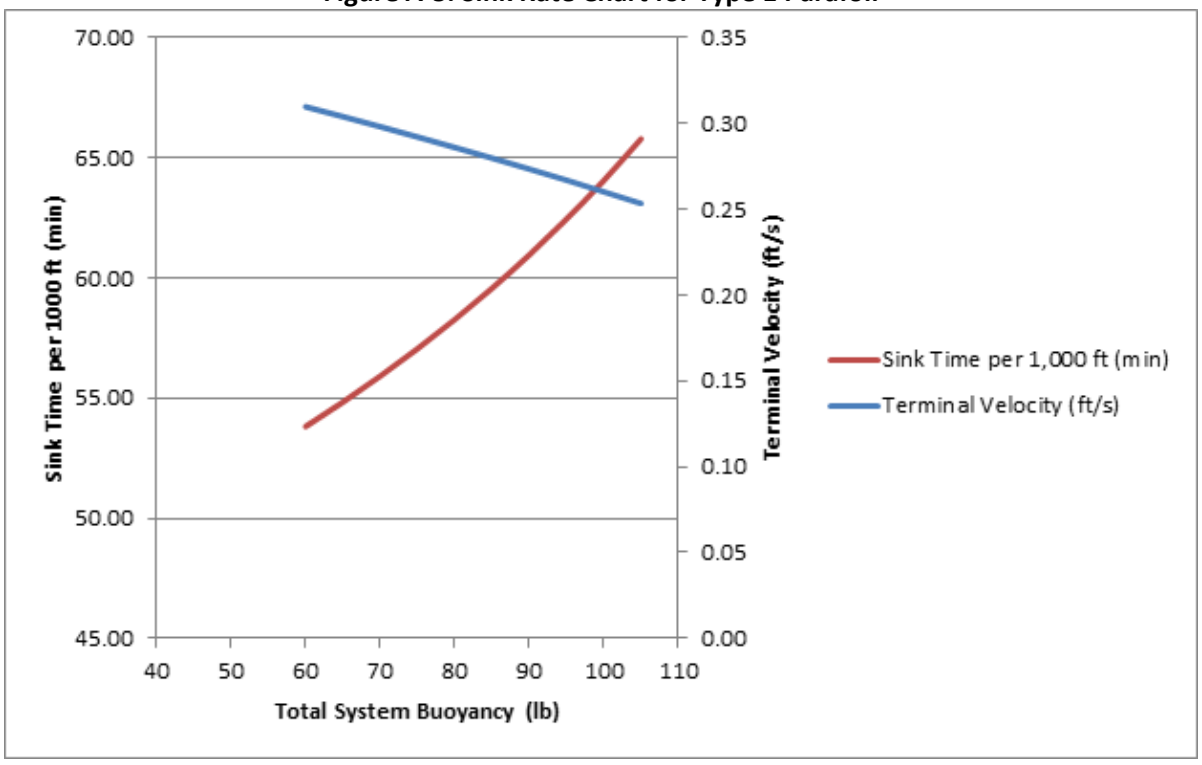


Table A-5. Projected Sink Rate for Type 2 Drogue Parachute

Properties	
Sum of masses:	18.2 pounds
Sum of buoyancy forces:	6.36 pounds
Sum of drag areas:	90 square feet
Sink Rate	
Terminal velocity of system in water:	0.36 feet/second
Sink time per 1,000 ft of depth:	45.9 minutes
Sink time per 100 m of depth:	15.07 minutes

Figure A-6. Sink Rate Chart for Type 2 Drogue Parachute

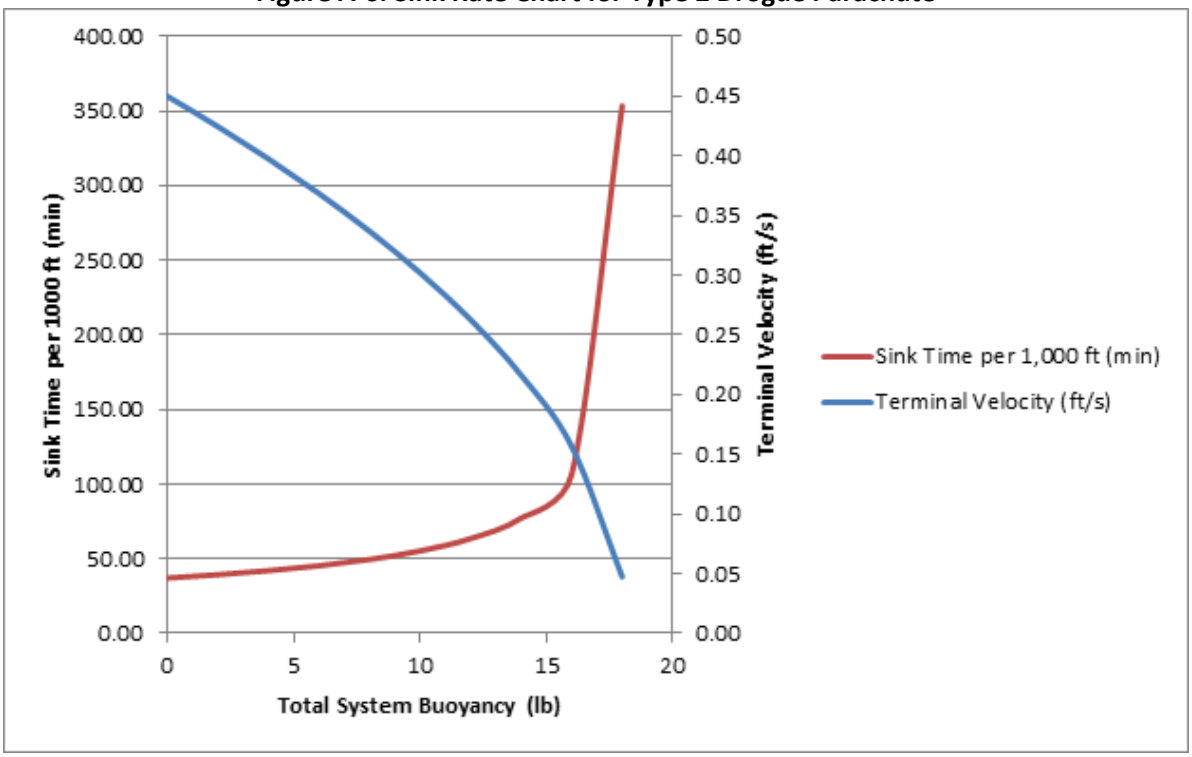


Table A-6. Projected Sink Rate for Type 2 Parafoil

Properties	
Sum of masses:	70 pounds
Sum of buoyancy forces:	39.01 pounds
Sum of drag areas:	2,376 square feet
Sink Rate	
Terminal velocity of system in water:	0.11 feet/second
Sink time per 1,000 ft of depth:	145.5 minutes
Sink time per 100 m of depth:	47.75 minutes

Figure A-7. Sink Rate Chart for Type 2 Parafoil