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

5/4/26

Refer to NMFS No: OPR-2025-02196

Ms. Stacey Zee
Manager, Operations Support Branch
U.S. Dept. Transportation, Federal Aviation Administration
Office of Commercial Space Transportation
800 Independence Ave SW, Suite 325
Washington, DC 20591

RE: Reinitiation of the Programmatic Letter of Concurrence for Space Launch and Reentry Operations

Dear Ms. Zee:

On July 29, 2025, the National Marine Fisheries Service (NMFS) received the Federal Aviation Administration's (FAA) request, in partnership with U.S. Space Force (USSF) and National Aeronautics and Space Administration (NASA), to reinitiate the programmatic consultation (hereafter referred to as the programmatic). FAA, USSF, and NASA proposed changes to the programmatic, to better meet the changing and growing demands of the commercial space industry.

This response to your request was prepared by NMFS pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.), implementing regulations at 50 CFR part 402, and agency guidance for preparation of letters of concurrence. On March 30, 2026, in *Center for Biological Diversity v. Burgum*, No. 24-cv-04651 (N.D. Cal.), the U.S. District Court for the Northern District of California vacated aspects of four provisions from the 50 CFR part 402 regulations governing interagency consultation under section 7 of the Endangered Species Act and reinstated the provisions that were previously in effect. Consistent with the Court's ruling, these are the governing provisions for this consultation:

- "*Effects of the action* refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration."[1] (50 CFR §402.02 (2018)).

- 50 CFR §402.16(a): "(a) Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service, where discretionary Federal involvement or control over the action has been retained or is authorized by law and . . . ." (50 CFR §402.16(a) (2023)).

Some of the information and analyses considered in this document were prepared under the version of the 50 CFR part 402 regulations in effect prior to the Court's order. We have reviewed the information and analyses and confirm that the content of that information and those analyses, including the identification and analyses of effects, would be the same under either version of the applicable regulations.

An ESA section 7(a)(2) programmatic consultation is a consultation addressing an agency's multiple similar, frequently occurring or routine actions in particular geographic areas; or under a proposed program, plan, policy, or regulation that provides a framework for future proposed actions (50 CFR §402.02). Programmatic consultations assess the program bounds or limits, referred to as the framework of the program, to insure the present and future actions conducted within that framework are not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. This is a programmatic consultation on an informal programmatic action.

This consultation is a reinitiation of the 2023 Amended 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 (OPR-2021-02908). Section 7(a)(2) of the ESA requires action agencies to consult with the Services, which is a continuing obligation for as long as the Federal action agency has discretion over the action and listed species or critical habitat may be affected. The reinitiation triggers for informal consultations are: 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 the concurrence letter; or if 3) a new species is listed or critical habitat designated that may be affected by the identified action. In those situations, where the action is ongoing, and the Federal action agency retains discretionary involvement or control over the action, it is appropriate to reinitiate consultation to satisfy the action agency's section 7(a)(2) responsibilities. This consultation is being reinitiated because the action has been subsequently modified in a manner that causes an effect to ESA-listed species or critical habitat that was not considered in the previous programmatic concurrence letter, and because new critical habitat was designated that may be affected by the action.

[1] This definition includes the second sentence of the definition of "effects of the action." That sentence provided the definition of "environmental baseline" in effect as of 2018. In the 2019 rule amending the 50 CFR part 402 regulations, the Services established "environmental baseline" as a stand alone definition. 84 Fed. Reg. 44976, 45016 (August 27, 2019). The Court's ruling did not touch upon that definition of "environmental baseline," and it therefore remains valid. The definition is also fully consistent with the definition of "effects of the action" from 2018.

The following species considered in this consultation are regulated under the Marine Mammal Protection Act (MMPA) and the ESA: the beluga whale (*Delphinapterus leucas*) – Cook Inlet Distinct Population Segment (DPS), blue whale (*Balaenoptera musculus*), bowhead whale (*Balaena mysticetus*), fin whale (*Balaenoptera physalus)*, gray whale (*Eschrichtius robustus*) – Western North Pacific DPS, humpback whale (*Megaptera novaeangliae*) – Cape Verde Islands/Northwest Africa DPS, Central America DPS, Mexico DPS, and Western North Pacific DPS, killer whale (*Orcinus orca*) – Southern Resident DPS, North Atlantic right whale (*Eubalaena glacialis*), North Pacific right whale (*Eubalaena japonica*), rice's whale (*Balaenoptera ricei*), sei whale (*Balaenoptera borealis*), Southern right whale (*Eubalaena australis*), sperm whale (*Physeter macrocephalus*), bearded seal (*Erignathus barbatus nauticus*) – Beringia DPS, Guadalupe fur seal (*Arctocephalus townsendi*), ringed seal (*Phoca hispida hispida*) – Arctic subspecies, and Steller sea lion (*Eumetopias jubatus*) – Western DPS. Each statute defines take distinctly. The MMPA defines take as to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal (16 U.S.C. §1632(13)). Take under the ESA is to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. §1532(19)). Actions considered 'take' under one statute do not necessarily rise to the level of take under the other statute.

This programmatic letter of concurrence underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA; section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file electronically with the NMFS Office of Protected Resources in Silver Spring, Maryland.

CONSULTATION HISTORY

The NMFS provided a programmatic letter of concurrence (PLoC) to the FAA, USSF, and NASA for launch and reentry vehicle operations and Space Exploration Technologies Corporation (SpaceX) Starship-Super Heavy operations in the marine environment on January 31, 2022, and subsequently amended it on April 14, 2023 to clarify information and to include a Bahamas and Caribbean area in the PLoC. On August 6, 2024, the PLoC was amended to include Morro Bay Harbor, and associated conservation measures, as a port for commercial space vessel operations. On September 11, 2024, the PLoC was amended to add waters within a 90-mile (mi) or 145-kilometer (km) radius around Bermuda to the action area. On January 17, 2025, NMFS provided a conference and biological opinion to FAA for SpaceX Starship-Super Heavy operations, which superseded all Starship-Super Heavy operations considered in the PLoC. Therefore, Starship-Super Heavy operations are not covered under this programmatic. On June 25, 2025, the PLoC was amended to increase the maximum number of annual spacecraft reentry and landing operations in the Pacific Ocean portion of the action area from three to 11. Following are notable dates in the development of this latest reinitiation of the PLoC:

- **May 28, 2025:** FAA, as the lead action agency, presented the action agencies' proposed changes for the programmatic to NMFS to expand the current scope of the PLoC. Proposed changes included expanding the action area to the whole globe, updating launch and reentry vehicle specifications envelopes, and increasing the number of operations.

- **June 5–July 18, 2025:** NMFS and FAA engaged in pre-consultation and technical assistance.
- **July 29, 2025:** FAA formally requested reinitiation of the programmatic via email to NMFS.
- **August 21–September 12, 2025:** NMFS and FAA met multiple times to discuss timing considerations for the programmatic, consistent with Executive Order 14335, "Enabling Competition in the Commercial Space Industry," and the activities that should be covered under the programmatic.
- **November 26, 2025:** NMFS requested, via email to FAA, additional information to analyze the action agencies' proposed changes to the programmatic. On December 3, 2025, NMFS and FAA met to discuss the information.
- **January 29, 2026:** NMFS presented an analysis of the action agencies' proposed changes to FAA.
- **February 19, 2026:** NMFS sent another request to FAA for additional information needed to initiate consultation. NMFS and FAA met to discuss the outstanding items needed for initiation. On February 20, 2026, FAA provided responses to our December 2025 and February 2026 requests for additional information via email.
- **February 23, 2026:** As requested, NMFS emailed the Proposed Action section of the programmatic to the FAA, with requests for additional information and for FAA's review to ensure accuracy in the description of the proposed activities.
- **March 2, 2026:** FAA provided their review of the Proposed Action and responses to our requests for additional information via email. On March 3, 2026, NMFS and FAA met to discuss the proposed action and how the programmatic will supersede other space consultations.
- **March 4–March 11, 2026:** FAA and NMFS met multiple times to discuss adjustments to the proposed action, including the consultations to be superseded and an expansion of the action area. FAA also provided additional information related to those adjustments.

Previous ESA section 7 consultations for the activities that are included in and superseded by this reinitiated programmatic consultation include:

- **OPR-2025-02194:** On July 29, 2025, NMFS received a request for consultation from FAA for the proposed licensing of testing activities of Blue Origin's launch vehicle, New Glenn. The proposed activities consisted of 1) New Glenn first stage testing, and 2) experiments on New Glenn's payload fairings. First stage testing activities will include one explosive event off North Carolina and three explosive events off Florida. Fairing experiments will include expending some and recovering some of the fairings and instruments housed in the fairings. NMFS issued a letter of concurrence for the proposed activities on September 29, 2025.
- **OPR-2025-01425:** On May 15, 2025, NMFS received FAA's request for concurrence on proposed Rocket Lab licensing activities, consisting of up to three launches of Rocket Lab's Neutron launch vehicle between 2025 and 2026, including controlled first stage landing and disposal in the North Atlantic Ocean and second stage reentry, landing, and debris in the southern Indian Ocean and Southern Ocean. On July 14, 2025, NMFS issued an expedited letter of concurrence for those proposed activities.
- **OPR-2024-02184:** On August 27, 2024, NMFS received FAA's request for concurrence for proposed Sierra Space Corporation (Sierra Space) licensing activities, consisting of

four Dream Chaser (Sierra Space's spacecraft) reentries per year 2025–2029. Each reentry included expending Dream Chaser's cargo module in the Pacific Ocean. On June 6, 2025, NMFS issued a letter of concurrence for those proposed activities.

- **OPR-2024-01961:** On August 14, 2024, NMFS received FAA's request for concurrence on proposed Boeing Company (Boeing) licensing activities, consisting of up to four Commercial Space Transport 100, also known as Starliner (Boeing's spacecraft), reentries per year 2024–2028. Each reentry included expending Starliner's service module in the Pacific Ocean. On November 14, 2024, NMFS issued a letter of concurrence for those proposed activities.
- **OPR-2024-01272:** On June 10, 2024, NMFS received FAA's request for concurrence on proposed Varda Space Industries, Inc. (Varda) licensing activities, consisting of three reentry, landing, and recovery operations of Varda's Winnebago series capsules, including expending of a Rocket Lab Corporation (Rocket Lab) satellite bus ('Pioneer'), in the Great Australian Bight. On August 20, 2024, NMFS issued a letter of concurrence for those proposed activities. On February 9, 2026, FAA relayed that Varda reentry, landing, and recovery operations will increase from three to 10. Given the small increase in operations in the same action area, NMFS concludes that this will not alter the effects analysis completed in OPR-2024-01272.
- **WCRO-2024-00812:** On March 21, 2024, NMFS West Coast Regional Office received a request for consultation from USSF on an annual cadence of 100 launches per year of SpaceX Falcon 9 and Falcon Heavy from VSFB, 36 first stage recoveries per year, and 10 expended Falcon 9 or Falcon Heavy center core boosters per year. The action area was also expanded for droneship landings and fairing recovery operations. An expedited letter of concurrence was issued on April 17, 2024.
- **WCRO-2023-00002:** On December 19, 2022, NMFS West Coast Regional Office received a request for consultation from USSF to increase the annual cadence of SpaceX Falcon 9 operations to 110 launches per year from VSFB and 36 first stage recoveries per year, with an expanded area for droneship landings and fairing recovery operations. An expedited letter of concurrence was issued on January 20, 2023.

Proposed Action and Action Area

When consulting on a national program, agencies are often not able to provide enough specificity about the number, location, timing, frequency, precise methods, and intensity of each action's activities to determine the site-specific effects those activities will have on ESA-listed species and critical habitat. This letter of concurrence documenting the programmatic consultation includes a review of the effects of activities covered by the FAA, USSF, and NASA space launch and reentry actions and establishes a framework for authorizing future actions and tracking their effects.

This programmatic consultation is multifaceted and consists of activities ranging from launch, reentry, and landing operations, pre- and post-launch surveillance, and recovery operations. The following sections provide an overview of the action agencies and their authorities pertaining to this consultation, the activities covered by this consultation, and conservation measures FAA, USSF, and NASA will implement to minimize the effects of the space launch and reentry program on ESA-listed or proposed species and designated or proposed critical habitat.

Action Agency Overview

Federal Aviation Administration

The FAA Office of Commercial Space Transportation oversees, licenses, and regulates U.S. commercial launch and reentry activities, as well as the operation of non-federal launch and reentry sites within the U.S. or as carried out by U.S. citizens, as authorized by the Commercial Space Launch Act of 1984, as amended and codified at 51 U.S.C. 50901–50923. 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 FAA also issues licenses to commercial launch/reentry site operators for operation of commercial launch/reentry sites. An FAA license or permit is required for any commercial launch or reentry, or the operation of any commercial launch or reentry site. An FAA license or permit is not required for launch or reentry activities carried out by and for the federal government, such as NASA or Department of Defense (DoD) launches.

The FAA Office of Commercial Space Transportation issues the following types of licenses and permits, in accordance with 14 CFR parts 420, 433, 437, and 450:

- **License to Operate a Launch Site** (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. 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 five 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 (14 CFR part 450) for the site.
- **License to Operate a Reentry Site** (14 CFR part 433): A license to operate a reentry site authorizes a licensee to offer its reentry site to a reentry vehicle operator to conduct reentry operations at the site. Issuance of a reentry 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. Actual reentries cannot occur at a reentry site until a reentry vehicle operator receives a vehicle operator license (14 CFR part 450) for the site.
- **Experimental Permits** (14 CFR part 437): An experimental permit authorizes launch or reentry of a reusable suborbital rocket or a reusable suborbital launch vehicle for research and development, showing of compliance with requirements for obtaining a license, or crew training. 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, is valid for one year from the date it is issued, and the permittee may apply to renew the permit yearly.
- **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. Vehicle operator licenses are valid for the period of time determined by the FAA Administrator as necessary to conduct the licensed activity, but may not exceed five years from the issuance date. The FAA may modify a vehicle operator license at any time by modifying or adding license terms and conditions to ensure compliance with the Commercial Space Launch Act and regulations.

U.S. Space Force

Under the USSF Space Systems Command, Space Launch Delta (SLD) 45 oversees launch operations at Cape Canaveral Space Force Station (CCSFS) and SLD 30 oversees launch operations at Vandenberg Space Force Base (VSFB). 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 launch operations at CCSFS (which includes multiple space launch complexes [SLC]) and ensuring range safety and supporting space missions, including launching of U.S. government and commercial payloads into orbit, from the Eastern Range (northwest Atlantic Ocean). SLD 45 also provides launch facilities and services to support NASA and commercial space operations. A USSF directive 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 U.S. East Coast.
- **Space Launch Delta 30:** SLD 30, headquartered at VSFB, is responsible for overseeing launch operations at VSFB, which includes multiple SLCs. 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 U.S. Air Force and Missile Defense Agency), NASA, foreign nations, and various private contractors.

National Aeronautics and Space Administration

The National Aeronautics and Space Act of 1958 established NASA. The National Aeronautics and Space Act gives NASA the responsibility for planning, directing, and conducting the nation's civilian space program, and 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, the Kennedy Space 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 recovery 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.
- **Wallops Flight Facility:** NASA Goddard Space Flight Center manages Wallops Flight Facility (WFF), the oldest active launch range in the continental U.S. 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 flight characteristics of launch vehicles and spacecraft, and in pursuit of knowledge of the Earth's upper atmosphere and the near space environment. WFF regularly provides launch support, range safety, and downrange tracking for the commercial space 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). WFF also facilitates various DoD research, development, testing, and evaluation and training missions, including target and missile launches.

Space Launch and Reentry Operations

Space launch and reentry operations cover several activities, which may vary based on the specific mission. For ease of understanding, in the following subsections we define commonly used terms in the space industry as they pertain to this consultation, overview the typical sequence of events for space operations, and break down the activities that occur at each phase.

Definitions

Anomaly: any condition during a licensed or permitted activity that deviates from what is standard, normal, or expected, during the verification or operation of a system, subsystem, process, facility, or support equipment.

Breakup: a failure resulting in a "breakup" (sometimes with an explosion) of the vehicle or stage, may be a type of anomaly or nominal (e.g., vehicle breakup during atmospheric reentry).

Disposal: the return or attempt to return, purposefully, a launch vehicle stage or component, not including a reentry vehicle, from Earth orbit to Earth, in a controlled manner. For example, operators may dispose of upper stages in the ocean.

Drogue parachutes: small, thin parachutes deployed at high altitude to gain control of the stage or vehicle component to which the parachute is attached. Part of the parachute system that facilitates recovery of spacecraft and payload fairings.

Droneship: also known as an autonomous spaceport drone ship, a self-propelled modified barge used to land and recover reusable boosters at sea.

Expend: to discard (as in, a stage, vehicle components such as fairings, or debris), often in the ocean. Usually items are expended during flight, shortly after takeoff.

Fairing: the nose cone of the upper stage that protects the payload during launch; it consists of two halves that separate to facilitate deployment of the payload.

First stage: also known as the booster, it is the bottom stage of a launch vehicle that propels the launch vehicle during launch.

Heat shield: a barrier that provides thermal protection for the vehicle during stage separation or during atmospheric reentry.

High-velocity impact: also known as a hard landing (as opposed to a soft landing, see below), where the stage impacts the ocean at terminal velocity, resulting in a breakup of the vehicle and a potential explosive event.

Horizontal launch: as opposed to a vertical launch, a launch (including takeoff and landing) that occurs from a runway at the launch site (similar to a commercial airplane).

Interstage: a structural component of the launch vehicle that connects the first stage and the second stage.

Landing burn: typically the final engine firing of the stage, substantially slowing down the stage for landing.

Landing operations: in reference to spacecraft, the reentry, splashdown, and recovery of the spacecraft.

Launch abort test: a test of the stage's safety system by intentionally triggering it.

Launch operator: person or company who conducts or will conduct the launch of a launch vehicle and any payload.

Launch site: location from which a launch takes place.

Launch vehicle: a vehicle built to operate in, or place a payload in, outer space or a suborbital rocket.

Main parachutes: large parachutes deployed after the drogue parachutes on a spacecraft, to provide the final slowdown of the spacecraft for splashdown.

Nominal: when all aspects, in reference to launch vehicle performance, systems, flight, landing, etc., occur as expected and planned.

Orbital spaceflight: where a vehicle reaches sufficient velocity to place it into orbit.

Parafoil: a large, steerable parachute, part of the system of parachutes that facilitates recovery of payload fairings.

Payload: the cargo or equipment (e.g., satellites, scientific instruments) on a vehicle or stage designed to achieve mission goals.

Pilot parachutes: small parachutes used to deploy the drogue parachutes on reentry vehicles (i.e., capsules). The pilot parachute is ejected, inflates, and then directly pulls the drogue parachute out.

Reentry: also referred to as atmospheric reentry, the return or attempt to return, purposefully, a reentry vehicle and its payload from Earth orbit or from outer space to Earth.

Reentry burn: also known as a deorbit burn, the engines fire to transition the vehicle from orbit to atmospheric reentry.

Reentry vehicle: a vehicle designed to return from Earth orbit or outer space to Earth substantially intact, and is the payload attached to the second (or upper) stage. A reusable launch vehicle that is designed to return from Earth orbit or outer space to Earth substantially intact is also a reentry vehicle. Often referred to as a spacecraft or capsule.

Reusable: as opposed to being expended, a vehicle or stage that can be recovered and used again.

Skirt ring: a structural component that may be used on launch vehicles for additional support. On SpaceX's Falcon 9 vehicle specifically, it is composed of four segments that prevent deformation of the second stage engine nozzle during stage separation.

Sonic boom: also known as overpressure, is a shock wave creating an impulsive sound that is generated during launch and landing when the vehicle reaches supersonic speed (travels faster than the speed of sound).

Space launch and reentry operations: all activities, including but not limited to pre-launch surveillance, launches, landings, expended components and debris, etc., as described in this programmatic consultation.

Splashdown: also referred to as a soft-water landing (as opposed to a hard landing or landing at terminal velocity, see above), where the vehicle or stage lands gently in the water and does not breakup.

Stage separation: During a vertical launch, where the first stage and the upper stage of the launch vehicle physically separate. During a horizontal launch, for example, when the rocket is attached to a carrier aircraft, stage separation occurs when the rocket detaches from the aircraft.

Suborbital spaceflight: where a vehicle may reach space but does not achieve sufficient velocity to place it into orbit.

Trajectory: the planned path for the vehicle's flight.

Upper stage(s): also referred to as the second stage (or third stage, if the launch vehicle has three stages), the stage on top of the first stage, which delivers a payload into orbit.

Vertical launch: as opposed to a horizontal launch, a launch (including takeoff and landing) that occurs from a launch pad, where the launch vehicle liftoff is straight up.

General Sequence of Events

Prior to launch, weather balloons, spotter aircraft, and surveillance vessels are used to ensure safe launch conditions. Pre-launch testing, such as a static fire test (firing the engines while the vehicle is bolted to the ground), may also occur. Launch vehicles may consist of multiple stages, but typically have two stages: the first stage, also referred to as the booster, and the second stage, also referred to as the upper stage or spacecraft. The second stage typically delivers the payload to its intended orbit or to outer space, and can include a reentry vehicle such as a spacecraft or capsule.

During a launch, the launch vehicle quickly gains altitude and flies along a pre-planned trajectory, often over the ocean (particularly vertical launches). At some point downrange (i.e., some point away from the launch site based on the flight trajectory), the launch vehicle reaches supersonic speeds, generating a sonic boom, and pitches over to attain its intended trajectory. Depending on the vehicle's orientation and trajectory, it is possible for the sonic boom to overlap with the marine environment. Stage separation occurs, and the first stage falls back to Earth, either being expended in the ocean or conducting controlled engine burns to decelerate the stage and land on an ocean-going barge or back at the launch site. The upper stage continues its mission and delivers the payload before reentering Earth's atmosphere and landing in the ocean. Vessels may be deployed to recover the stages or any remaining debris.

Weather Balloons

Weather balloons are deployed to measure weather data, including wind speeds, and are necessary to determine if it is safe to launch and land vehicles. Between five and 15 weather balloons are used for each launch. Weather balloons are made of latex with a radiosonde attached to each balloon. A radiosonde is an instrument that measures and transmits atmospheric data to the launch operator, and is typically the size of a half-gallon milk carton. The latex balloon typically has a diameter at launch of approximately four feet (ft; 1.2 meters [m]). When a weather balloon is deployed, it rises approximately 12–18 mi (19–29 km) into the air and then 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 when it lands over water.

Aircraft and Vessels

A number of spotter aircraft, including drones, and surveillance vessels are used prior to launch to ensure that designated hazard areas are clear of non-participating crafts. A combination of radar, spotter aircraft, surveillance vessels, and law enforcement vessels may be deployed prior to launch. Vessels will be up to 200 ft (61 m) in length, except barges or droneships, which may be up to 400 ft (122 m) in length. Most fixed wing aircraft operate at altitudes of 15,000 ft (4,572 m) but may drop to 1,500 ft (457 m) to obtain a call sign from a non-participating vessel.

Ports that could be used for surveillance vessel transit include all major ports on the U.S. coasts, and airports could include any airports within 50 mi (80.5 km) from the U.S. coast.

Launch Sites

Space launches are authorized to occur at several launch sites (see Table 1). The FAA, USSF, and/or NASA may receive new proposals in the future for launch operations at existing launch sites (e.g., constructing additional infrastructure or re-developing a launch site) or new launch sites that involve operations affecting the marine environment. Upon receipt of a new proposal, the lead action agency will review the proposal and coordinate with NMFS to determine if the proposed action falls within the scope of this programmatic.

Table 1. Current launch sites

Launch Site	Location	Site Operator
Cecil Airport	Florida, U.S.	Commercial – Jacksonville Aviation Authority
Cape Canaveral Space Force Station (CCSFS) – multiple space launch complexes (SLC)	Florida, U.S.	Government – U.S. Space Force (USSF)
CCSFS – SLC-46 and SLC-20	Florida, U.S.	Commercial – Space Florida
Houston Spaceport (Ellington Airport)	Texas, U.S.	Commercial – Houston Airport System
Kennedy Space Center (KSC) – multiple launch complexes	Florida, U.S.	Government – National Aeronautics and Space Administration (NASA)
KSC – Launch and Landing Facility (formerly Shuttle Landing Facility)	Florida, U.S.	Commercial – Space Florida
Mojave Air and Space Port	California, U.S.	Commercial – Mojave Air and Spaceport
Pacific Spaceport Complex Alaska	Alaska, U.S.	Commercial – Alaska Aerospace Corporation
Rocket Lab Launch Complex 1	New Zealand	Private – Rocket Lab
Space Coast Regional Airport	Florida, U.S.	Commercial – Titusville-Cocoa Airport Authority
Vandenberg Space Force Base – multiple launch complexes	California, U.S.	Government – U.S. Space Force
Wallops Flight Facility (WFF)	Virginia, U.S.	Government – NASA

Launch Site	Location	Site Operator
WFF – Launch Complex 0 (Mid-Atlantic Regional Spaceport)	Virginia, U.S.	Commercial – Virginia Commercial Space Flight Authority

Launch Vehicles

Launch vehicles, commonly known as rockets, can take off either vertically from a launch pad or horizontally from a runway. There is variability in launch vehicle design. For example: the SpaceX Falcon 9 vertical launch vehicle is a two-stage launch vehicle with an interstage, which connects the first and second stages and facilitates stage separation; the United Launch Alliance's (ULA) Atlas V vertical launch vehicle consists of first stage core booster, which can be enhanced with up to five side boosters, interstage, and second stage; and the Northrop Grumman Corporation's Pegasus horizontal launch vehicle is flown to altitude by a carrier aircraft (which is considered as part of the launch vehicle) before the three-stage rocket is released and the first stage engines ignite and the rocket continues on its mission. Companies may develop upper stages, spacecraft, or capsules that launch on top of a different company's booster. NASA or DoD may conduct launches and/or reentries of vehicles that were built by the commercial space industry, and commercial launch operators may conduct operations for NASA or DoD. Launch vehicles may use a variety of fuels and propellant combinations.

Currently, a majority of launch vehicles are expendable, meaning the stages are used once and then disposed of in the ocean. Some companies (e.g., SpaceX, Blue Origin) have developed or are planning to develop reusable launch vehicles and/or stages, which can be launched, recovered, and launched again multiple times. The action agencies developed a framework of specifications for existing and future launch vehicles (based on their knowledge of the industry) to be covered under this consultation. Based on those specifications, the total engine thrust of a launch vehicle will be a maximum of 6.5 million pounds (lbs). During launch, when the launch vehicle or booster reaches supersonic speeds either during ascent or landing, a sonic boom of up to 50 pounds per square foot (psf) will be generated. This programmatic consultation covers existing and future launch vehicles whose specifications fall under those described in Table 2.

Table 2. Launch vehicle envelope specifications

	Vertical launch vehicle	Horizontal launch vehicle
Number of stages	3	3
Vehicle length	Approximately 450 ft (137.2 m)	Approximately 80 ft (24.4 m)
Vehicle Diameter	Approximately 23 ft (7 m)	Approximately 10 ft (3 m)
Propellant maximum amount on takeoff for solid fuel rocket	Hydroxyl-terminated Polybutadiene (HTPB): 145,000 lbs High-density polyethylene (HDPE): 23,500 lbs	HTPB: 1,800 lbs

	Vertical launch vehicle	Horizontal launch vehicle
Propellant maximum amount on takeoff liquid fuel rocket	Liquefied natural gas (LNG): 800,000 lbs LOX: 3,200,000 lbs Liquid hydrogen (LH_2): 142,000 lbs Rocket Propellant-1 (RP-1): 875,000 lbs RP-X (potential next generation propellant; Exxsol D40, similar to mineral spirits): 45,000 lbs	Jet A fuel: 8,000 lbs Nitrous oxide (N_2O): 13,250 lbs Hydrogen peroxide (H_2O_2): 600 lbs

ft=feet; lbs=pounds

Launch Abort Tests

These may include pad abort tests (triggering the abort system while the spacecraft is on the ground, in the event of an emergency at the launch pad) and launch ascent abort tests (triggering the launch abort system while the spacecraft is ascending, in the event of an emergency during launch). The latter typically involves the breakup or explosion of the first stage over the ocean and may be conducted prior to transporting crew aboard the spacecraft, to ensure safety (for example, SpaceX's Crew Dragon conducted an in-flight abort test before it carried astronauts to the International Space Station). Both types of tests may involve a waterborne landing of the spacecraft in the Atlantic Ocean. Launch abort tests typically involve a non-propulsive spacecraft landing using a system of parachutes (see more information on parachutes under the Reentry section, below). The launch operator is responsible for recovering as many pieces of debris as feasible; it is possible debris will not be recovered.

Launch Failure Anomaly

A launch failure anomaly is possible during any launch operation and could result in the breakup (i.e., explosion) of the booster and/or spacecraft on or near the launch pad or landing area. Anomalies may also occur during flight.

Expended Stages/Components/Debris

After launch, one or more stages of the launch vehicle, or other components of the launch vehicle, may be expended (i.e., discarded) in the ocean.

During stage separation, the first stage, which has burned up most of its fuel, and upper stage physically separate. The first stage and interstage fall back to Earth and the engines of the upper stage ignite to continue on the intended mission. Some launch vehicles such as SpaceX's Falcon 9 utilize a skirt ring to prevent deformation of the upper stage engine during stage separation, which also falls back to Earth after stage separation. The skirt ring is made of four segments that are temporarily bonded to the second stage engine nozzle, so that when the second stage engines are ignited, the bond and segments are released. For a majority of launch vehicles, the first stage, interstage, skirt ring, and heat shield will be expended in the ocean. For reusable or partially reusable (e.g., SpaceX Falcon 9 and Falcon Heavy boosters and Blue Origin boosters are reusable) launch vehicles, the first stage either lands back at the launch site or on an ocean-going barge/platform (also referred to as a droneship).

As the upper stage continues on its mission, the payload fairing, the nose cone of the upper stage that protects the payload during launch and consists of two halves, separates to facilitate deployment of the payload. Most payload fairings are expended in the ocean as they fall back to Earth. Payload fairings under this consultation may be up to 75 ft (22.9 m) in length with a diameter of 30 ft (9.1 m). Similar to reusable boosters, some companies (e.g., SpaceX) have developed the ability to recover and reuse payload fairings (for more information on fairing recovery parachutes, see Recovery section, below).

Depending on the launch vehicle and mission, other components may also be expended in the ocean. These components could include cargo and service modules (approximately 15 ft by 15 ft by 15 ft [4.6 m by 4.6 m by 4.6 m]) and interstage adapters (approximately 15 ft [4.6 m] in length and 23 ft [7 m] in diameter). Stages and components that reenter Earth's atmosphere before being expended in the ocean are expected to break up during reentry. This results in a debris field in the ocean, consisting of parts of the stages and components that were not fully destroyed during reentry.

Explosive Events

During the development of a reusable launch vehicle, the launch vehicle may experience a landing failure before being able to land back at a launch site or land on an ocean-going barge or platform. A landing failure may result in an explosive event near the surface of the ocean. Under this programmatic, explosions will only occur when related to the development of a reusable commercial launch vehicle. Landing failure explosive events, if permitted or licensed by an action agency for development of a reusable vehicle, under this programmatic may occur only under specific conditions: 1) explosive events will occur, at minimum, 11 ft (3.4 m) above the surface of the ocean; 2) the explosive weight (calculated from the amount of remaining propellant and its explosive yield) will not exceed 55,800 kilograms (123,018 lbs); and 3) explosive events will only occur in the Atlantic portion of the action area at least 100 mi (160.9 km) from any major land mass (see Figure 5).

Reentry

Reentry, splashdown, and recovery (see Recovery section, below) are the three elements of a spacecraft landing operation. During reentry, when the reentry vehicle reaches supersonic speeds, a sonic boom is generated. Reentry sonic booms for spacecraft/capsules, given the envelope of reentry vehicle specifications developed by the action agencies, may be up to 3 psf. Reentry vehicles will be a maximum of 30 ft (9.1 m) in length and 15 ft (4.6 m) in diameter. The reentry vehicle will only have residual amounts of propellant upon reentry because a majority of propellant will have been used earlier during its mission. Propellants for reentry vehicles may include hydrogen peroxide (H_2O_2), monomethylhydrazine (MMH), nitrogen tetroxide (NTO and N_2O_4), Rocket Propellant-1 (RP-1), or propene and nitrous oxide (N_2O).

If landing in the ocean (versus on land), crewed (i.e., humans on board) spacecraft need to be located closer to shore for recovery and human safety. Currently, the only approved operating spacecraft for commercial crew is SpaceX's Dragon. Although FAA's reentry license allows Dragon to land in the wider North Pacific Ocean, per an agreement with FAA's Air Traffic Organization (ATO), Dragon (whether crewed or uncrewed) is only approved to land in three specific locations approximately 15.5 mi (25 km) off the coast of California (see Figure 3). A new capsule is being designed which will land at least 13.8 mi (22.2 km) from the west coast of North America, within Zone 1 or Pacific Zone 2 (see Figure 1 and Figure 2).

Recovery

As mentioned previously, SpaceX and Blue Origin have developed the ability to recover and reuse stages and fairings, and other companies are or may develop this ability in the future. First stage recovery typically consists of maneuvering the stage so that it lands back at the launch site or on a modified ocean-going barge or platform, or an autonomous spaceport droneship (or droneship, for current SpaceX operations). SpaceX droneships currently operate in the Pacific and Atlantic oceans. They are approximately 295 ft (90 m) in length, 150 ft (46 m) wide, and are able to maintain their position at sea using thruster engines. Blue Origin's droneship currently operates in the Atlantic Ocean. It is approximately 380 ft (115.8 m) in length and 150 ft (45.7 m) in width. Droneships may be up to 450 ft (137.2 m) in length and are towed to/from port and landing sites by tugs or support vessels that may be up to 200 ft (61 m) in length. During a first stage landing on a droneship, a sonic boom directly underneath and directed towards the droneship, is produced. Sonic booms generated during booster landings are typically approximately 8 psf, but may be up to 50 psf.

Fairing recovery uses a system of parachutes. Each fairing half uses one drogue parachute and one parafoil. The parachute system slows the descent of the fairing to facilitate a soft, intact splashdown of the fairing for recovery. Following reentry of the fairing into Earth's atmosphere, the drogue parachute is deployed at altitude (approximately 50,000 ft or 15,240 m) to begin the initial slowdown and to extract the parafoil. Drogue parachutes are small, thin parachutes deployed at a high altitude to gain control of the fairing at speeds that would destroy the parafoil. Each drogue parachute is made of nylon, has an area of approximately 120 square feet (ft^2; 11 square meters [m^2]), and has a Kevlar or Kevlar with nylon overwrap suspension line length of approximately 72 ft (22 m). Following successful deployment of the parafoil, the drogue parachute is cut away. The parafoil is made of nylon, has an area of approximately 3,000 ft^2 (278.7 m^2), and has a nylon or nylon with Kevlar overwrap suspension line length of approximately 50 ft (15.2 m). The fairing and parafoil are then recovered by a support vessel and/or rigid-hulled inflatable boats (RHIBs; approximately 12 ft or 3.7 m in length), which are stationed in a designated safety zone near the anticipated splashdown area. The vessel then transports the fairing back to port. Recovery of the drogue parachute is attempted if weather conditions allow and the recovery team is able to obtain a visual fix on the landing location; however, that can be difficult because the drogue parachute is deployed at high altitude.

Recovery of a reentry vehicle or spacecraft is similar to fairing recovery and uses a system of parachutes. For Dragon, two drogue parachutes and four main parachutes are used during recovery. The drogue parachutes are made of nylon, each with an area of approximately 200 ft^2 (18.6 m^2), and suspension line length of approximately 75 ft (22 m). Shortly after the drogue parachutes are deployed, they are released and are expected to land in the ocean approximately one mile from the reentry vehicle. The main parachutes are then deployed to slow the spacecraft down to allow for a soft splashdown in the ocean or on land. The main parachutes are made of Kevlar and nylon, each with an area of approximately 10,600 ft^2 (984.8 m^2), and suspension line length of approximately 150 ft (45.7 m). Following splashdown, an electronic locator beacon on the vehicle assists the recovery team in locating and recovering the vehicle using a pre-positioned recovery vessel of up to 200 ft (61 m) in length and RHIBs. The recovery vessel transports the vehicle back to port. Recovery of the parachutes is attempted if weather conditions allow and the recovery team is able to visually locate the parachutes. If there are crew on the reentry vehicle, they and any time-sensitive cargo will be transported to the nearest airport via helicopter. For the new capsule, a system consisting of one pilot parachute, one drogue parachute, and one main parachute will facilitate recovery. All three of these parachutes for the planned capsule are smaller than Dragon's parachutes. The pilot parachute is small, approximately 13.5 ft (4.1 m) in diameter made of nylon broad cloth, with Kevlar suspension line lengths of approximately 8.75 ft (2.7 m), and helps deploy the drogue parachute on this capsule. Like Dragon operations, recovery of the parachutes is attempted if weather conditions allow and the recovery team is able to visually locate the parachutes.

Action Area

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 CFR §402.02). The action area is global, and is categorized by ocean basin and further subcategorized by zones (see Figures 1–7). The action area also includes U.S. waters (except for Hawai'i and the remote Pacific) from the coast out to five nautical miles (NM) or to one of the zones in Figures 2–7 (for example, in Figure 7, vessels may transit from Puerto Rico to Zone 4), within which only vessel and aircraft transit will occur.

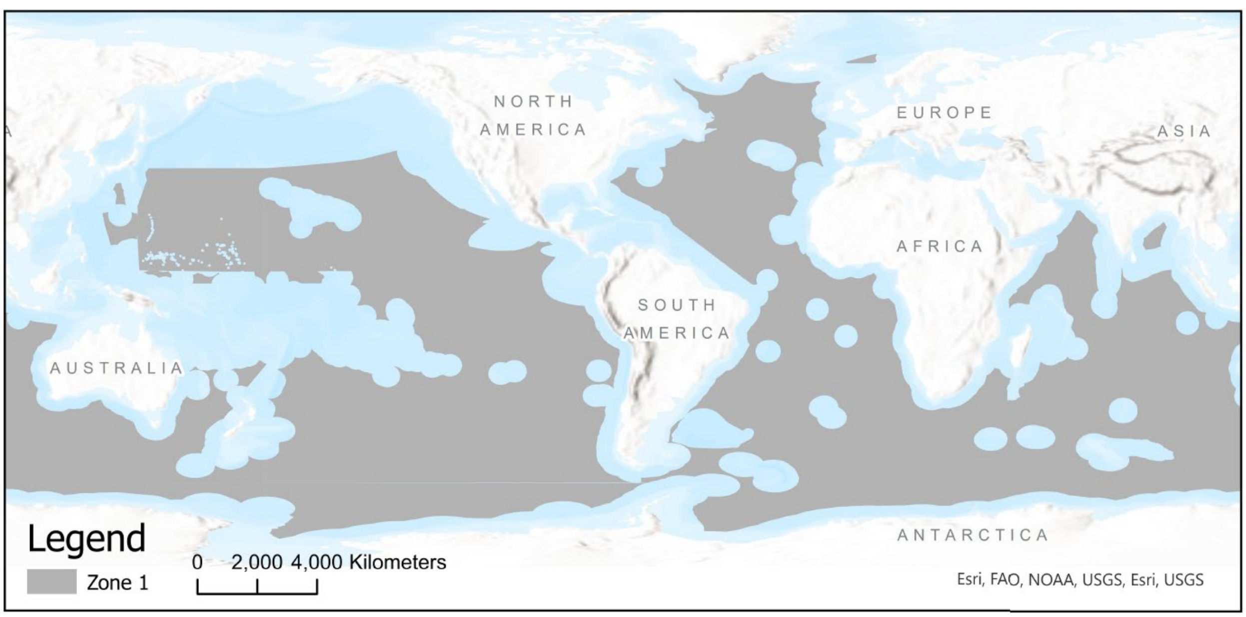

Figure 1. Zone 1 portion of the action area (grey)

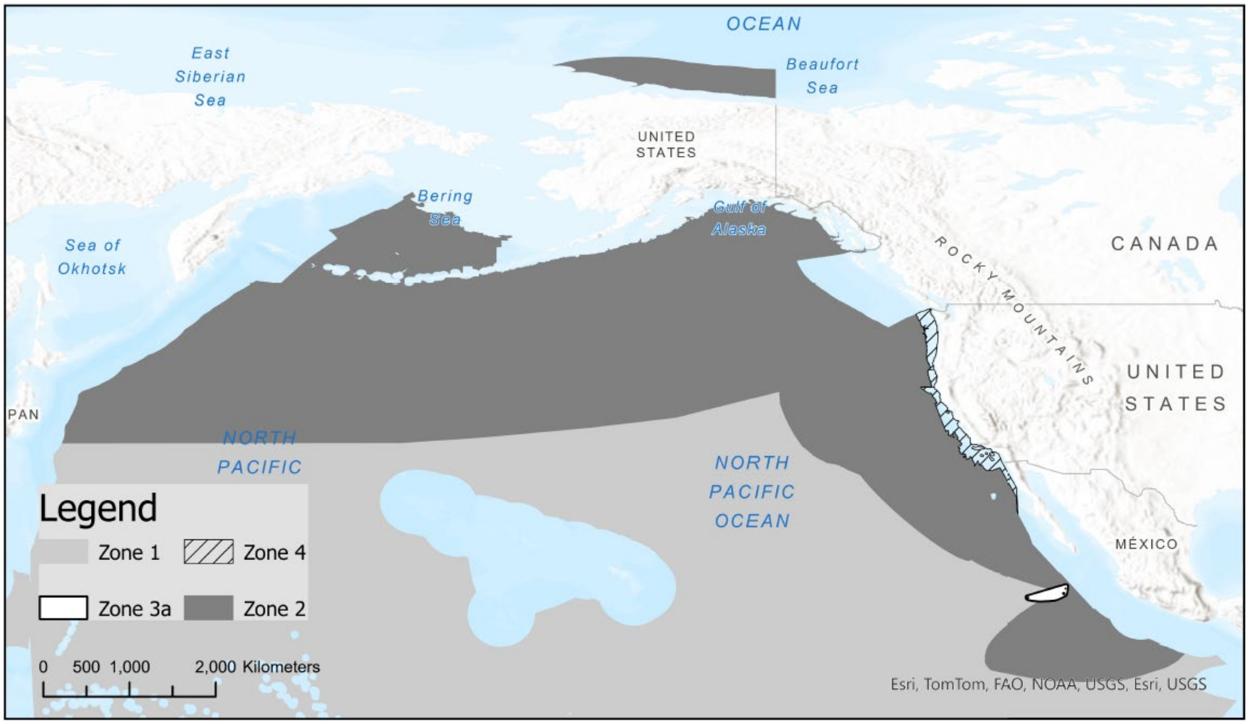

Figure 2. Pacific portion of the action area (Zone 1 – grey; Zone 2 – dark grey; Zone 3a – white with black outline; Zone 4 – hatch; no color – outside the action area)

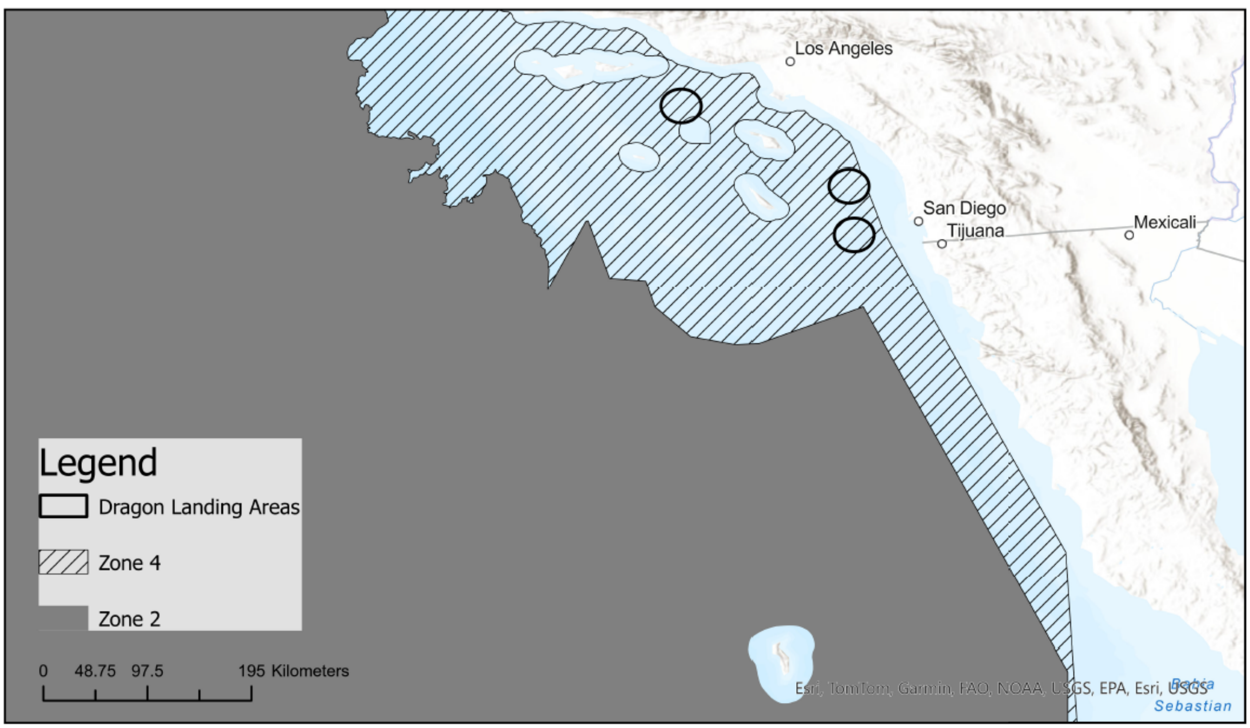

Figure 3. Subset of Pacific portion of the action area (Zone 2 – dark grey; Zone 4 – hatch; Dragon landing areas – black outline; no color – outside the action area)

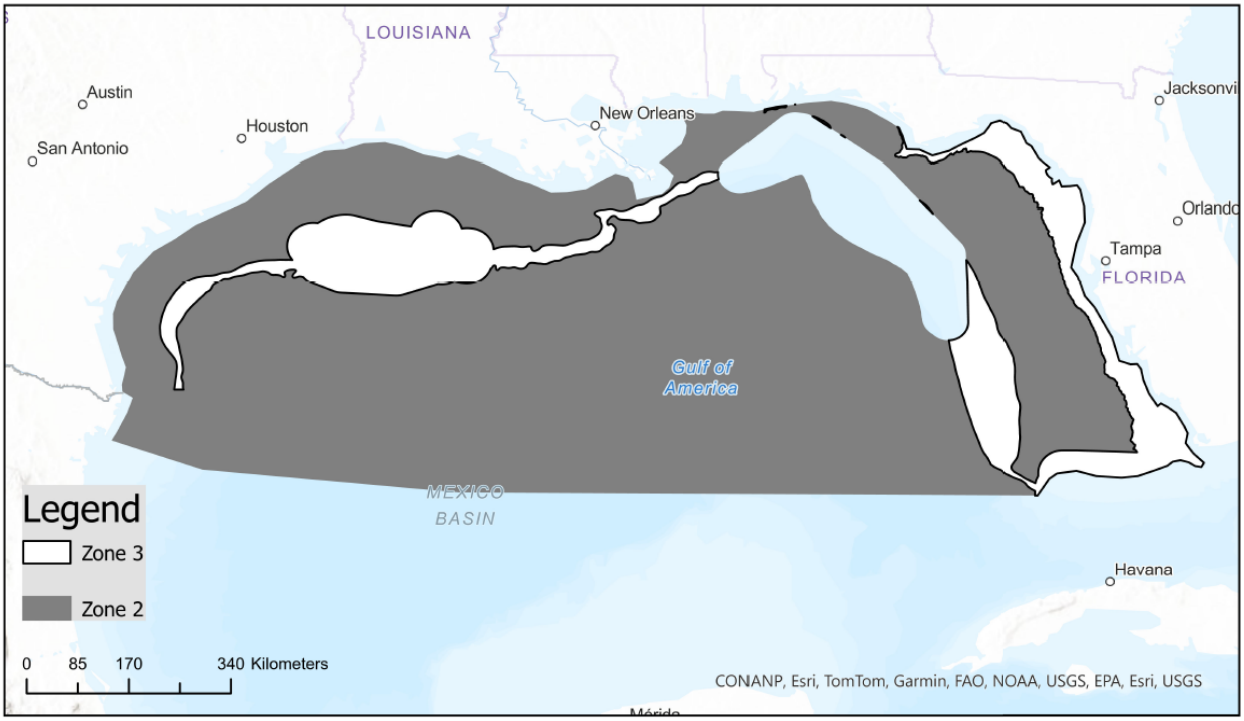

Figure 4. Gulf portion of the action area (Zone 2 – dark grey; Zone 3 – white with black outline; no color – outside the action area)

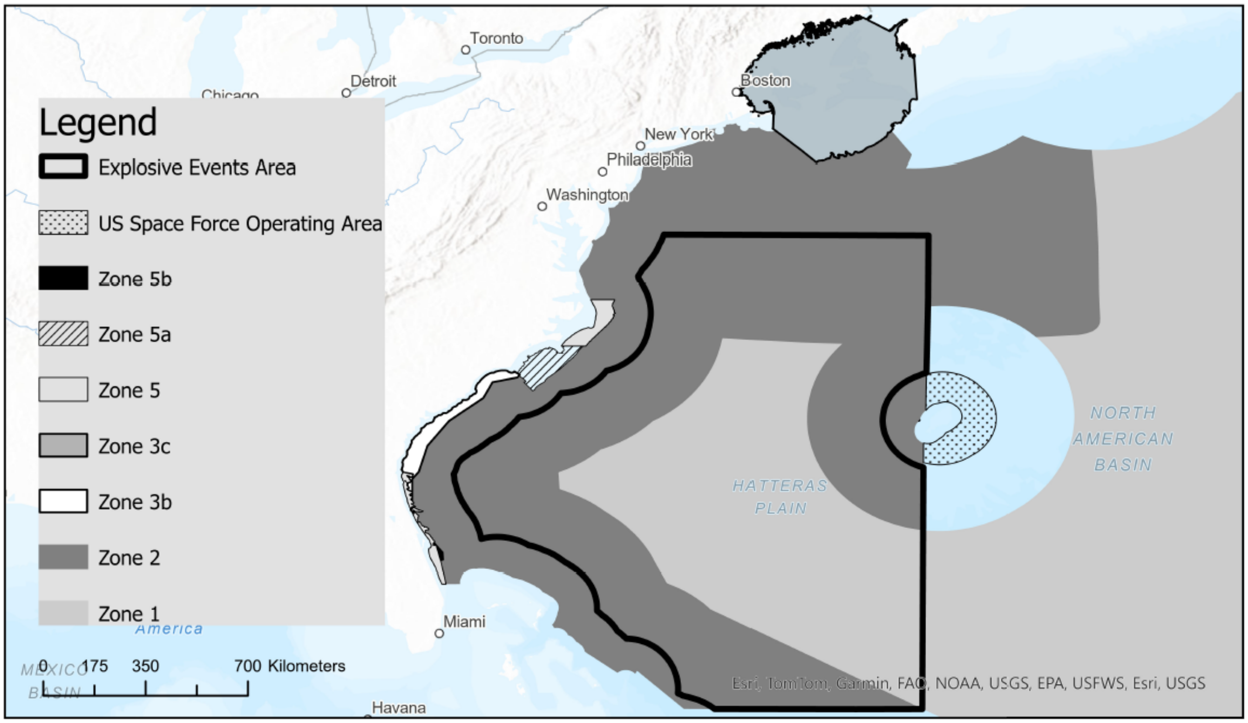

Figure 5. Atlantic portion of the action area (Zone 1 – grey; Zone 2 – dark grey; Zone 3b – white with black outline; Zone 3c – transparent grey with black outline; Zone 5 – light grey; Zone 5a – hatch; Zone 5b – black; U.S. Space Force operating area – dotted; Explosive Events area – bolded black outline; no color – outside the action area)

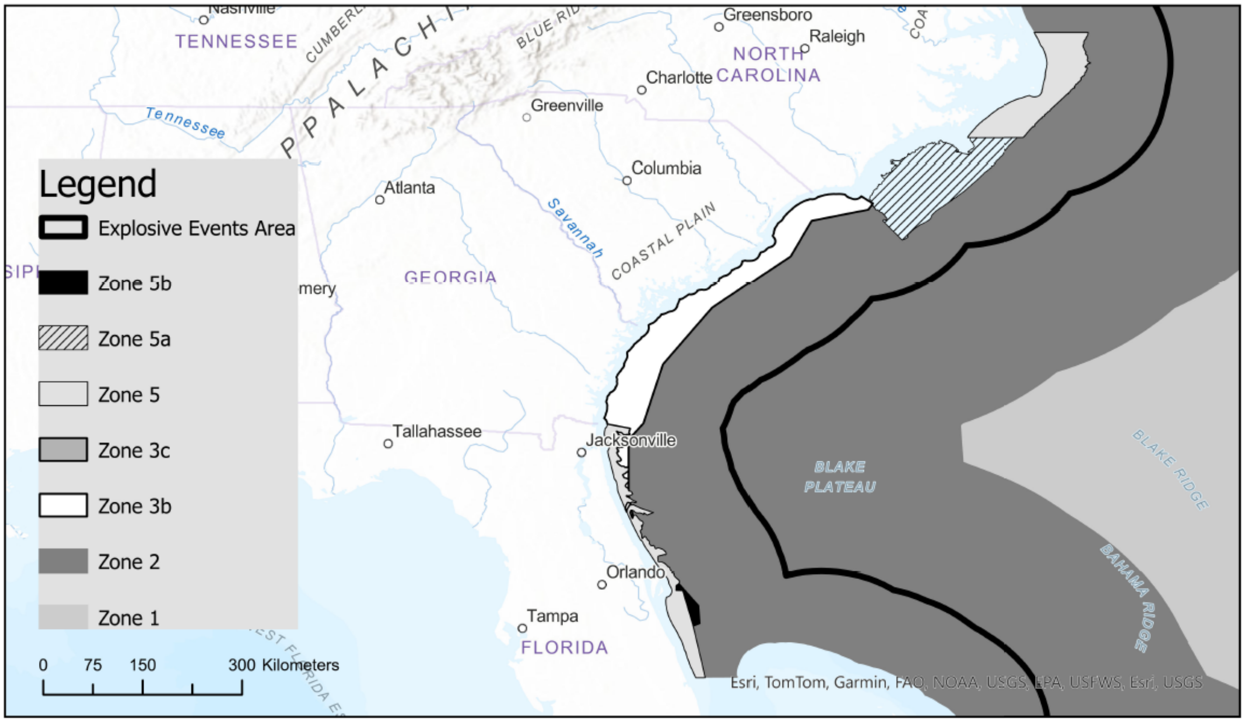

Figure 6. Subset of Atlantic portion of the action area (Zone 1 – grey; Zone 2 – dark grey; Zone 3b – white with black outline; Zone 3c – transparent grey with black outline; Zone 5 – light grey; Zone 5a – hatch; Zone 5b – black; Explosive Events area – bolded black outline; no color – outside the action area)

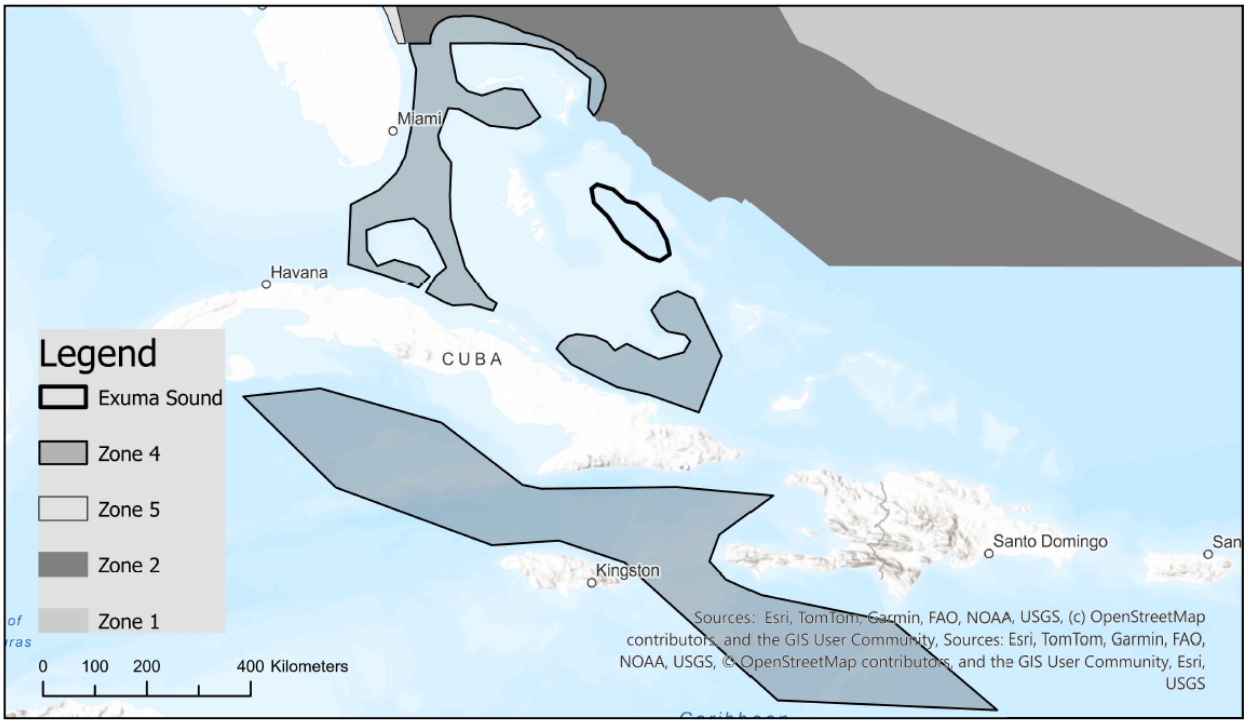

Figure 7. Bahamas/Caribbean portion of the action area (Zone 1 – grey; Zone 2 – dark grey; Zone 4 – transparent grey with black outline; Zone 5 – light grey; Exuma Sound – black outline; no color – outside the action area)

The action area also includes specific portions of the Pacific Ocean and Indian Ocean, not depicted in Figures 1–7, that correspond to the action areas of previous consultations (see Consultation History). These previous consultations are included in this programmatic because they are ongoing FAA-licensed projects. Though the activities described in those previous consultations fall under the activities in this programmatic, some portions of those previous consultations' action areas fall outside the action area depicted in Figures 1–7. Those areas will only be used by the specific project as described in those previous consultations (see Figures 8–10).

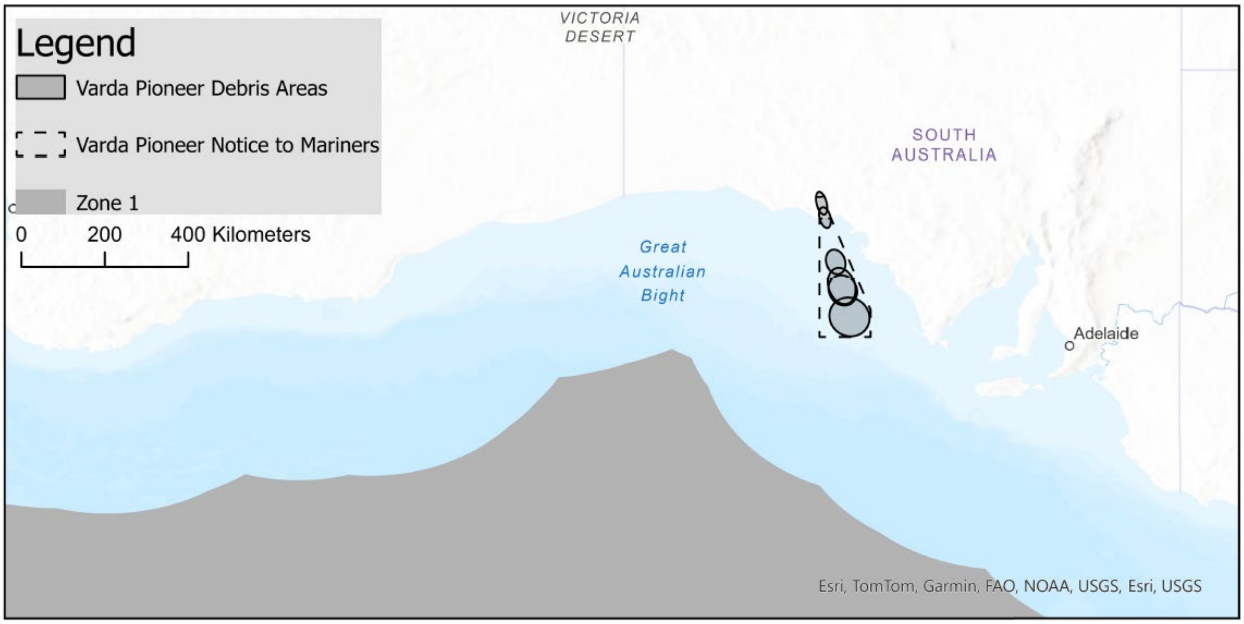

Figure 8. Portion of the action area associated with OPR-2024-01272, Varda Space Industries, Inc. reentry operations licensed by FAA (Zone 1 – grey; Notice to Mariners – dashed line; debris areas – black outline; no color – outside the action area)

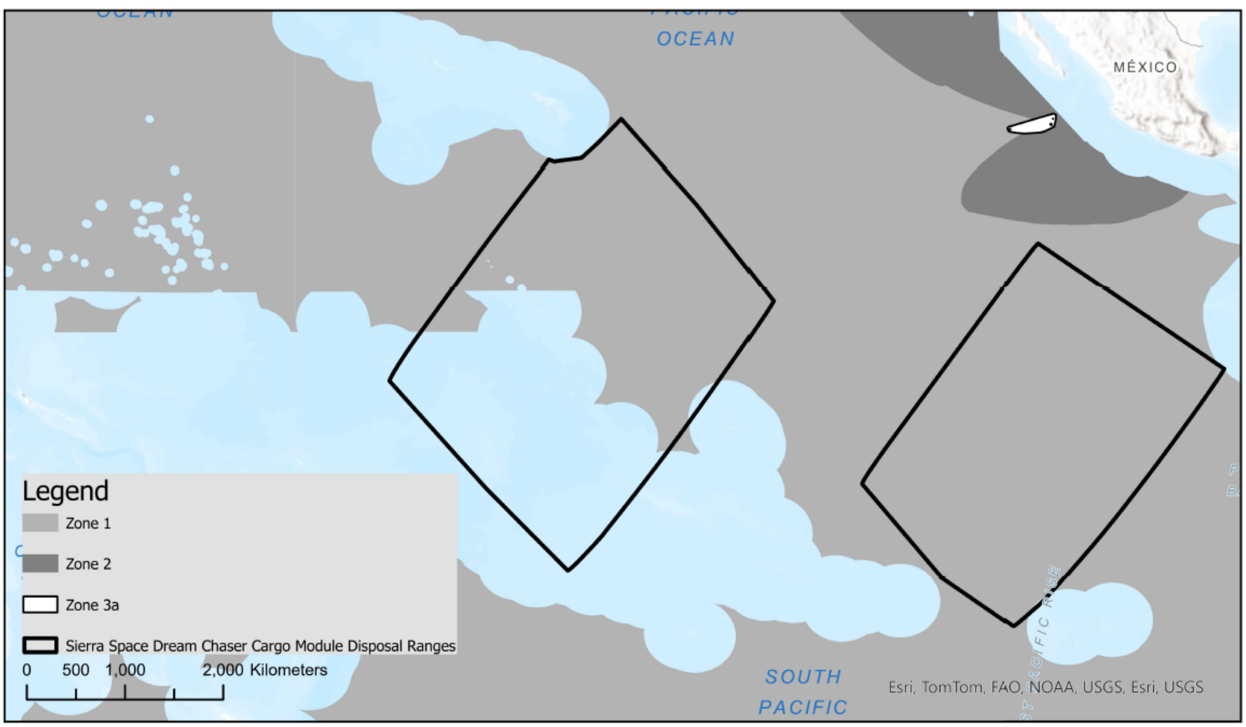

Figure 9. Portion of the action area associated with OPR-2024-02184, proposed FAA license to Sierra Space Corporation (Zone 1 – grey; Zone 2 – dark grey; Zone 3a – white; Sierra Space disposal ranges – black outline; no color – outside the action area)

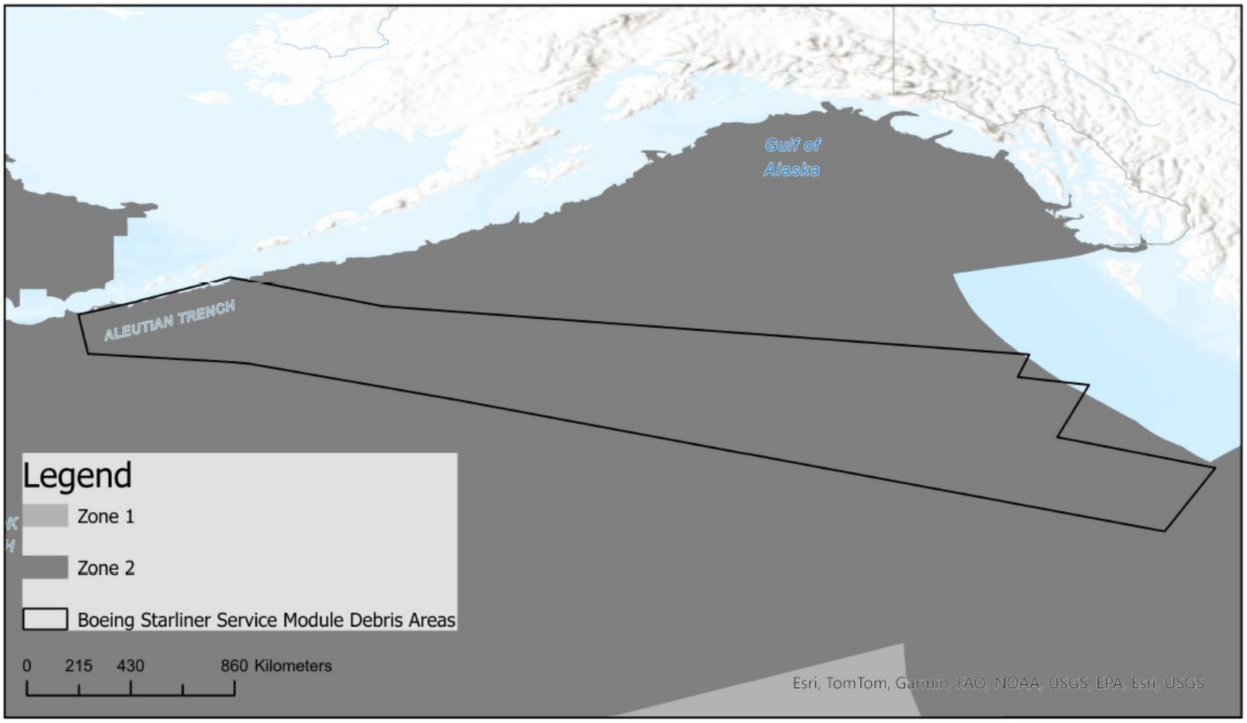

Figure 10. Portion of the action area associated with OPR-2024-01961, proposed FAA license to Boeing Company (Zone 1 – grey; Zone 2 – dark grey; Boeing debris areas – black outline; no color – outside the action area)

Project Design Criteria

Project design criteria (PDCs) are generally best management practices for a particular action. In a programmatic consultation, they are applicable to all projects implemented under the program. PDCs include measures that avoid or reduce the severity of the effects of the program on ESA-listed species and their critical habitat. The PDCs also identify planned monitoring, which is used to observe or check the progress of the actions and minimization measures over time to ensure that any measures implemented to reduce or avoid adverse effects on ESA-listed species and their critical habitats are successful.

As part of this programmatic, launch and reentry operations will be conducted by the USSF, NASA, or FAA-licensed (or permitted) commercial space operators from a launch site identified in Table 1. Operations will occur in compliance with PDCs currently implemented at these existing launch sites. Space launch operations will utilize launch vehicles that fall under the launch vehicle envelopes (Table 2).

General Project Design Criteria

The following are PDCs that will be implemented in all portions of the action area:

1. All space launch and reentry operations will occur within the action area and at least 5 NM (9.3 km) from the coast of the U.S. and U.S. islands and territories (except Hawai'i). The only exception to this is vessel or aircraft transit for surveillance or recovery within 5 NM

(9.3 km) of the coast (note this nearshore vessel and aircraft transit area is not depicted in the action area figures).

2. Stages, components, and debris will not be expended, and disposals will not occur, over coral reef areas.
3. Space launch and reentry operations will not occur in a National Marine Sanctuary or Marine National Monument, or affect National Marine Sanctuary or Marine National Monument resources, without the appropriate authorization, permit, or consultation.
4. In the event of a launch failure, launch operators will follow the emergency response and cleanup procedures outlined in their Hazardous Material Emergency Response Plan (or similar plan).
5. Launch operators will instruct all personnel associated with space launch and reentry operations about ESA-listed marine species and critical habitat, and species protected under the MMPA that may be present in the operating area. Note that the Federal action agency is responsible for ensuring ESA compliance (launch operators are responsible for MMPA compliance). Launch operators will notify personnel associated with space launch and reentry operations of the civil and criminal penalties for unauthorized take of ESA-listed and MMPA-protected species.
6. All vessel operators will be on the lookout for and attempt to avoid collision with ESA-listed and MMPA-protected species.
7. Launch operators will provide a dedicated observer(s), defined as a biologist or person other than the vessel operator who can recognize ESA-listed and MMPA-protected species, for all in-water operations. The observer(s) is responsible for continuous monitoring of ESA-listed and MMPA-protected species with the aid of binoculars during all in-water operations (e.g., surveillance, recovery).
   7.1. The dedicated observer will a) alert the vessel operators to implement the appropriate vessel speed restrictions and vessel avoidance measures, and b) gather relevant data.
   7.2. Dedicated observers will record the date, time, GPS location, species, number of animals, distance and bearing from the vessel, direction of travel, behavior, effects to the animals from space launch and reentry operations, and other relevant information for all sightings of ESA-listed or MMPA-protected species.
   7.3. Dedicated observers will monitor the launch, landing, recovery areas (including areas where things are expended or disposed of, as feasible) for effects to ESA-listed and MMPA-protected species. Any effects, including injury and mortality, will be reported as noted below.
8. When an ESA-listed or MMPA-protected species is observed, vessel operators will do the following:
   8.1. Maintain a minimum distance of 150 ft (45.7 m) from sea turtles.
   8.2. Maintain a minimum distance of 300 ft (91.4 m) from all other ESA-listed and MMPA-protected species.
   8.3. If the distance from the vessel to the ESA-listed or MMPA-protected species becomes less than the distance specified in these PDCs, reduce vessel speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area and transit route.
   8.4. Reduce vessel speed to 10 knots or less when mother/calf pairs or groups (more than two individuals) of marine mammals are observed.

8.5. Attempt to remain parallel to (e.g., when animals are bow-riding), or move the vessel away from, an ESA-listed or MMPA-protected species' course while the vessel is in transit and avoid excessive speed or abrupt changes in direction until the animal(s) have left the area or transit route.

9. Launch operators will immediately report any ESA-listed or MMPA-protected species collision(s), injury(ies), mortality(ies), entanglement(s), or stranding(s) to the appropriate NMFS regional contact listed below (see also https://www.fisheries.noaa.gov/report), and to Tanya Dobrzynski, Chief, ESA Interagency Cooperation Division, by email at Tanya.Dobrzynski@noaa.gov, and to nmfs.hq.esa.consultations@noaa.gov with the subject line "OPR-2025-02196 – Collison, Injury, Mortality, or Stranding Report."
   9.1. For operations off Maine through Virginia: for marine mammals and sea turtles 866-755-6622 (also report North Atlantic right whales to the U.S. Coast Guard via VHF Channel 16 and through the Whale Alert app) and for sturgeon 978-281-9328 or noaa.sturg911@noaa.gov
   9.2. For operations off North Carolina through Texas, and the Caribbean: for marine mammals (877) WHALE-HELP (877-942-5343; also report North Atlantic right whales to the U.S. Coast Guard via VHF Channel 16 and through the Whale Alert app) and for sea turtles (844) SEA-TRTL (844-732-8785) and for sturgeon 844-788-7491 or noaa.sturg911@noaa.gov
   9.3. For operations off California, Oregon, and Washington: for marine mammals and sea turtles (877) SOS-WHALE (877-767-9425) or 866-767-6114
   9.4. For operations off Alaska: for marine mammals and sea turtles 877-925-7773
   9.5. For operations off Hawaii: for marine mammals and sea turtles 888-256-9840
   9.6. Off Florida, report any smalltooth sawfish sightings to (844) 4SAWFISH (844-472-9347) or via email to sawfish@fwc.com
   9.7. Report any giant manta ray sightings to (727) 824-5312 or via email to manta.ray@noaa.gov
10. Aircraft will maintain a baseline minimum height of 1,000 ft (304.8 m) above ESA-listed or MMPA-protected species
11. Aircraft will avoid flying in circles over any marine mammals and sea turtles, if observed, to avoid harassing behaviors.

Area-specific Project Design Criteria

The following PDCs correspond to specific ocean basins and zones depicted in Figures 2–7 (there are no limits to the operations or number of operations in Zone 1; see Figure 1) and will be implemented in those specified areas as part of the proposed action. Dependent on mission needs, the number of annual launch and recovery operations can be variable. Table 3 below outlines the maximum annual operations expected by the action agencies that will occur in Zone 2 of the Atlantic Ocean, Gulf, and Pacific Ocean portions of the action area.

PDCs for the Pacific portion of the action area (Figure 2 and Figure 3; note no activities will occur within the Hawai'i exclusive economic zone [EEZ] or the Papahānaumokuākea National Marine Sanctuary):

- Operations in Zone 2 are limited to the number of maximum annual operations described in Table 3.

- Operations in Zone 3a are limited to vessel transit only from December 1 through April 30 to minimize impacts on ESA-listed humpback whales when listed DPS breeding aggregations are likely to be present.
- Operations in Zone 4 are limited to vessel transit and barge landings only to minimize impacts on ESA-listed species and critical habitat.
- Note that Isla Guadalupe and surrounding waters are outside the action area (i.e., no operations will occur there) to minimize impacts on the ESA-listed Guadalupe fur seal as that location is the only known breeding site for Guadalupe fur seals.
- No operations will occur over areas with sea ice cover off Alaska to minimize impacts on ESA-listed Arctic seals.
- Steller sea lion critical habitat in:
    - Alaska
        - No operations will occur within the aquatic zone that extends 20 NM (37 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery and major haulout that is west of 144° W longitude.
        - No operations will occur within the aquatic zone that extends 3,000 ft (0.9 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery and major haulout in Alaska east of 144° W longitude.
        - No operations will occur within the air zone that extends 3,000 ft (0.9 km) above the terrestrial zone of each major rookery and major haulout in Alaska (measured vertically from sea level).
        - No vessel operations will occur within 3 NM (5.6 km) of all Steller sea lion rookeries west of 150° W longitude.
        - In the unlikely event that debris is expected to occur over or land within the air or aquatic critical habitat zones, debris should be monitored and cleaned up if in the water. If debris lands within 3 NM (5.6 km) of a rookery west of 150° W longitude, or if debris occurs on a major rookery or major haulout (i.e., on land), notify the NMFS Alaska Regional Office and the ESA Interagency Cooperation Division at akr.prd.section7@noaa.gov and nmfs.hq.esa.consultations@noaa.gov with the subject line "OPR-2025-02196 – Debris in Steller sea lion critical habitat."
    - California and Oregon
        - No operations will occur in an aquatic zone that extends 3,000 ft (0.9 km) seaward from major rookeries.
        - No operations will occur in an air zone that extends 3,000 ft (0.9 km) above the terrestrial zone of major rookeries (measured vertically from sea level).

PDCs for the Gulf portion of the action area (Figure 4):

- Operations in Zone 2 are limited to the number of maximum annual operations described in Table 3.

- Operations in Zone 3 are limited to vessel transit only to minimize impacts on ESA-listed species.
- No operations will occur within Rice's whale core distribution area.
- No operations will occur within 20 NM (37 km) of the Flower Garden Banks National Marine Sanctuary and the Florida Keys National Marine Sanctuary or listed coral reef areas.
- Vessels will slow to 10 knots or less and maintain a minimum distance of 1,500 ft (457.2 m) from Rice'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.
- Vessels will maintain speeds to 10 knots or less in Rice's whale proposed critical habitat.

PDCs for the Atlantic portion of the action area (Figure 5 and Figure 6):

- Operations in Zone 2 are limited to the number of maximum annual operations described in Table 3.
- Operations in Zone 3b are limited to vessel transit only, from November 1 through April 30 to minimize impacts on North Atlantic right whales during calving season.
- Operations in Zone 3c are limited to vessel transit only, from January 1 through July 31 to minimize impacts on foraging North Atlantic right whales.
- Operations in Zone 5 (off North Carolina and Florida) will not include any disposals or expended stages, expended components, or debris to minimize impacts to Northwest Atlantic Ocean DPS loggerhead sea turtle constricted migratory critical habitat and proposed North Atlantic DPS green turtle reproductive and migratory critical habitat.
- Operations in Zone 5a will not include any disposals or expended stages, expended components, or debris between November 1 through April 30 to minimize impacts to Northwest Atlantic Ocean DPS loggerhead sea turtles when they occur in high concentrations during winter months in designated critical habitat.
- Operations in Zone 5b will not include any disposals or expended stages, expended components, or debris between April 1 through November 30 to minimize impacts to Northwest Atlantic Ocean DPS loggerhead sea turtles when they occur in high densities during the breeding season in designated critical habitat.
- Vessels will slow to 10 knots or less and maintain a minimum distance of 1,500 ft (457.2 m) from North Atlantic right whales.
- Vessels will comply with the Right Whale Ship Strike Reduction Rule (50 CFR §224.105)[2] and reduce speeds to 10 knots or less in Seasonal Management Areas or in Right Whale Slow Zones, which are dynamic management areas established where North Atlantic 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 vessel 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.
- Aircraft will maintain a baseline minimum height of 1,500 ft (457.2 m) above North Atlantic right whales.

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

- Launch abort tests will not occur in designated critical habitat for the North Atlantic right whale, Seasonal Management Areas, or Right Whale Slow Zones, and will not occur during the North Atlantic right whale winter calving season from November 1 through April 30.

Bahamas/Caribbean portion of the action area (Figure 7):

- Operations in Zone 4 are limited to vessel transit and barge landings only to minimize impacts on ESA-listed corals.
- Operations in the Exuma Sound are limited to vessel transit, barge landings, and fairing recoveries.

Table 3. Maximum annual operations in Zone 2

Type of Operation	**Maximum annual operations in Atlantic Ocean Zone 2**	**Maximum annual operations in Gulf Zone 2**	**Maximum annual operations in Pacific Zone 2**
Launches involving stages and fairings that are expended	350	0	470
Launches involving attempted recovery of stages and fairings	210	0	100
Launches involving attempted recovery of stages and expended fairings	40	0	0
Spacecraft reentry and landing in the ocean (may involve debris expended in the ocean)	10	22	70
Spacecraft reentry to a landmass with debris expended in the ocean	0	0	10
Launch abort test	1	0	0

Note: these numbers do not include operations conducting upper stage atmospheric reentry and disposing or expending the stage, components, or debris in the ocean 200 NM from land (those operations will still be included in annual reports)

Reporting

The FAA, USSF, and NASA, in collaboration with launch operators, plan to prepare and submit reports to NMFS by April 1 each year and new annual reports will be produced each year activities covered under this consultation occur. Annual reports will be submitted electronically to nmfs.hq.esa.consultations@noaa.gov with the subject line "Annual Report OPR-2025-02196 Space Launch and Reentry Program." The reports will document the action agencies' activities from the previous year, particularly activities that occurred in or may have affected the marine environment or ESA-listed species under NMFS's jurisdiction. See Appendix B.

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 or ESA-listed species, such as stage landings at sea, activities that involve entry of materials into the marine environment, and activities that may indirectly affect the marine environment;
4) Dates of reentry and recovery operations if different from launch date;
5) Approximate locations with GPS coordinates (or last known GPS coordinates) of all landing locations, including recovered and unrecovered stages, fairings, skirt rings, parachutes, debris, and any other components that end up in the marine environment.
6) Information regarding vessels used during operations and transit routes, as well as aircraft activity associated with an event;
7) Any available information on the location and fate of unrecovered parachutes, parafoils, expended components, and debris;
8) Information regarding the implementation of the PDCs described above, including any relevant PDCs not implemented or issues with implementing the PDCs;
9) Information regarding any potential effects to ESA-listed species and critical habitat due to the activities; and
10) Sighting logs with observations of ESA-listed species with date, time, location, species, number of animals, distance and bearing from the vessel, direction of travel, behavior, and other relevant information.

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 to ESA-listed species and critical habitat predicted continue to be valid.

Project-Specific Review

Project-specific reviews for launch and reentry proposals that may affect an ESA-listed species or critical habitat will not require additional consultation as long as the activities are within the scope of this programmatic's identified framework, above. Action agencies may use the checklist in Appendix A to help determine whether a project falls within the scope of the programmatic framework. When projects do not fully meet those requirements, a project-specific review is required. The project lead action agency will coordinate with NMFS to determine if the scope of the project is within the scope of this programmatic, or if a separate, individual consultation is required. Examples of when an action agency should coordinate a project-specific review include: operations using a new launch site, use of a launch or reentry vehicle that is not the same as those analyzed here or does not fall under the vehicle envelopes previously described, substantial changes in technology or operations, or when activities cannot fully comply with the applicable PDCs.

If an action agency has any uncertainty that a proposed activity falls within the scope of this programmatic or needs a project-specific review, they should contact the NMFS Office of Protected Resources ESA Interagency Cooperation Division. Project-specific review requests should be sent by email to the consultation biologist and to nmfs.hq.esa.consultations@noaa.gov with the subject line "Project Specific Review Request OPR-2025-02196 Space Launch and Reentry Program" and include the following information: a project description that details the proposed operations, including details on the activities that the action agency identified do not fall under this programmatic or are unsure whether they fall under this programmatic, where and when they will occur, the number or frequency of the proposed operations, any criteria or measures that may not be fully implemented and any proposed changes to these measures or additional measures, and determination of effects to ESA-listed species and critical habitat that could result from the project. Requests for a 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.

Species and Critical Habitat That May be Affected by the Proposed Action

Implementing regulations for the ESA require consultation on any action which may affect ESA listed species or critical habitat (50 CFR §402.14(a)). No consultation is required when an action would cause no effect. The Act envisioned all consultations to be formal, but the implementing regulations established an informal consultation process when effects are unlikely (50 CFR §402.13). Therefore, there are three general determinations when analyzing the effects of an action on listed species and critical habitat: 1) no effect, 2) may affect, likely to adversely affect (LAA; formal consultation), and 3) may affect, not likely to adversely affect (NLAA). Action agencies, prior to requesting ESA consultation, determine whether their proposed action may affect ESA-listed or proposed species or their designated or proposed critical habitat. Generally, a "no effect" determination means there is no plausible exposure or response to stressors generated by the proposed action for any ESA-listed species or critical habitat. Any scenario for which there is a plausible exposure to stressors generated by the action is considered "may affect." For any action that "may affect" an ESA-listed species or its critical habitat, the action agency shall consult with the Services under section 7(a)(2) of the ESA.

This section identifies the ESA-listed or proposed species and designated or proposed critical habitat that occurs in the action area and thus may be affected by the stressors introduced to the action area by the proposed action. Critical habitats that occur in the action area are shown in Figures 11–27, and physical and biological features (PBFs) that may be affected by the program are discussed in the Effects Analysis. Detailed information about the biology, habitat, and conservation status of the species and critical habitat listed in Table 4 can be found in species' status reviews, recovery plans, *Federal Register* notices, and other sources here.

Table 4. Species and critical habitat present in the action area

Species	ESA Status	Critical Habitat	Recovery Plan
Beluga Whale (*Delphinapterus leucas*) – Cook Inlet DPS	E – 73 Fed. Reg. 62919	76 Fed. Reg. 20179	12/2016

Species	ESA Status	Critical Habitat	Recovery Plan
Blue Whale (*Balaenoptera musculus*)	E – 35 Fed. Reg. 18319	-- --	07/1998 11/2020
Bowhead Whale (*Balaena mysticetus*)	E – 35 Fed. Reg. 18319	-- --	-- --
Fin Whale (*Balaenoptera physalus)*	E – 35 Fed. Reg. 18319	-- --	07/2010
Gray Whale (*Eschrichtius robustus*) – Western North Pacific DPS	E – 35 Fed. Reg. 18319	-- --	-- --
Humpback Whale (*Megaptera novaeangliae*) – Cape Verde Islands/Northwest Africa DPS	E – 81 Fed. Reg. 62259	-- --	11/1991
Humpback Whale (*Megaptera novaeangliae*) – Central America DPS	E – 81 Fed. Reg. 62259	86 Fed. Reg. 21082	11/1991 06/2022 (Outline)
Humpback Whale (*Megaptera novaeangliae*) – Mexico DPS	T – 81 Fed. Reg. 62259	86 Fed. Reg. 21082	11/1991 06/2022 (Outline)
Humpback Whale (*Megaptera novaeangliae*) – Western North Pacific DPS	E – 81 Fed. Reg. 62259	86 Fed. Reg. 21082	11/1991 06/2022 (Outline)
Killer Whale (*Orcinus orca*) – Southern Resident DPS	E – 70 Fed. Reg. 69903 and 80 Fed. Reg. 7380	71 Fed. Reg. 69054 86 Fed. Reg. 41668	01/2008
North Atlantic Right Whale (*Eubalaena glacialis*)	E – 73 Fed. Reg. 12024	81 Fed. Reg. 4837	08/2004
North Pacific Right Whale (*Eubalaena japonica*)	E – 73 Fed. Reg. 12024	73 Fed. Reg. 19000	06/2013
Rice's Whale (*Balaenoptera ricei*)	E – 84 Fed. Reg. 15446 and 86 Fed. Reg. 47022	88 Fed. Reg. 47453 (Proposed)	09/2020 (Outline)
Sei Whale (*Balaenoptera borealis*)	E – 35 Fed. Reg. 18319	-- --	12/2011
Southern Right Whale (*Eubalaena australis*)	E – 35 Fed. Reg. 18319	-- --	
Sperm Whale (*Physeter macrocephalus*)	E – 35 Fed. Reg. 18319	-- --	12/2010
Bearded Seal (*Erignathus barbatus nauticus*) – Beringia DPS	T – 77 Fed. Reg. 76739	87 Fed. Reg. 19180	-- --
Guadalupe Fur Seal (*Arctocephalus townsendi*)	T – 50 Fed. Reg. 51252	-- --	-- --
Ringed Seal (*Phoca hispida hispida*) –Arctic subspecies	T – 77 Fed. Reg. 76706	87 Fed. Reg. 19232	-- --

Species	ESA Status	Critical Habitat	Recovery Plan
Steller Sea Lion (*Eumetopias jubatus*) – Western DPS	E – 55 Fed. Reg. 49204	58 Fed. Reg. 45269	03/2008
Green Sea Turtle (*Chelonia mydas*) – Central North Pacific DPS	T – 81 Fed. Reg. 20057	88 Fed. Reg. 46572 (Proposed)*	01/1998
Green Sea Turtle (*Chelonia mydas*) – Central South Pacific DPS	E – 81 Fed. Reg. 20057	88 Fed. Reg. 46572 (Proposed)*	01/1998
Green Sea Turtle (*Chelonia mydas*) – Central West Pacific DPS	E – 81 Fed. Reg. 20057	88 Fed. Reg. 46572 (Proposed)*	01/1998
Green Sea Turtle (*Chelonia mydas*) – East Indian-West Pacific DPS	T – 81 Fed. Reg. 20057	-- --	-- --
Green Sea Turtle (*Chelonia mydas*) – East Pacific DPS	T – 81 Fed. Reg. 20057	88 Fed. Reg. 46572 (Proposed)	01/1998
Green Sea Turtle (*Chelonia mydas*) – North Atlantic DPS	T – 81 Fed. Reg. 20057	63 Fed. Reg. 46693 88 Fed. Reg. 46572 (Proposed)	10/1991 – U.S. Atlantic
Green Sea Turtle (*Chelonia mydas*) – North Indian DPS	T – 81 Fed. Reg. 20057	-- --	-- --
Green Sea Turtle (*Chelonia mydas*) – South Atlantic DPS	T – 81 Fed. Reg. 20057	88 Fed. Reg. 46572 (Proposed)	-- --
Green Sea Turtle (*Chelonia mydas*) – Southwest Indian DPS	T – 81 Fed. Reg. 20057	-- --	-- --
Green Sea Turtle (*Chelonia mydas*) – Southwest Pacific DPS	T – 81 Fed. Reg. 20057	-- --	-- --
Hawksbill Sea Turtle (*Eretmochelys imbricata)*	E – 35 Fed. Reg. 8491	63 Fed. Reg. 46693	08/1992 – U.S. Caribbean, Atlantic, and Gulf of Mexico 05/1998 – U.S. Pacific
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)	E – 35 Fed. Reg. 18319	-- --	03/2010 – U.S. Caribbean, Atlantic, and Gulf of Mexico 09/2011
Leatherback Sea Turtle (*Dermochelys coriacea*)	E – 35 Fed. Reg. 8491	44 Fed. Reg. 17710 77 Fed. Reg. 4170	10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico

Species	ESA Status	Critical Habitat	Recovery Plan
			05/1998 – U.S. Pacific
Loggerhead Sea Turtle (*Caretta caretta*) – North Indian Ocean DPS	E – 76 Fed. Reg. 58868	-- --	-- --
Loggerhead Sea Turtle (*Caretta caretta*) – North Pacific Ocean DPS	E – 76 Fed. Reg. 58868	-- --	01/1998 – U.S. Pacific
Loggerhead Sea Turtle (*Caretta caretta*) – Northeast Atlantic Ocean DPS	E – 76 Fed. Reg. 58868	-- --	-- --
Loggerhead Sea Turtle (*Caretta caretta*) – Northwest Atlantic Ocean DPS	T – 76 Fed. Reg. 58868	79 Fed. Reg. 39855	12/2008
Loggerhead Sea Turtle (*Caretta caretta*) – South Atlantic Ocean DPS	T – 76 Fed. Reg. 58868	-- --	-- --
Loggerhead Sea Turtle (*Caretta caretta*) – South Pacific Ocean DPS	E – 76 Fed. Reg. 58868	-- --	-- --
Loggerhead Sea Turtle (*Caretta caretta*) – Southeast Indo-Pacific Ocean DPS	T – 76 Fed. Reg. 58868	-- --	-- --
Loggerhead Sea Turtle (*Caretta caretta*) – Southwest Indian Ocean DPS	T – 76 Fed. Reg. 58868	-- --	-- --
Olive Ridley Sea Turtle (*Lepidochelys olivacea*) – All Other Areas	T – 43 Fed. Reg. 32800	-- --	-- --
Olive Ridley Sea Turtle (*Lepidochelys olivacea*) – Mexico's Pacific Coast Breeding Colonies	E – 43 Fed. Reg. 32800	-- --	63 Fed. Reg. 28359
Atlantic Salmon (*Salmo salar*) – Gulf of Maine DPS	E – 65 Fed. Reg. 69459 and 74 Fed. Reg. 29344	74 Fed. Reg. 39903	02/2019
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) – Carolina DPS	E – 77 Fed. Reg. 5913	82 Fed. Reg. 39160	02/2012 (Outline)
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) – Chesapeake Bay DPS	E – 77 Fed. Reg. 5880	82 Fed. Reg. 39160	02/2012 (Outline)
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) – Gulf of Maine DPS	T – 77 Fed. Reg. 5879	82 Fed. Reg. 39160	02/2012 (Outline)

Species	ESA Status	Critical Habitat	Recovery Plan
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) – New York Bight DPS	E – 77 Fed. Reg. 5879	82 Fed. Reg. 39160	02/2012 (Outline)
Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) – South Atlantic DPS	E – 77 Fed. Reg. 5913	82 Fed. Reg. 39160	02/2012 (Outline)
Bocaccio (*Sebastes paucispinis*) – Puget Sound/Georgia Basin DPS	E – 75 Fed. Reg. 22276 and 82 Fed. Reg. 7711	79 Fed. Reg. 68042	10/2017
Chinook Salmon (*Oncorhynchus tshawytscha)* – California Coastal ESU	T – 70 Fed. Reg. 37160	70 Fed. Reg. 52488	10/2016
Chinook Salmon (*Oncorhynchus tshawytscha)* – Central Valley Spring-Run ESU	T – 70 Fed. Reg. 37160	70 Fed. Reg. 52488	07/2014
Chinook Salmon (*Oncorhynchus tshawytscha)* – Lower Columbia River ESU	T – 70 Fed. Reg. 37160	70 Fed. Reg. 52629	06/2013
Chinook Salmon (*Oncorhynchus tshawytscha)* – Puget Sound ESU	T – 70 Fed. Reg. 37160	70 Fed. Reg. 52629	01/2007
Chinook Salmon (*Oncorhynchus tshawytscha)* – Sacramento River Winter-Run ESU	E – 70 Fed. Reg. 37160	58 Fed. Reg. 33212	07/2014
Chinook Salmon (*Oncorhynchus tshawytscha)* – Snake River Fall-Run ESU	T – 70 Fed. Reg. 37160	58 Fed. Reg. 68543	11/2017
Chinook Salmon (*Oncorhynchus tshawytscha)* – Snake River Spring/Summer-Run ESU	T – 70 Fed. Reg. 37160	64 Fed. Reg. 57399	11/2017
Chinook Salmon (*Oncorhynchus tshawytscha)* – Upper Columbia River Spring-Run ESU	E – 70 Fed. Reg. 37160	70 Fed. Reg. 52629	08/2007
Chinook Salmon (*Oncorhynchus tshawytscha)* – Upper Willamette River ESU	T – 70 Fed. Reg. 37160	70 Fed. Reg. 52629	08/2011
Chum Salmon (*Oncorhynchus keta*) – Columbia River ESU	T – 70 Fed. Reg. 37160	70 Fed. Reg. 52629	06/2013
Chum Salmon (*Oncorhynchus keta*) – Hood Canal Summer-Run ESU	T – 70 Fed. Reg. 37160	70 Fed. Reg. 52629	11/2005

Species	ESA Status	Critical Habitat	Recovery Plan
Coho Salmon (*Oncorhynchus kisutch*) – Central California Coast ESU	E – 70 Fed. Reg. 37160	64 Fed. Reg. 24049	09/2012
Coho Salmon (*Oncorhynchus kisutch*) – Lower Columbia River ESU	T – 70 Fed. Reg. 37160	81 Fed. Reg. 9251	06/2013
Coho Salmon (*Oncorhynchus kisutch*) – Oregon Coast ESU	T – 73 Fed. Reg. 7816	73 Fed. Reg. 7816	12/2016
Coho Salmon (*Oncorhynchus kisutch*) – Southern Oregon and Northern California Coasts ESU	T – 70 Fed. Reg. 37160	64 Fed. Reg. 24049	09/2014
Eulachon (*Thaleichthys pacificus*) –Southern DPS	T – 75 Fed. Reg. 13012	76 Fed. Reg. 65323	09/2017
Giant Manta Ray (*Manta birostris*)	T – 83 Fed. Reg. 2916	-- --	12/2019 (Outline)
Green Sturgeon (*Acipenser medirostris*) – Southern DPS	T – 71 Fed. Reg. 17757	74 Fed. Reg. 52300	08/2018
Gulf Grouper (*Mycteroperca jordani*)	E – 81 Fed. Reg. 72545	-- --	-- --
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	T – 56 Fed. Reg. 49653	68 Fed. Reg. 13370	09/1995
Nassau Grouper (*Epinephelus striatus*)	T – 81 Fed. Reg. 42268	89 Fed. Reg. 126	08/2018 (Outline)
Oceanic Whitetip Shark (*Carcharhinus longimanus*)	T – 83 Fed. Reg. 4153	-- --	07/2024
Scalloped Hammerhead Shark (*Sphyrna lewini*) – Central and Southwest Atlantic DPS	T – 79 Fed. Reg. 38213	-- --	-- --
Scalloped Hammerhead Shark (*Sphyrna lewini*) – Eastern Atlantic DPS	E – 79 Fed. Reg. 38213	-- --	-- --
Scalloped Hammerhead Shark (*Sphyrna lewini*) – Eastern Pacific DPS	E – 79 Fed. Reg. 38213	-- --	-- --
Shortnose Sturgeon (*Acipenser brevirostrum*)	E – 32 Fed. Reg. 4001	-- --	12/1998
Smalltooth Sawfish (*Pristis pectinata*) – U.S. portion of range DPS	E – 68 Fed. Reg. 15674	74 Fed. Reg. 45353	01/2009
Smalltooth Sawfish (*Pristis pectinata*) – Non-U.S. portion of range DPS	E - 79 Fed. Reg. 73977	-- --	-- --

Species	ESA Status	Critical Habitat	Recovery Plan
Sockeye Salmon (*Oncorhynchus nerka*) – Ozette Lake ESU	T – 70 Fed. Reg. 37160	70 Fed. Reg. 52630	05/2009
Sockeye Salmon (*Oncorhynchus nerka*) – Snake River ESU	E – 70 Fed. Reg. 37160	58 Fed. Reg. 68543	06/2015
Steelhead Trout (*Oncorhynchus mykiss*) – California Central Valley DPS	T – 71 Fed. Reg. 834	70 Fed. Reg. 52487	07/2014
Steelhead Trout (*Oncorhynchus mykiss*) – Central California Coast DPS	T – 71 Fed. Reg. 834	70 Fed. Reg. 52487	10/2016
Steelhead Trout (*Oncorhynchus mykiss*) – Lower Columbia River DPS	T – 71 Fed. Reg. 834	70 Fed. Reg. 52629	06/2013
Steelhead Trout (*Oncorhynchus mykiss*) – Middle Columbia River DPS	T – 71 Fed. Reg. 834	70 Fed. Reg. 52629	11/2009
Steelhead Trout (*Oncorhynchus mykiss*) – Northern California DPS	T – 71 Fed. Reg. 834	70 Fed. Reg. 52487	10/2016
Steelhead Trout (*Oncorhynchus mykiss*) – Puget Sound DPS	T – 72 Fed. Reg. 26722	81 Fed. Reg. 9251	12/2019
Steelhead Trout (*Oncorhynchus mykiss*) – Snake River Basin DPS	T – 71 Fed. Reg. 834	70 Fed. Reg. 52629	11/2017
Steelhead Trout (*Oncorhynchus mykiss*) – South-Central California Coast DPS	T – 71 Fed. Reg. 834	70 Fed. Reg. 52487	12/2013
Steelhead Trout (*Oncorhynchus mykiss*) – Southern California DPS	E – 71 Fed. Reg. 834	70 Fed. Reg. 52487	01/2012
Steelhead Trout (*Oncorhynchus mykiss*) – Upper Columbia River DPS	T – 71 Fed. Reg. 834	70 Fed. Reg. 52629	08/2007
Steelhead Trout (*Oncorhynchus mykiss*) – Upper Willamette River DPS	T – 71 Fed. Reg. 834	70 Fed. Reg. 52629	08/2011
Yelloweye Rockfish (*Sebastes rubberimus*) – Puget Sound/Georgia Basin DPS	T – 75 Fed. Reg. 22276 and 82 Fed. Reg. 7711	79 Fed. Reg. 68041	10/2017
Black Abalone (*Haliotis cracherodii*)	E – 74 Fed. Reg. 1937	76 Fed. Reg. 66805	11/2020
Boulder Star Coral (*Orbicella franksi*)	T – 79 Fed. Reg. 53851	88 Fed. Reg. 54026	03/2015 (Outline)

Species	ESA Status	Critical Habitat	Recovery Plan
Chambered Nautilus (*Nautilus pompilius*)	T – 83 Fed. Reg. 48976	-- --	-- --
Elkhorn Coral (*Acropora palmata*)	T – 79 Fed. Reg. 53851	73 Fed. Reg. 72210	03/2015
Lobed Star Coral (*Orbicella annularis*)	T – 79 Fed. Reg. 53851	88 Fed. Reg. 54026	03/2015 (Outline)
Mountainous Star Coral (*Orbicella faveolata*)	T – 79 Fed. Reg. 53851	88 Fed. Reg. 54026	03/2015 (Outline)
Pillar Coral (*Dendrogyra cylindrus*)	E – 89 Fed. Reg. 101993	88 Fed. Reg. 54026	03/2015 (Outline)
Queen conch (*Aliger gigas*)	T – 89 Fed. Reg. 11208	-- --	-- --
Rough Cactus Coral (*Mycetophyllia ferox*)	T – 79 Fed. Reg. 53851	88 Fed. Reg. 54026	03/2015 (Outline)
Staghorn Coral (*Acropora cervicornis*)	T – 79 Fed. Reg. 53851	73 Fed. Reg. 72210	03/2015
Sunflower Sea Star (*Pycnopodia helanthoides*)	T – 88 Fed. Reg. 16212 (Proposed)	-- --	-- --
White Abalone (*Haliotis sorenseni*)	E – 66 Fed. Reg. 29046	-- --	10/2008

DPS=distinct population segment; ESU=evolutionarily significant unit; E=endangered; T=threatened; Fed. Reg.=*Federal Register*
* = not in action area

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 off Okinawa and the Philippines, and they migrate to northern feeding grounds primarily off the Russian coast. Those areas are outside of the action area of this programmatic; however, the Western North Pacific DPS of humpback whales also feeds near the Aleutian Islands and the Gulf of Alaska, which is within the action area (81 Fed. Reg. 62259). The Mexico DPS of humpback whales breeds along the Pacific coast of mainland Mexico, but also near the Revillagigedo Archipelago, which overlaps the action area, and feeds in the action area across a broad geographic range from California to the Aleutian Islands (81 Fed. Reg. 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 Fed. Reg. 62259). The Cape Verde Islands/Northwest Africa DPS consists of humpback whales primarily known to breed and calve around the Cape Verde Islands, with feeding grounds near Iceland and Norway (81 Fed. Reg. 62259).

Bowhead whales reside almost exclusively in Arctic and subarctic waters experiencing seasonal sea ice coverage, primarily between 60° and 75° north latitude. They spend the winter associated with the southern limit of the pack ice and move north as the sea ice breaks up and recedes during spring. The Western Arctic stock is found in waters around Alaska; Bering, Chukchi, and Beaufort seas (Rugh and Shelden 2009).

The Western North Pacific gray whales tend to feed near the bottom in productive waters closer to shore. Some Western North Pacific 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).

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 (73 Fed. Reg. 12024). In the summer, they feed on large concentrations of zooplankton in sub-polar waters around Alaska.

Southern right whales are found in the Southern Hemisphere worldwide from temperate to polar waters, favoring shallow waters less than 65.6 ft (20 m) deep. Southern right whales migrate between winter breeding areas in coastal waters of the South Atlantic, Pacific, and Indian Oceans from May to December and offshore summer (January to April) foraging locations in the Subtropical and Antarctic Convergence zones (NMFS 2015).

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, to feeding in summer off the northeastern U.S. and up to Canadian waters (Waring and et al. 2016).

Rice's whales (formerly the Gulf of Mexico Bryde's whale) live year-round in the Gulf of America (formerly Gulf of Mexico) and are the only resident baleen whale in the Gulf. Most sightings of Rice's whales have been in waters 328.1–1,312.3 ft (100–400 m) deep along the continental shelf break, more often in a biologically important area of the northeastern Gulf near De Soto Canyon (Rosel et al. 2021). Sightings have also been documented, albeit less frequently, in the western Gulf, offshore of Louisiana and Texas.

The sperm whale is widely distributed globally, found in all major oceans. Sperm whales mostly inhabit areas with a water depth of 1,968 ft (600 m) or more and are uncommon in waters less than 984 ft (300 m) 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.

The Southern Resident DPS killer whale is found along the Pacific Coast of the U.S. and Canada. Southern Resident killer whales occur in the inland waterways 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.

Cook Inlet DPS beluga whales reside in Cook Inlet year-round, which makes them geographically and genetically isolated from other beluga whale stocks (Allen et al. 2011). Within Cook Inlet, they generally occur in shallow, coastal waters, often in water barely deep enough to cover their bodies (Harrison and Ridgway 1981).

Bearded seals are boreoarctic with a circumpolar distribution and are closely associated with sea ice. Bearded seals inhabit circumpolar Arctic and sub-Arctic waters that are relatively shallow (typically less than about 650 ft or 198 m deep) and seasonally ice-covered. Beringia DPS bearded seals are found in the continental shelf waters throughout the Eastern Siberian, Chukchi, Beaufort, and Bering Seas. Bearded seals generally move north in late spring and summer as the ice melts and retreats, and then south in the fall as sea ice freezes and expands; however, some remain near the coasts during the summer and early fall.

Ringed seals have a circumpolar distribution. The Arctic subspecies of ringed seals are widely distributed throughout the Arctic Ocean, in waters of Russia, Canada, Greenland, Finland, and the U.S. In U.S. waters, Arctic ringed seals are found around Alaska in the Bering, Chukchi, and Beaufort Seas. Most seals move seasonally, following the extent of the sea ice.

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 (the latter of which 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.

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 have been observed at California’s Channel Islands.

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 on coastal foraging grounds, which include open coastlines and protected bays and lagoons. Figure 11 shows the ranges and boundaries of all green turtle DPSs (Seminoff et al. 2015).

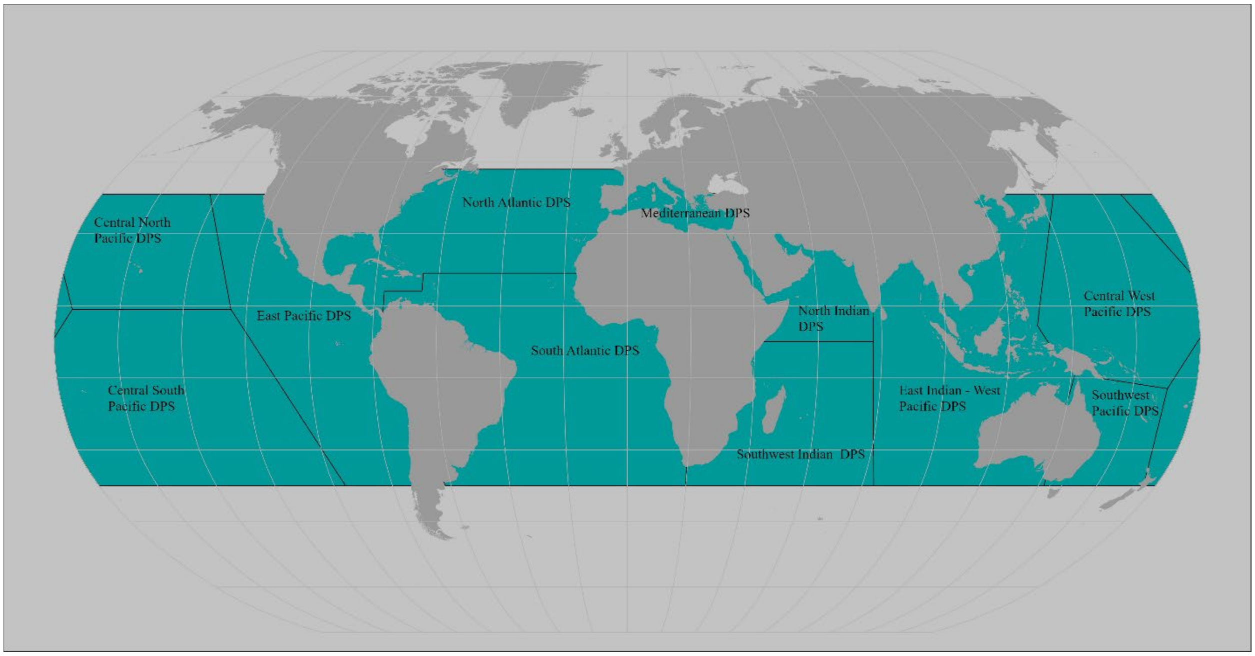

Figure 11. Map of the 11 Distinct Population Segments of green turtles

The North Atlantic DPS of green turtle nests primarily outside the action area in Costa Rica and Mexico, but also in Cuba and Florida. Nesting for the green turtle South Atlantic DPS occurs on both sides of the North and South Atlantic Oceans, Ascension Island, and the U.S. Virgin Islands. On the western side of the Atlantic, juveniles and adults can be found on feeding grounds in the Caribbean, which overlaps the action area, and the nearshore waters of Brazil, Uruguay and Argentina, which are not in the action area. 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. Central West Pacific DPS green turtle nesting occur in the Federated States of Micronesia and the Marshall Islands. East Pacific DPS nesting occurs outside the action area at major sites in Michoacán, Mexico, and the Galapagos Islands, Ecuador. Smaller nesting sites are found in the Revillagigedo Archipelago, Mexico, and along the Pacific Coast of Costa Rica, Columbia, Ecuador, Guatemala, and Peru. 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 Southwest Pacific DPS major nesting sites include the Great Barrier Reef, eastern Torres Strait, and the northern Great Barrier Reef. East Indian-West Pacific DPS nesting sites are in Northern Australia, Indonesia, Malaysia, Peninsular Malaysia and the Philippine Turtle Islands. North Indian DPS major nesting sites are found on the Arabian Peninsula to the Pakistani-Indian border. Major nesting beaches for the Southwest Indian DPS are found in the French Eparses Islands, Mayotte and the outer Seychelles Islands.

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 America 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 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, with only occasional occurrence in the Atlantic Ocean (NMFS et al. 2010).

Globally, olive ridley 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 Mexico's Pacific coast breeding population extends as far south as Peru and up to California. Olive ridley turtles of the Mexico's 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 sea 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 sea turtles undertake long migrations using ocean currents. Adults and subadults occupy nearshore habitat important for foraging and inter-nesting migration. The Northwest Atlantic Ocean DPS of loggerhead sea 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 (71–88%) of individuals found in foraging grounds throughout the western and eastern Atlantic (Masuda 2010). Northeast Atlantic Ocean DPS loggerheads are found from western Europe to western Africa. Nesting for the Northeast Atlantic Ocean DPS occurs on the islands of the Cape Verde Archipelago, off the coast of western Africa. South Atlantic Ocean DPS loggerheads are found between the eastern coast of South America and the west coast of Africa. Nesting for the South Atlantic Ocean DPS occurs in Brazil, from the state of Rio de Janeiro to Sergipe, with the majority occurring in Bahia. North Pacific Ocean DPS loggerhead sea 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 range of South Pacific Ocean DPS loggerheads extends from eastern Australia to western South America, south of the equator. Nesting for the South Pacific DPS occurs mostly in eastern Australia (e.g., Queensland) and New Caledonia, outside the action area. North Indian Ocean DPS loggerheads are found in the northern Indian Ocean, along the east coast of Africa, the coasts of Yemen, Oman, Iran, Pakistan, India and Southeast Asia. Major nest sites for the North Indian Ocean DPS occurs along the coast of Oman and nearby islands. Masirah Island in Oman is one of the largest loggerhead nesting sites in the world (Baldwin et al. 2003). Southeast Indo-Pacific DPS loggerheads are found in the Indian Ocean, in the waters around western Australia, Indonesia, and Papua New Guinea. Nesting for loggerheads of the Southeast Indo-Pacific Ocean DPS is restricted to western Australia, with three main nesting beaches: Dirk Hartog Island, Murion Island, and North West Cape (Baldwin et al. 2003). Southwest Indian Ocean DPS loggerheads are found off the coasts of Africa and Madagascar. Nesting is confined to South Africa and Mozambique.

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 Invertebrates in the Action Area

The range of black abalone encompasses coastal waters from Point Arena in Mendocino County, California to Northern Baja California, Bahia Tortugas, and Isla Guadalupe, Mexico. Black abalone are uncommon north of San Francisco (Morris et al. 1980) and south of Punta Eugenia (P.Raimondi, pers. comm. as cited in Butler et al. 2009). Black abalone live on rocky substrates in coastal and offshore island intertidal reefs up to approximately 18 ft (5.5 m) deep (Leighton 2005 as cited in Butler et al. 2009).

White abalone occur between Point Conception in Santa Barbara County, California, to Punta Abreojos, Baja California, Mexico. White abalone occur along the U.S. west coast among offshore islands and banks (particularly Santa Catalina and San Clemente islands) and mainland inshore waters from Point Conception, California south to Punta Abreojos, Baja California, Mexico (Cox 1960; Cox 1962; Bartsch 1940). Individuals have also been found around several Mexican islands including Isla Cedros and Isla Natividad (Guzmán Del Proó 1992). White abalone occupy open low relief rock or boulder habitat surrounded by sand (Tutschulte 1976) at 98.4–213.3 ft (30–65 m) depth (Haaker et al. 1986).

The chambered nautilus is found in coastal reef habitats in the tropical Indo-Pacific including: American Samoa, Australia, Fiji, India, Indonesia, Malaysia, Papua New Guinea, Philippines, Solomon Islands, and Vanuatu. The chambered nautilus is also possibly native to China, Myanmar, Western Samoa, Thailand, and Vietnam. The species is considered a habitat specialist with a patchy distribution, found in association with steep-sloped forereefs and cannot tolerate temperatures above approximately 25°C or depths exceeding around 2,460.6–2,624.7 ft (750–800 m; Miller 2018).

Queen conch can be found in Flower Garden Banks, Florida Keys, Bermuda, and throughout the Caribbean (Horn et al. 2022). Queen conch inhabit a range of habitat types during their life cycle including seagrass beds, sand flats, algal beds, and rubble areas from a couple inches (few centimeters) deep to approximately 98.4 ft (30 m) deep (NMFS 2014).

There are seven species of corals (elkhorn, staghorn, lobed star, boulder star, mountainous star, pillar, and rough cactus) that occur on shallow reefs from south Florida, in the Gulf of America, and throughout the Caribbean. These corals are often found in coastal reefs, but some may be found farther offshore in bank reefs, if it is shallow enough to provide the necessary photic zone habitat.

The range of the proposed sunflower sea star encompasses coastal waters in the northeast Pacific Ocean from the Aleutian Islands to Baja California, Mexico. The sunflower sea star is considered a habitat generalist and most commonly occurs in coastal waters less than 82 ft (25 m), though they can be found to a depth of 1,427 ft (435 m) throughout the known range. They are rare in waters deeper than 394 ft (120 m; Fisher 1928; Gravem et al. 2021; Hemery et al. 2016; Lambert 2000) but have been observed in depths exceeding 1,427.2 ft (435 m) off Oregon and central California (e.g., Keller et al. 2008).

ESA-Listed Fishes in the Action Area

The Atlantic salmon is an anadromous fish, and the Gulf of Maine DPS is found in watersheds throughout Maine. Gulf of Maine DPS Atlantic salmon migrate nearly 2,500 mi (approximately 4,000 km) in the open ocean to reach feeding areas in the Davis Strait between Labrador and Greenland.

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 DPSs 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 subadults (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).

Rockfish occupy the eastern Pacific Ocean in waters from California to Alaska. The bocaccio and the yelloweye rockfish are two different long-lived species of rockfish. The listed bocaccio and yelloweye that reside in the Puget Sound/Georgia Basin are their own distinct DPSs.

The Pacific salmon (chinook, coho, chum, and sockeye) and steelhead trout are anadromous fishes and the various ESA-listed DPSs and ESUs (see Table 4) 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 also an anadromous fish, though smaller than salmonids, that can be found in the continental shelf waters of the eastern Pacific Ocean. Adult and juvenile Southern DPS eulachon typically occupy waters 164–656.2 ft (50–200 m) deep (Gustafson 2016), and up to depths of about 984.3 ft (300 m), from California to the Bering Sea. Southern DPS eulachon 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 and may aggregate in shallow waters (less than 32.8 ft [10 m]) to feed. Giant manta rays can dive to depths between 656.2–1,476.4 ft (200–450 m) deep, sometimes exceeding 3,280.8 ft (1,000 m) deep.

The green sturgeon is an anadromous fish that occurs in the nearshore coastal waters to a depth of 360.9 ft (110 m) from Baja California, Mexico to the Bering Sea, Alaska (Erickson and Hightower 2007). Adult Southern DPS green sturgeon enter San Francisco Bay and migrate up the Sacramento River to spawn (Heublein et al. 2009).

The Gulf sturgeon ranges 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 will enter the marine environment to forage on benthic (bottom dwelling) invertebrates along the shallow nearshore (6.6–13.1 ft or 2–4 m depth), barrier island passes, and in unknown offshore locations in the Gulf (Carr et al. 1996; Fox et al. 2002; Huff 1975; Ross et al. 2009).

The gulf grouper occurs throughout the subtropical Pacific Ocean from approximately La Jolla, California, to Mazatlán, Sinaloa, Mexico. They are commonly found in the Gulf of California which is not a part of the action area. Young gulf grouper inhabit shallow coastal habitat whereas adults mainly inhabit rocky reefs, seamounts, and kelp beds 16–600 ft (4.9–182.9 m) deep.

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 328.1 ft (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° North to 10°

South, but may be found up to 30° North to 35° South (Young 2016). They occur from the surface to at least 498.7 ft (152 m) deep and display a preference for water temperatures above 20°C.

The scalloped hammerhead shark is found throughout the world and the listed Central and Southwest Atlantic DPS, Eastern Atlantic DPS, and Eastern Pacific DPS 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 et al. 2003). It ranges from the intertidal and surface to depths of up to 1,476.4–1,679.8 ft (450–512 m), 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 down to Uruguay, including the Caribbean Sea, but not the Gulf of America. The Eastern Pacific DPS of scalloped hammerhead shark's range extends from the coast of southern California, and south to Ecuador and part of Peru. The Eastern Atlantic DPS ranges along the west coast of Africa, from Morocco to Namibia.

Shortnose sturgeon occur in estuaries, rivers, and the sea along the east coast of North America (Vladykov and Greeley 1963). Their northerly distribution extends from the Saint John River, New Brunswick, Canada, 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 (Altenritter et al. 2015; Dionne et al. 2013; Quattro et al. 2002; Wirgin et al. 2005).

Historically within the U.S., 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 (Poulakis and Seitz 2004; Seitz and Poulakis 2002). Outside the U.S., smalltooth sawfish have been confirmed in the Bahamas, and sightings off the coasts of Honduras, Belize, Cuba, Guinea Bissau, and Sierra Leone. Juvenile sawfish spend the first two to three years of their lives in shallow waters provided in the lower reaches of rivers, estuaries, and coastal bays (Simpfendorfer et al. 2008; Simpfendorfer et al. 2011). As smalltooth sawfish approach 98.4 inches (250 centimeters), they become less sensitive to salinity changes and begin to move out of 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 and proposed critical habitat that is either completely encompassed by the action area or is partially within the action area. The following species have critical habitat that overlaps in areas where the only activity that will occur is vessel or aircraft transit:

- Beluga Whale – Cook Inlet DPS
- North Pacific Right Whale

- Rice's Whale (proposed)
- Green Sea Turtle – East Pacific DPS (proposed) and South Atlantic DPS (proposed)
- Hawksbill Sea Turtle
- Atlantic Salmon – Gulf of Maine DPS
- Atlantic Sturgeon – Carolina DPS, Chesapeake Bay DPS, Gulf of Maine DPS, New York Bight DPS, and South Atlantic DPS
- Bocaccio – Puget Sound/Georgia Basin DPS
- Chinook Salmon – California Coastal ESU, Central Valley Spring-Run ESU, Lower Columbia River ESU, Puget Sound ESU, Sacramento River Winter-Run ESU, Snake River Fall-Run ESU, Snake River Spring/Summer Run ESU, Upper Columbia River Spring-Run ESU, and Upper Willamette River ESU
- Chum Salmon – Columbia River ESU and Hood Canal Summer-Run ESU
- Coho Salmon – Central California Coast ESU, Lower Columbia River ESU, Oregon Coast ESU, and Southern Oregon/Northern California Coast ESU
- Eulachon – Southern DPS
- Gulf Sturgeon
- Smalltooth Sawfish – U.S. DPS
- Sockeye Salmon – Ozette Lake ESU and Snake River ESU
- Steelhead – California Central Valley DPS, Central California Coast DPS, Lower Columbia River DPS, Middle Columbia River DPS, Northern California DPS, Puget Sound DPS, Snake River Basin DPS, South-Central California Coast DPS, Southern California DPS, Upper Columbia River DPS, and Upper Willamette River DPS
- Yelloweye Rockfish – Puget Sound/Georgia Basin DPS
- Elkhorn Coral
- Staghorn Coral
- Black Abalone

The following species have critical habitat in the action area where activities beyond just vessel or aircraft transit may occur (e.g., landings with disposal or expended objects, explosive events) and/or are in the vicinity of launch sites:

- Humpback Whale – Central America DPS, Mexico DPS, and Western North Pacific DPS
- Killer Whale – Southern Resident DPS
- North Atlantic Right Whale
- Bearded Seal – Beringia DPS
- Ringed Seal – Arctic subspecies
- Steller Sea Lion – Western DPS
- Green Sea Turtle – North Atlantic DPS (proposed)
- Green Sturgeon – Southern DPS
- Leatherback Sea Turtle
- Loggerhead Sea Turtle – Northwest Atlantic Ocean DPS
- Nassau Grouper
- Boulder Star Coral
- Lobed Star Coral
- Mountainous Star Coral

- Pillar Coral
- Rough Cactus Coral

The majority of these species' critical habitats occur in areas where only vessel transits associated with the action would occur. Below we describe the areas of their critical habitats where additional components of the action may occur.

Humpback Whale – Western North Pacific DPS, Central America DPS, and Mexico DPS

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 Fed. Reg. 21082; Figure 12, Figure 13, Figure 14). These areas support prey species that are essential to the conservation of the DPSs. The Central America DPS critical habitat overlaps Pacific Zone 4 where barge landings may occur, and a small portion of the critical habitat also overlaps Pacific Zone 2 where objects may be expended or recovered (e.g., stages and fairings). The Mexico DPS critical habitat includes the Central America DPS critical habitat. A unit of the Mexico DPS and Western North Pacific DPS critical habitats occur around the Pacific Spaceport Complex Alaska in Kodiak, Alaska where launches may occur, though has not occurred for some time.

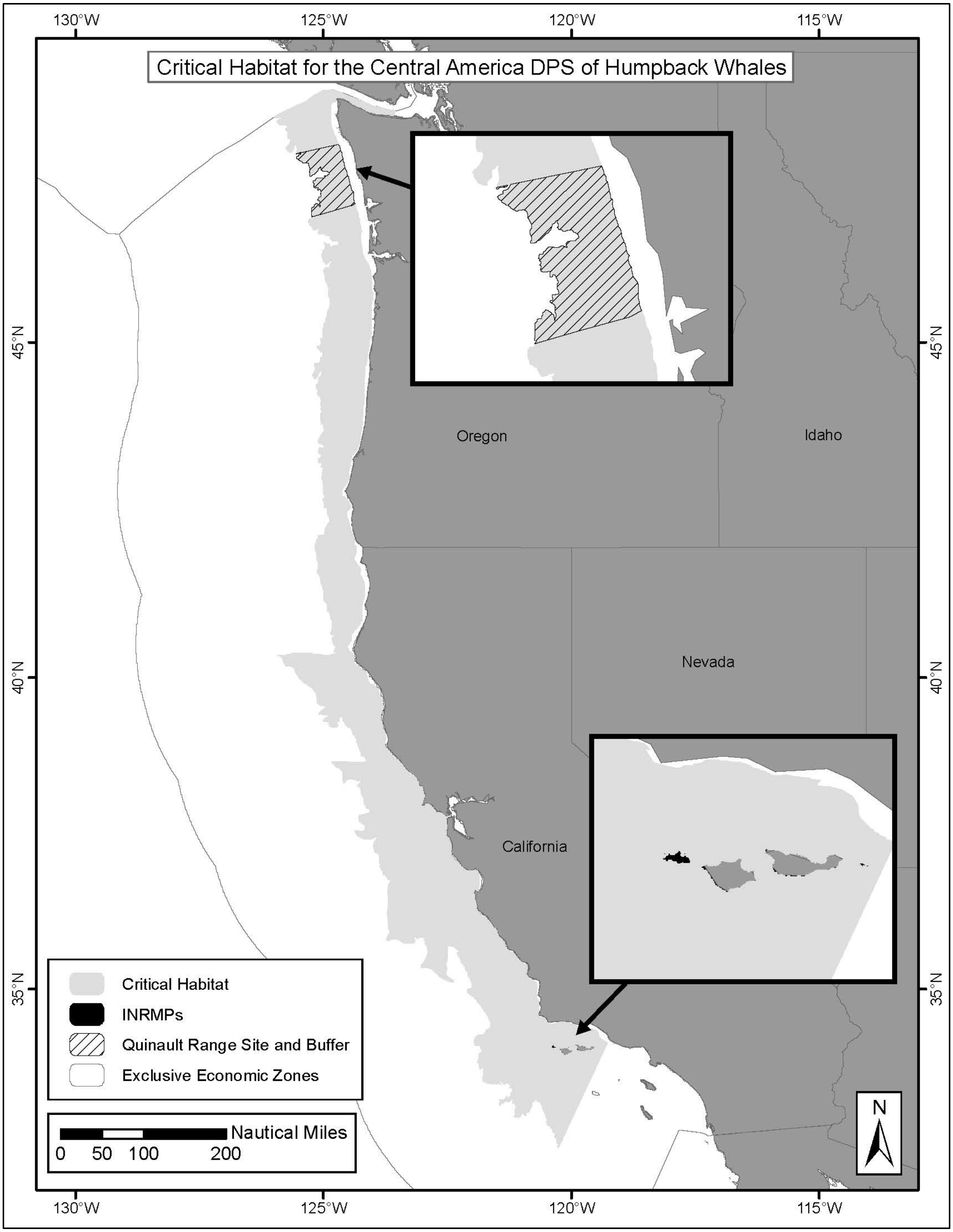

Figure 12. Critical Habitat for Central America DPS humpback whales

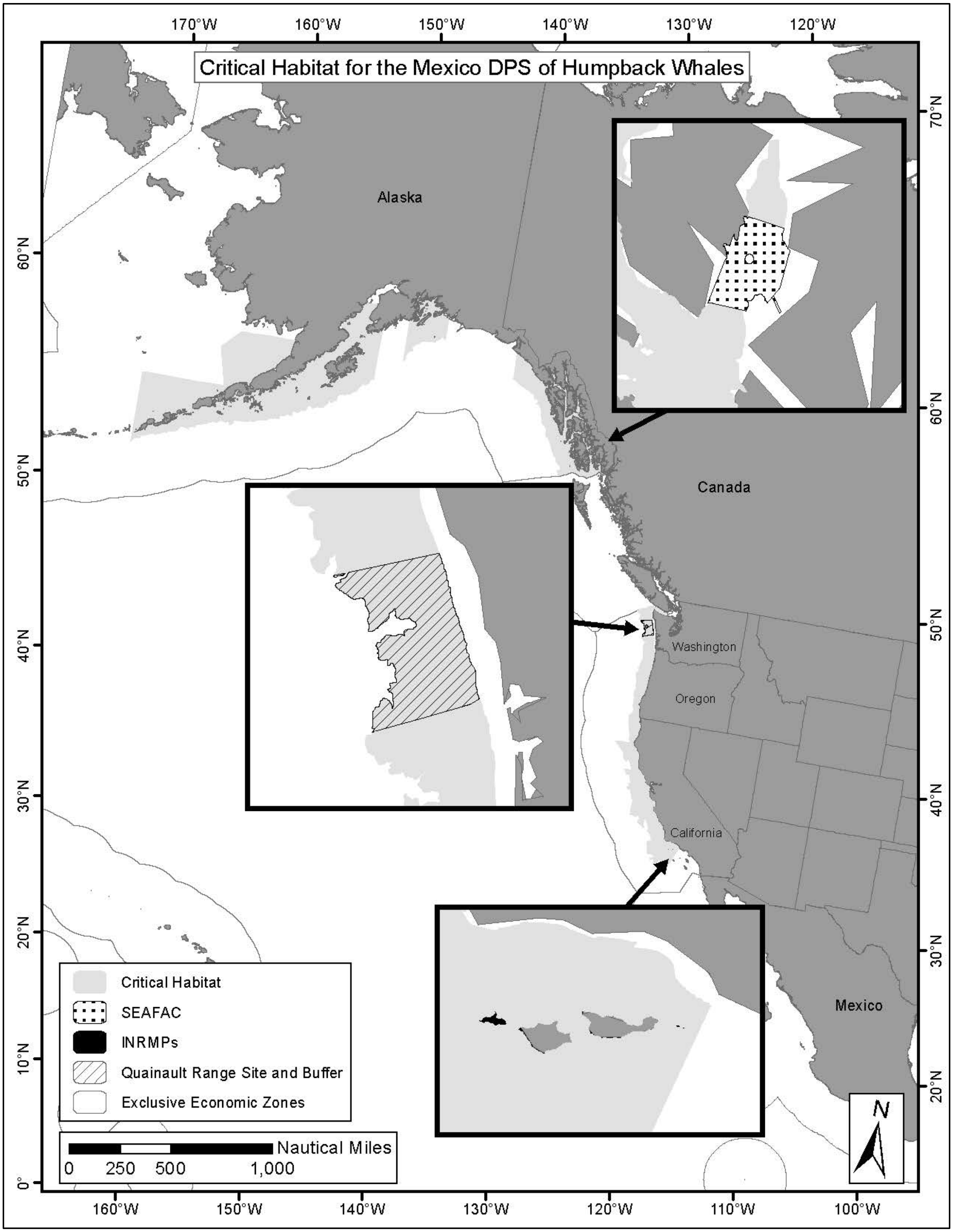

Figure 13. Critical Habitat for Mexico DPS humpback whales

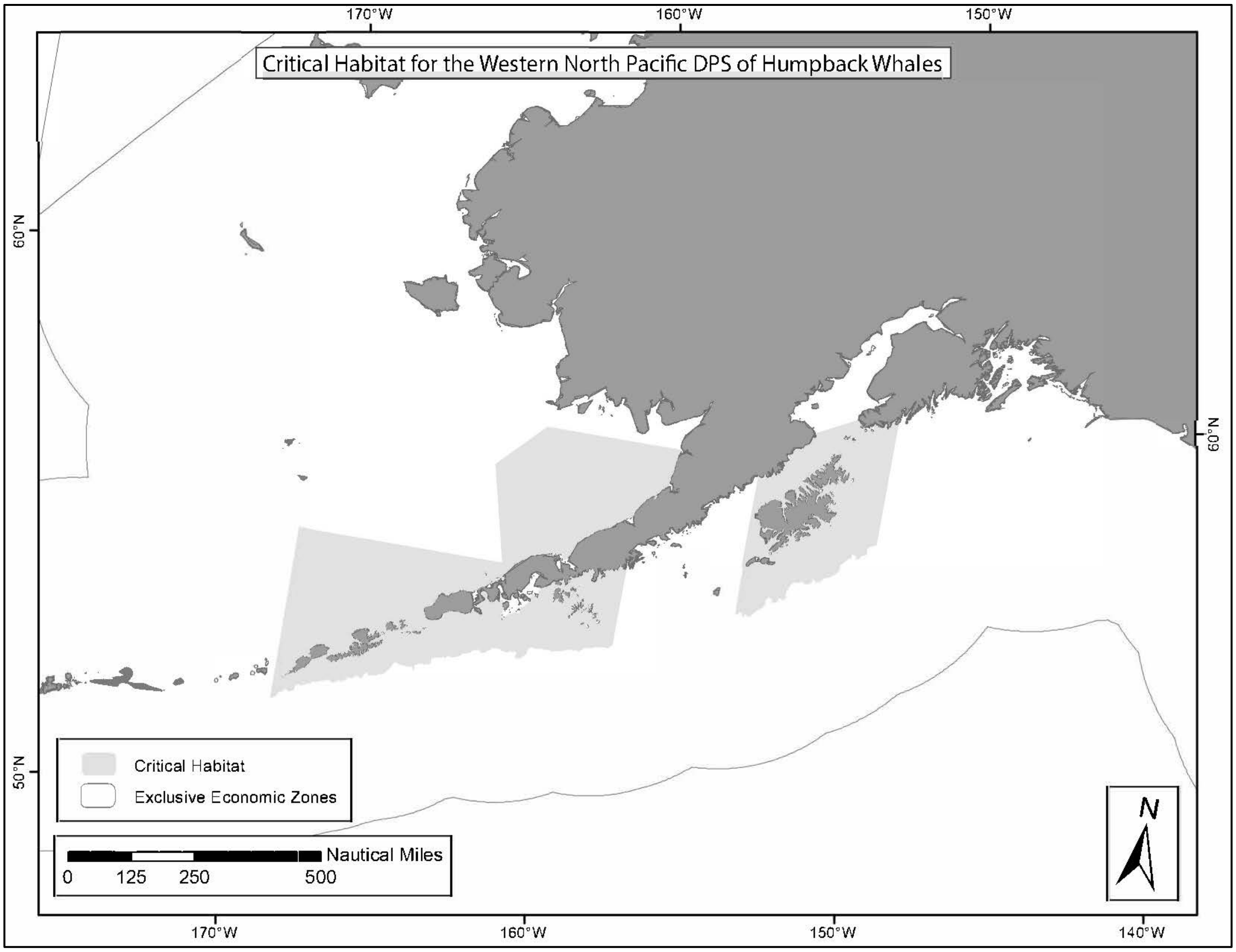

Figure 14. Critical Habitat for Western North Pacific DPS humpback whales

Killer Whale – Southern Resident DPS

NMFS designated critical habitat for the Southern Resident DPS killer whale in 2006 (71 Fed. Reg. 69054) and revised it in 2021 (86 Fed. Reg. 41668; Figure 15). Coastal waters designated as critical habitat overlap Pacific Zone 4 where barge landings may occur.

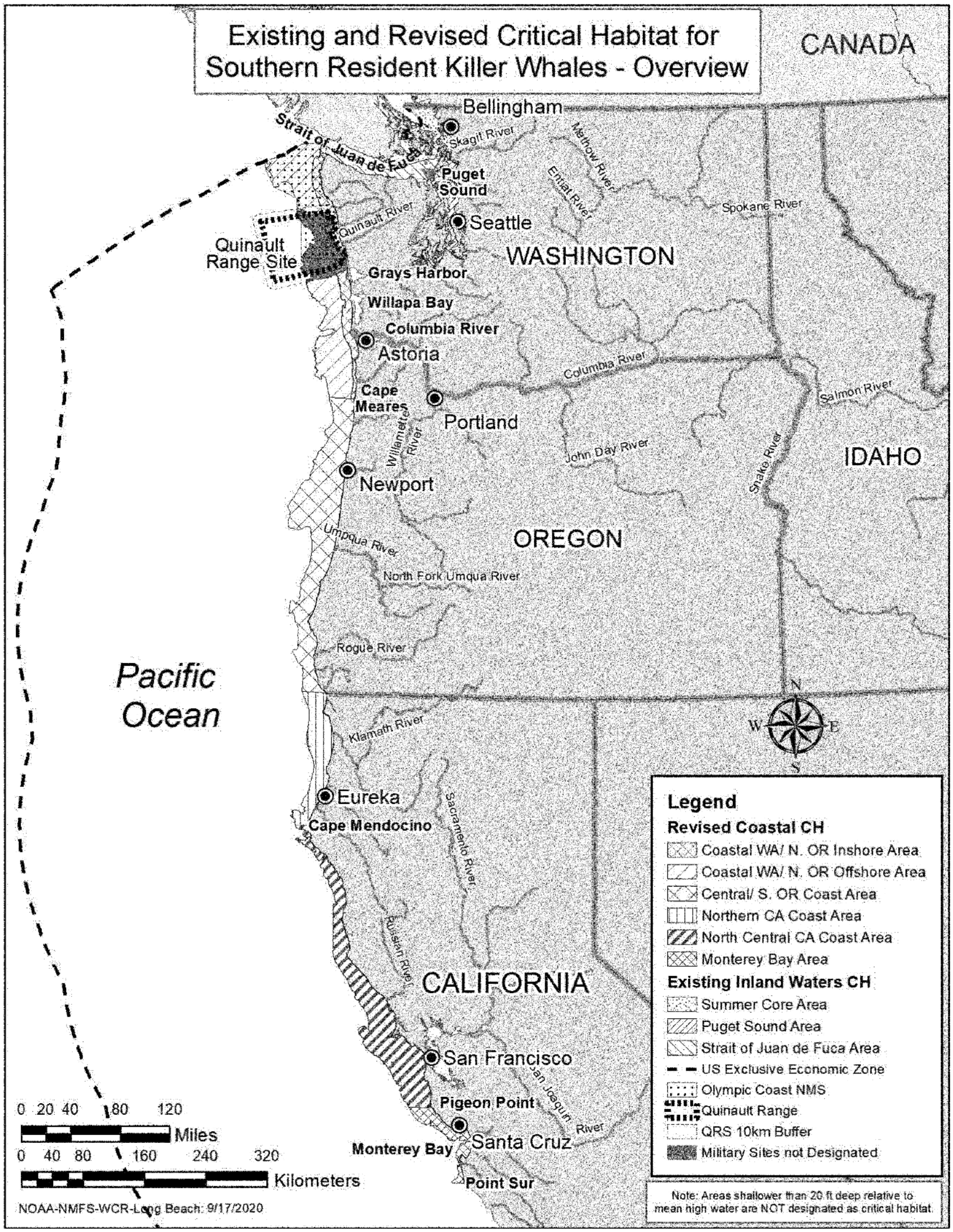

Figure 15. Critical Habitat for Southern Resident DPS Killer Whale

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 (Figure 16), and is in Zone 3c of the action area, which would have no operations with the exception of vessel transits January through July. Unit 2 is for calving, consisting of all marine waters from Cape Fear, North Carolina, southward to approximately 27 NM below Cape Canaveral, Florida (Figure 17). Unit 2 occurs in Zone 3b of the action area, where operations are also restricted to only vessel traffic during January to July. However, Unit 2 is off the coast of CCSFS and, therefore, adjacent the associated launch and landing sites.

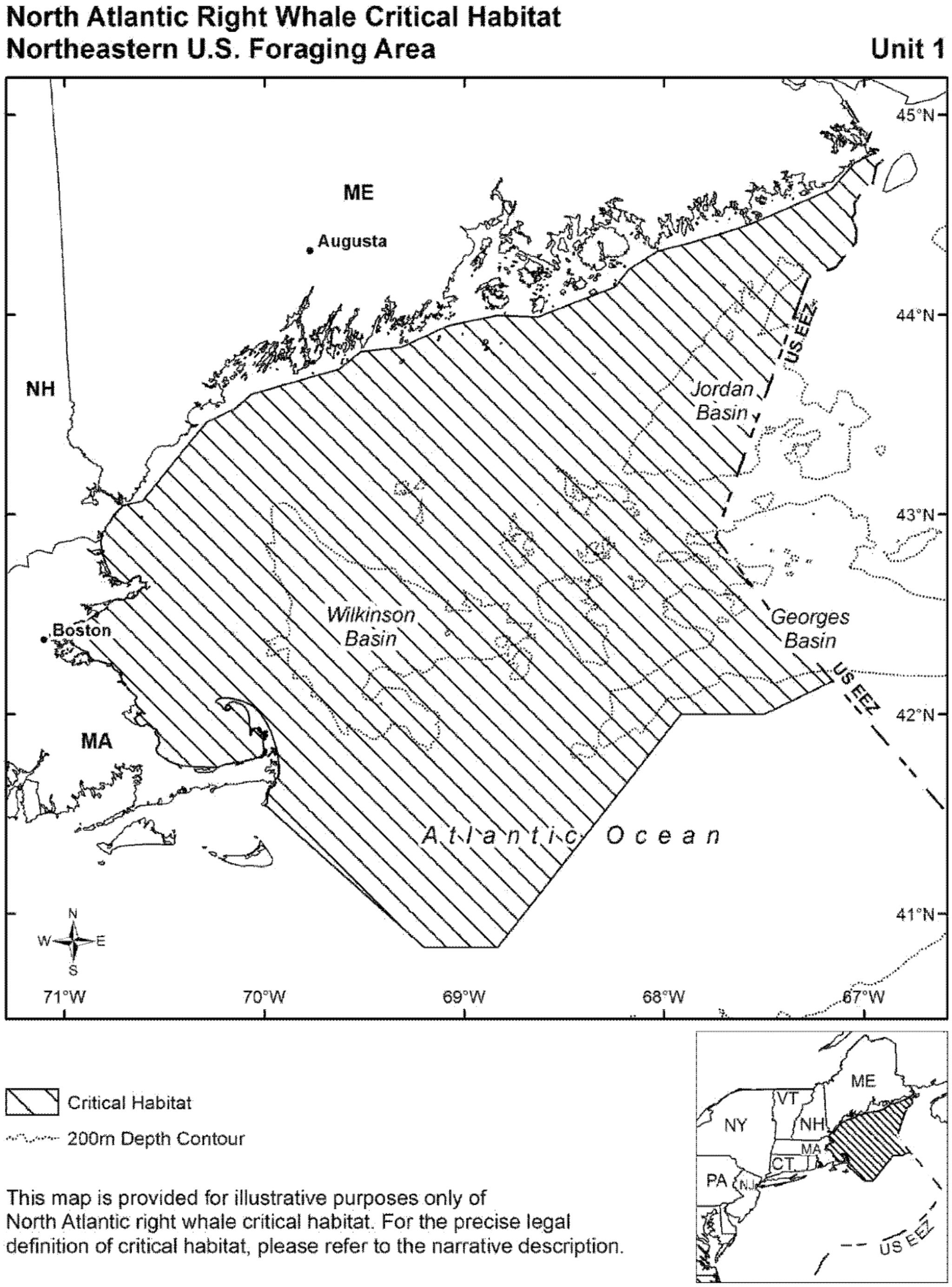

Figure 16. North Atlantic Right Whale Critical Habitat Unit 1

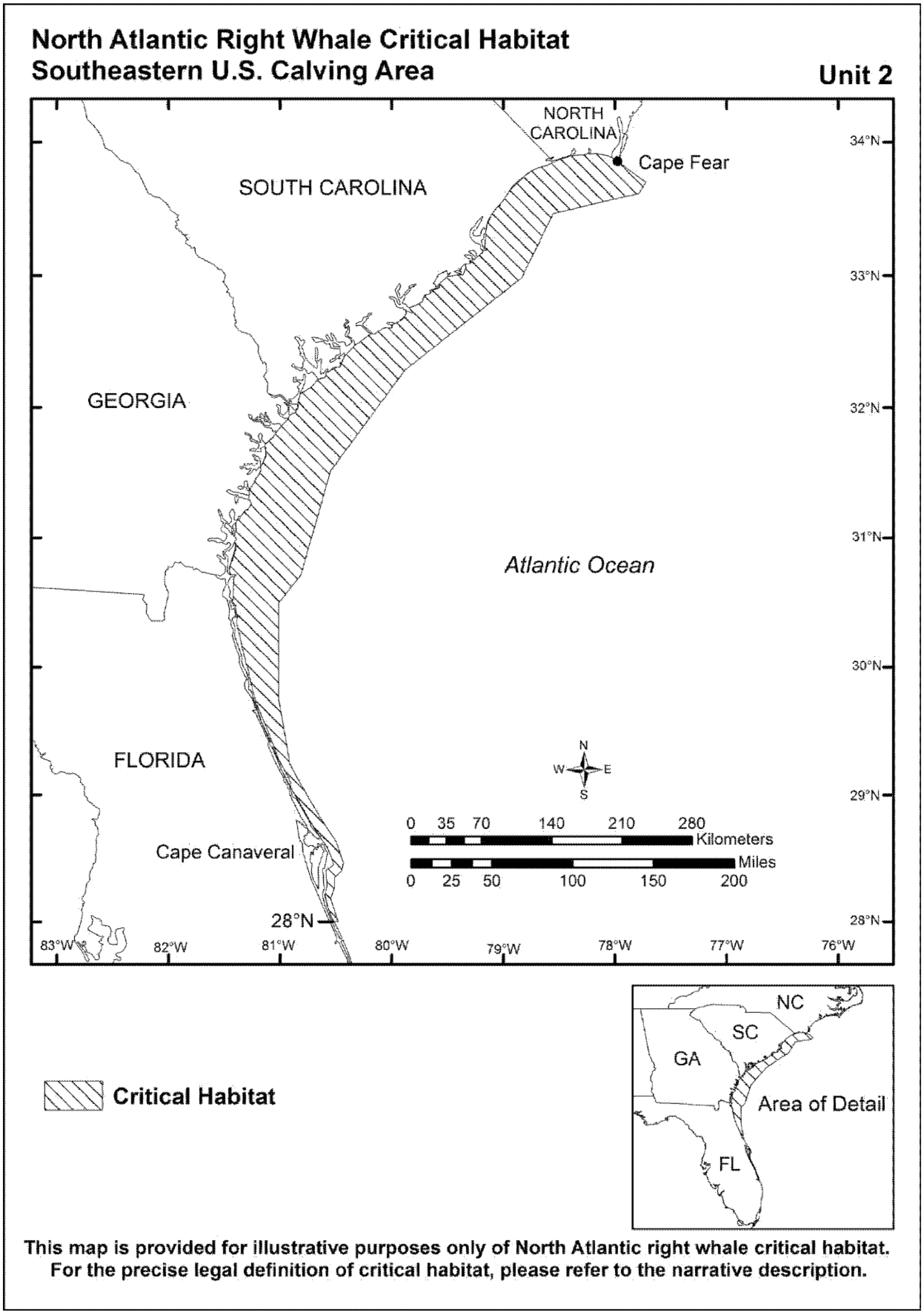

Figure 17. North Atlantic Right Whale Critical Habitat Unit 2

Bearded Seal – Beringia DPS

Critical habitat for the Beringia DPS of bearded seal encompasses marine areas in the Bering, Chukchi, and Beaufort seas (Figure 18). Small portions of critical habitat overlap Zone 2 in the Pacific portion of the action area.

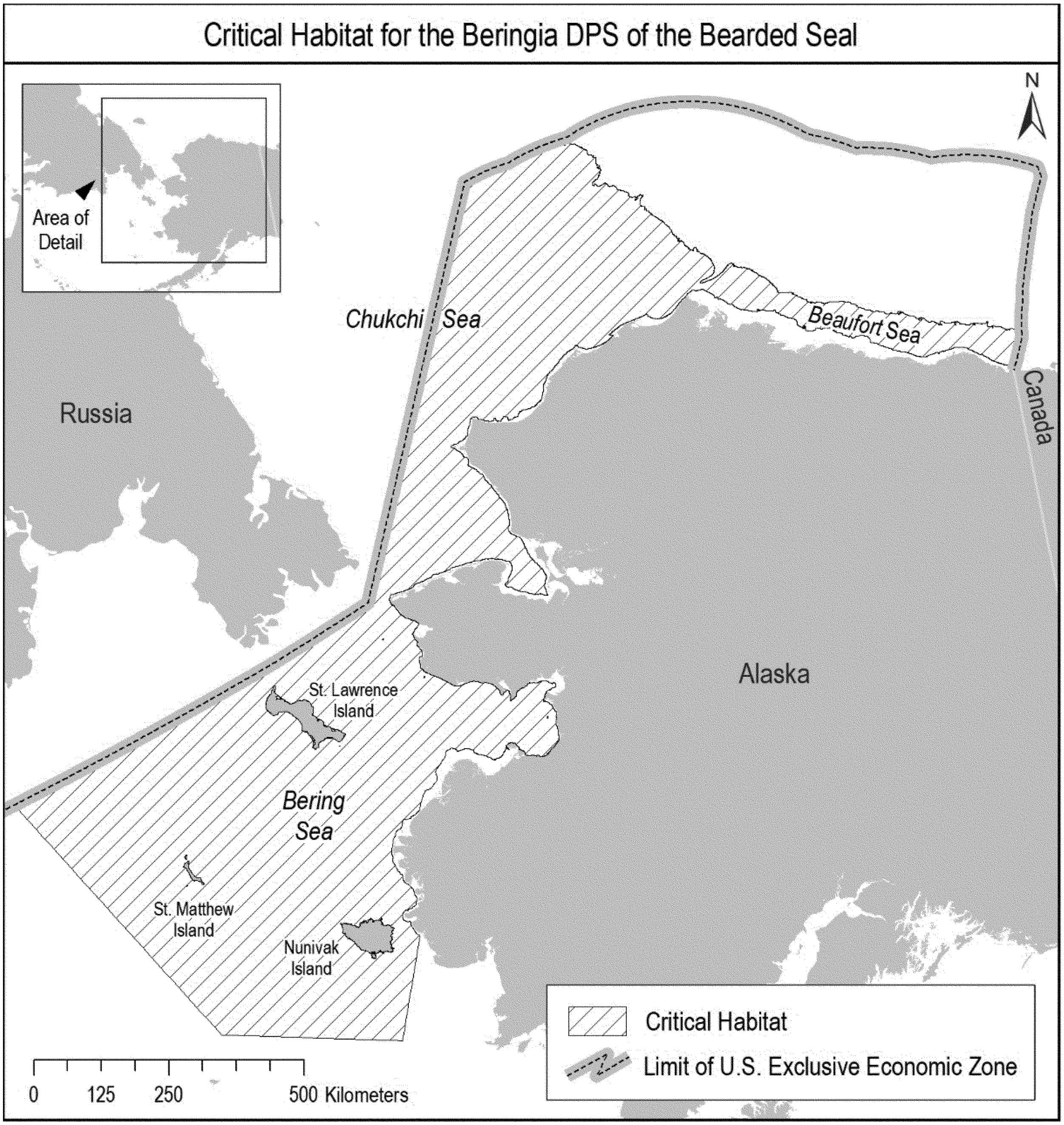

Figure 18. Critical habitat for Beringia DPS bearded seal

Ringed Seal – Arctic subspecies

Designated critical habitat for the Arctic subspecies of ringed seal includes marine area in the Bering, Chukchi, and Beaufort seas (Figure 19). Small portions of critical habitat overlap Zone 2 in the Pacific portion of the action area.

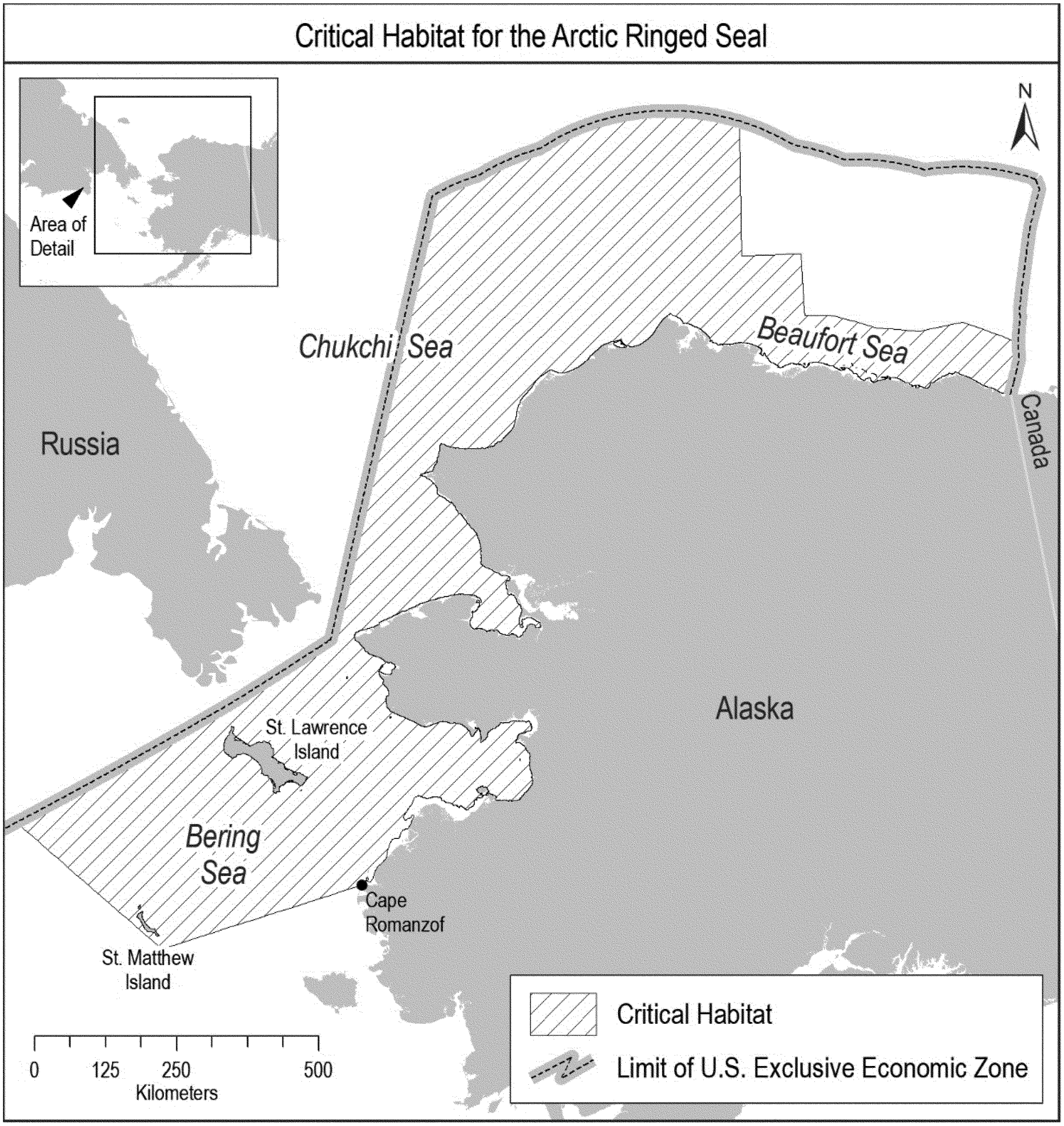

Figure 19. Critical habitat for the Arctic subspecies of ringed seal

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. 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. 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 20). While the areas of critical habitat were excluded from the zones identified in the Action Area section above (i.e., would be subject only to vessel and aircraft transits), the Pacific Spaceport Complex Alaska on the southeastern side of Kodiak Island overlaps with Steller sea lion critical habitat.

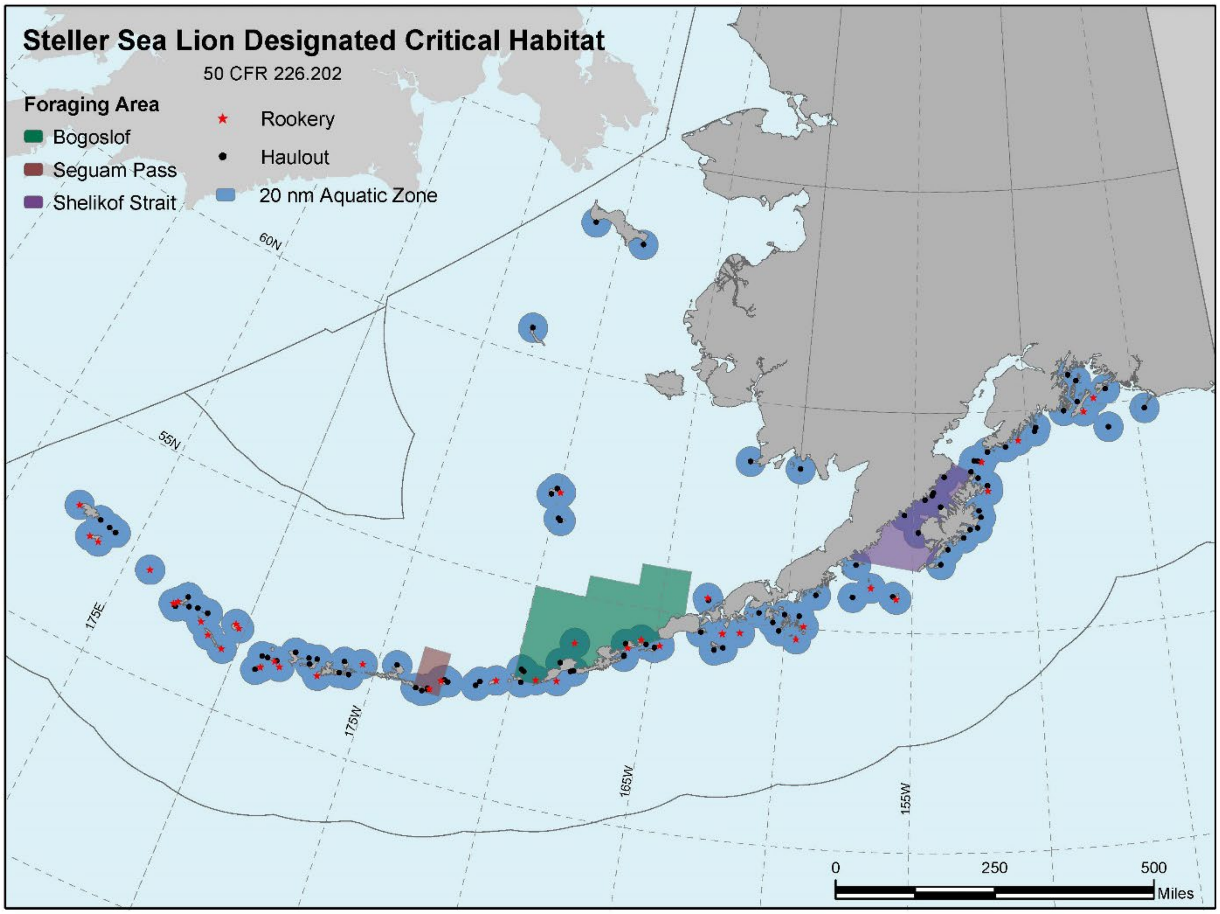

Figure 20. Steller Sea Lion Critical Habitat – Western Alaska

Green Sea Turtle – North Atlantic DPS

NMFS proposed to designate critical habitat for the North Atlantic DPS green turtle in 2023 (88 Fed. Reg. 46572; Figure 21). Proposed critical habitat includes surface-pelagic foraging/resting features that overlap with the Gulf Zone 2, Atlantic Zone 2, Atlantic explosive events area, and Bahamas/Caribbean Zone 4. Reproductive and migratory features are in the Atlantic Zone 5, where no disposals or expended stages, expended components, or debris will occur.

Proposed Critical Habitat for the North Atlantic DPS of Green Turtles

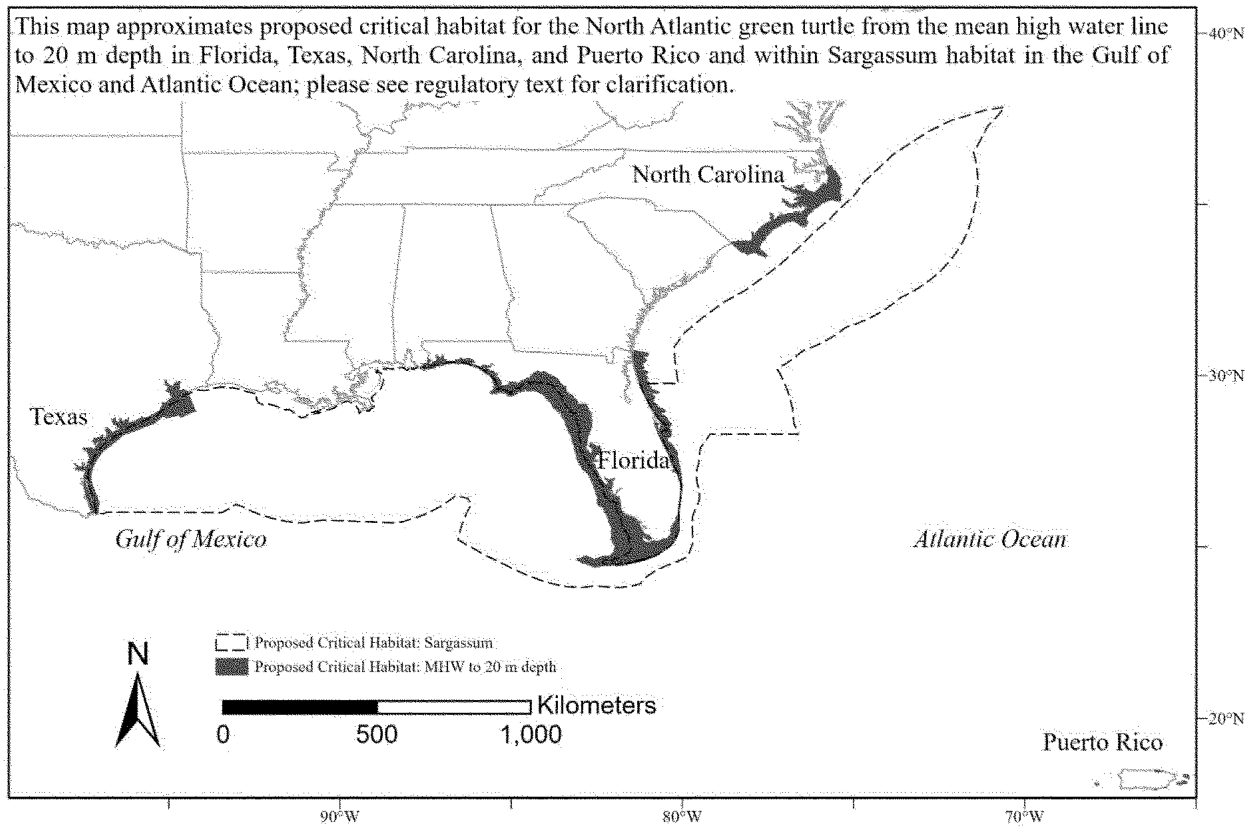

Figure 21. Overview of proposed critical habitat for the North Atlantic DPS green turtle

Green Sturgeon – Southern DPS

NMFS designated critical habitat for the threatened Southern DPS of green sturgeon (74 Fed. Reg. 52299; Figure 22). Coastal marine waters of the critical habitat overlap with the Pacific Zone 4 where barge landings may occur.

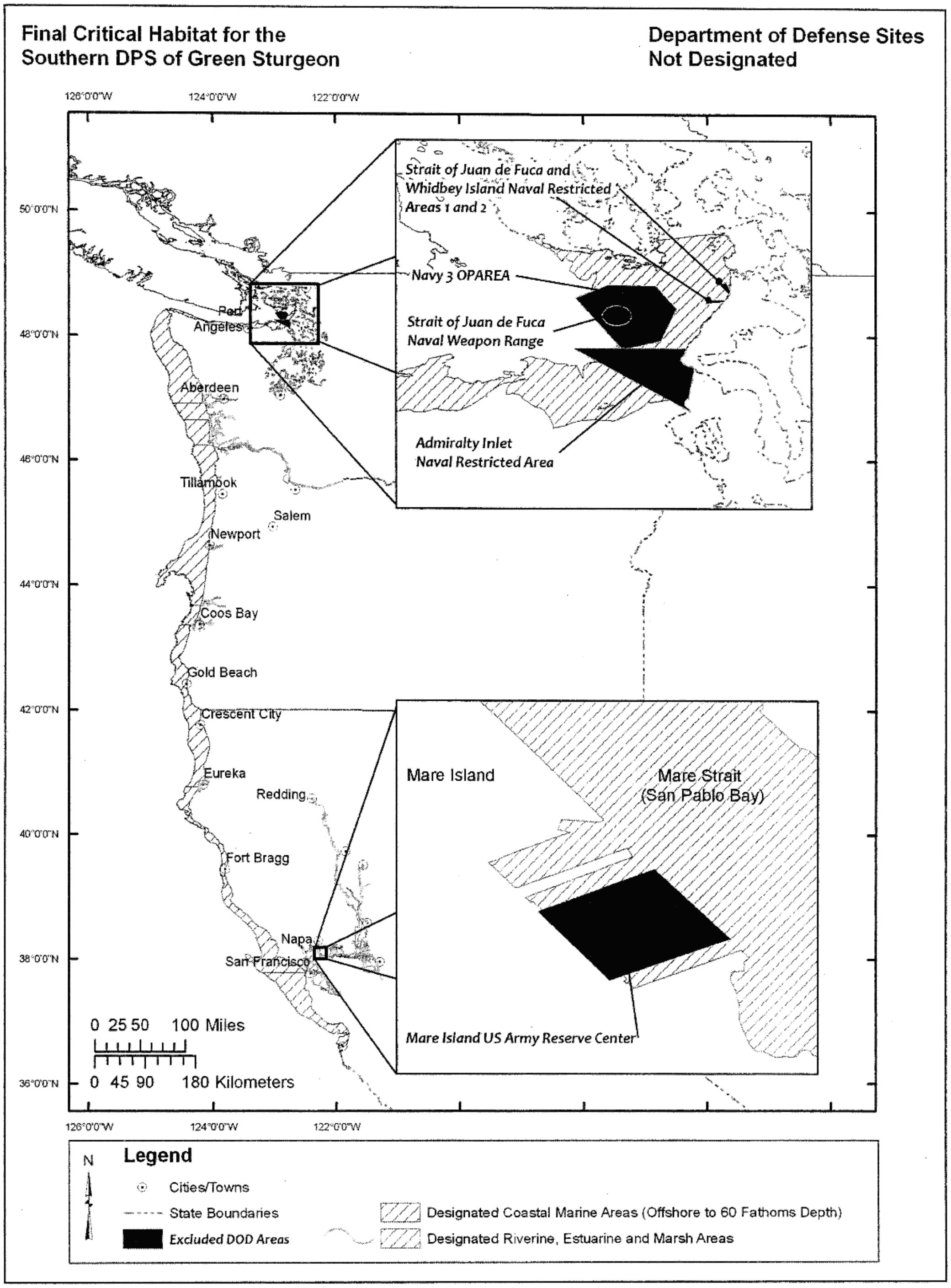

Figure 22. Critical Habitat for the Southern DPS Green Sturgeon

Leatherback Sea Turtle

NMFS designated critical habitat for the leatherback sea turtle (77 Fed. Reg. 4170; Figure 23). Leatherback sea turtle critical habitat in the Pacific overlaps with the Pacific Zone 4, where barge landings may occur.

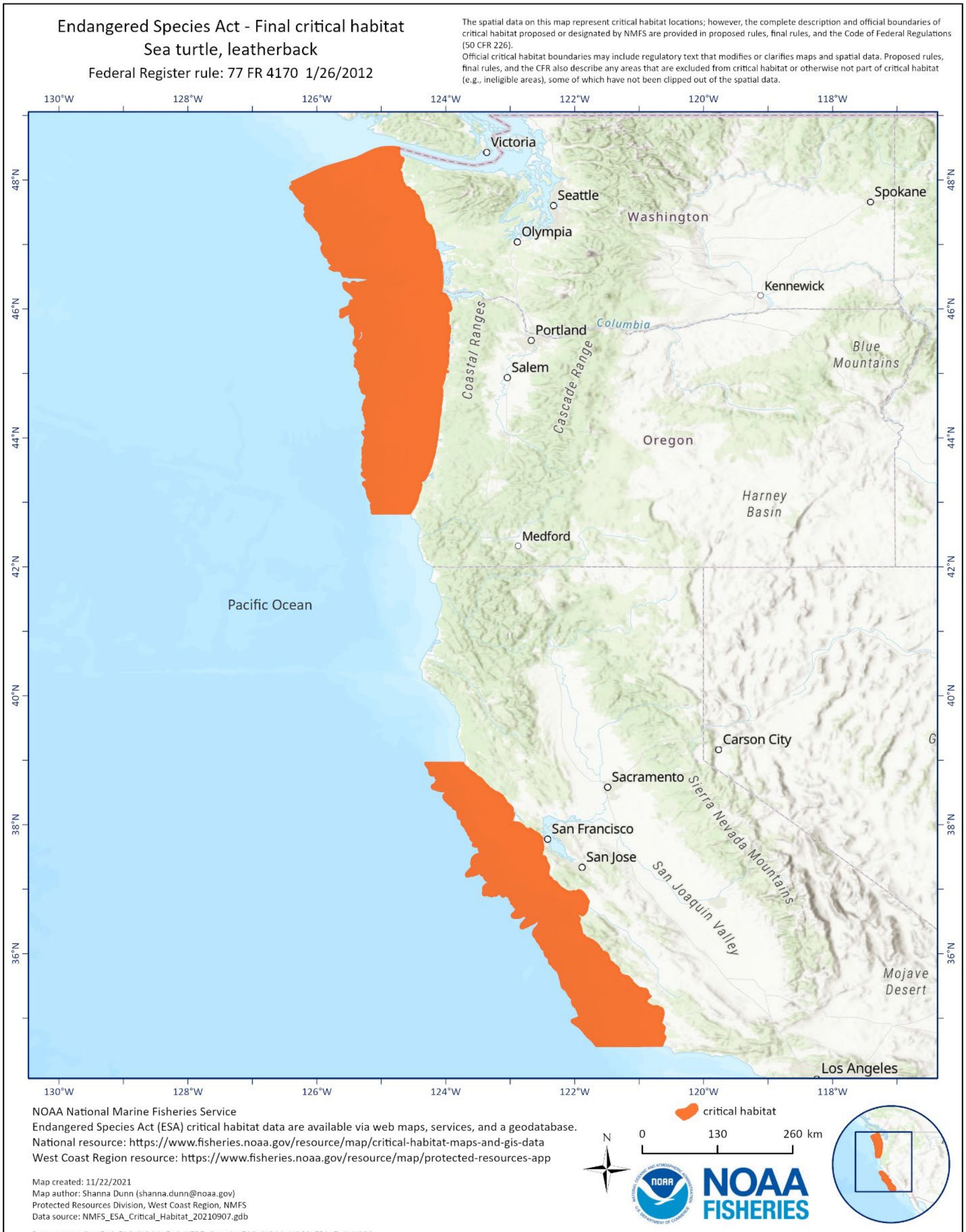

Figure 23. Leatherback Sea Turtle Critical Habitat

Loggerhead Sea Turtle – Northwest Atlantic Ocean DPS

NMFS designated critical habitat for the Northwest Atlantic Ocean DPS loggerhead sea turtle includes overlapping areas of nearshore reproductive habitat, constricted migratory habitat, breeding habitat, and *Sargassum* habitat (Figure 24). Constricted migratory habitat is in Atlantic Zone 5 where no disposals or expended stages, components, or debris will occur. Winter habitat is in Atlantic Zone 5a where no disposal or expended stages, components, or debris will occur between November through April. Breeding habitat is in Atlantic Zone 5b where no disposals or expended stages, components, or debris will occur between April through November. *Sargassum* habitat overlaps the Atlantic Zone 2 and explosive events area.

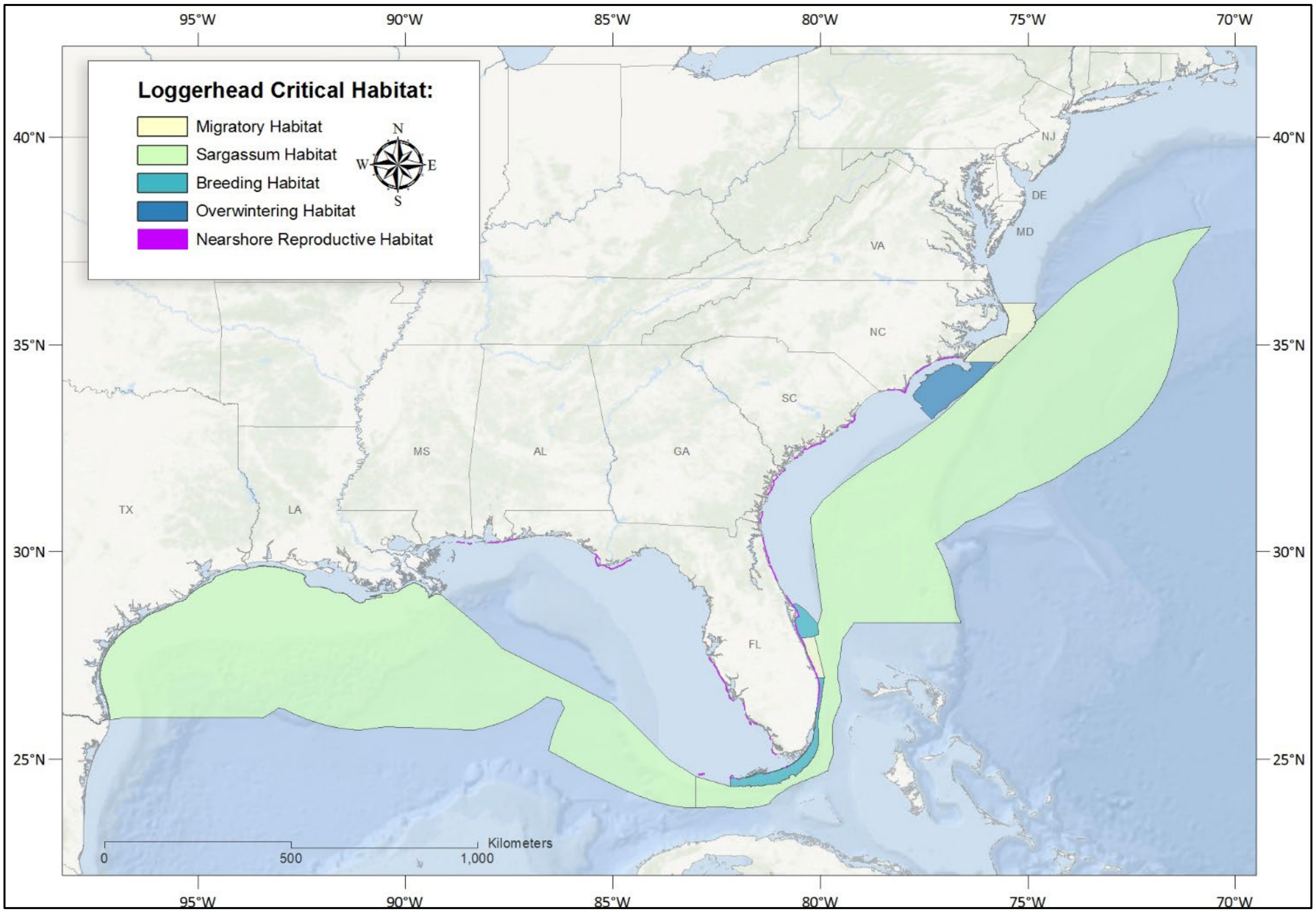

Figure 24. Loggerhead Sea Turtle Critical Habitat

Nassau Grouper

NMFS designated critical habitat for the Nassau grouper off Florida, Puerto Rico, Navassa, and the U.S. Virgin Islands. Only critical habitat designated off Navassa (Figure 25) will overlap the Bahamas/Caribbean Zone 4 where barge landings may occur.

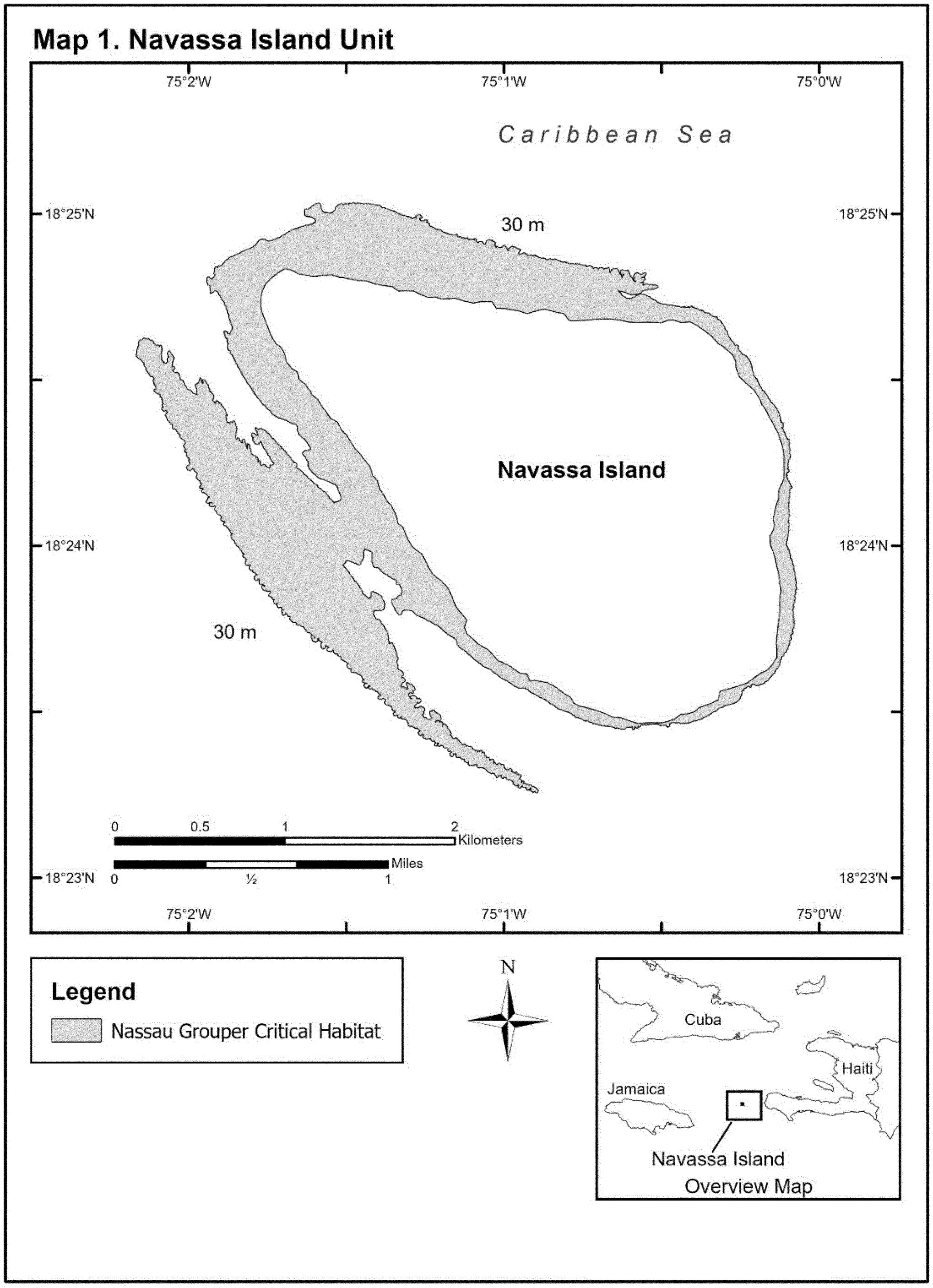

Figure 25. Nassau grouper critical habitat off Navassa Island

Caribbean Corals

NMFS designated critical habitat for the boulder star coral, lobed star coral, mountainous star coral, pillar coral, and rough cactus coral (88 Fed. Reg. 54026). Critical habitat occurs off Florida, Puerto Rico, the U.S. Virgin Islands, Navassa Island, and in the Flower Garden Banks National Marine Sanctuary in the Gulf of America. Only critical habitat designated off Navassa

(Figure 26, Figure 27, Figure 28, Figure 29, Figure 30) will overlap the Bahamas/Caribbean Zone 4 where barge landings may occur.

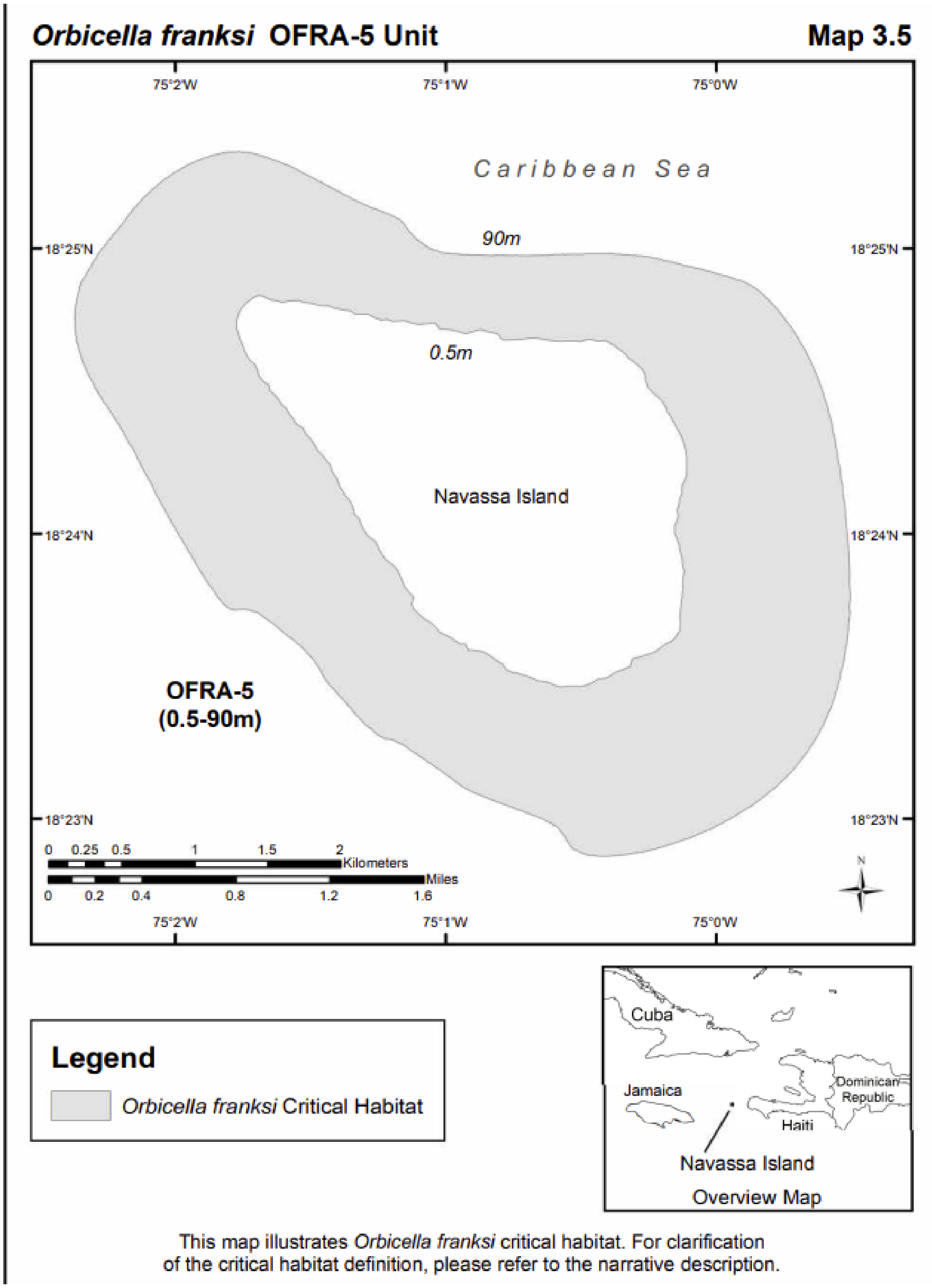

Figure 26. Boulder star coral critical habitat off Navassa Island

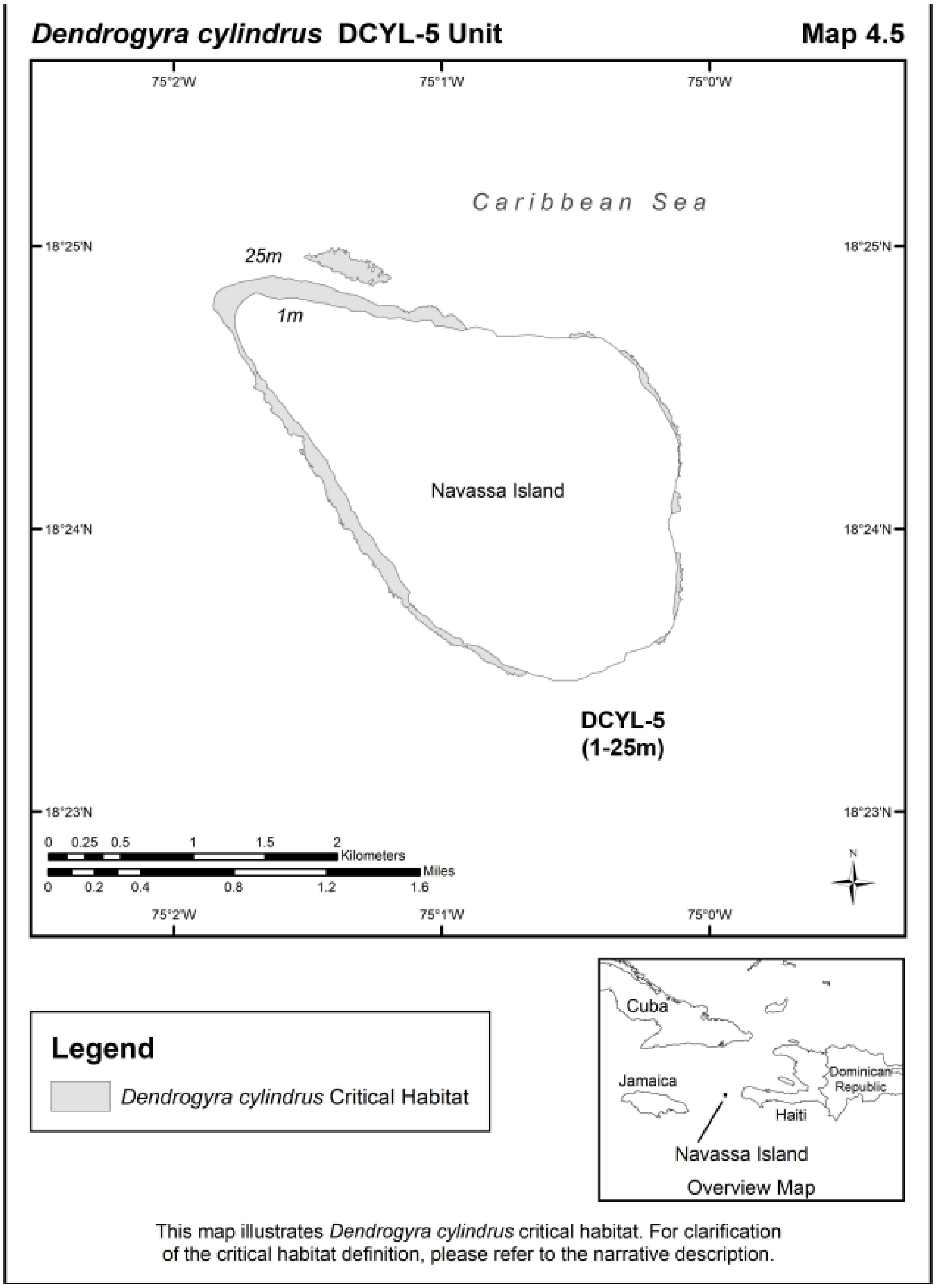

Figure 27. Pillar coral critical habitat off Navassa Island

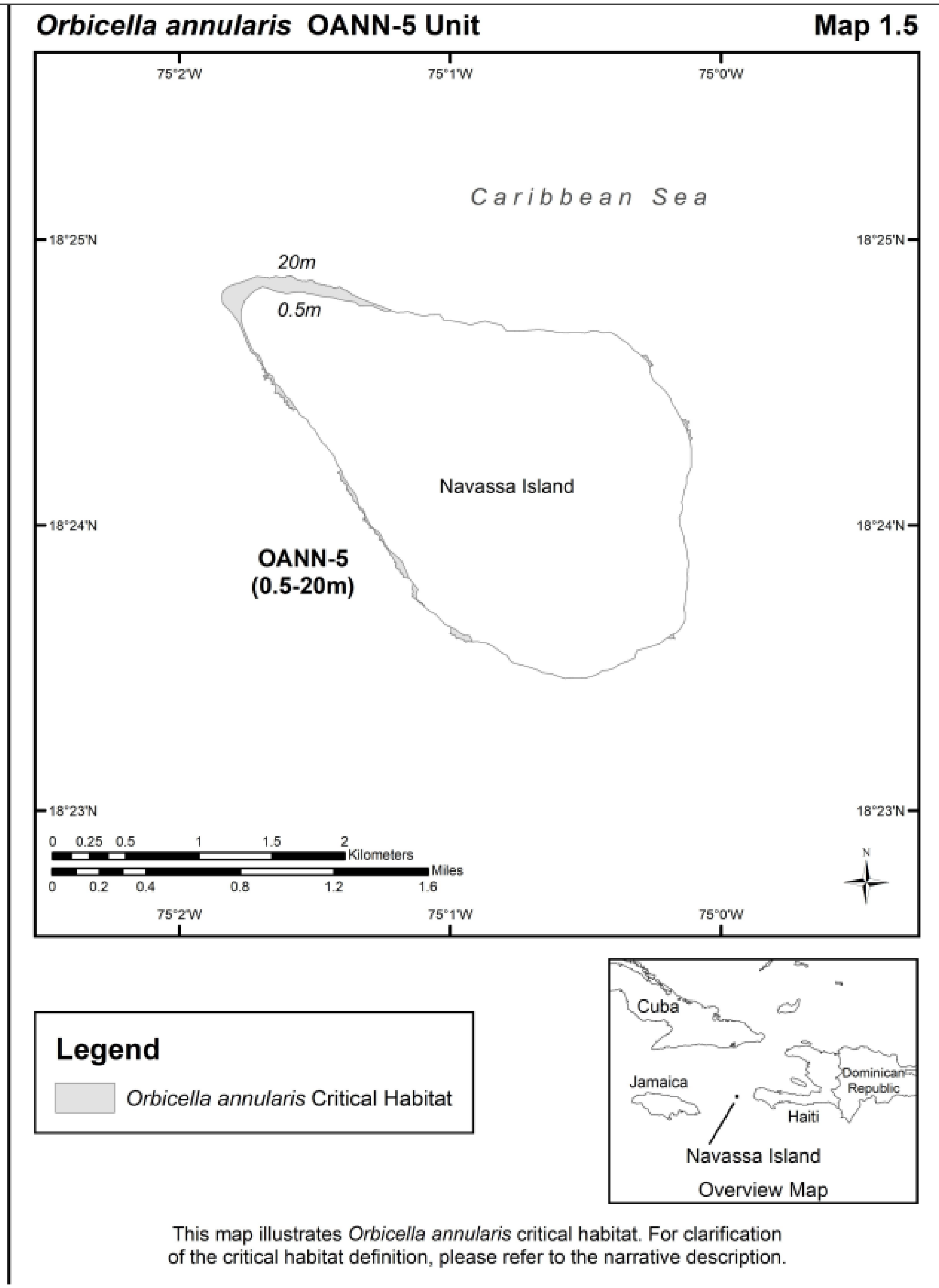

Figure 28. Lobed star coral critical habitat off Navassa Island

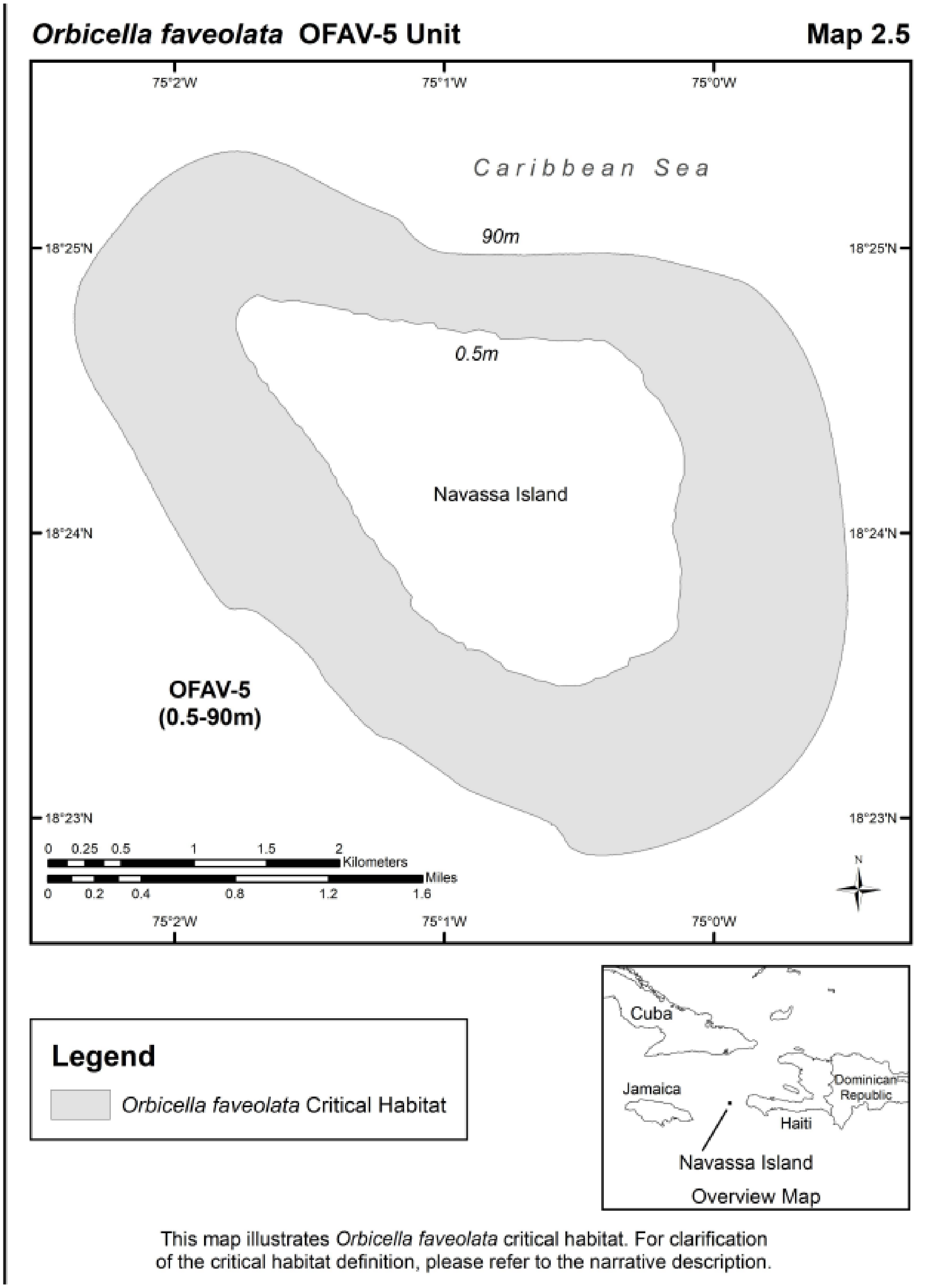

Figure 29. Mountainous star coral critical habitat off Navassa Island

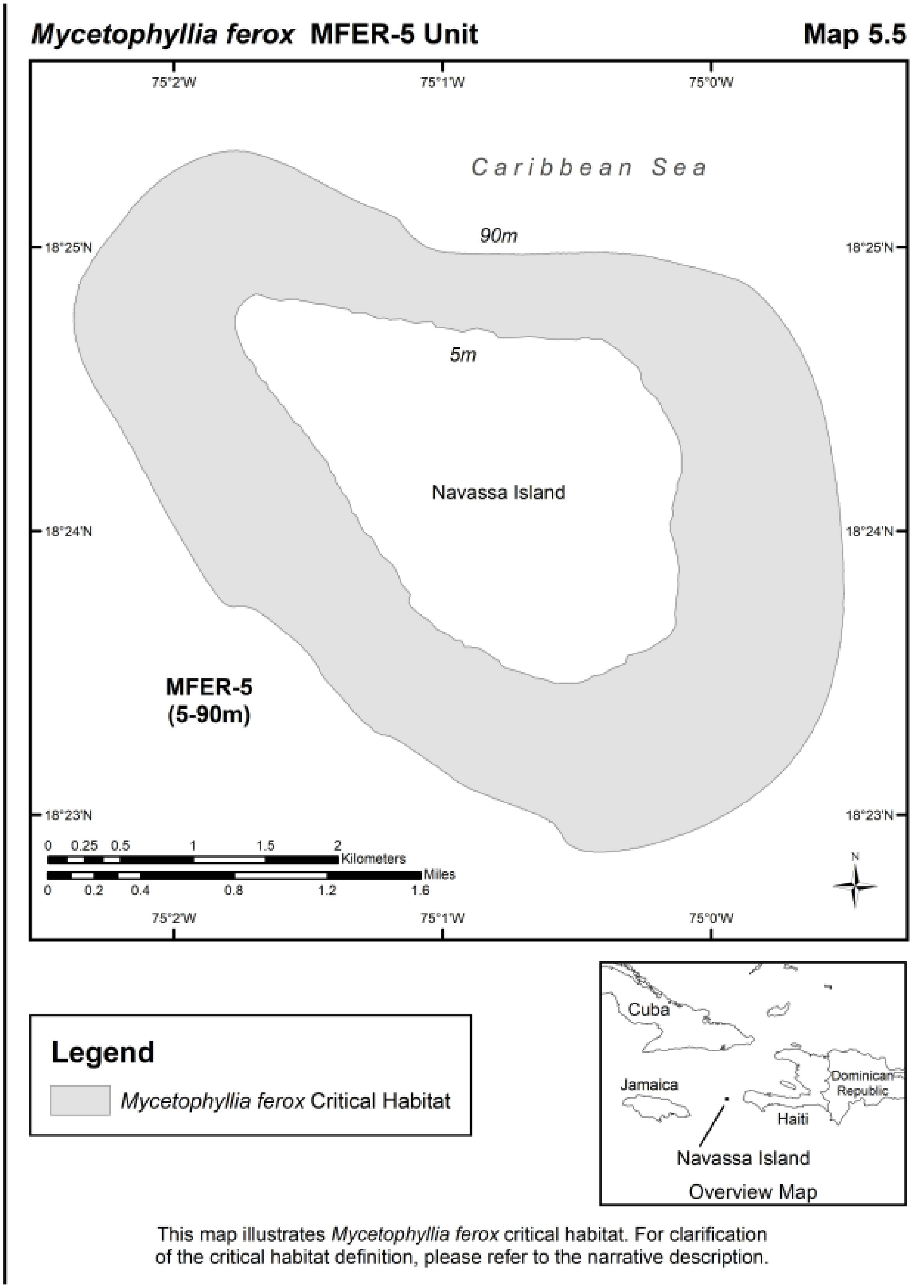

Figure 30. Rough cactus coral critical habitat off Navassa Island

EFFECTS ANALYSIS

Once we have determined the action may affect ESA-listed or proposed species or their designated or proposed critical habitat, the next step is to consider whether the action is NLAA for each listed species and critical habitat in the action area. We accomplish this by evaluating individual stressors in the proposed action for each listed species and critical habitat. An action warrants a NLAA finding when its effects are wholly beneficial, discountable, or insignificant. Wholly beneficial effects are contemporaneous positive effects without any adverse effects to the species or habitat. Discountable effects are those that could occur while an ESA-listed species is in the action area but, because of the intensity, magnitude, frequency, duration, or timing of the stressor, exposure to the stressor is extremely unlikely to occur. Insignificant effects relate to the response of exposed individuals where the response, in terms of an individual's growth, survival, or reproduction, would be too small to be measured, would be undetectable, or an impact to the conservation value of a PBF would be too small to be measured or undetectable.

To assist in reaching an NLAA conclusion, we perform a two-step assessment that considers all of the stressors caused by the action and all of the ESA-listed species and critical habitats in the action area. First, we consider whether it is likely that a listed species or critical habitat is exposed to a stressor or there is a reasonable expectation of the stressor and an individual or habitat co-occurring. If we conclude that exposure of a species or critical habitat to a stressor caused by the proposed action or activity is discountable, we must also conclude it is NLAA. However, if exposure is probable, the second step is to evaluate the probability of a response to the stressor. Given the physical, chemical, or biological extent of the stressor, we evaluate the anticipated response of a species or critical habitat to that exposure to understand whether the response would be meaningful or biologically measurable. Again, if we conclude that the response of a species or critical habitat to a stressor caused by the proposed action or activity is insignificant, we must also conclude it is NLAA. When the evaluation of all stressors, species, and critical habitats relevant to the action result in all effects being NLAA, we can concur with the Action agency's determination.

The following subsections identify the potential stressors and analyze the potential effects of the proposed space launch and reentry operations on the ESA-listed species and critical habitat in the action area.

Potential Stressors to ESA-Listed Species

Direct or indirect modifications to the land, water, or air caused by an action are identified as stressors. Here we identify all of the stressors resulting from the proposed action, as well as the sources of those stressors. Some stressors may have multiple sources. Likewise, multiple sources may combine to create a stressor that would not exist if only one of the sources were present. Potential stressors to ESA-listed or proposed species and designated or proposed critical habitats from the proposed activities include the following:

- Direct impact by falling objects (e.g., from stages, components, or debris landing or being expended in the ocean);
- Entanglement (e.g., in unrecovered parachutes and parafoils);
- Unrecovered debris (e.g., from expended stages or components, launch);
- Pollution (e.g., from vessels, propellant from expended stages, launch and reentry emissions)
- In-air sound (e.g., sonic booms, landings, explosive events, launches);
- Impulsive underwater sound (e.g., sonic booms, landings, explosive events);

- Noise and visual disturbance (e.g., from vessels and aircraft);
- Vessel strike;
- Increased sea surface temperature (explosive events, launch); and
- Vibration from launches.

Effects to the ESA-listed species from these stressors are discussed in the following subsections, followed by effects to the PBFs of designated or proposed critical habitat. There are many uncertainties regarding potential effects to ESA-listed species and critical habitat from launch and reentry operations due to a variety of reasons, including but not limited to: lack of resources dedicated to observing and monitoring for potential effects; lack of historical data about impacts to ESA resources given the rapid expansion of the commercial space industry; many operations occur out at sea and encompass large areas with no feasible way to monitor for potential effects; lack of knowledge of specific areas where certain operations may or may not occur; and potential effects and the magnitude of those effects may vary depending on the project, mission, and goals of the launch operators (i.e., the companies), which is largely unknown until a license or permit application is received. The following effects analysis draws upon the best scientific and commercial data available at the time of this consultation, including annual reports submitted by action agencies, other information provided by the action agencies, and effects considered by similar activities.

Direct Impact by Falling Objects

Radiosondes, stages, fairings, and debris falling and landing in the action area have the potential to affect ESA-listed species. The primary concern is direct impact from these objects striking an ESA-listed species. An object striking an ESA-listed species may result in injury or mortality to the individual struck. The following subsections assess the effects to ESA-listed species from this stressor in each zone.

Zone 1

Zone 1 excludes all countries' EEZs (which includes coastal areas where species generally occur in higher densities), Important Marine Mammal Areas (IMMA) relevant to ESA-listed species, Important Shark and Ray Areas relevant to ESA-listed species, and the species ranges for ESA-listed species whose ranges are restricted to a specific region (i.e., species that do not have a cosmopolitan distribution). Given these exclusions, ESA-listed species are expected to be rare throughout Zone 1. Thus, the likelihood that an ESA-listed species will be in the exact location at the exact time that an object falls and lands in the action area is extremely unlikely, and thus, the effects are discountable.

Pacific – Zone 2

Zone 2 in the Pacific portion of the action area excludes all designated critical habitat (except for very small portions of the Central America DPS and Mexico DPS humpback whale critical habitats), National Marine Sanctuaries, Isla Guadalupe (where a majority of Guadalupe fur seals occur and where over 99% of Guadalupe fur seal pups are born; McCue et al. 2021), the Revillagigedo Archipelago where humpback whale breeding aggregations, including the Mexico DPS, occur December–April (e.g., Jacobsen et al. (In Press)), and the Alaskan continental shelf (where a majority of Arctic listed seals occur; Cameron et al. 2010; Harwood et al. 2012; NMFS 2020; Von Duyke et al. 2020). Thus, Zone 2 excludes most areas where listed species are expected to occur in higher numbers.

The best available density data in this zone does not provide density data across the entire zone and covers areas not in the action area. It also does not provide mean densities, which would be the more appropriate statistic because activities could occur anywhere throughout the zone and at any time of year. Therefore, based on what data is available, we separate our analysis of the Pacific Zone 2 into two areas for analysis: offshore (beyond the EEZ) and nearshore (within the EEZ).

In the offshore area, ESA-listed marine mammal and sea turtle species for which there are available density data include the blue, fin, humpback, sei, and sperm whale, Guadalupe fur seal, and green, loggerhead, and leatherback turtle. Densities for those species are low and near zero in the offshore area (U.S. Department of the Navy 2024b). Density data for other ESA-listed marine mammals, sea turtles, and protected fishes that may occur in the offshore area were not available. However, it is expected that those densities will be lower than those for the aforementioned species because the offshore area does not include aggregation or spawning areas. Thus, the likelihood that an ESA-listed species will be in the exact location at the exact time that an object falls and lands in the offshore area is extremely unlikely.

In the nearshore area, we focused on an area off Southern California and Baja California where all past operations have occurred and are expected to continue. This also includes the area where the ATO-approved Dragon landing areas occur. Based on the available data, we use density to estimate species exposure. Areas of high density are small relative to the U.S. EEZ and generally occur close to shore (Zone 4) where only barge landings and vessel transit will occur. The density for marine mammals was 0.195 humpback whales per square kilometers (km^2) within approximately 27 NM (50 km) from shore off San Francisco, California and the density for sea turtles was 0.24 loggerhead sea turtles per km^2 west of the Channel Islands (U.S. Department of the Navy 2024b). All other species densities were lower than the densities for humpback whales and loggerhead sea turtles.

Based on current available information, we expect operations to continue in the Southern California and Baja California area at a rate of approximately 100 launches per year (Department of the Air Force 2025). Thus, we can estimate the probability of a direct impact by estimating the species exposure to being struck by a falling object. Under this programmatic, the largest object that could fall and land in the Southern California and Baja California area is a launch vehicle. The 100 launches are all expected to use Falcon 9 or Falcon Heavy, both of which are reusable launch vehicles. Falcon (referring to both Falcon 9 and Falcon Heavy) has a failure rate of approximately 1% over 400 launches since June 2010. Based on Department of the Air Force (2025), there may be a combined 10 expended Falcon 9 or Falcon Heavy center core first stage boosters each year. Falcon Heavy essentially consists of three reusable Falcon 9 boosters, so the Falcon Heavy center core is simply a Falcon 9. Falcon 9 is approximately 229.6 ft (70 m) in length and 12 ft (3.7 m) in diameter. Thus, we estimate that the largest object that could land in this area is approximately 25,967.1 square feet (ft^2) or 2,412.4 square meters (m^2; 0.002412 km^2). Exposure to a direct impact from launch vehicle landings can be calculated as the product of the species density, area of a launch vehicle, and 10 landings per year. This results in a maximum species exposure of 0.006 (Table 5).

Spacecraft (Dragon and new capsule) and fairings are also expected to fall and land in that area. Dragon is 26.7 ft (8.1 m) in length and 13 ft (4 m) in diameter. Thus, we estimate that the largest object that could land in this area is approximately 3,543.95 ft^2 or 329.24 m^2 (0.000329 km^2). Spacecraft may land in this area up to 70 times a year. Exposure to a direct impact from spacecraft landings can be calculated as the product of the species density, area of a reentry vehicle, and the number of landings per year. This results in a maximum species exposure of 0.006 (Table 5). Fairings of Falcon 9 are 43 ft (13.1 m) in length and 17.1 ft (5.2 m) in diameter. Thus, we estimate the size of a single fairing half to be approximately 735.3 ft^2 or 68.3 m^2 (0.0000683 km^2). Assuming each launch carries a payload, both fairing halves will fall and land in the ocean during each launch, resulting in 200 fairing halves landing in the ocean each year. Exposure to a direct impact from a fairing can be calculated as the product of the species density, area of a fairing, and the number of fairing landings per year. This results in a maximum species exposure of 0.004 (Table 5).

Table 5. Estimated maximum species exposure to falling objects off Southern California and Baja California within Pacific Zone 2

	Marine Mammals	Sea Turtles
Density (animals/ km^2)	0.195	0.24
Launch Vehicle Area (km^2)	0.002412	0.002412
Reentry vehicle area (km^2)	0.0032924	0.0032924
Fairing half area (km^2)	0.0000683	0.0000683
Number of launch vehicle landings	1	1
Number of reentry vehicle landings	70	70
Number of fairing half landings	220	220
Estimated Exposure – Launch Vehicle	0.0047	0.0058
Estimated Exposure – Reentry Vehicle	0.0045	0.0055
Estimated Exposure – Fairings	0.0027	0.0036

km^2 = square kilometers

Density data for marine mammals, sea turtles, and protected fishes were not available; however, it is expected that those densities will be lower than those for the humpback whales and loggerhead sea turtles because this area does not include aggregation or spawning areas. Additionally, because fishes are able to detect particle motion and are highly mobile, listed fishes are likely able to detect an object landing in the water and evade the oncoming object. Chambered nautilus may also occur in the Pacific Zone 2; however, their densities are also not expected to exceed those for marine mammals and sea turtles. Further, chambered nautilus distribution is irregular and patchy (Miller 2018). Other components, debris, and radiosondes that may land in this area will be smaller than Dragon or would not land in as high numbers as the fairings, and therefore would result in an even smaller number of species exposures. Thus, the likelihood that an ESA-listed species will be in the exact location at the exact time that an object falls and lands in the nearshore area is extremely unlikely, and thus, the effects are discountable.

Pacific – Zone 3a

In Zone 3a, the Revillagigedo Archipelago, space launch and reentry operations are limited to vessel transit only from December 1–April 30. This seasonal restriction reduces potential adverse effects to humpback whales, including the Mexico DPS, which aggregate in the area to breed (e.g., Jacobsen et al. (In Press)). Thus, except for humpback whales, the effects analysis is similar to that of the Zone 2 Pacific area. Regarding humpback whales, due to the seasonal restriction on operations, it is extremely unlikely that an object will strike an ESA-listed humpback whale. Thus, the effects are discountable.

Gulf – Zone 2

Zone 2 in the Gulf portion of the action area excludes National Marine Sanctuaries, the Rice's whale core distribution area, and all designated and proposed critical habitats except for green turtle North Atlantic DPS proposed and loggerhead sea turtle Northwest Atlantic Ocean DPS *Sargassum* critical habitat. The excluded critical habitats include: Rice's whale proposed critical habitat, Gulf sturgeon critical habitat, smalltooth sawfish critical habitat, green turtle North Atlantic DPS proposed critical habitat (reproductive and migratory habitats), loggerhead sea turtle Northwest Atlantic Ocean DPS critical habitat (nearshore reproductive, breeding, and winter habitat), Nassau grouper critical habitat, and rough cactus, staghorn, pillar, elkhorn, boulder star, lobed star, and mountainous star coral critical habitat. Thus, Zone 2 excludes some areas where listed species are expected to occur in higher numbers.

Based on the best available density data, the highest species densities (Rice's whale, sperm whale, and green, Kemp's ridley, leatherback, and loggerhead sea turtles) in the Gulf Zone 2 occur closer to shore and are small relative to Zone 2 (Roberts et al. 2023; Garrison et al. 2023a; Garrison et al. 2023b). Because operations could occur anywhere within the Gulf Zone 2, we used the highest monthly mean (i.e., average) species density to estimate species exposure to a direct strike from a falling object. The highest monthly mean density for marine mammals was 0.0056 sperm whales per km^2 and the highest monthly mean density for sea turtles was 0.866 Kemp's ridley turtles per km^2. Under this programmatic, the largest object that could land in this area is a reentry vehicle. We approximate the size of a reentry vehicle using the reentry vehicle envelope specifications. Under this programmatic, the maximum length of a reentry vehicle will be 30 ft (9.1 m), and the maximum diameter of a reentry vehicle will be 15 ft (4.57 m). Thus, we estimate that the largest object that could land in this area is approximately 5,301.43 ft^2 or 492.52 m^2 (0.0004925 km^2). The number of animals that could be exposed to a direct impact from a falling object can be estimated by multiplying the area of the object, by the highest monthly mean species density (as a proxy for all species considered in this consultation), by the number of times the object may fall into the ocean. Using the highest monthly mean species density, largest object, and the number of reentries (22), the maximum number of species exposures that could be exposed per year to a direct impact is 0.009.

Density data for protected fishes were not available; however, it is expected that those densities will be lower than that for marine mammals and sea turtles because Zone 2 does not include aggregation and spawning areas. Additionally, because fishes are able to detect particle motion and are highly mobile, listed fishes are likely able to detect an object landing in the water and evade the oncoming object. Other components, debris, and radiosondes that may land in this area will be smaller than a reentry vehicle and therefore would result in an even smaller number of species exposures. Therefore, the likelihood that an ESA-listed species will be in the exact location at the exact time that an object falls and lands in the Gulf Zone 2 is extremely unlikely, and thus, the effects are discountable.

Atlantic – Zone 2

Zone 2 in the Atlantic portion of the action area excludes National Marine Sanctuaries, IMMAs for North Atlantic right whales, and all designated and proposed critical habitats except for green turtle North Atlantic DPS proposed and loggerhead sea turtle Northwest Atlantic Ocean DPS *Sargassum* critical habitat (North Atlantic right whale critical habitat, green turtle North Atlantic DPS proposed critical habitat [reproductive and migratory habitats], loggerhead sea turtle Northwest Atlantic Ocean DPS critical habitat [nearshore reproductive, breeding, and winter habitat], Nassau grouper critical habitat, and mountainous star coral critical habitat). Thus, Zone 2 excludes some areas where listed species are expected to occur in higher numbers.

Based on the best available density data, the highest species densities (blue, fin, North Atlantic right, sei, and sperm whale, and green, Kemp's ridley, leatherback, and loggerhead sea turtles) in the Atlantic Zone 2 occur closer to shore and are small relative to Zone 2 (Roberts et al. 2023; Roberts et al. 2016; Roberts et al. 2024; DiMatteo et al. 2024). A majority of those areas of high density do not overlap where stages and fairings have landed or been expended in the past – based on annual reports, stages and fairings have generally landed approximately 200 mi (321.9 km) from shore. However, because there are small portions that overlap, we used the highest monthly mean species density to estimate species exposure to a direct strike from a falling object. The highest monthly mean density for marine mammals was 0.0068 sperm whales per km^2.

The highest monthly mean density for sea turtles was 0.1269 loggerhead sea turtles per km^2. However, there was a substantial difference in densities nearshore (off Florida, Georgia, and South Carolina) compared to other areas of Zone 2. In the nearshore area, densities were much higher than the highest monthly mean density (the highest monthly mean density in the nearshore area was 1.553 loggerhead sea turtles per km^2 compared to 0.1269 loggerhead sea turtles per km^2) and therefore would contribute to higher than discountable exposures. However, that nearshore area represents only approximately 7% of the Atlantic Zone 2 area. Further, based on annual reports, a vast majority of falling objects occurred more than approximately 200 mi (321.9 km) from shore. Only less than approximately 2% of falling objects occurred in the nearshore area. In the Zone 2 area excluding the nearshore area, sea turtle densities are low; the highest monthly mean density was 0.067 loggerhead sea turtles per km^2.

Based on the differing densities and areas where falling objects have occurred in the past, we analyze three exposure scenarios: 1) for marine mammals, using the highest monthly mean density of 0.0068 perm whales per km^2 and the maximum number of operations that may occur in the Zone 2 area; 2) for nearshore sea turtles, using the highest monthly mean density of 1.553 loggerhead sea turtles per km^2 and approximately 2% of the maximum number of operations that may occur in the Zone 2 area; and 3) for offshore sea turtles, using the highest monthly mean density of 0.067 loggerhead sea turtles per km^2 and the maximum number of operations that may occur in the Zone 2 area. All other species densities were lower than the densities for sperm whales and loggerhead sea turtles.

Under this programmatic, the largest object that could land in this area is a launch vehicle. Under the launch vehicle envelope specifications, a launch vehicle may be up to 450 ft (137.2 m) in length and 23 ft (7 m) in diameter. Thus, we estimate that the largest object that could land in this area is approximately 186,963.87 ft^2 or 17,369.5 m^2 (0.0173695 km^2). The number of times a launch vehicle may fall and land in the Atlantic Zone 2 is 601 times per year; however, based on annual reports, a majority (approximately 90%) of launches use Falcon 9 which is reusable and lands on a droneship or barge. As previously mentioned, Falcon has a failure rate of approximately 1%. Therefore, the number of times a launch vehicle is likely to fall and land in the water is approximately 65 times per year. The number of animals that could be exposed to a direct impact from a falling launch vehicle can be estimated by multiplying the area of the object, by the highest monthly mean species density (as a proxy for all species considered in this consultation), by the number of times the object may fall into the ocean. Using the highest monthly mean species density (loggerhead sea turtles), largest object, and the number of operations, the maximum number of species exposures per year is 0.076 (Table 6).

Spacecraft and fairings are also expected to fall and land in this area. Using the same method of analysis in other Zone 2 areas, we can estimate species exposure to a direct hit by a landing spacecraft and fairings. There may be up to 10 spacecraft landings and 1,200 fairing halves landings in the Atlantic Zone 2 per year. A reentry vehicle (spacecraft) under this programmatic is estimated to be approximately 5,301.43 ft^2 or 492.52 m^2 (0.0004925 km^2). Thus, exposure to a direct impact from spacecraft landings can be calculated as the product of the species density, area of a reentry vehicle, and 10 landings per year. This results in a maximum species exposure of 0.0003 (Table 6). The size of a single fairing half under this programmatic is 75 ft (22.9 m) in length and 30 ft (9.1 m) in diameter. The area of a single fairing half is thus estimated to be approximately 2,250 ft^2 or 209.03 m^2 (0.000209 km^2). Thus, exposure to a direct impact from a fairing can be calculated as the product of the species density, area of a fairing, and 1,200 fairing landings per year. This results in a maximum species exposure of 0.017 (Table 6).

Table 6. Estimated maximum species exposure to falling objects, using mean estimated densities of the most common marine mammals and sea turtles in Atlantic Zone 2

	Marine Mammals	Sea Turtles – Offshore	Sea Turtles – Nearshore
Density (animals/ km^2)	0.0068	0.067	1.553
Launch Vehicle Area (km^2)	0.01737	0.01737	0.01737
Reentry vehicle area (km^2)	0.00049	0.00049	0.00049
Fairing half area (km^2)	0.00021	0.00021	0.00021
Number of launch vehicle landings	60	60	1*
Number of reentry vehicle landings	10	10	1*
Number of fairing half landings	1,200	1,200	24
Estimated Exposure – Launch Vehicle	0.0071	0.076	0.035
Estimated Exposure – Reentry Vehicle	0.00003	0.0003	0.0002
Estimated Exposure – Fairings	0.0017	0.017	0.0078

km^2 = square kilometers
* Rounded to largest whole number

Density data for hawksbill sea turtles and protected fishes were not available; however, it is expected that those densities will be lower than that for sperm whales and loggerhead sea turtles because Zone 2 does not include aggregation or spawning areas. Additionally, because fishes are able to detect particle motion and are highly mobile, listed fishes are likely able to detect an object landing in the water and evade the oncoming object. Other components, debris, and radiosondes that may land in this area will be smaller than a launch vehicle and therefore would result in an even smaller number of species exposures. Additionally, based on six years of annual reporting from the action agencies, nearly 95% of falling objects occurred at least 80 mi (128.7 km) from shore, where species densities are lower than as described above for sperm whales and loggerhead sea turtles. Therefore, the likelihood that an ESA-listed species will be in the exact location at the exact time that an object falls and lands in the Atlantic Zone 2 is extremely unlikely, and thus, the effects are discountable.

Atlantic – Zone 3b

In Zone 3b, which encompasses the Southeastern unit of North Atlantic right whale critical habitat, space launch and reentry operations are limited to vessel transit only from November 1–April 30. This seasonal restriction reduces potential adverse effects to North Atlantic right whales during their calving season (81 Fed. Reg. 4838). Thus, except for North Atlantic right whales, the effects analysis is similar to that of the Zone 2 Atlantic area. Regarding North Atlantic right whales, due to the seasonal restriction on operations, it is extremely unlikely that an object will strike a North Atlantic right whale. Thus, the effects are discountable.

Atlantic – Zone 3c

In Zone 3c, which encompasses the Northeastern unit of North Atlantic right whale critical habitat and the Gulf of Maine and Georges Bank IMMA, space launch and reentry operations are limited to vessel transit only from January 1–July 31. This seasonal restriction reduces potential adverse effects to North Atlantic right whales that aggregate in this area to forage (81 Fed. Reg. 4838). Thus, except for North Atlantic right whales, the effects analysis is similar to that of the Zone 2 Atlantic area. Regarding North Atlantic right whales, due to the seasonal restriction on operations, it is extremely unlikely that an object will strike a North Atlantic right whale. Thus, the effects are discountable.

Atlantic – Zone 5a

In Zone 5a, which encompasses the loggerhead sea turtle Northwest Atlantic Ocean DPS critical habitat – specifically, winter critical habitat – space launch and reentry operations are limited so that no stages, components, or debris will be expended November 1–April 30. This seasonal restriction reduces potential adverse effects to juvenile and adult loggerhead sea turtles that aggregate in this warm-water area over the winter months (79 Fed. Reg. 39856). Thus, except for Northwest Atlantic Ocean DPS loggerhead sea turtles, the effects analysis is similar to that of the Zone 2 Atlantic area. Regarding Northwest Atlantic Ocean DPS loggerhead sea turtles, due to the seasonal restriction on operations, it is extremely unlikely that an object will strike a Northwest Atlantic Ocean DPS loggerhead sea turtle. Thus, the effects are discountable.

Atlantic – Zone 5b

In Zone 5b, which encompasses the loggerhead sea turtle Northwest Atlantic Ocean DPS critical habitat – specifically, breeding critical habitat – space launch and reentry operations are limited so that no stages, components, or debris will be expended April 1–November 30. This seasonal restriction reduces potential adverse effects to male and female adult loggerhead sea turtles that occur in high densities in this area during the breeding season (79 Fed. Reg. 39856). Thus, except for Northwest Atlantic Ocean DPS loggerhead sea turtles, the effects analysis is similar to that of the Zone 2 Atlantic area. Regarding Northwest Atlantic Ocean DPS loggerhead sea turtles, due to the seasonal restriction on operations, it is extremely unlikely that an object will strike a Northwest Atlantic Ocean DPS loggerhead sea turtle. Thus, the effects are discountable.

Bahamas/Caribbean

Based on annual reports, operations that have occurred in the Bahamas include expended skirt rings and fairing/parachute recoveries. As part of this reinitiation, skirt rings will no longer be expended in the Bahamas/Caribbean portion of the action area (see Area-specific PDCs). Only booster landings on a droneship and fairing recoveries (fairing recoveries only in the Exuma Sound) will occur in the Bahamas/Caribbean portion of the action area. It is extremely unlikely that ESA-listed species will be directly struck by a fairing landing in the Exuma Sound. For an ESA-listed species to be directly struck by a fairing landing, they would have to occur at the same time and same place as the fairing, which is unlikely. Only 20 missions may occur in the Exuma Sound, making that likelihood even less. The Exuma Sound is characterized by steep drops past the continental shelf to depths of approximately 5,250–6,562 ft (1,600–2,000 m).

ESA-listed corals inhabit shallow waters and would not be exposed to falling fairings as all recovery operations will occur in deep waters. Given the limited number of times fairings may land in the Exuma Sound, the likelihood of a direct impact on ESA-listed species is extremely unlikely, and thus, the effects are discountable.

Summary

It is extremely unlikely that ESA-listed marine mammals, sea turtles, fishes, corals, and the chambered nautilus will be directly struck by falling objects. Throughout the action area, other ESA-listed benthic invertebrates (black abalone, queen conch, white abalone, and the proposed sunflower sea star) may be exposed to a direct impact from an object sinking through the water column. However, as part of the proposed action, PDCs exclude any stages, components, or debris from landing, hitting the water, and sinking within these species' ranges. The National Institute of Water and Atmospheric Research Ltd (2017) came to a similar conclusion of the effects of a direct strike from space launches causing species mortality off New Zealand. Though they estimated that the likelihood of debris in the marine environment was high, they estimated that the consequence of a direct strike was negligible, and thus overall risk was very low. Additionally, ESA-listed species spend a majority, if not all, of their time underwater. A direct strike would only occur if an animal were at or near the surface. Therefore, the potential for effects to ESA-listed species from a direct impact by falling objects is discountable, and we conclude that direct impacts from fallen objects to ESA-listed species in the action area, because of activities covered under this programmatic, may affect, but are not likely to adversely affect ESA-listed species.

Entanglement

Space launch and reentry operations such as the deployment of weather balloons, spacecraft recovery, and fairing recovery may result in entanglement of ESA-listed species in the parachutes, parafoils, and attached suspension lines, particularly if the launch operator does not recover them. Launch operators typically try to recover these components particularly when part of recovery operations, though it may be limited (see below). Entanglement can impact a marine animal by limiting its ability to move through the water and can affect feeding, reproduction, migration, or predation escape (Laist 1997). Animals with gear entangled tightly around a body part may cut into tissues, enable infection, and severely compromise an individual's health, and may even lead to death.

Drogue and pilot parachutes are the smallest and are cut away at altitude, separating from the spacecraft or fairing well before the point of splashdown (i.e., much further from shore) and thus are less likely to be recovered than the main 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 1975). 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 (304.8 m) in 46 minutes (or approximately 22 ft [6.7 m] per minute), 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).

Based on annual reports, approximately 12% of drogue parachutes were recovered. Fairing recovery has generally occurred approximately 200 mi (321.9 km) offshore, thus drogue parachutes are expected to land even further offshore and settle in waters more than 9,800 ft (3,000 m) deep. Species densities are low (near zero for a majority of species for which there is density data) that far offshore and none of the ESA-listed species considered in this programmatic forage that deep. Therefore, they are not expected to encounter drogue or pilot parachutes.

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 (304.8 m) in 145.5 minutes (or approximately 7 ft [2.1 m] per minute). 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. Based on annual reports, the main parachutes and parafoils were less likely to be recovered when recovery operations first began. However, as operations continued to improve, recovery was more likely. For example, 40% of main parachutes and 45% of parafoils were recovered between 2018 and 2024. But in 2025, approximately 87.5% of main parachutes were recovered. Fairing recovery (parafoil) has generally occurred approximately 200 mi (321.9 km) offshore, where species densities are expected to be low. Dragon landings (main parachutes) will occur approximately 15.5 mi (25 km) off San Diego and northern Los Angeles, California. The future planned capsule (main parachutes) will initially land hundreds of miles offshore and land closer to shore following successful missions. Once fully operational, it will land at least 13.8 mi (22.2 km) from shore off the west coast of North America. As mentioned previously, Dragon parachutes have been recovered a majority of the time and are expected to sink within hours.

Daniel et al. (2023) observed two Kemp's ridley turtles entangled and deceased in weather balloon equipment off Virginia. For context, an average of 60 Kemp's ridley turtles stranded per year in Virginia from 2012–2021. Approximately 67,000 weather balloons are released each year in the U.S. by the National Weather Service compared to a maximum of approximately 17,500 released each year under this programmatic – if each launch used the maximum number of weather balloons. Weather balloons released as part of the programmatic action, and weather balloons released by the National Weather Service are not recovered.

Considering that in areas of high species density, there is a relatively low occurrence of unrecovered weather balloons, parachutes, and parafoils, and that unrecovered components spend limited time in the water column before settling in deep water, exposure of ESA-listed mammals, sea turtles, fishes, or invertebrates to unrecovered weather balloons, parachutes, and parafoils is extremely unlikely. Therefore, the effects to ESA-listed species from entanglement are discountable, and we conclude that the effects of entanglement on ESA-listed species in the action area, because of activities covered under this programmatic, may affect, but are not likely to adversely affect ESA-listed species.

Unrecovered Debris

Unrecovered debris from expended stages, components, weather balloons, radiosondes, and debris may affect ESA-listed species. Unrecovered debris may be ingested by ESA-listed species foraging in the action area. Nearly all ingested debris is plastic (Alzugaray et al. 2020; de Carvalho et al. 2015; Im et al. 2020; Jacobsen et al. 2010; Rodríguez et al. 2022; Rosel et al. 2021; Schuyler et al. 2014; Werth et al. 2024; Wilcox et al. 2018). In a recent global review on ingested marine debris, a majority of mortalities in marine mammals were caused by ingestion of film-like plastic (e.g., plastic bags), plastic fragments (hardness not specified), rope/nets, and fishing debris (Roman et al. 2021). For sea turtles, a majority of mortalities were caused by ingestion of hard plastic, film-like plastic, and fishing debris (Roman et al. 2021). Plastics are also the main type of debris ingested by fishes (Cliff et al. 2002; Germanov et al. 2018).

Based on more detailed information from the Reinitiation of the Conference and Biological Opinion on SpaceX Starship-Super Heavy Operations in the North Atlantic Ocean, Gulf of Mexico (non-U.S. waters), Gulf of America, North Pacific Ocean, South Pacific Ocean, and Indian Ocean Authorized by the Federal Aviation Administration (OPR-2025-02468; NMFS 2025), a majority of debris from expended stages and components (such as fairings) is expected to be stainless steel, composite materials, or other similar metallic materials that will sink immediately due to their density and weight, if not recovered. In 2024, 94% of fairings were recovered in the Atlantic and Pacific Oceans. Debris that may float, such as plastic, is either likely to be contained within the stage or component if it is expended intact, or likely to be incinerated by heat generated during the breakup of a stage or component during reentry. It is difficult to assess the impacts of unrecovered debris on ESA-listed species in a robust way because a majority of expended stages, components, and debris are expended far offshore. Additionally, as mentioned by the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), the impact of space debris is uncertain and there is no information on its final fate in the marine environment (GESAMP 2021). Because of the emerging and rapidly expanding industry, it is difficult to predict exactly what materials would survive to the ocean surface and where they will end up, both across the ocean and within the water column. However, based on the aforementioned studies on debris ingestion, it appears unlikely that ESA-listed species would ingest unrecovered debris.

Latex weather balloons undergo "brittle fracture" at altitude, where the rubber shatters along grain boundaries of crystallized segments and the balloon bursts. The resultant pieces of rubber are small strands comparable to the size of a quarter (Burchette 1989b; Cullis et al. 2017). This was confirmed by researchers at the University of Colorado and NOAA (Cullis et al. 2017). As these small strands descend through the air and back to the ocean, their distribution is influenced by changes in atmospheric pressure and wind, which disperses the strands before they land on the surface of the ocean where they are further dispersed due to surface currents and wind. These latex fragments float on the surface of the water and start to degrade over months from UV exposure and weathering (Andrady 1990; Irwin 2012; Pegram and Andrady 1989), eventually sinking due to the weight from biofouling (Burchette 1989a; Foley 1990; Lobelle and Cunliffe 2011; Thompson et al. 2004; Ye and Andrady 1991). Burchette (1989a) observed significant degradation of balloon samples after six weeks of exposure. The degree to which such biofouling 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).

Out of 12 categories of ingested marine debris, balloons/latex were one of the least common types of ingested debris, and were recorded in fewer than 10 sea turtles compared to the largest category, film-like plastic, which was recorded in over 300 sea turtles (Roman et al. 2021). Given the small balloon shreds from the use of weather balloons as part of the proposed action are likely to be scattered and not concentrated, and they should only be present in the upper portions of the water column on the order of weeks, the potential for exposure of ESA-listed species to these shreds, and thus the likelihood of their ingestion, is extremely low.

Parachutes and parafoils will also sink to the seafloor, typically 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. There are benthic ESA-listed species, but as previously discussed, recovery operations involving parachutes and parafoils typically have occurred approximately 200 mi (321.9 km) from shore and those that are not recovered are expected to settle in waters more than 9,800 ft (3,000 m) deep. None of the ESA-listed species considered in this programmatic forage that deep. The National Institute of Water and Atmospheric Research Ltd (2017) came to a similar conclusion for species off New Zealand, determining that the risk of ingestion of debris was very low. Therefore, the likelihood of them encountering ingestible material once it has settled over the long-term is expected to be extremely unlikely to occur.

Therefore, the potential for effects to ESA-listed species from unrecovered debris is discountable, and we conclude that effects from unrecovered debris to ESA-listed species in the action area, because of activities covered under this programmatic, may affect, but are not likely to adversely affect, ESA-listed species.

Pollution

Pollution from vessels, propellant from expended stages, and launch and reentry emissions may affect ESA-listed species. This includes in-air and in-water pollution.

In-air pollutants include those emitted by vessels used during pre-launch surveillance or recovery operations (carbon dioxide, nitrogen oxides, sulfur oxides), emissions from launches (including nitrogen oxides, carbon dioxide, vaporized metal particles such as alumina and black carbon), and propellant from vehicle launch failures.

ESA-listed species that occur near launch sites will be more exposed to this stressor than other species. Although vessels and launches will occur in areas where ESA-listed species are expected to occur in higher numbers or densities (e.g., close to shore, critical habitat), it is unlikely that pollutants in the air would have a measurable impact on air-breathing ESA-listed marine mammals or sea turtles given the relatively small amount of pollutants especially compared to global emissions, dispersion of pollutants in the air, and the brief amount of time that marine mammals and sea turtles spend at the water's surface to breathe.

Recently, scientists have studied how rocket launch emissions and particles associated with rocket launches and reentries can lead to ozone depletion and cause detrimental effects to climate and ecosystems (Dallas et al. 2020; Ferreira et al. 2024; Kokkinakis and Drikakis 2022; Maloney et al. 2022; Murphy et al. 2023; Ross et al. 2004; Ryan et al. 2022). This may affect ESA-listed species because climate can drive range and distribution shifts in ESA-listed species and their prey (Record et al. 2019). Monitoring from the NASA Space Shuttle Program also documented particulates and exhaust from solid rocket boosters in the environment post-launch (Hall et al. 2014). Hawkins et al. (1984) documented changes in pH in lagoons near the launch site that were exposed to the exhaust plume, which the authors hypothesized led to some mortality of small fishes. However, they also conclude that the cause of death was unclear and that some fish recovered after exposure. We currently do not have sufficient information on the magnitude of activities that will occur to determine whether effects to ESA-listed species will be more than insignificant. At present, it is reasonable to conclude that the emissions emitted by space launch and reentry operations covered under this programmatic are a minute fraction of the global level of emissions, and effects to ESA-listed species are not measurable.

In the event of a launch failure, propellant may be released into the air. 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 failures, a majority of the propellant will be consumed by the failure (i.e., consumed by the ensuing explosion). and will not be prevalent or pervasive enough in the atmosphere to have a measurable impact on air-breathing ESA-listed marine mammals and sea turtles.

In-water pollutants include those emitted by vessels such as fuel or oil leaks and spills, and propellant from expended vehicles.

A fuel or oil leak would likely pose a risk to the vessel and its crew, and actions to correct a leak would occur immediately to the fullest extent possible. There are no reports of a fuel or oil spill over many years of vessel surveillance and recovery activities related to space launch and reentry vessel operations. In the unlikely event that a leak should occur, the amount of fuel or oil onboard a given vessel is not expected to cause widespread, high-dose contamination (given dispersion by surface currents and wind) that would impact ESA-listed species.

Residual propellant, including hypergolic fuels, may remain on launch vehicles and stages that land or are expended in the ocean. Launch vehicles and reentry vehicles are generally designed to retain propellant. However, if residual propellant ends up in the ocean, it is expected to evaporate/burn (if vented to the air, or if there is a launch failure or explosive event), transform into a much less toxic substance (through chemical reactions with air or water), or be dispersed relatively quickly due to surface currents and ocean mixing.

It is unlikely that residual propellant will contribute measurably to the overall pollutant levels in the action area. Given that a majority (approximately 90%) of space launch and reentry operations use Falcon 9, which is reusable and lands on a droneship or barge, only a small fraction of space launch and reentry operations will result in a stage being expended and residual propellant reaching the ocean. The National Institute of Water and Atmospheric Research Ltd (2017) came to a similar conclusion for species off New Zealand, determining that the risk of exposure to toxic contaminants was very low. Other studies have documented or modeled the occurrence of pollutants such as heavy metals (mercury, aluminum, zinc, arsenic, lead, etc.) and hydrocarbons from space launch and reentry operations in the marine environment (Ayassamy 2025; Fourie et al. 2019; Lonsdale and Phillips 2021). Only one study has documented trace elements in a species (the American alligator [*Alligator missisippiensis*] at the Merritt Island National Wildlife Refuge near Cape Canaveral, Florida), though it is still unclear the exact impacts of those elements and whether those elements are directly caused by nearby space activities (Horai et al. 2014). Thus, at this time, the effects of pollution from space launch and reentry operations on ESA-listed species are not measurable.

Therefore, the potential for effects to ESA-listed species from pollution is insignificant, and we conclude that effects from pollution to ESA-listed species in the action area, because of activities covered under this programmatic, may affect, but are not likely to adversely affect, ESA-listed species.

In-Air Sound

ESA-listed species that surface to breathe (marine mammals and sea turtles) may be exposed to in-air sound from launch and reentry operations involving aircraft, sonic booms, stage landings, explosive events, and launch operations. To be exposed to this stressor, ESA-listed marine mammals and sea turtles would have to be in the exact same place at the exact same time that the activity occurs. ESA-listed marine mammals and sea turtles spend very little time at the surface, and generally only spend a few seconds to breathe before diving back underwater. Sonic booms, stage landings, and explosive events may occur across a broad area. Species densities in a vast majority of these areas are low and given the large areas over which ESA-listed species can be distributed, it is extremely unlikely that an ESA-listed species will occur at the surface at the exact time and place as a sonic boom, stage landing, or explosive event. Thus, the effects are discountable.

ESA-listed species that occur in close proximity to launch sites, particularly CCSFS and KSC where nearly all space launches have occurred in the past couple of years, will be exposed to in-air sound from launch operations (e.g., the launch itself but also static fire tests and other pre-launch safety checks) more than other species. Based on density, the species that will be most exposed to in-air launch noise would be the North Atlantic DPS of green turtle and Northwest Atlantic Ocean DPS of loggerhead sea turtle. The Kemp's ridley turtle and leatherback turtle may be exposed but to a lesser degree, and it is unlikely that North Atlantic right whales would be exposed. At present, our knowledge of the potential effects of launch noise on sea turtles is limited. Though the amount of time that sea turtles spend at the surface is short and it is unlikely that a sea turtle would surface at the same time as a launch, given the increase in launches, it is reasonable to conclude that at some point in the future, sea turtles will be exposed to in-air sound from launches. Hauled-out pinnipeds may be present around VSFB. Monitoring of launch impacts has occurred at VSFB for many years due to MMPA Letter of Authorization (LoA) requirements for VSFB (e.g., USSF 2026). Monitoring does not occur for all activities, nor does it occur for every launch. However, in accordance with the LoA, USSF must conduct marine mammal monitoring and acoustic measurements 1) for all new rockets, 2) for rockets (existing and new) launched from new facilities, 3) for larger or louder rockets than those that have been previously launched from VSFB during their first three launches, and 4) for the first three launches from any new facilities during March through July. Observed behavioral reactions during that monitoring of launches included alerting and flushing, with no documented instances of prolonged or severe disturbance, injury, or mortality. Thus, available information on potential effects at this time indicates that the effects would not be more than insignificant.

We conclude that in-air sound effects to ESA-listed species in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect, ESA-listed species.

Impulsive Underwater Sound

During space launch and reentry operations, impulsive sounds such as sonic booms, stage/component/debris landings, and explosive events may affect ESA-listed species underwater.

During space launch and reentry operations, sonic booms of up to 50 pounds per square foot (psf) may be generated. An overpressure of 1 psf is similar to a thunderclap. Boom intensity, in terms of psf, is greatest under the flight path and progressively weakens with horizontal distance away from the flight path. Acoustic energy in the air does not effectively cross the air-water boundary and most of the sound energy is reflected off the water's surface (Richardson et al. 1995). Previous research conducted by the U.S. Air Force Research Laboratory (2000) determined that a peak pressure of 12 pounds per square inch (psi) in the water would be needed to meet the outdated 182 decibels (dB) referenced (re) to the standard unit of acoustic pressure underwater, 1 micro Pascal (μPa), threshold for marine mammal and sea turtle adverse effects. Current thresholds utilized by NMFS (FHWG 2008; NMFS 2024; U.S. Department of the Navy 2024a) for the onset of behavioral disturbance from impulsive sound sources (in water) are lower than the outdated 182 dB: 175 dB for sea turtles, 160 dB for marine mammals, and 150 dB for fishes. It is important to note that these current thresholds are root mean square (rms) values and not peak pressure values. The rms value is the square root of the average of the square of the sound signal pressure over a given duration. Due to the squaring and averaging of sound pressure values (which tends to level out large values), the rms value generally results in a lower value than the peak value. However, to produce even 12 psi in water, a surface (i.e., at the ocean surface) pressure of approximately 900 psf is needed.

Rather than responding primarily to sound pressure, fish and invertebrates mainly detect particle motion and can sense local water movements (Solé et al. 2023). This detection is limited, as particle motion diminishes rapidly with distance from the sound source, making the impact of noise on fish and invertebrates likely less than the impact on marine mammals and sea turtles.

Thus, it would take a much greater sonic boom than will be generated by the vehicles under this programmatic to create an acoustic impact underwater that could cause a measurable response in ESA-listed species exposed to the sonic booms, and thus the effects are insignificant.

Impulse noise from vehicle launches and landings may affect ESA-listed species' hearing underwater. Noise from a launch is unlikely to effectively cross the air-water boundary, as previously discussed. The likelihood that an animal occurs at the same time and place as a stage landing, and would be exposed to sound generated by the landing, is expected to be extremely unlikely given relatively low species densities, large areas over which vehicles may land or be expended, and the short duration (only a few seconds) of landings. Ribeiro Guimaraes Dombroski (2023) detected airborne sounds (such as commercial airplanes and emergency vehicle sirens) underwater on tagged manatees. However, the manatees did not exhibit any behavioral changes to the sounds and they occurred in much shallower and protected waters than where ESA-listed species under NMFS's jurisdiction are expected to occur (i.e., the airborne sounds are likely only detected at the surface of the water; J. Dombroski, RWSC, pers. comm. to E. Chou, NMFS, December 10, 2025). Therefore, any effect from vehicle launches and landings on ESA-listed species while underwater would be immeasurable or extremely unlikely, respectively, and therefore the effects are insignificant or discountable, respectively.

ESA-listed species may also be affected by the underwater sound from explosive events. Explosive events under this programmatic may occur only under the following conditions: 1) explosive events will occur, at minimum, 11 ft (3.4 m) above the surface of the ocean; 2) the explosive weight (calculated from the amount of remaining propellant and its explosive yield) will not exceed 55,800 kilograms (123,018 lbs); and 3) explosive events will only occur in the Atlantic portion of the action area at least 100 mi (160.9 km) from any major land mass (see Figure 5).

To estimate exposure of ESA-listed species to underwater sound from explosive events, we reviewed and adopted FAA's calculations of the ensonified area (area filled with sound from an explosive event) within which species could respond to the sound. The ensonified area within which species could respond was determined by the bounding (largest) explosive event and NMFS's acoustic thresholds (Table 7).

Table 7. NMFS acoustic thresholds and resulting underwater ensonified area from first stage testing explosive events

Hearing/Species Group	Minimum Threshold to a Response* (dB re 1 µPa)	Ensonified Area (km^2) per Explosive Event
Low-frequency cetacean (blue whale, fin whale, North Atlantic right whale, sei whale)	216	1.923
High-frequency cetacean (sperm whale)	224	0.305
Sea turtle (green turtle, Kemp's ridley turtle, leatherback turtle, loggerhead sea turtle)	224	0.305
Fish ≥ 2g (giant manta ray, oceanic whitetip shark, scalloped hammerhead shark)	206	19.225

dB re 1 µPa = Decibels referenced to a pressure of one microPascal; km^2 = square kilometers; g = grams
* Note peak sound pressure level thresholds are used

Marine mammal and sea turtle (blue, fin, North Atlantic right, sei, and sperm whales; green, Kemp's ridley, leatherback, and loggerhead sea turtles) densities are near zero 100 mi (160.9 km) from shore where explosive events may occur (Roberts et al. 2023; Roberts et al. 2016; Roberts et al. 2024; DiMatteo et al. 2024). The highest monthly mean species density in the explosive events area (see Figure 5) was 0.007 sperm whales per km^2, other marine mammal and sea turtle densities are magnitudes lower than those for sperm whales. Given the relatively small ensonified areas within which measurable responses could be expected, it is extremely unlikely that ESA-listed marine mammals and sea turtles (blue, fin, North Atlantic right, sei, and sperm whales; green, Kemp's ridley, leatherback, and loggerhead sea turtles) will be exposed to underwater acoustic effects from explosive events. Densities for other ESA-listed species including other sea turtles (hawksbill turtle), fishes, and invertebrates are not expected to be higher than the densities described above. This is because the areas where explosive events can occur are far offshore and do not include where these species aggregate. Therefore, it is extremely unlikely that these species will be exposed to underwater acoustic effects from explosive events, and the effects are discountable.

We conclude that effects to ESA-listed species in the action area from impulsive underwater sound because of activities covered under this programmatic may affect, but are not likely to adversely affect, ESA-listed species.

Noise and Visual Disturbance

Aircraft overflights, vessels, and stages/components/debris expended from space launch and reentry operations will have sounds associated with their activity (see also In-Air Sound and Impulsive Underwater Sound). There could also be a visual stimulus from aircraft, vessels, and falling objects that could potentially lead to a change in behavior. Visual disturbance and noise can co-occur, making it difficult to discern which stimulus causes a reaction or whether the reaction is to the combined stimuli. Similar to noise, the visual stimulus impacts would be transient and only occur if an individual is surfacing or very close to the surface at the same time an aircraft happens to be flying over, a vessel is transiting, or an expended object is descending, within a detectable distance.

Cetacean (sperm whales and bowhead whales) studies observed that a few individuals may dive in response to fixed wing aircraft overflights, and some individuals may delay vocalizations, surface for shorter periods, breach, or tail slap (Patenaude et al. 2002b; Richter et al. 2003a; Smultea et al. 2008b; Würsig et al. 1998). These responses mostly occurred when the aircraft was below an altitude of approximately 820.2 ft (250 m), which is lower than the altitude at which aircraft will be operating during proposed activities under this programmatic (1,000 ft, or 304.8 m).

Species-specific studies on the reaction of sea turtles to fixed-wing aircraft overflights are lacking. 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. (2007a) 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 underwater (Lutcavage and Lutz 2017) and the low frequency and short duration of surveillance flights, the probability of exposing an individual to a visually-induced stressor from aircraft momentarily flying overhead would be very low. The same is relevant for ESA-listed fishes in the action area, considering their limited time near the surface and brief aircraft overflight.

As stated in the PDCs, aircraft will maintain a minimum of 1,000 ft (304.8 m) over ESA-listed or MMPA-protected species and 1,500 ft (457.2 m) 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. Thus, the chances of an individual ESA-listed species being exposed to the proposed aircraft overflights are extremely low.

Studies have observed changes in the behavior of marine mammals, sea turtles, and fishes to vessel noise (Hazel et al. 2007b; Holt et al. 2009; Luksenburg and Parsons 2009; Noren et al. 2009; Patenaude et al. 2002a; Richter et al. 2003b; Smultea et al. 2008a). Vessel noise will not exceed that of larger commercial shipping vessels and will only be temporary (only used for pre-launch surveillance and post-launch recovery) compared to the more persistent presence of commercial vessels. Additionally, while not specifically designed to do so, several aspects of the PDCs will minimize effects associated with vessel acoustic disturbance to ESA-listed species (e.g., maintaining separation distances from protected species, slowing to 10 knots or less around certain species and in specific areas; see Project Design Criteria). Similar to noise, visual stimulus impacts would be transient and even less likely to be perceived than sound as light does not travel as well underwater. Given the PDCs and the relatively small contribution of the vessels associated with the proposed action to the overall vessel activity in the action area, effects from vessel presence (visual or acoustic) are expected to be so minor that they cannot be meaningfully evaluated.

After an expended stage, components, or debris has descended and hit the surface of the water (associated acoustic impact discussed in Impulsive Underwater Sound), it begins to sink through the water column. Because the object is sinking through the water column (i.e., underwater), there may be greater opportunities for the object to been seen by an ESA-listed species as opposed to in the atmosphere. If the object is visually detected by an ESA-listed species it could result in a behavioral response, such as leaving the vicinity. Marine animals may avoid areas with disturbing stimuli (visual presence, noise), such as from marine energy devices (Hemery et al. 2024). The sinking expended object may incite temporary avoidance but once it has sunk or sunk past the detection range of the animal, the animal may reoccupy that area of water column, resulting in only a brief minor disruption. As previously discussed (in Direct Impact by Falling Objects), exposure to objects expended during space launch and reentry operations is extremely unlikely considering vast areas where they return to earth and the low densities of ESA-listed species in those areas.

Given the limited and temporary behavioral responses to similar stimuli documented in available research, we expect that potential effects on ESA-listed species, should they occur, would be insignificant. We conclude that visual and acoustic effects to ESA-listed species in the action area from aircraft overflight, vessel transit, and expended objects covered under this programmatic may affect, but are not likely to adversely affect, ESA-listed species.

Vessel Strike

ESA-listed species may be exposed to vessels associated with launch and reentry operations in all portions of the action area (except the Indian Ocean, South Pacific Ocean, South Atlantic Ocean, and Southern Ocean). A vessel strike could result in injury or mortality. The duration of vessel operations is temporary (for example, with SpaceX's Starship-Super Heavy, vessel operations last approximately five days for each launch with a recovery). Vessel operations only apply to pre-launch surveillance and post-launch recovery (i.e., vessels are not active continuously every day). The proposed action has a limited amount of vessel activity, especially compared to the amount of recreational and commercial vessel traffic across the action area.

The potential for a vessel striking an ESA-listed marine mammal, sea turtles, or fish is unlikely because the proposed action consists of limited vessel operations and the action area is extremely large. A vessel grounding in an area where ESA-listed corals, black abalone, white abalone, queen conch, or the proposed sunflower sea star occur would be extremely unlikely because there is no planned vessel activity in shallow nearshore or offshore reef areas. No vessel groundings have occurred during any previous vessel operations associated with space launch and reentry operations.

Sturgeon may be exposed to vessel strikes when vessels are departing or returning to ports that are located where sturgeon are present. Ports that have been used or are planned to be used including Piney Point, Maryland, Port of Baltimore, Maryland, Port of Hampton Roads, Virginia, and Port of Norfolk, Virginia, occur where migratory and foraging Atlantic and shortnose sturgeon may be present. It is unlikely that sturgeon would be struck by vessels because they are generally bottom-dwelling, though they swim at various depths and may occur near the surface during migrations or spawning movements (Balazik et al. 2012a; Balazik et al. 2012b). The draft of the vessels that would be used would not approach the depth of the channels and ports used. Sturgeon tend to occur in the bottom 3 ft (1 m) of the channel or port; thus, it is unlikely that sturgeon will be struck by vessels. Additionally, vessel activity is temporary and limited, further reducing the likelihood of a vessel strike.

The PDCs include several measures to avoid vessel strikes including the presence of dedicated observers on board to monitor for marine mammals and sea turtles, as well as adhering to minimum avoidance distances and speed restrictions when in proximity to certain ESA-listed species. Implementation of the PDCs reduces the potential risk for vessel strike making it extremely unlikely to occur.

Thus, effects to ESA-listed species from vessel strike are discountable. We conclude that impacts from vessel strike to ESA-listed species in the action area because of vessel activities covered under this programmatic may affect, but are not likely to adversely affect ESA-listed species.

Increased Sea Surface Temperature

Heat from stage landings (produced by engines during the landing burn), explosive events, or launches (heat plume) may affect ESA-listed species that spend time at the surface of the ocean (marine mammals, sea turtles, fishes, and chambered nautilus). These activities may result in a temporary but significant increase in temperature at the surface of the ocean.

To be exposed to this stressor, ESA-listed species would have to be in the exact same place at the exact same time that a vehicle landing, launch, or explosive event occurs. As previously discussed, it is extremely unlikely that an ESA-listed species would occur at the exact same place and time as a vehicle landing or explosive event, the latter of which will only occur far from shore where species densities are low or near zero. Species that occur near launch sites (see In-Air Sound) have a greater chance of being exposed to heat plumes from launches than other species. Water has a significantly higher specific heat capacity (the amount of heat that needs to be added to one unit of mass of a substance to cause an increase of one unit in temperature) than air, meaning it takes much more energy to raise the temperature of water than to raise the temperature of air. Thus, we expect that ocean temperatures are not affected by launches as significantly as the surrounding air.

We are not aware of heat plume monitoring for any Falcon 9 launch, which is the most widely used launch vehicle. However, monitoring of heat plumes from SpaceX's Starship-Super Heavy launches observed temperatures of approximately 300°F (149°C) at the Boca Chica Launch Site, approximately 212°F (100°C) within a 0.3-mi (0.5-km) radius surrounding the launch site, and approximately 90°F (32°C; which is similar ambient temperature at some launch sites during certain months) within a 0.6-mi (1-km) radius surrounding the launch site (FAA 2024). Starship-Super Heavy is expected to have a much larger and more intense (in terms of degrees in temperature) heat plume than launch vehicles covered under this programmatic because the total thrust of Starship-Super Heavy is more than 2.5 times the total thrust of a launch vehicle under this programmatic. This results in a very small area that may be exposed to high temperatures.

Additionally, ESA-listed marine mammals, sea turtles, fishes, and chambered nautilus spend a majority of their time underwater compared to at or just above the surface (when breathing, in the case of marine mammals and sea turtles), and water temperatures below the surface are unlikely to be changed by the heat plume from launches. Thus, based on the limited information, we believe that species' exposure to heat plumes from launches is extremely unlikely and, thus, discountable.

We conclude that impacts to ESA-listed species in the action area from heat because of activities covered under this programmatic may affect, but are not likely to adversely affect, ESA-listed species.

Vibration

Vibration from launches may affect species near the launch sites, particularly CCSFS and KSC, where nearly all launches have occurred in the past couple of years. Based on density data mentioned previously, this includes the North Atlantic DPS of green turtle and Northwest Atlantic Ocean DPS of loggerhead sea turtle. The Kemp's ridley turtle and leatherback turtle may be exposed but to a lesser degree, and it is unlikely that North Atlantic right whales will be exposed. Smalltooth sawfish and Atlantic sturgeon may also be exposed to vibration from launches.

We are not aware of launch vibration monitoring for vehicles other than Starship-Super Heavy. During previous Starship-Super Heavy launches, vibration was observed from the launch site out to a radius of approximately 0.7 mi (1.1 km) from the launch site (FAA 2024). Though monitoring stations were only located on land, it was determined that a majority of the energy was distributed through the air and not the ground (FAA 2024). This information is limited because not all monitoring information is available, and, of the information that is available, monitoring only occurred for a handful of launches. Vibration from Starship-Super Heavy launches is expected to affect a much larger area than vibration from launch vehicles covered under this programmatic because the total thrust of Starship-Super Heavy is more than 2.5 times the total thrust of a launch vehicle under this programmatic. This results in a very small area that may be exposed to vibration.

In the event that those vibrations enter the marine environment, it is likely only to affect fishes such as smalltooth sawfish and Atlantic sturgeon because fish are especially able to detect particle motion. Thus, based on the limited information currently available, we conclude that effects to ESA-listed fishes from launch vibrations will be so small as to not be measurable and, thus, insignificant. Thus, impacts to ESA-listed species in the action area from vibration because of activities covered under this programmatic may affect, but are not likely to adversely affect, ESA-listed species.

Critical Habitat

Most of the proposed operations would occur well offshore in deep waters and avoid critical habitat areas (see zones identified in the Action Area section). PDCs associated with zones of the action area avoid or restrict activities in most critical habitat areas. In this section, we assess the potential effects of activities that may occur in designated or proposed critical habitat.

Temperature

Heat from stage landings (produced by engines during the landing burn), explosive events, or launches (heat plume) may cause a temporary increase in sea surface temperatures. PBFs of critical habitat occurring in the action area that may be affected by changes in temperature are listed in Table 8.

Table 8. Temperature-related PBFs of critical habitat in the action area that may be affected

Physical and Biological Feature	Associated Critical Habitat	Activities
Calving habitat: Sea surface temperatures from a minimum of 7°C, and never more than 17°C	North Atlantic Right Whale	Launches, landings (stage/barge)
Calving habitat: Water depths of 6–28 m, where the sea surface conditions and temperature features simultaneously co-occur over contiguous areas of at least 231 NM^2 of ocean waters during the months of November through April	North Atlantic Right Whale	Launches, landings (stage/barge)
Sargassum habitat: 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	Loggerhead Sea Turtle – Northwest Atlantic Ocean DPS	Launches, landings (stage/barge), explosive events
Winter habitat: Water temperatures above 10°C from November through April	Loggerhead Sea Turtle – Northwest Atlantic Ocean DPS	Landings (stage/barge)
Foraging habitat: Water temperatures to support loggerhead inhabitance, generally above 10°C	Loggerhead Sea Turtle – Northwest Atlantic Ocean DPS	Launches, landings (stage/barge), explosive events

Launch (i.e., ignition of the rocket's engines) can cause a temporary increase in temperatures near coastal launch sites (e.g., KSC, CCSFS). Heat continues to be emitted as the rocket gains altitude. Most of this heat dissipates in the atmosphere, while a fraction may be absorbed in the top layer of the ocean surface directly adjacent to the launch site. This temperature increase is expected to extend only into a very shallow layer at the surface in the first few seconds after launch and dissipate within seconds.

Return of stages, whether resulting in a controlled landing (i.e., there is a landing burn), barge landing, or explosive event, may also increase sea surface temperatures. The stage enters the atmosphere at hypersonic speeds, and the friction causes compression of air, producing heat. For stages that land in the ocean, the landing burn or physical impact of the stage hitting the water at high speed can create a brief, localized surge of heat at the surface. An explosive event would also result in a temporary but significant increase in temperatures at the surface of the ocean due to the burning of residual propellant. However, explosive events will not occur near any critical habitat.

As mentioned previously, water has a significantly higher specific heat capacity than air, so we expect that ocean temperatures are not affected by launches as significantly as the surrounding air. Heat added at the surface is anticipated to be localized to the area near the launch or landing location, and would be temporary. The likelihood of effects is also minimized through PDCs, such as no disposals (controlled landings) in Zone 5a, which overlaps Northwest Atlantic Ocean DPS loggerhead sea turtle winter critical habitat, November through April.

Thus, based on the limited information, the effect of temperature on critical habitats listed in Table 8 is expected to not be measurable and are insignificant. We conclude that impacts to designated critical habitats in the action area from heat because of activities covered under this programmatic may affect, but are not likely to adversely affect, designated critical habitat.

Benthic/Obstruction

Radiosondes, stages, fairings, and debris falling and landing in the action area have the potential to affect critical habitat. As described for effects to species, the action area where objects may land encompasses vast expanses of ocean, the vast majority of which is outside critical habitat. Therefore, debris is more likely to be expended outside critical habitat. For the fraction that are expended within critical habitat, expended components could crush or smother features of critical habitat, disturb substrate, and/or act as an obstruction if they are unrecovered.

Benthic impacts

Unrecovered debris (e.g., from disposals or expended boosters, fairings, spacecraft, debris, or radiosondes from weather balloons) that does not fully burn up on reentry or break up, may sink and can affect benthic habitat features (Table 9).

Table 9. Benthic habitat PBFs of critical habitat within the action area that may be affected

Physical and Biological Feature	Associated Critical Habitat	Activities
Benthic foraging/resting essential features: From the mean high water line to 20 m depth, underwater refugia and food resources (i.e., seagrasses, macroalgae, and/or invertebrates) of sufficient condition, distribution, diversity, abundance, and density necessary to support survival, development, growth, and/or reproduction	Green Sea Turtle – North Atlantic DPS (Proposed)	Landings (disposal and expended)

Only a small portion of the proposed North Atlantic DPS green turtle critical habitat benthic foraging/resting feature overlaps Zone 2 in the Gulf, where spacecraft reentry and debris may land and sink. Given the limited area of critical habitat that overlaps Zone 2, the effects of unrecovered debris on the benthic foraging/resting feature of North Atlantic DPS green turtle proposed critical habitat is expected to be so small as to not be measurable. Thus, effects to the North Atlantic DPS green turtle proposed critical habitat are insignificant.

Movement obstruction impacts

Unrecovered debris in the ocean may present barriers to movement and obstruct passage of ESA-listed species, impacting related critical habitat PBFs (Table 10).

Table 10. Migration, passage, movement, and access PBFs of critical habitat in the action area that may be affected

Physical and Biological Feature	Associated Critical Habitat	Activities
Migratory essential feature: From the mean high water line to 20 m depth, sufficiently unobstructed corridors that allow for unrestricted transit between foraging and nesting areas for reproductive individuals	Green Sea Turtle – North Atlantic DPS (Proposed)	Landings (disposal and expended)
Reproductive essential feature: From the mean high water line to 20 m depth, sufficiently dark and unobstructed nearshore waters adjacent to nesting beaches proposed as critical habitat by U.S. Fish and Wildlife Service, to allow for the transit, mating, and internesting of reproductive individuals and the transit of post-hatchlings	Green Sea Turtle – North Atlantic DPS (Proposed)	Landings (disposal and expended)
Constricted migratory habitat: Passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas	Loggerhead Sea Turtle – Northwest Atlantic Ocean DPS	Landings (disposal and expended)

Potential effects to these PBFs are minimized by the PDCs. For example, Zone 5, which encompasses Northwest Atlantic Ocean DPS loggerhead sea turtle constricted migratory critical habitat and proposed North Atlantic DPS green turtle reproductive and migratory critical habitat, will not have any disposals or expended stages, components, or debris. Thus, it is extremely unlikely that unrecovered debris will occur in the critical habitats listed in Table 10, and the effects are discountable.

We conclude that impacts to designated or proposed critical habitats in the action area from unrecovered debris because of activities covered under this programmatic may affect, but are not likely to adversely affect, designated or proposed critical habitat.

Noise

Rocket launches, landings, disposals/expenditures, and vessel and aircraft transits will introduce sound in the action area. These could have both in-air and underwater components and may affect critical habitat PBFs related to noise (Table 11).

Table 11. Noise-related PBFs of critical habitat in the action area that may be affected

Physical and Biological Feature	Associated Critical Habitat	Activities
Terrestrial, air, and aquatic areas that support reproduction, foraging, rest, and refuge	Steller Sea Lion – Western DPS	Launches, sonic booms, vessels, aircraft
Spawning Habitat. Marine sites used for spawning and adjacent waters that support movement and staging associated with spawning	Nassau Grouper	Barge landings, vessels, aircraft
Sufficiently quiet conditions for normal use and occupancy, including intraspecific communication, navigation, and detection of prey, predators, and other threats	Rice's Whale (Proposed)	Vessels, aircraft

Given the temporary nature and short duration that sonic booms, impulse noise, and vessel and aircraft noise will occur, in addition to the ineffective transmission of acoustic energy across the air-water boundary (for in-air sounds), the additional sound from these activities is not expected to measurably affect the long-term acoustic conditions of critical habitat. Thus, the effects of sound on the critical habitats listed in Table 11 are insignificant. We conclude that impacts to designated or proposed critical habitat in the action area from sound because of activities covered under this programmatic may affect, but are not likely to adversely affect, designated or proposed critical habitat.

Pollution

Pollutants discussed in regards to effects to species (e.g., from vessels including droneships, propellant from expended stages, launch and reentry emissions) may also affect PBFs of multiple species' critical habitats (Table 12).

Table 12. Pollution-related PBFs of critical habitat in the action area that may be affected

Physical and Biological Feature	Associated Critical Habitat	Actions
Terrestrial, air, and aquatic areas that support reproduction, foraging, rest, and refuge	Steller Sea Lion – Western DPS	Launches, vessels
Spawning Habitat. Marine sites used for spawning and adjacent waters that support movement and staging associated with spawning	Nassau Grouper	Barge landings, vessels

Physical and Biological Feature	Associated Critical Habitat	Actions
Sites that support the normal function of all life stages of the corals, including reproduction, recruitment, and maturation. These sites are natural, consolidated hard substrate or dead coral skeleton free of algae and sediment at the appropriate scale at the point of larval settlement or fragment reattachment, and the associated water column. Several attributes of these sites determine the quality of the area and influence the value of the associated feature to the conservation of the species, including: Marine water with levels of anthropogenically-introduced (from humans) chemical contaminants that do not preclude or inhibit any demographic function	Boulder Star Coral Lobed Star Coral Mountainous Star Coral Pillar Coral Rough Cactus Coral	Barge landings, vessels
Marine water with (i) elevated productivity, (ii) bottom temperatures of 10–19°C, and (iii) levels of pollutants that do not preclude or inhibit any demographic function	Rice's Whale (Proposed)	Vessels
Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels	Chinook Salmon – Puget Sound ESU Chum Salmon – Hood Canal Summer-Run ESU	Vessels
Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages	Gulf Sturgeon	Vessels
Suitable water quality. Suitable water quality includes temperature, salinity, pH, and other chemical characteristics necessary for normal settlement, growth, behavior, and viability of black abalone	Black Abalone	Vessels
The critical habitat designation did not precisely define PBFs; however, critical habitat was designated to provide protection	Green Sea Turtle – North Atlantic DPS	Vessels

Physical and Biological Feature	Associated Critical Habitat	Actions
for important developmental and resting habitats. Seagrass is the principal dietary component of juvenile and adult green sea turtles. Coral reefs and other topographic features within the waters surrounding Culebra provide shelter from predators. Nearby sandy beaches provide nesting grounds for adult females		
The critical habitat designation did not precisely define PBFs; however, important features of these areas for hawksbill turtles include foraging habitat, shelter for resting and refuge from predators, access to nesting sites, and natal development habitat	Hawksbill Sea Turtle	Vessels
Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities	Yelloweye Rockfish – Puget Sound/Georgia Basin DPS Bocaccio – Puget Sound/Georgia Basin DPS	Vessels
Water quality to support growth and development	Killer Whale – Southern Resident DPS	Barge landings, vessels
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	Gulf Sturgeon	Vessels
Coastal marine areas: Water quality - Coastal marine waters with adequate dissolved oxygen levels and acceptably low levels of contaminants (e.g., pesticides, PAHs, heavy metals that may disrupt the normal behavior, growth, and viability of subadult and adult green sturgeon)	Green Sturgeon – Southern DPS	Barge landings, vessels
Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales	Beluga Whale – Cook Inlet DPS	Vessels

Water quality may be temporarily degraded as a result of vessel pollutants or a launch failure. Recovery activities and any emergency response and cleanup procedures would reduce the magnitude and duration of impacts from a launch failure. As previously discussed, pollutants are expected to evaporate and quickly become dispersed due to wind and currents, limiting any impacts to a temporary duration. Given the limited use of vessels and brief exposure to pollutants, the effect of pollution on related PBFs will be so small as to not be measurable. Thus, the effects on designated critical habitats in Table 12 are insignificant. We conclude that impacts to designated or proposed critical habitat in the action area from pollution because of activities covered under this programmatic may affect, but are not likely to adversely affect, designated or proposed critical habitat.

Food Resources

Many species' critical habitats include PBFs related to their food or prey resources (Table 13). Food, prey, and forage areas may be affected by similar stressors as ESA-listed species.

Table 13. Food, prey, and forage PBFs of critical habitat in the action area that may be affected

Physical and Biological Feature	Associated Critical Habitat	Activities
Abundant food items, such as detritus, aquatic insects, worms, and/or molluscs, within riverine habitats for larval and juvenile life stages; and abundant prey items, such as amphipods, lancelets, polychaetes, gastropods, ghost shrimp, isopods, molluscs and/or crustaceans, within estuarine and marine habitats and substrates for subadult and adult life stages	Gulf Sturgeon	Vessels
Benthic foraging/resting essential features: From the mean high water line to 20 m depth, underwater refugia and food resources (i.e., seagrasses, macroalgae, and/or invertebrates) of sufficient condition, distribution, diversity, abundance, and density necessary to support survival, development, growth, and/or reproduction	Green Sea Turtle – East Pacific DPS, North Atlantic DPS, South Atlantic DPS (Proposed)	Launches, barge landings (North Atlantic DPS only), landings (disposal and expended; North Atlantic DPS only), vessels
Food resources. Abundant food resources including bacterial and diatom films, crustose coralline algae, and a source of detrital macroalgae, are required for growth and survival of all stages of black abalone	Black Abalone	Vessels

Physical and Biological Feature	Associated Critical Habitat	Activities
Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival. Eulachon prey on a wide variety of species including crustaceans such as copepods and euphausiids, unidentified malacostracans, cumaceans mysids, barnacle larvae, and worm larvae	Eulachon – Southern DPS	Vessels
Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels	Chinook Salmon – Puget Sound ESU Chum Salmon – Hood Canal Summer-Run ESU	Vessels
Nutrients, physical oceanography processes, certain species of zooplankton (copepods), and long photo-period due to the high latitude	North Pacific Right Whale	Vessels
Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth	Killer Whale – Southern Resident DPS	Barge landings, vessels
Prey species, primarily euphausiids (*Thysanoessa* and *Euphausia*) and small pelagic schooling fishes, such as Pacific herring (*Clupea pallasii*), capelin (*Mallotus villosu*s), juvenile walleye pollock (*Gadus chalcogrammus*) and Pacific sand lance (*Ammodytes personatus*) of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth	Humpback Whale – Western North Pacific DPS	Launches, vessels

Physical and Biological Feature	Associated Critical Habitat	Activities
Prey species, primarily euphausiids (*Thysanoessa*, *Euphausia*, *Nyctiphanes*, and *Nematoscelis*) and small pelagic schooling fishes, such as Pacific sardine (*Sardinops sagax*), northern anchovy (*Engraulis mordax*), Pacific herring (*Clupea pallasii*), capelin (*Mallotus villosus*), juvenile walleye pollock (*Gadus chalcogrammus*), and Pacific sand lance (*Ammodytes personatus*) of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth	Humpback Whale – Mexico DPS	Launches, barge landings, landings (disposal and expended), vessels
Prey species, primarily euphausiids (*Thysanoessa*, *Euphausia*, *Nyctiphanes*, and *Nematoscelis*) and small pelagic schooling fishes, such as Pacific sardine (*Sardinops sagax*), northern anchovy (*Engraulis mordax*), and Pacific herring (*Clupea pallasii*), of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth	Humpback Whale – Central America DPS	Barge landings, landings (disposal and expended), vessels
Primary prey resources to support Arctic ringed seals, which are defined to be small, often schooling, fishes, in particular Arctic cod, saffron cod, and rainbow smelt; and small crustaceans, in particular, shrimps and amphipods	Ringed Seal – Arctic Subspecies	Barge landings, landings (disposal and expended), vessels
Primary prey resources to support bearded seals: Waters 200 m or less in depth containing benthic organisms, including epifaunal and infaunal invertebrates, and demersal fishes	Bearded Seal – Beringia DPS	Barge landings, landings (disposal and expended), vessels
Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities	Yelloweye Rockfish – Puget Sound/Georgia Basin DPS	Vessels

Physical and Biological Feature	Associated Critical Habitat	Activities
Sufficient density, quality, abundance, and accessibility of small demersal and vertically migrating prey species, including scombriformes, stomiiformes, myctophiformes, and myopsida	Rice's Whale (Proposed)	Vessels
Surface-pelagic foraging/resting essential features: Convergence zones, frontal zones, surface-water downwelling areas, the margins of major boundary currents, and other areas that result in concentrated components of the *Sargassum*-dominated drift community, as well as the currents which carry turtles to *Sargassum*-dominated drift communities, which provide sufficient food resources and refugia to support the survival, growth, and development of post-hatchlings and surface-pelagic juveniles, and which are located in sufficient water depth (at least 10 m) to ensure offshore transport via ocean currents to areas which meet forage and refugia requirements	Green Sea Turtle – North Atlantic DPS (Proposed)	Launches, barge landings, landings (disposals and expended), explosive events, vessels
Terrestrial, air, and aquatic areas that support reproduction, foraging, rest, and refuge	Steller Sea Lion – Western DPS	Launches, vessels
The critical habitat designation did not precisely define PBFs; however, critical habitat was designated around Puerto Rico to provide protection for important developmental and resting habitats. Seagrass is the principal dietary component of juvenile and adult green sea turtles. Coral reefs and other topographic features within the waters surrounding Culebra provide shelter from predators. Nearby sandy beaches provide nesting grounds for adult females	Green Sea Turtle – North Atlantic DPS	Vessels
The critical habitat designation did not precisely define PBFs; however, important features of these areas for hawksbill turtles include foraging habitat, shelter for resting	Hawksbill Sea Turtle	Vessels

Physical and Biological Feature	Associated Critical Habitat	Activities
and refuge from predators, access to nesting sites, and natal development habitat		
U.S. West Coast – Prey species, primarily scyphomedusae (i.e., jellyfish) of the order Semaeostomeae (e.g., Chrysaora, Aurelia, Phacellophora, and Cyanea), of sufficient condition, distribution, diversity, abundance, and density necessary to support individual as well as population growth, reproduction, and development	Leatherback Sea Turtle	Barge landings, vessels
Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities	Bocaccio – Puget Sound/Georgia Basin DPS	Vessels
Coastal marine areas: Food resources. Abundant prey items for subadults and adults, which may include benthic invertebrates and fish	Green Sturgeon – Southern DPS	Barge landings, vessels
Foraging habitat: Diapausing *C. finmarchicus* in aggregations in the Gulf of Maine and Georges Bank region	North Atlantic Right Whale	Landings (disposal and expended), vessels
Foraging habitat: Late stage *C. finmarchicus* in dense aggregations in the Gulf of Maine and Georges Bank region	North Atlantic Right Whale	Landings (disposal and expended), vessels
Foraging habitat: Low flow velocities in Jordan, Wilkinson, and Georges Basins that allow diapausing *C. finmarchicus* to aggregate passively below the convective layer so that the copepods are retained in the basins	North Atlantic Right Whale	Landings (disposal and expended), vessels
Foraging habitat: Sufficient prey availability and quality, such as benthic invertebrates, including crabs (spider, rock, lady, hermit,	Loggerhead Sea Turtle – Northwest Atlantic Ocean DPS	Launches, barge landings, landings (disposals and

Physical and Biological Feature	Associated Critical Habitat	Activities
blue, horseshoe), mollusks, echinoderms and sea pens		expended), explosive events, vessels
Sargassum habitat: 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	Loggerhead Sea Turtle – Northwest Atlantic Ocean DPS	Landings (disposal and expended), explosive events, vessels
Sargassum habitat: *Sargassum* in concentrations that support adequate prey abundance and cover	Loggerhead Sea Turtle – Northwest Atlantic Ocean DPS	Landings (disposal and expended), explosive events, vessels
Sargassum habitat: 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 depth	Loggerhead Sea Turtle – Northwest Atlantic Ocean DPS	Landings (disposal and expended), explosive events, vessels
Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole	Beluga Whale – Cook Inlet DPS	Vessels

Stressors such as falling objects, impulsive sounds (including overpressures from barge landings), and noise and visual disturbance (e.g., vessels) may affect prey. These stressors may temporarily displace prey for the short time a vessel transits through an area, an object sinks through the water column, or the duration of the sound. However, the duration of these stressors is brief (the longest vessel transit would likely be on the order of days), limited to the immediate vicinity of the activity, and is not expected to measurably affect the condition, distribution, diversity, abundance, or density of prey. Pieces of weather balloons or parachutes/parafoils are not expected to be available to prey species in sufficient concentrations to measurably affect prey populations. Prey species could get entrapped or entangled in the parachute/parafoil if parachutes/parafoils land within critical habitat and are not recovered. However, the removal of a small amount of prey is not expected to reduce the conservation value of that PBF in any designated or proposed critical habitats. Thus, the consequences from stressors on critical habitats listed in Table 13 will be so small as to not be measurable and thus are insignificant.

We conclude that impacts to designated or proposed critical habitat in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect, designated or proposed critical habitat.

Conclusion

Based on this analysis, NMFS ESA Interagency Cooperation Division concurs with the FAA, NASA, and USSF, that the proposed action may affect, but is not likely to adversely affect, ESA-listed or proposed species and designated or proposed 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 "suggestions … regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information" (50 CFR §402.02).

The following conservation recommendations should be considered by the FAA to minimize or avoid effects to threatened and endangered species associated with this action:

1. The action agencies should coordinate with NMFS ESA Interagency Cooperation Division and the NOAA Marine Debris Program (MDP), to evaluate how activities of the MDP may apply to debris that originates from space launch and reentry operations (e.g., expended stages, components, debris, and parachutes).
2. Action agencies should consider all means to reduce marine debris (from expended stages, component, parachutes, etc.) from space launch and reentry operations. This includes, but is not limited to, exploring ways to recover all parachutes/parafoils, weather balloons, and using materials, instruments, or components that are biodegradable or use less plastic. For example, radiosonde RS41-E models use biodegradable materials and reduces plastic use by 66% and High Altitude LiDAR Atmospheric Sensing (HALAS) can provide real-time atmospheric data for launches without expending weather balloons.
3. The action agencies should follow the voluntary vessel speed reduction zones and Areas To Be Avoided (ATBA) off California (https://channelislands.noaa.gov/manage/resource/ship-strikes.html). NOAA annually issues these May 1–December 31 to reduce the risk of vessel strike, reduce ocean noise, and reduce air pollution.
4. We recommend the action agencies help fund or undertake scientific research to investigate the assumptions in the Effects Analysis and the potential impacts of space launch and reentry operations on ESA-listed species and critical habitat. This could include analyzing species' responses to operations, locations and fates of unrecovered debris (weather balloons, parachutes/parafoils, stages, components, debris, etc.), verification of underwater sound levels from operations, etc.

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 USSF should notify the ESA Interagency Cooperation Division 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 (FAA, USSF, and/or NASA) or NMFS, 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; or if (3) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR §402.16).

Programmatic consultations often involve actions that occur at some frequency over many years and possibly continue for an indefinite time. The action agencies are required to submit annual reports to NMFS describing the activities and any effects to ESA-listed species and critical habitat (see Reporting). Should the annual reports indicate that the activities undertaken may affect ESA resources differently than assessed in this programmatic letter of concurrence, or that the scope and magnitude of the activities are inconsistent with the description of the proposed action and action area, reinitiation may be required.

Please direct questions regarding this programmatic letter of concurrence to Emily Chou, Consulting Biologist, at (301) 427-8483 or emily.chou@noaa.gov, or me at (240) 723-6321 or tanya.dobrzynski@noaa.gov.

Sincerely,

DOBRZYNSKI.TANYA.JANINE.1365846517

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Tanya Dobrzynski
Chief, ESA Interagency Cooperation Division
Office of Protected Resources

Cc: Nicholas Baker, FAA
Amy Hanson, FAA

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APPENDIX A – PROJECT-SPECIFIC REVIEW CHECKLIST

This checklist may be used to determine whether a proposed projects falls under the scope of the space launch and reentry programmatic consultation and therefore does not require a project-specific review. A project-specific review is not required if the activities conducted are as described in the programmatic consultation's proposed action, occur within the action area, and comply with all relevant PDCs (see Proposed Action and Action Area).

Examples of when an action agency might need to coordinate a project-specific review include: operations using a new launch site, construction of a new launch site, a new launch or reentry vehicle that does not fall under the vehicle envelopes as described in the proposed action, vessels, tugs, or droneships that do not fall under the vessel specifications as described in the proposed action, substantial changes in technology or operations, or when activities will not occur within the action area, or cannot fully comply with the applicable PDCs.

When evaluating whether a project satisfies the requirements of this programmatic, the action agency should consider all activities of the proposed action and effects caused by proposed action. The action agency should also consider all areas where activities will occur, including pre-flight activities (e.g., vessels, aircraft, launch site, etc.), in-flight impacts (e.g. sonic booms, expended stages, components, or debris, etc.), and recovery operations (e.g., vessels, debris salvage, barge landings, etc.). In other words, the areas to be considered should include all areas that may be affected, directly or indirectly, by the project and not merely the immediate area of the launch or landing (see 50 CFR §402.02).

If an action agency has any uncertainty that a proposed activity falls within the scope of this programmatic consultation or needs a project-specific review, they should contact the NMFS Office of Protected Resources ESA Interagency Cooperation Division. Project-specific review requests should be sent by email to nmfs.hq.esa.consultations@noaa.gov with the subject line "Project Specific Review Request OPR-2025-02196 Space Launch and Reentry Program" and include the following information: a project description that details the proposed operations, including details on the activities that the action agency identified do not fall under this programmatic or are unsure whether they fall under this programmatic, where and when the activities will occur, the number or frequency of the proposed operations, any PDCs that may not be fully implemented, any proposed changes to those PDCs, or additional measures, and determination of effects to ESA-listed species and critical habitat that could result from the project. Requests for a 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.

General requirements for projects that fall within the scope of the space launch and reentry programmatic consultation, as described in the Proposed Action and Action Area section (see section for details):

- ☐ The Federal action is one of the following:
    1. FAA commercial space transportation license or permit for launch or reentry operations: license to operate a launch site, license to operate a reentry site, experimental permit, or vehicle operator license;

2. USSF authorization for launch operations at CCSFS or VSFB (non-FAA-licensed operations); or
3. NASA authorization for launch operations at KSC or WFF (non-FAA-licensed operations).

☐ The proposed activities must be within the following parameters, and adhere to the listed requirements:
1. Weather balloon deployment
   - ☐ Five to 15 weather balloon deployments per launch
   - ☐ Radiosonde, which does not use a parachute
- ☐ Pre-launch vessel or aircraft surveillance
   - ☐ Surveillance vessels up to a maximum of 200 ft (61 m) in length
- ☐ Launches
   - ☐ Launches occur only at launch sites listed in Table 1
   - ☐ Launch vehicles adhere to the launch vehicle specifications in Table 2, and do not exceed a total engine thrust of 6.5 million lbs or generate sonic booms over 50 psf during ascent or landing
- ☐ Launch abort tests
   - ☐ Launch abort tests only occur in the Atlantic Zone 2 (see Figure 5)
- ☐ Launch failure or anomalies
- ☐ Expended stages, components, or debris
   - ☐ Launch vehicles of a maximum size as listed in Table 2
   - ☐ Reentry vehicles of a maximum size of 30 ft (9.1 m) in length and 15 ft (4.6 m) in diameter
   - ☐ Fairings of a maximum size of 75 ft (22.9 m) in length and 30 ft (9.1 m) in diameter
   - ☐ Components of a maximum size of 15 ft by 15 ft by 15 ft (4.6 m by 4.6 m by 4.6 m)
   - ☐ Interstage adapters of a maximum size of 15 ft (4.6 m) in length and 23 ft (7 m) in diameter
   - ☐ Debris of smaller size than stages, components, and interstage adapters.
- ☐ Explosive events
   - ☐ Occur at minimum 11 ft (3.4 m) above the surface of the ocean
   - ☐ Explosive weight (calculated from the amount of remaining propellant and its explosive yield) will not exceed 55,800 kilograms (123,018 lbs)
   - ☐ Explosive events will only occur in the Atlantic portion of the action area at least 100 mi (160.9 km) from any major land mass (see Figure 5)
- ☐ Reentries
   - ☐ Reentry vehicles adhere to the reentry vehicle specifications of a maximum size of 30 ft (9.1 m) in length and 15 ft (4.6 m) in diameter, and do not generate sonic booms of over 3 psf
- ☐ Recovery of stages, components, or debris
   - ☐ Reentry vehicles of a maximum size of 30 ft (9.1 m) in length and 15 ft (4.6 m) in diameter
   - ☐ Fairings of a maximum size of 75 ft (22.9 m) in length and 30 ft (9.1 m) in diameter
   - ☐ Barges and droneships up to a maximum of 400 ft (122 m) in length

- ☐ Vessels and tugs up to a maximum of 200 ft (61 m) in length
    - ☐ Drogue parachutes do not exceed 200 ft^2 (18.6 m^2) in size and do not exceed a suspension line length of 75 ft (22 m)
    - ☐ Parafoils do not exceed 3,000 ft^2 (278.7 m^2) in size and do not exceed a suspension line length of 50 ft (15.2 m)
    - ☐ Main parachutes do not exceed 10,600 ft^2 (984.8 m^2) in size and do not exceed a suspension line length of 150 ft (45.7 m)
    - ☐ Pilot parachutes do not exceed 13.5 ft (4.1 m) in diameter, do not exceed a suspension line length of 8.75 ft (2.7 m), and are only used for the new SpaceX capsule
- ☐ All activities will occur within the action area as described in the programmatic and the area-based PDCs (see section below). No operations except vessel and aircraft transit will occur outside the areas depicted in Figures 1–11
- ☐ Only vessel or aircraft transit will occur within 5 NM of the U.S. coast (vessel transit will not occur in other countries' waters)
- ☐ Nothing will be expended or disposed of over coral reef areas
- ☐ No operations will occur in a National Marine Sanctuary, or affect National Marine Sanctuary resources, without the appropriate authorization, permit, or consultation
- ☐ If there is a launch failure, operators will follow their emergency response cleanup procedures
- ☐ All personnel associated with space launch and reentry operations will understand the ESA-listed species and critical habitat, and MMPA-protected species, that may be present in the operating area
- ☐ All vessel operators will look out for and attempt to avoid collision with ESA-listed and MMPA-protected species
- ☐ A dedicated observer, who can recognize ESA-listed and MMPA-protected species, will be on board for all vessel activity and monitor for ESA-listed and MMPA-protected species
- ☐ The dedicated observer will a) alert the vessel operators to implement the appropriate vessel speed restrictions and vessel avoidance measures, and b) gather relevant data on ESA-listed and MMPA-protected species including date, time, GPS location, species, number of animals, distance and bearing from the vessel, direction of travel, behavior, effects to the animals from space launch and reentry operations, any effects including injury and mortality observed in launch, landing, or recovery areas, and other relevant information
- ☐ When an ESA-listed or MMPA-protected species is observed, the vessel will:
    - ☐ Maintain a minimum distance of 150 ft (45.7 m) from sea turtles
    - ☐ Maintain a minimum distance of 300 ft (91.4 m) from all other ESA-listed and MMPA-protected species
    - ☐ If the distance from the vessel to the ESA-listed or MMPA-protected species becomes less than the distance specified in these PDCs, reduce vessel speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area and transit route
    - ☐ Reduce vessel speed to 10 knots or less when mother/calf pairs or groups (more than two individuals) of marine mammals are observed

- ☐ Attempt to remain parallel to (e.g., when animals are bow-riding), or move the vessel away from, an ESA-listed or MMPA-protected species' course while the vessel is in transit and avoid excessive speed or abrupt changes in direction until the animal(s) have left the area or transit route

☐ Aircraft will maintain a minimum height of 1,000 ft (304.8 m) above ESA-listed or MMPA-protected species and avoid flying in circles, or other types of harassing behaviors, above them

☐ Any ESA-listed or MMPA-protected species collision(s), injury(ies), mortality(ies), entanglement(s), or stranding(s) will be reported immediately to the appropriate contacts

☐ Action agencies will report annually on the nature of their activities, as covered under this programmatic consultation, including but not limited to locations of the activities, effects to ESA-listed species and critical habitat, implementation of PDCs, and implementation of conservation recommendations

Additional requirements for projects that occur in the Pacific Ocean (see Figure 2, Figure 3, and associated shapefiles for confirmation), as described in the Proposed Action and Action Area section (see section for details):

☐ Operations in Zone 2 are limited to the number of maximum annual operations described in Table 3

☐ Operations in Zone 3a are limited to vessel transit only from December 1 through April 30

☐ Operations in Zone 4 are limited to vessel transit and barge landings only

☐ No operations will occur around Isla Guadalupe and surrounding waters

☐ No operations will occur over areas with sea ice cover off Alaska

☐ Steller sea lion critical habitat in:

- Alaska
  - ☐ No operations will occur within the aquatic zone that extends 20 NM (37 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery and major haulout that is west of 144° W longitude
  - ☐ No operations will occur within the aquatic zone that extends 3,000 ft (0.9 km) seaward in State and Federally managed waters from the baseline or basepoint of each major rookery and major haulout in Alaska east of 144° W longitude
  - ☐ No operations will occur within the air zone that extends 3,000 ft (0.9 km) above the terrestrial zone of each major rookery and major haulout in Alaska (measured vertically from sea level)
  - ☐ No vessel operations will occur within 3 NM (5.6 km) of all Steller sea lion rookeries west of 150° W longitude
  - ☐ In the unlikely event that debris is expected to occur over or land within the air or aquatic critical habitat zones, debris should be monitored and cleaned up if in the water. If debris lands within 3 NM (5.6 km) of a rookery west of 150° W longitude, or if debris occurs on a major rookery or major haulout (i.e., on land), notify the appropriate contacts
- California and Oregon

- ☐ No operations will occur in an aquatic zone that extends 3,000 ft (0.9 km) seaward from major rookeries
- ☐ No operations will occur in an air zone that extends 3,000 ft (0.9 km) above the terrestrial zone of major rookeries (measured vertically from sea level)

Additional requirements for projects that occur in the Gulf (see Figure 4 and associated shapefiles for confirmation), as described in the Proposed Action and Action Area section (see section for details):

- ☐ Operations in Zone 2 are limited to the number of maximum annual operations described in Table 3
- ☐ Operations in Zone 3 are limited to vessel transit only
- ☐ No operations will occur within Rice's whale core distribution area
- ☐ No operations will occur within 20 NM (37 km) of the Flower Garden Banks National Marine Sanctuary and the Florida Keys National Marine Sanctuary or listed coral reef areas
- ☐ Vessels will slow to 10 knots or less and maintain a minimum distance of 1,500 ft (457.2 m) from Rice'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
- ☐ Vessels will maintain speeds to 10 knots or less in Rice's whale proposed critical habitat

Additional requirements for projects that occur in the Atlantic Ocean (see Figure 5, Figure 6, and associated shapefiles for confirmation), as described in the Proposed Action and Action Area section (see section for details):

- ☐ Operations in Zone 2 are limited to the number of maximum annual operations described in Table 3
- ☐ Operations in Zone 3b are limited to vessel transit only, from November 1 through April 30
- ☐ Operations in Zone 3c are limited to vessel transit only, from January 1 through July 31
- ☐ Operations in Zone 5 (off North Carolina and Florida) will not include any disposals or expended stages, expended components, or debris
- ☐ Operations in Zone 5a will not include any disposals or expended stages, expended components, or debris between November 1 through April 30
- ☐ Operations in Zone 5b will not include any disposals or expended stages, expended components, or debris between April 1 through November 30
- ☐ Vessels will slow to 10 knots or less and maintain a minimum distance of 1,500 ft (457.2 m) from North Atlantic right whales
- ☐ Vessels will comply with the Right Whale Ship Strike Reduction Rule and reduce speeds to 10 knots or less in Seasonal Management Areas or in Right Whale Slow Zones
- ☐ Check various communication media for general information regarding avoiding vessel 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
- ☐ Aircraft will maintain a baseline minimum height of 1,500 ft (457.2 m) above North Atlantic right whales

- ☐ Launch abort tests will not occur in designated critical habitat for the North Atlantic right whale, Seasonal Management Areas, or Slow Zones, and will not occur between November 1 through April 30

Additional requirements for projects that occur in the Caribbean (see Figure 7 and associated shapefiles for confirmation), as described in the Proposed Action and Action Area section (see section for details):

- ☐ Operations in Zone 4 are limited to vessel transit and barge landings only
- ☐ Operations in the Exuma Sound are limited to vessel transit, barge landings, and fairing recoveries

APPENDIX B – ANNUAL REPORTING FORM

See Excel sheet AppendixB_OPR-2025-02196_AnnualReportingForm