BILLING CODE 3510-22-P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648-XR040

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Long Beach Cruise Terminal Improvement Project in the Port of Long Beach, California

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed incidental harassment authorization; request for comments on proposed authorization and possible renewal.

SUMMARY: NMFS has received a request from Carnival Corporation & PLC (Carnival) for authorization to take marine mammals incidental to the Port of Long Beach Cruise Terminal Improvement Project in Port of Long Beach, California. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an incidental harassment authorization (IHA) to incidentally take marine mammals during the specified activities. NMFS is also requesting comments on a possible one-year renewal that could be issued under certain circumstances and if all requirements are met, as described in *Request for Public Comments* at the end of this notice. NMFS will consider public comments prior to making any final decision on the issuance of the requested MMPA authorizations and agency responses will be summarized in the final notice of our decision.

DATES: Comments and information must be received no later than [*insert date 30 days after date of publication in the FEDERAL REGISTER*].

ADDRESSES: Comments should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service. Physical comments should be sent to 1315 East-West Highway, Silver Spring, MD 20910 and electronic comments should be sent to *ITP.Piniak@noaa.gov*.

Instructions: NMFS is not responsible for comments sent by any other method, to any other address or individual, or received after the end of the comment period. Comments received electronically, including all attachments, must not exceed a 25-megabyte file size. Attachments to electronic comments will be accepted in Microsoft Word or Excel or Adobe PDF file formats only. All comments received are a part of the public record and will generally be posted online at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities* without change. All personal identifying information (*e.g.,* name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

FOR FURTHER INFORMATION CONTACT: Wendy Piniak, Office of Protected Resources, NMFS, (301) 427-8401. Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *chttps://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-construction-activities*. In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

The MMPA prohibits the "take" of marine mammals, with certain exceptions. Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq*.) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed incidental take authorization may be provided to the public for review.

Authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses (where relevant). Further, NMFS must prescribe the permissible methods of taking and other "means of effecting the least practicable adverse impact" on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stocks for taking for certain subsistence uses (referred to in shorthand as "mitigation"); and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. The definitions of all applicable MMPA statutory terms cited above are included in the relevant sections below.

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq*.) and NOAA Administrative Order (NAO) 216-6A, NMFS must review our proposed action (*i.e.*, the issuance of an incidental harassment authorization) with respect to potential impacts on the human environment.

This action is consistent with categories of activities identified in Categorical Exclusion B4 (incidental harassment authorizations with no anticipated serious injury or mortality) of the Companion Manual for NOAA Administrative Order 216-6A, which do not individually or cumulatively have the potential for significant impacts on the quality of the human environment and for which we have not identified any extraordinary circumstances that would preclude this categorical exclusion. Accordingly, NMFS has preliminarily determined that the issuance of the proposed IHA qualifies to be categorically excluded from further NEPA review.

We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the IHA request.

Summary of Request

On February 15, 2019, NMFS received a request from Carnival for an IHA to take marine mammals incidental to the Port of Long Beach Cruise Terminal Improvement Project in Port of Long Beach (POLB), California. The application was deemed adequate and complete on July 12, 2019. Subsequent revisions to the application were submitted by Carnival on September 13, 2019. Carnival’s request is for take of five species of marine mammals by Level B harassment and one of these five species by Level A harassment. Neither Carnival nor NMFS expects serious injury or mortality to result from this activity and, therefore, an IHA is appropriate. In-water activities (pile installation and dredging) associated with the project are anticipated to require five months.

Description of Proposed Activity

Overview

Carnival has requested authorization for take of marine mammals incidental to in-water activities associated with the Port of Long Beach Cruise Terminal Improvement Project in POLB, California. The purpose of the project is to make improvements to its existing berthing facilities at the Long Beach Cruise Terminal at the Queen Mary located at Pier H in the POLB, in order to accommodate a new, larger class of cruise ships. The project would also resolve safety issues in the existing parking structure and vessel mooring. Implementation of the project requires installation of two high-capacity mooring dolphins, fenders, and a new passenger bridge system, and dredging at the existing berth and the immediate surrounding area. In-water construction will include installation of a maximum of 49 permanent, 36-inch (91.4 centimeters (cm)) steel pipe piles using impact and vibratory pile driving. Sounds produced by these activities may result in take, by Level A harassment and Level B harassment, of marine mammals located in the POLB, California.

Dates and Duration

In-water activities (pile installation and dredging) associated with the project are anticipated to begin November 15, 2019, and be completed by April 15, 2020, however Carnival is requesting the IHA for one year from November 15, 2019 through November 14, 2020. Pile driving activities would occur for 26 days and dredging activities would occur for 30 days during the proposed project dates. In-water activities will occur during daylight hours only.

Specific Geographic Region

The activities would occur in the POLB, which is located in San Pedro Bay within the southwest portion of the City of Long Beach in southern Los Angeles County, California (Figure 1). The POLB is bounded to the south by hard structure breakwaters, and is a highly industrialized port and the second-busiest container seaport in the United States. The POLB is administered by the City of Long Beach Harbor Department and encompasses 3,200 acres, with 31 miles (50 kilometers (km)) of waterfront, 10 piers, and 80 berths.

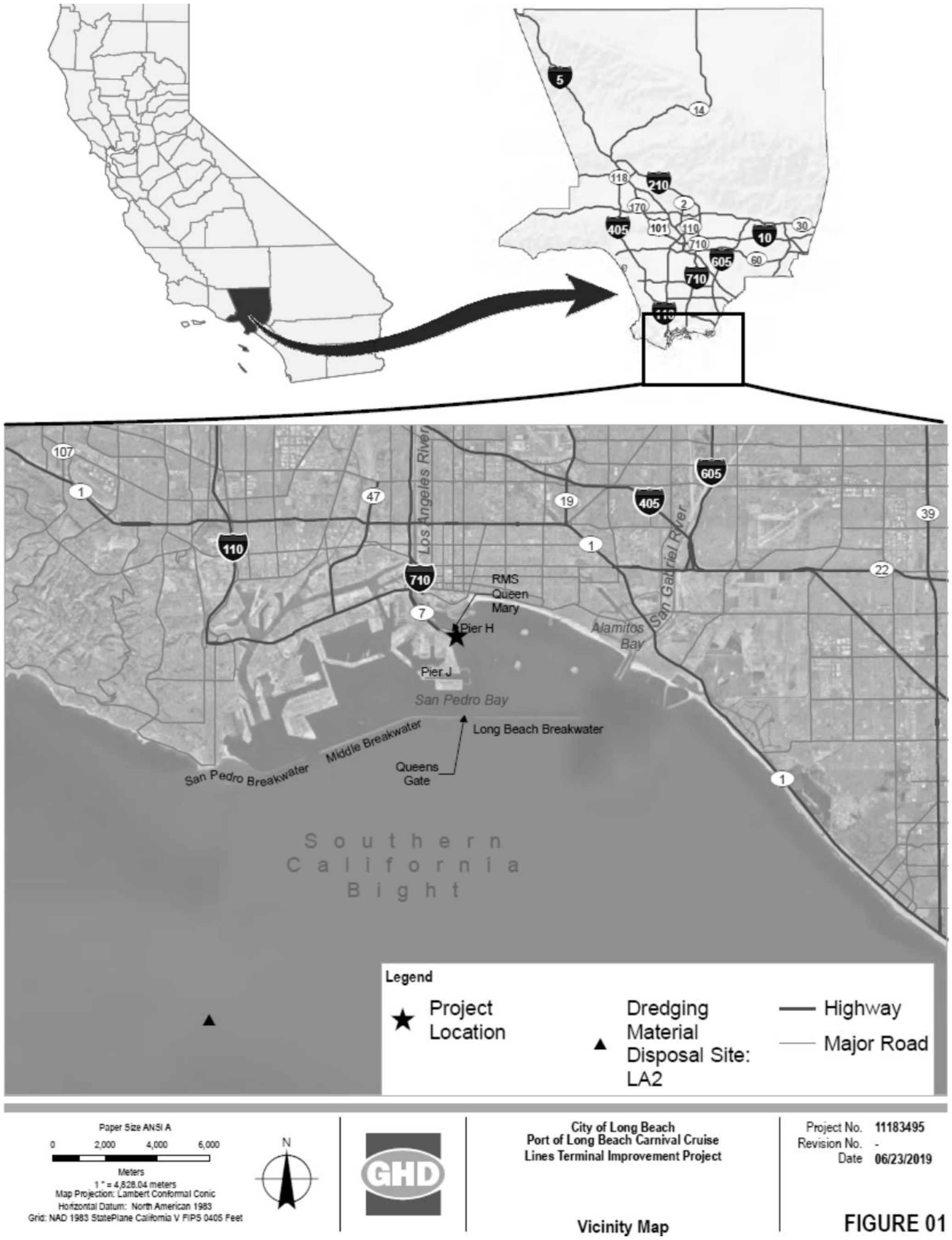

Figure 1. Map of the Port of Long Beach Cruise Terminal Improvement Project area in Port of Long Beach, California.

The site of the project is located adjacent to Royal Mail Ship Queen Mary (Pier J), at Pier H within the Queen Mary Seaport at 231 Windsor Way (see Appendix A of the application for detailed maps of the Project Area). The Queen Mary Seaport is located at the south end of the Interstate 710 Freeway, directly across Queensway Bay from downtown Long Beach (see Appendix C of the application for detailed photographs of the project area and surrounding vicinity). The project site is located near the mouth of the Los Angeles River and several miles from the mouth of the San Gabriel River. The project site is approximately 2.5 miles (4 km) from Queens Gate, the southern entrance to the Port Complex and approximately 3 miles (5 km) from the entrance to Alamitos Bay. The project site lies adjacent to the main navigational channel used by commercial and recreational vessels transiting to the City of Long Beach's shoreline facilities and marinas. The area east of the project site supports an expansive mooring field for cargo ships and barges, with a broad sand beach area extending from downtown Long Beach to Belmont Shores.

Current bathymetric data for the area indicates the water depth ranges from approximately 28 feet (ft) to 47 ft (8.5 to 14.3 meters (m)) Mean Lower Low Water (MLLW) within the existing berth perimeter. Water depths in this area generally slope from slightly lower bathymetry in the west (near the pier) to deeper depths to the east (see Figure 3 of the application for a detailed benthic map of the Port of Long Beach). Bathymetry at the Port Complex has been significantly altered by filling and dredging. The Port Complex bottom has been dredged to a depth of approximately 20-40 ft (6.1 to 12.2 m) MLLW, while the bathymetry of the east basin retains a more gradual downward slope moving offshore. Adjacent and inshore of the existing berthing structure, the bottom was dredged to depths of roughly 30 to 50 ft (9.1 to 15.2 m), and the bottom slopes downward from Pier H to the southeast. Beyond the berthing structure, the depth increases sharply from roughly 20 to 40 ft (6.1 to 12.2 m) out to the navigation channel, where depths exceed 50 ft (15.2 m) (navigation channel depths between 75 and 90 ft (22.9 to 27.4 m) MLLW) (NOS 2018). Sediments in northern Port Complex are composed of relatively sandy silt and clay and much of the shoreline consists of riprap and manmade structures (MBC Applied Environmental Sciences 2016). Narrow linear strips of kelp are associated with some of the rock protection features; however submerged vegetation and natural rocky substrate are rare. No known eelgrass beds occur at the project site as water depth and turbidity preclude presence in most areas. Adjacent terrestrial habitat is predominantly industrial or recreational including considerable hardscape. Several small parks and beaches bordering the harbor can have heavy human usage and have limited habitat structure or value as haul-out sites (GHD 2019a).

Although water quality in the POLB and San Pedro Bay has improved in the past several decades, it remains degraded and impacted by many anthropogenic sources such as industrial effluent and vessel discharge and untreated run-off. Turbidity is high in the POLB, particularly in the rainy season. The Environmental Protection Agency California State Water Resources Control Board (SWRCB) have listed many areas within the Port Complex as impaired waterbodies under Section 303(d) of the Clean Water Act.

The Port Complex is heavily used by commercial, recreational, and military vessels. Tetra Tech (2011) reported the underwater ambient noise levels in active shipping areas of the POLB were approximately 140 decibels (dB) re: 1 micropascal (μPa) root mean square (rms) and noise levels in non-shipping areas (Terminal Island) were between 120 dB re: 1 μPa (rms) and 132 re: 1 μPa (rms). These underwater ambient noise levels are typical of a large marine bay with heavy commercial boat traffic (Buehler *et al.* 2015). Ship noise in the POLB may mask underwater sounds produced by the proposed activities, and continuous sources of in-water noise (vibratory pile driving and dredging) will likely become indistinguishable from other background noise as they attenuate to near ambient sound pressure levels moving away from the project site.

Detailed Description of Specific Activity

The proposed activities will make improvements to the existing berthing facilities at the Long Beach Cruise Terminal at the Queen Mary located at Pier H in the POLB, in order to accommodate safe and secure moorage for a new, larger class of cruise ships. The project would also resolve safety issues in the existing, adjacent parking structure and vessel mooring. These improvements and activities would include the addition of two high-capacity, pile-founded mooring dolphins to allow for adequate mooring capacity during reasonably anticipated dockside conditions, often including high winds and long-period wave swell actions, which have been anecdotally observed more frequently than in the past. The new dolphins will structurally follow the design of the existing dolphins, which are located off the north and south ends of the dock. All dolphins will connect back to the wharf deck of the marine structure via installed catwalk bridge elements.

A maximum of 49 permanent, 36-inch (91.4 cm) steel pipe piles would be installed using a derrick barge with a pile driver. Piles would be installed approximately two-thirds of the way using a vibratory pile driver, and would be installed the remaining one-third and proofed using an impact pile driver. Proposed active pile driving is planned to occur from November 15, 2019 through April 15, 2020, and may be concurrent with the dredging workdays. The total number of pile driving days would not exceed 26 days (working days may be non-continuous and are expected to be limited to the in water work window proposed for pile driving: November 15, 2019 to April 15, 2020).

Above water, an extension to the existing passenger bridge system for an added ramp section would be constructed to include an additional tower element on the existing wharf deck. This new tower and platform deck would be constructed using the new proposed piles or current piles just south of the existing wharf deck. These new structures would connect to the existing gangway, be approximately 63 ft (19.2 m) above the water's surface, and designed to follow the specifications and design criteria of the existing gangway (adjustable for tidal conditions while remaining compliant with the Americans with Disabilities Act).

Dredging would be conducted to deepen the existing berth from the current depth of 30 ft (9.1 m) MLLW plus 1 foot (0.3 m) of over-dredge to a new depth of 36 ft (11 m) MLLW plus 1 foot (0.3 m) of over-dredge for a total depth of 37 ft (11.3 m) MLLW. Over-dredge is a standard construction design method to compensate for physical conditions and inaccuracies in the dredging process, and allow for efficient dredging practices. Dredging would be conducted with two tugboats and a clamshell dredge. The applicant estimates 30 days of dredging will be required during the proposed November 15, 2019 to April 15, 2020 project dates. Working days may be non-continuous and may be concurrent with pile driving work days. The new depth will increase navigable and mooring margins, accommodate for pitch and roll movement of vessels due to long period wave swells, and assist in managing mooring loads on the dock structure. Because the loudest sound associated with dredging is produced by the tugboat engine, the activity would occur an industrialized port where marine mammals are continuously exposed to vessel engine sounds, and sounds produced by dredging would primarily occur on the same days as pile driving, no authorization for incidental take resulting from dredging is proposed for authorization.

Proposed mitigation, monitoring, and reporting measures are described in detail later in this document (please see *Proposed Mitigation* and *Proposed Monitoring and Reporting*).

Description of Marine Mammals in the Area of Specified Activities

Sections 3 and 4 of the application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history, of the potentially affected species. Additional information regarding population trends and threats may be found in NMFS' Marine Mammal Stock Assessment Reports (SARs; *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*) and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS' website (*https://www.fisheries.noaa.gov/find-species*).

Table 1 lists all species with expected potential for occurrence in the POLB and summarizes information related to the population or stock, including regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2018). PBR is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (as described in NMFS' SARs). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS' stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS' U.S. Pacific SARs (*e.g.*, Carretta *et al.*, 2019). All values presented in Table 1 are the most recent available at the time of publication and are available in the 2018 Final SARs (Carretta *et al.*, 2019) (available online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*).

Table 1 -- Marine Mammals Potentially Present Within Port of Long Beach, California During the Specified Activity

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N)[1]	Stock abundance (CV, N_{min}, most recent abundance survey)[2]	PBR	Annual M/SI[3]
Order Cetartiodactyla – Cetacea – Superfamily Mysticeti (baleen whales)						
Family Eschrichtiidae						
Gray whale	*Eschrichtius robustus*	Eastern North Pacific	-, -, N	26,960 (0.05, 25,849, 2016)	801	139
Family Balaenopteridae (rorquals)						
Blue whale	*Balaenoptera musculus*	Eastern North Pacific	E, D, Y	1,647 (0.07, 1,551, 2011)	2.3	≥19
Fin whale	*Balaenoptera physalus*	California/Oregon/ Washington	E, D, Y	9,029 (0.12, 8,127, 2014)	81	≥43.5
Humpback whale	*Megaptera novaeangliae*	California/Oregon/ Washington	-, -, Y	2,900 (0.05, 2,784, 2014)	16.7	≥40.2
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Delphinidae						
Short-beaked common dolphin	*Delphinus delphis*	California/Oregon/ Washington	-, -, N	969,861 (0.17, 839,325, 2014)	8,393	≥40
Long-beaked common dolphin	*Delphinus capensis*	California	-, -, N	101,305 (0.49, 68,432, 2014)	657	≥35.4

Common bottlenose dolphin	*Tursiops truncates*	Coastal California	-, -, N	453 (0.06, 346, 2011)	2.7	≥2.0
Risso's dolphin	*Grampus griseus*	California/Oregon/ Washington	-, -, N	6,336 (0.32, 4,817, 2014)	46	≥3.7
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	California/Oregon/ Washington	-, -, N	26,814 (0.28, 21,195, 2014)	191	7.5
Northern right whale dolphin	*Lissodelphis borealis*	California/Oregon/ Washington	-, -, N	26,556 (0.44, 18,608, 2014)	179	3.8
Order Carnivora – Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions)						
California sea lion	*Zalophus californianus*	U.S.	-, -, N	257,606 (N/A, 233,515, 2014)	14,011	>320
Family Phocidae (earless seals)						
Harbor seal	*Phoca vitulina*	California	-, -, N	30,968 (0.157, 27,348, 2012)	1,641	43

1 Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.
2 NMFS marine mammal stock assessment reports online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments*. CV is coefficient of variation; Nmin is the minimum estimate of stock abundance. In some cases, CV is not applicable. California sea lion population size was estimated from a 1975-2014 time series of pup counts (Lowry *et al.* 2017), combined with mark-recapture estimates of survival rates (DeLong *et al.* 2017, Laake *et al.* 2018).
3 These values, found in NMFS' SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (*e.g.*, commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range. A CV associated with estimated mortality due to commercial fisheries is presented in some cases.
NOTE - Italicized species are not expected to be taken or proposed for authorization

All species that could potentially occur in the proposed survey areas are included in Table 1. However, the temporal and/or spatial occurrence of the blue whale, fin whale, Risso's dolphin, Pacific white-sided dolphin, and northern right whale dolphin is such that take is not expected to occur, and they are not discussed further beyond the explanation provided here. Blue whales have been observed in the Southern California Bight during their fall migration, however the closest live blue whale sighting record is 4.1 km south of the POLB breakwater (8.5 km from the project site; OBIS SEAMAP

2019). Given that blue whales are more commonly observed in higher concentrations around the Channel Islands in southern California (Irvine *et al.* 2014), the rarity of live sightings in POLB (five reports of deceased individuals in 20 years, and no live sightings) and all deceased individuals), and that the noise produced by the proposed project's in-water activities are not anticipated to propagate large distances outside the POLB, no takes are anticipated for blue whales. Fin whales occur in the Southern California Bight year round, although they also seasonally range to central California and Baja California before returning to the Southern California Bight (Falcone and Schorr 2013). The closest live fin whale sighting record is 1.5 km south of the Port of Los Angeles breakwater (8.8 km from the project site; OBIS SEAMAP 2019). Given the rarity of live sightings in POLB (in recent past only one dead juvenile has been sighted in POLB and was believed to have been struck by a whale outside the POLB), and that the noise produced by the proposed project's in-water activities are not anticipated to propagate large distances outside the POLB, no takes are anticipated for fin whales. The California, Oregon, and Washington (CA/OR/WA) stock of Risso's dolphins is commonly observed in the Southern California Bight (Carretta *et al.* 2019), however they are infrequently observed very close to shore and no known records exist for this species in the POLB. The closest Risso's dolphin sighting record is 7.2 km south of the Port of Los Angeles breakwater (12.6 km from the project site; OBIS SEAMAP 2019). Given that there have been no sightings of Risso's dolphins in the POLB and that the noise produced by the proposed project's in-water activities are not anticipated to propagate large distances outside the POLB, no takes are anticipated for Risso's dolphins. The CA/OR/WA stock of Pacific white-sided dolphin is seasonally present in colder months outside the POLB breakwater in offshore water. The species was reported by USACE (1992) as present in the POLB, however there are no known occurrence data. The closest Pacific white-sided dolphin sighting record is 2.1 km west of the Port of Los Angeles breakwater (13.8 km from the project site; OBIS SEAMAP 2019). Given that there have been no sightings of Pacific white-sided dolphins in the POLB and that the noise produced by the proposed project's in-water activities are not anticipated to propagate large distances outside the POLB, no takes are anticipated for Pacific white-sided dolphins. The CA/OR/WA stock of northern right whale dolphins rarely occurs nearshore in the Southern California Bight (Carretta *et al.* 2019), and no sightings have occurred in the POLB. The closest northern right whale dolphin sighting record is 26.5 km southwest of the Port of Los Angeles breakwater (32.5 km from the project site; OBIS SEAMAP 2019). Given that there have been no sightings of northern right whale dolphins in the POLB and that the noise produced by the proposed project's in-water activities are not anticipated to propagate large distances outside the POLB, no takes are anticipated for northern right whale dolphins.

Cetaceans

Humpback Whale

The humpback whale is distributed worldwide in all ocean basins. In winter, most humpback whales are found in the subtropical and tropical waters of the Northern and Southern Hemispheres, and then migrate to high latitudes in the summer to feed. The historic summer feeding range of humpback whales in the North Pacific encompassed coastal and inland waters around the Pacific Rim from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the

Kamchatka Peninsula and into the Sea of Okhotsk and north of the Bering Strait (Johnson and Wolman 1984).

Prior to 2016, humpback whales were listed under the Endangered Species Act (ESA) as an endangered species worldwide. Following a 2015 global status review (Bettridge *et al*. 2015), NMFS established 14 distinct population segments (DPSs) with different listing statuses (81 FR 62259; September 8, 2016) pursuant to the ESA. The DPSs that occur in U.S. waters do not necessarily equate to the existing stocks designated under the MMPA and shown in Table 2. Because MMPA stocks cannot be portioned, *i.e.*, parts managed as ESA-listed while other parts managed as not ESA-listed, until such time as the MMPA stock delineations are reviewed in light of the DPS designations, NMFS considers the existing humpback whale stocks under the MMPA to be endangered and depleted for MMPA management purposes (*e.g.*, selection of a recovery factor, stock status).

Within U.S. west coast waters, three current DPSs may occur: the Hawaii DPS (not listed), Mexico DPS (threatened), and Central America DPS (endangered). The CA/OR/WA stock of humpback whales along the U.S. west coast includes two feeding groups: the California/Oregon feeding group that includes whales from the Central American and Mexican DPSs defined under the ESA (81 FR 62259; September 8, 2016), and the northern Washington and southern British Columbia feeding group that primarily includes whales from the Mexican DPS, but also includes small numbers of whales from the Hawaii and Central America DPSs (Calambokidis *et al.* 2008, Barlow *et al.* 2011, Wade *et al.* 2016). Humpback whales occurring in the project area would include animals from the California/Oregon feeding group. These whales spend the winter/spring in breeding grounds in the coastal waters of Central America and Mexico and migrate to the coast of California and Oregon in the summer/fall to forage on small crustaceans and fish (Calambokidis *et al.* 1989; Steiger *et al.* 1991; Calambokidis *et al.* 1993).

The CA/OR/WA stock of humpback whales showed an increase in abundance from 1990 through approximately 2008 (8 percent growth per year, Calambokidis *et al.* 1999), however more recent estimates using data collected through 2014 indicate a leveling-off of the population size (Calambokidis *et al.* 2017). Threats to the CA/OR/WA stock include entanglements, interactions with fishing gear, ship strike, and impacts of anthropogenic sound on habitat (Carretta *et al.* 2019).

Humpback whales seasonally migrate (spring and fall) past the POLB and are frequently observed in waters outside the POLB outer harbor (MBC Applied Environmental Sciences 2016). Two live humpback whales have been documented in the neighboring Port of Los Angeles (one in June of 2016 and one in April of 2017) in by Harbor Breeze Cruises (HappyWhale 2019, OBIS SEAMAP 2019). Based on humpback whale migration patterns, humpback whales could be present near the project site during near the end of the proposed construction timeline in the spring of 2020, but are most likely to observed outside the POLB.

Gray Whale

Gray whales are commonly observed in the North Pacific Ocean (Carretta *et al.* 2019). Genetic studies indicate there are two population stocks: the Eastern North Pacific stock and the Western North Pacific stock (LeDuc *et al.* 2002; Lang *et al.* 2011a; Weller *et al.* 2013). Most Eastern North Pacific gray whales spend the summer and fall foraging on benthic and epibenthic invertebrates in the Chukchi, Beaufort, and northwestern

Bering Seas, with a small group foraging between Kodiak Island, Alaska and northern California in the summer months (Darling 1984, Gosho *et al.* 2011, Calambokidis *et al.* 2017) and utilize wintering lagoons in Baja California, Mexico.

The population size of the Eastern North Pacific stock of gray whales has increased over the last several decades despite Unusual Mortality Events (UMEs) in 1999 and 2000. Abundance estimates of the Pacific Coast Feeding Group of gray whales which forages along the along the coastal waters of the Pacific coast of North America from California to southeast Alaska, increased from 1998 through 2004, remained stable from 2005-2010, and steadily increased from 2011-2015 (Calambokidis *et al.* 2017). This stock is currently experiencing an UME. As of September 5, 2019, 208 whales have been observed stranded in the U.S., Canada, and Mexico. Preliminary findings from partial necropsies have shown evidence of emaciation. Additional information about this UME can be found at *https://www.fisheries.noaa.gov/national/marine-life-distress/2019-gray-whale-unusual-mortality-event-along-west-coast*.

Subsistence hunters in Russia and the U.S. have traditionally hunted whales from the Eastern North Pacific stock in the Bering Sea. From 2012-2016 the average annual subsistence take was 128 whales (captured during the Russian hunts). The International Whaling Commission approved a 7-year quota (2019-2025) or 980 gray whales, with an annual limit of 140 whales for both Russia and the U.S. Threats to the Eastern North Pacific stock include entanglements, interactions with fishing gear, ship strike, marine debris, and climate change (Carretta *et al.* 2019).

Gray whales seasonally migrate past the POLB. They migrate southward in January and February and northward in March and April (Hildebrand *et al.* 2012).

Jefferson *et al.* (2013) estimated an abundance of 221 gray whales in the waters around nearby San Clemente Island, California in the cold water season. At least 19 documented occurrences of gray whales have been recorded in the POLB. Almost all records are from the late winter (February) and early spring (March through April), however, one gray whale was observed near the Southeast Basin in the POLB in December of 2017. Most available records of this species are from just outside the POLB in San Pedro Bay, with three records from August through November and over 40 records in December (HappyWhale 2019, OBIS SEAMAP 2019). Based on gray whale migration patterns, gray whales could be present near the project site during much of the proposed construction time from November through April, but they are more likely to be observed outside the POLB.

Short-beaked common dolphin

Short-beaked common dolphins occur in temperate and tropical waters globally. Short beaked common dolphins from the CA/WA/OR stock are the most common cetacean off the coast of California, occurring year-round and ranging from the coast to at least 300 nautical miles offshore (Carretta *et al.* 2019). They travel in large social pods and are generally associated with oceanic and offshore waters, prey-rich ocean upwellings, and underwater landscape features such as seamounts, continental shelves, and oceanic ridges. Though they are present off the coast of California year-round, their abundance varies with seasonal and interannual changes in oceanographic conditions (increasing with higher temperatures) with peak abundance in the summer and fall (Forney and Barlow 1998, Barlow 2016). Short-beaked common dolphins largely forage on schooling fish and squid. Off the California coast, calving takes place in winter months.

Abundance of the CA/OR/WA stock short-beaked common dolphins has increased since large-scale surveys began in 1991. This stock is known to increase in abundance in California during warm water periods. The most recent survey in 2014 survey was conducted during extremely warm oceanic conditions (Bond *et al.* 2015) and recorded the highest abundance estimate since large-scale surveys began. This observed increase in abundance of short-beaked common dolphins off California likely reflects a northward movement of this transboundary stock from waters off Mexico (distributional shift), rather than an overall population increase due to growth shift (Anganuzzi *et al.* 1993; Barlow 1995; Barlow 2016; Forney and Barlow 1998; Forney *et al.* 1995). The largest threat to the CA/OR/WA stock is interactions with fishing gear, however cooperative international management programs have dramatically reduced overall dolphin mortality in recent decades (IATTC 2015).

Both short- and long-beaked common dolphins have been observed in the vicinity of the project action area. It is often difficult to distinguish between these two species in the field, but generally short-beaked common dolphins are more abundant, making up an estimated 72 percent of individuals observed in the Southern California Bight during a 2008-2013 monitoring efforts (Jefferson *et al.* 2013). In monthly marine mammal monitoring in the POLB from 2013-2014, MBC Applied Environmental Sciences (2016) reported only one pod of common dolphins (40 individuals) in February, 2014. OBIS SEAMAP (2019) has records of common dolphins within 6.7 km of the POLB breakwater and 17.6 km from the project site. Based on the available observations in and surrounding the POLB (all in winter months), common dolphins may be present within the project action area but their presence is likely occasional and of short duration.

Long-beaked common dolphin

Long-beaked common dolphins are found in the Atlantic, Pacific, and Indian Oceans. The distribution of long-beaked common dolphins in the California stock along the U.S. west coast overlaps with that of the short-beaked common dolphin, however long-beaked common dolphins are commonly found only within 50 nautical miles of the coast, from Baja California (including the Gulf of California) northward to central California (Carretta *et al.* 2019). They travel in large social pods and are generally associated with shallow, subtropical, and warm temperate waters close to the coast and on the continental shelf. Though they can be found of the California coast year-round, California represents the northern limit for this stock and animals likely move between U.S. and Mexican waters, with the distribution and abundance varying inter-annually and seasonally with oceanographic conditions (Heyning and Perrin 1994). Off the California coast, calving takes place in winter and spring months. Like short-beaked common dolphins, long-beaked common dolphins largely forage on schooling fish and squid.

While there is no trend analysis available for the California stock of long-beaked common dolphins, abundance estimates for California waters from vessel-based line-transect surveys have been greater in recent years as water conditions have been warmer (Barlow 2016) and long-beaked common dolphins appear to be increasing in abundance in California waters over the last 30 years (Moore and Barlow 2011, 2013). The ratio of strandings and visual observations of long-beaked to short-beaked common dolphin in southern California has varied, suggesting that varying oceanographic conditions affect the proportions of each species present (Heyning and Perrin 1994, Danil *et al.* 2010). The largest threat to the California stock is interactions with fishing gear, however other mortalities caused by blast trauma from explosions, ingestion of marine debris. Additionally, NMFS has documented long-beaked common dolphin UMEs due to domoic acid toxicity as recently as 2007, and Tatters *et al.* (2012) suggest that increasing anthropogenic CO_2 levels and ocean acidification may increase the toxicity of the diatom responsible for these UMEs.

As previously described, both short- and long-beaked common dolphins have been observed (though infrequently) in the vicinity of the project action area during winter months.

Common bottlenose dolphin

Common bottlenose dolphins are found in temperate and tropical waters throughout the world in offshore and coastal waters including harbors, bays, gulfs, and estuaries. Common bottlenose dolphins in the California coastal stock inhabit waters within one kilometer of shore (Hansen, 1990; Carretta *et al.* 1998; Defran and Weller 1999) from central California south into Mexican waters (at least as far south as San Quintin, Mexico). In southern California near the project action area, individuals are found even closer to shore and are found within 500 meters (m) of the shoreline 99 percent of the time and within 250 m 90 percent of the time (Hanson and Defran 1993). Photo-identification studies show little site fidelity and documented north-south movements with 80 percent of dolphins identified in Santa Barbara, Monterey, and Ensenada have also been identified off San Diego (Defran *et al.* 1999, Feinholz 1996, Defran *et al.* 2015). Bottlenose dolphins forage on a wide variety of fishes, cephalopods, and shrimps (Wells and Scott 1999). The peak periods of calving for the California coastal stock occur in spring and fall.

Mark-recapture abundance estimates from 1987-89, 1996-98, and 2004-05 indicated that the population size remained stable during this period (Dudzik *et al.* 2006). Recent higher estimates based on surveys from 2009-2011 suggest the population may be growing, however it whether this increase is due to population increase or immigration (Weller *et al.* 2016). Threats to the California coastal stock include interactions with fisheries and coastal pollution (Carretta *et al.* 2019).

Common bottlenose dolphins have been observed in both the inner and outer harbors of POLB. They were observed during five of 12 monthly sampling events during the most recent (2013-2014) biological surveys (MBC Applied Environmental Sciences 2016), including the months of November, December, and March which are within the proposed project timeframe. Common bottlenose dolphins were recently sighted near the Queen Mary Dock and elsewhere in the project action area (MBC Applied Environmental Sciences 2016, Laura McCue NOAA, personal communication).

Pinnipeds

California Sea Lion

California sea lions inhabit the eastern North Pacific Ocean from Islas Marias north of Puerto Vallarta, Mexico, north throughout the Gulf of California, and along the Baja California Peninsula north to the Gulf of Alaska. The U.S. stock ranges from the U.S./Mexico border to Canada. They occupy shallow ocean waters and prefer sandy beaches or rocky coves for breeding and haul-out sites, however they also commonly haul out on marina docks, jetties, and buoys. Pupping and breeding occur from May through July outside of the proposed project timeframe. Rookery sites in Southern California include San Miguel Island and to the more southerly Channel Islands of San Nicolas, Santa Barbara, and San Clemente (Lowry *et al.* 2017). California sea lions commonly forage on a variety of prey including fish and squid, and exhibit annual migratory movements between breeding and foraging habitats. From August to December, adult and sub-adult males migrate north along the U.S. west coast to foraging areas along the coasts of California, Oregon, Washington, British Columbia, Canada, and southeast Alaska. In the spring, males migrate southward to breeding rookeries in the Channel Islands and Mexico. Females and pups/juveniles commonly stay near breeding areas (Lowry *et al.* 2017), but some females may migrate as far north as San Francisco Bay in winter, and during El Niño events, have been observed as far north as central Oregon. The California sea lion molts gradually over several months during late summer and fall.

As with most sea lions, a complete population count of all harbor seals in California is not possible as all members of the population are not ashore simultaneously. Population estimates for the U.S. stock have increased since the 1970s and are derived from 3 primary data sources: 1) annual pup counts (Lowry *et al.* 2017); 2) annual survivorship estimates from mark-recapture data (DeLong *et al.* 2017); and 3) estimates of human-caused serious injuries, mortalities, and bycatch (Carretta and Enriquez 2012a, 2012b, Carretta *et al.* 2016, Carretta *et al.* 2018a, 2018b). Using a logistic growth model and reconstructed population size estimates from 1975-2014, Laake *et al.* (2018) estimated a net productivity rate of 7 percent per year. The population is considered within the range of its optimum sustainable population (OSP) size (Laake *et al.* 2018).

From January 2013 through September 2016, a greater than expected number of young malnourished California sea lions stranded along the coast of California and NMFS declared this an UME. Sea lions stranding from an early age (6-8 months old) through two years of age (hereafter referred to as juveniles) were consistently underweight without other disease processes detected. The proposed primary cause of the UME was malnutrition of sea lion pups and yearlings due to ecological factors. These factors included shifts in distribution, abundance and/or quality of sea lion prey items around the Channel Island rookeries during critical sea lion life history events (nursing by adult females, and transitioning from milk to prey by young sea lions). Threats to the U.S. stock include interactions with fisheries, entanglement in marine debris, entrainment in power plant intakes, oil exposure, vessel strikes, dog attacks, and human interactions/harassment (shootings, direct removals) (Carretta *et al.* 2019).

California sea lions have been observed year round in POLB, and they have recently been observed in both the inner and outer harbors of POLB (MBC Applied Environmental Sciences 2016, Laura McCue NOAA, personal communication). The closest known pinniped regular use haul-out site used for basking is along the breakwater approximately 3 km south of the project site, however pinnipeds may also haul out on buoys or rip rap that are less than 1 km from the project site (see Appendix A, Figure 4 of the application).

Harbor Seal

Harbor seals are widely distributed in the North Atlantic and Pacific Oceans. In the North Pacific Ocean two sub-species occur: *Phoca vitulina stejnegeri* in the western North Pacific near Japan and *Phoca vitulina richardii* in the eastern North Pacific, including areas around the project site (Carretta *et al.* 2019). Three stocks are currently recognized along the west coast of the continental U.S.: 1) California, 2) Oregon and Washington outer coast waters, and 3) inland waters of Washington (Carretta *et al.* 2019). The California stock of Pacific harbor seals is found in the project action area and inhabits coastal and estuarine areas including sand bars, rocky shores, and beaches along the entire coast of California, including the offshore islands, forming small, relatively stable populations. Pacific harbor seals are do not make extensive pelagic migrations like other pinnipeds, but do travel distances of 300-500 km to forage or find appropriate breeding habitat (Herder 1986; Harvey and Goley 2011). Harbor seals are rarely found more than 10.8 nm from shore (Baird 2001) and are generally are non-migratory (Burns 2002; Jefferson *et al.* 2008) and solitary at sea. Harbor seals spend more than 80 percent of their time in the upper 164 ft (50 m) of the water column (Womble *et al.* 2014) and forage most commonly on fish, shellfish, and crustaceans.

The California stock of harbor seals breeds along the California coast between from March to May and pupping occurs between April and May (Alden *et al.* 2002; Reeves *et al.* 2002). Molting occurs from late May through July or August and lasts approximately 6 weeks. Between fall and winter, harbor seals spend less time on land, but they usually remain relatively close to shore while at sea. The peak haul-out period for harbor seals in California is May through July (Carretta *et al.* 2019).

As with most seals, a complete population count of all harbor seals in California is not possible as all seals do not haul out simultaneously. A complete pup count (as is done for other pinnipeds in California) is also not possible because harbor seals enter the water almost immediately after birth. Population size is estimated by counting the number of seals hauled out during the peak haul-out period (May to July) and by multiplying this count by a correction factor equal to the inverse of the estimated fraction of seals on land (Carretta *et al.* 2019). Harvey and Goley (2011) calculated a correction factor of 1.54 (CV=0.157) based on 180 seals radio-tagged in California. Population counts of harbor seals increased from 1981 to 2004, when the maximum count in California was recorded. More recent counts in 2009 and 2012 have lower than the 2004 maximum count. Threats to the California stock include interactions with fisheries, entanglement in marine debris, ship strikes, research-related deaths, entrainment in power plants, and human interactions/harassment (shootings, stabbing/gaff wounds, human-induced abandonment of pups) (Carretta *et al.* 2019).

Harbor seals have been observed year round in POLB and have been observed occasionally following cruise ships to forage on organisms churned up from the benthos by ship propellors and food thrown from decks by passengers (MBC Applied Environmental Sciences 2016, M. Peters, Carnival Cruise Lines, personal communication). The closest known pinniped regular use haul-out site used for basking is along the breakwater approximately 3 km south of the project site, however pinnipeds may also haul out on buoys or rip rap that are less than 1 km from the project site (see Appendix A, Figure 4 of the application).

Additional information on the biology and local distribution of these species can be found in the NMFS Marine Mammal Stock Assessment Reports, which may be found at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments.*

Habitat

No ESA-designated critical habitat overlaps with the project area. A migration Biologically Important Area (BIA) for gray whales overlaps with the project area, however as previously described, gray whales are rarely observed in the POLB and the proposed project's in-water activities are not anticipated to propagate large distances outside the POLB.

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.*, Richardson *et al.*, 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.*, low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 decibel (dB) threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.*

(2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 2.

Table 2 -- Marine Mammal Hearing Groups (NMFS, 2018)

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
High-frequency (HF) cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*)	275 Hz to 160 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz

***** Represents the generalized hearing range for the entire group as a composite (*i.e.*, all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall *et al.* 2007) and PW pinniped (approximation).

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä *et al.*, 2006; Kastelein *et al.*, 2009; Reichmuth and Holt, 2013).

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information. Seven marine mammal species (5 cetacean and 2 pinniped (1 otariid and 1 phocid) species) have the reasonable potential to co-occur with the proposed activities (Table 1). Of the cetacean species that may be present, two are classified as low-frequency cetaceans (*i.e.*, all mysticete species), three are classified as mid-frequency cetaceans (*i.e.*, all *delphinid* species), and none are classified as high-frequency cetaceans.

Potential Effects of Specified Activities on Marine Mammals and their Habitat

This section includes a summary and discussion of the ways that components of the specified activity may impact marine mammals and their habitat. The *Estimated Take by Incidental Harassment* section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The *Negligible Impact Analysis and Determination* section considers the content of this section, the *Estimated Take by Incidental Harassment* section, and the *Proposed Mitigation* section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Description of Sound Sources

The marine soundscape is comprised of both ambient and anthropogenic sounds. Ambient sound is defined as the all-encompassing sound in a given place and is usually a composite of sound from many sources both near and far (ANSI 1994 1995). The sound level of an area is defined by the total acoustical energy being generated by known and unknown sources. These sources may include physical (*e.g.*, waves, wind, precipitation, earthquakes, ice, atmospheric sound), biological (*e.g.*, sounds produced by marine mammals, fish, and invertebrates), and anthropogenic sound (*e.g.*, vessels, dredging, aircraft, construction).

The sum of the various natural and anthropogenic sound sources at any given location and time – which comprise “ambient” or “background” sound – depends not only on the source levels (as determined by current weather conditions and levels of biological and shipping activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor, and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10-20 dB from day to day (Richardson *et al.* 1995). The result is that, depending on the source type and its intensity, sound from the specified activity may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals.

In-water construction activities associated with the project would include impact pile driving, vibratory pile driving, and dredging. The sounds produced by these activities fall into one of two general sound types: impulsive and non-impulsive. Impulsive sounds (*e.g.*, explosions, gunshots, sonic booms, impact pile driving) are typically transient, brief (less than 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay (ANSI 1986; NIOSH 1998; ANSI 2005; NMFS 2018). Non-impulsive sounds (*e.g.* aircraft, vessels, machinery operations such as drilling or dredging, vibratory pile driving, and active sonar systems) can be broadband, narrowband or tonal, brief or prolonged (continuous or intermittent), and typically do not have the high peak sound pressure with raid rise/decay time that impulsive sounds do (ANSI 1995; NIOSH 1998; NMFS 2018). The distinction between these two sound types is important because they have differing potential to cause physical effects, particularly with regard to hearing (*e.g.*, Ward 1997 in Southall *et al.* 2007).

Two types of pile hammers would be used on this project: impact and vibratory. Impact hammers operate by repeatedly dropping a heavy piston onto a pile to drive the pile into the substrate. Sound generated by impact hammers is characterized by rapid rise times and high peak levels, a potentially injurious combination (Hastings and Popper 2005). Vibratory hammers install piles by vibrating them and allowing the weight of the hammer to push the pile into the sediment. Vibratory hammers produce significantly less sound than impact hammers. Peak sound pressure level (SPL) may be 180 dB or greater, but are generally 10 to 20 dB lower than SPLs generated during impact pile driving of the same-sized pile (Oestman *et al.* 2009). Rise time is slower, reducing the probability and severity of injury, and sound energy is distributed over a greater amount of time (Nedwell and Edwards 2002; Carlson *et al.* 2005).

The likely or possible impacts of Carnival's proposed activity on marine mammals could involve both non-acoustic and acoustic stressors. Potential non-acoustic stressors could result from the physical presence of the equipment and personnel; however, any impacts to marine mammals are expected to primarily be acoustic in nature. Acoustic stressors include effects of heavy equipment operation during pile installation and dredging.

Acoustic Impacts

The introduction of anthropogenic noise into the aquatic environment from pile driving and dredging is the primary means by which marine mammals may be harassed from Carnival's specified activity. In general, animals exposed to natural or anthropogenic sound may experience physical and psychological effects, ranging in magnitude from none to severe (Southall *et al.* 2007). Exposure to in-water construction noise has the potential to result in auditory threshold shifts and behavioral reactions (*e.g.*, avoidance, temporary cessation of foraging and vocalizing, changes in dive behavior) and/or lead to non-observable physiological responses such an increase in stress hormones ((Richardson *et al.*, 1995; Gordon *et al.*, 2004; Nowacek *et al.*, 2007; Southall *et al.*, 2007; Gotz *et al.*, 2009). Additional noise in a marine mammal's habitat can mask acoustic cues used by marine mammals to carry out daily functions such as communication and predator and prey detection. The effects of pile driving and dredging noise on marine mammals are dependent on several factors, including, but not limited to, sound type (*e.g.*, impulsive vs. non-impulsive), the species, age and sex class (*e.g.*, adult male vs. mom with calf), duration of exposure, the distance between the pile and the animal, received levels, behavior at time of exposure, and previous history with exposure (Wartzok *et al.* 2004; Southall *et al.* 2007). Here we discuss physical auditory effects (threshold shifts), followed by behavioral effects and potential impacts on habitat.

Richardson *et al.* (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal's hearing range. First is the area within which the acoustic signal would be audible (potentially perceived) to the animal, but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory or other systems. Overlaying these zones to a certain extent is the area within which masking (*i.e.*, when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold) may occur; the masking zone may be highly variable in size.

We describe the more severe effects (*i.e.*, permanent hearing impairment, certain non-auditory physical or physiological effects) only briefly as we do not expect that there is a reasonable likelihood that Carnival's activities would result in such effects (see below for further discussion). NMFS defines a noise-induced threshold shift (TS) as a change, usually an increase, in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS 2018). The amount of threshold shift is customarily expressed in dB. A TS can be permanent or temporary. As described in NMFS (2018), there are numerous factors to consider when examining the consequence of TS, including, but not limited to, the signal temporal pattern (*e.g.*, impulsive or non-impulsive), likelihood an individual would be exposed for a long enough duration or to a high enough level to induce a TS, the magnitude of the TS, time to recovery (seconds to minutes or hours to days), the frequency range of the exposure (*i.e.*, spectral content), the hearing and vocalization frequency range of the exposed species relative to the signal's frequency spectrum (*i.e.*, how animal uses sound within the frequency band of the signal; *e.g.*, Kastelein *et al.* 2014b), and the overlap between the animal and the source (*e.g.*, spatial, temporal, and spectral).

Permanent Threshold Shift (PTS) - NMFS defines PTS as a permanent, irreversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS 2018). Available data from humans and other terrestrial mammals indicate that a 40 dB threshold shift approximates PTS onset (see Ward *et al.* 1958, 1959; Ward 1960; Kryter *et al.* 1966; Miller 1974; Ahroon *et al.* 1996; Henderson *et al.* 2008). PTS levels for marine mammals are estimates, as with the exception of a single study unintentionally inducing PTS in a harbor seal (Kastak *et al.* 2008), there are no empirical data measuring PTS in marine mammals largely due to the fact that, for various ethical reasons, experiments involving anthropogenic noise exposure at levels inducing PTS are not typically pursued or authorized (NMFS 2018).

Temporary Threshold Shift (TTS) - A temporary, reversible increase in the threshold of audibility at a specified frequency or portion of an individual's hearing range above a previously established reference level (NMFS 2018). Based on data from cetacean TTS measurements (see Southall *et al.* 2007), a TTS of 6 dB is considered the minimum threshold shift clearly larger than any day-to-day or session-to-session variation in a subject's normal hearing ability (Schlundt *et al.* 2000; Finneran *et al.* 2000, 2002). As described in Finneran (2016), marine mammal studies have shown the amount of TTS increases with cumulative sound exposure level (SELcum) in an accelerating fashion: At low exposures with lower SELcum, the amount of TTS is typically small and the growth curves have shallow slopes. At exposures with higher higher SELcum, the growth curves become steeper and approach linear relationships with the noise SEL.

Depending on the degree (elevation of threshold in dB), duration (*i.e.*, recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals ranging from discountable to serious (similar to those discussed in auditory masking, below). For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that takes place during a time when the animal is traveling through the open ocean, where ambient noise is lower and there are not as many competing sounds present.

Alternatively, a larger amount and longer duration of TTS sustained during time when communication is critical for successful mother/calf interactions could have more serious impacts. We note that reduced hearing sensitivity as a simple function of aging has been observed in marine mammals, as well as humans and other taxa (Southall *et al.* 2007), so we can infer that strategies exist for coping with this condition to some degree, though likely not without cost.

Currently, TTS data only exist for four species of cetaceans (bottlenose dolphin (*Tursiops truncatus*), beluga whale (*Delphinapterus leucas*), harbor porpoise (*Phocoena phocoena*), and Yangtze finless porpoise (*Neophocoena asiaeorientalis*)) and five species of pinnipeds exposed to a limited number of sound sources (*i.e.*, mostly tones and octave-band noise) in laboratory settings (Finneran 2015). TTS was not observed in trained spotted (*Phoca largha*) and ringed (*Pusa hispida*) seals exposed to impulsive noise at levels matching previous predictions of TTS onset (Reichmuth *et al.* 2016). In general, harbor seals and harbor porpoises have a lower TTS onset than other measured pinniped or cetacean species (Finneran 2015). Additionally, the existing marine mammal TTS data come from a limited number of individuals within these species. No data are available on noise-induced hearing loss for mysticetes. For summaries of data on TTS in marine mammals or for further discussion of TTS onset thresholds, please see Southall *et al.* (2007), Finneran and Jenkins (2012), Finneran (2015), and Table 5 in NMFS (2018). Installing piles requires a combination of impact pile driving and vibratory pile driving. For the project, these activities would not occur at the same time and there would likely be pauses in activities producing the sound during each day. Given these pauses and that many marine mammals are likely moving through the action area and not remaining for extended periods of time, the potential for TS declines.

Behavioral Harassment - Behavioral disturbance may include a variety of effects, including subtle changes in behavior (*e.g.*, minor or brief avoidance of an area or changes in vocalizations), more conspicuous changes in similar behavioral activities, and more sustained and/or potentially severe reactions, such as displacement from or abandonment of high-quality habitat. Disturbance may result in changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where sound sources are located. Pinnipeds may increase their haul out time, possibly to avoid in-water disturbance (Thorson and Reyff 2006). Behavioral responses to sound are highly variable and context-specific and any reactions depend on numerous intrinsic and extrinsic factors (*e.g.*, species, state of maturity, experience, current activity, reproductive state, auditory sensitivity, time of day), as well as the interplay between factors (*e.g.*, Richardson *et al.* 1995; Wartzok *et al.* 2003; Southall *et al.* 2007; Weilgart 2007; Archer *et al.* 2010). Behavioral reactions can vary not only among individuals but also within an individual, depending on previous experience with a sound source, context, and numerous other factors (Ellison *et al.* 2012), and can vary depending on characteristics associated with the sound source (*e.g.*, whether it is moving or stationary, number of sources, distance from the source). In general, pinnipeds seem more tolerant of, or at least habituate more quickly to, potentially disturbing underwater sound than do cetaceans, and generally seem to be less responsive to exposure to industrial sound than most cetaceans. Please see Appendices B-C of Southall *et al.* (2007) for a review of studies involving marine mammal behavioral responses to sound.

Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.*, 2003). Animals are most likely to habituate to sounds that are predictable and unvarying. It is important to note that habituation is appropriately considered as a "progressive reduction in response to stimuli that are perceived as neither aversive nor beneficial," rather than as, more generally, moderation in response to human disturbance (Bejder *et al.*, 2009). The opposite process is sensitization, when an unpleasant experience leads to subsequent responses, often in the form of avoidance, at a lower level of exposure.

As noted above, behavioral state may affect the type of response. For example, animals that are resting may show greater behavioral change in response to disturbing sound levels than animals that are highly motivated to remain in an area for feeding (Richardson *et al.*, 1995; NRC, 2003; Wartzok *et al.*, 2003). Controlled experiments with captive marine mammals have showed pronounced behavioral reactions, including avoidance of loud sound sources (Ridgway *et al.*, 1997; Finneran *et al.*, 2003). Observed responses of wild marine mammals to loud pulsed sound sources (typically seismic airguns or acoustic harassment devices) have been varied but often consist of avoidance behavior or other behavioral changes suggesting discomfort (Morton and Symonds 2002; see also Richardson *et al.*, 1995; Nowacek *et al.*, 2007).

Available studies show wide variation in response to underwater sound; therefore, it is difficult to predict specifically how any given sound in a particular instance might affect marine mammals perceiving the signal. If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (*e.g.*, Lusseau and Bejder 2007; Weilgart 2007; NRC 2005). However, there are broad categories of potential response, which we describe in greater detail here, that include alteration of dive behavior, alteration of foraging behavior, effects to breathing, interference with or alteration of vocalization, avoidance, and flight.

Changes in dive behavior can vary widely, and may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive (*e.g.*, Frankel and Clark 2000; Costa *et al.*, 2003; Ng and Leung 2003; Nowacek *et al.*, 2004; Goldbogen *et al.*, 2013a,b). Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.*, foraging) or they may be of little biological significance. The impact of an alteration to dive behavior resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.*, bubble nets or sediment plumes), or changes in dive behavior. As for other types of behavioral response, the frequency, duration, and temporal pattern of signal presentation, as well as differences in species sensitivity, are likely contributing factors to differences in response in any given circumstance (*e.g.,* Croll *et al.* 2001; Nowacek *et al.* 2004; Madsen *et al.* 2006; Yazvenko *et al.* 2007). A determination of whether foraging disruptions incur fitness consequences would require information on or estimates of the energetic requirements of the affected individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal.

Variations in respiration naturally vary with different behaviors and alterations to breathing rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Various studies have shown that respiration rates may either be unaffected or could increase, depending on the species and signal characteristics, again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (*e.g.*, Kastelein *et al.*, 2001, 2005b, 2006; Gailey *et al.*, 2007).

Marine mammals vocalize for different purposes and across multiple modes, such as whistling, echolocation click production, calling, and singing. Changes in vocalization behavior in response to anthropogenic noise can occur for any of these modes and may result from a need to compete with an increase in background noise or may reflect increased vigilance or a startle response. For example, in the presence of potentially masking signals, humpback whales and killer whales have been observed to increase the length of their songs (Miller *et al.*, 2000; Fristrup *et al.*, 2003; Foote *et al.*, 2004), while right whales (Eubalaena glacialis) have been observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.*, 2007b). In some cases, animals may cease sound production during production of aversive signals (Bowles *et al.*, 1994).

Avoidance is the displacement of an individual from an area or migration path as a result of the presence of a sound or other stressors, and is one of the most obvious manifestations of disturbance in marine mammals (Richardson *et al.*, 1995). For example, gray whales (Eschrictius robustus) are known to change direction – deflecting from customary migratory paths – in order to avoid noise from seismic surveys (Malme *et al.*, 1984). Avoidance may be short-term, with animals returning to the area once the noise has ceased (*e.g.*, Bowles *et al.*, 1994; Goold 1996; Stone *et al.*, 2000; Morton and Symonds, 2002; Gailey *et al.*, 2007). Longer-term displacement is possible, however, which may lead to changes in abundance or distribution patterns of the affected species in the affected region if habituation to the presence of the sound does not occur (*e.g.*, Blackwell *et al.*, 2004; Bejder *et al.*, 2006; Teilmann *et al.*, 2006).

A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. The flight response differs from other avoidance responses in the intensity of the response (*e.g.*, directed movement, rate of travel). Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus 1996). The result of a flight response could range from brief, temporary exertion and displacement from the area where the signal provokes flight to, in extreme cases, marine mammal strandings (Evans and England 2001). However, it should be noted that response to a perceived predator does not necessarily invoke flight (Ford and Reeves 2008), and whether individuals are solitary or in groups may influence the response.

Behavioral disturbance can also impact marine mammals in more subtle ways. Increased vigilance may result in costs related to diversion of focus and attention (*i.e.*, when a response consists of increased vigilance, it may come at the cost of decreased attention to other critical behaviors such as foraging or resting). These effects have generally not been demonstrated for marine mammals, but studies involving fish and terrestrial animals have shown that increased vigilance may substantially reduce feeding rates (*e.g.*, Beauchamp and Livoreil 1997; Fritz *et al*,, 2002; Purser and Radford 2011). In addition, chronic disturbance can cause population declines through reduction of fitness (*e.g.*, decline in body condition) and subsequent reduction in reproductive success, survival, or both (*e.g.*, Harrington and Veitch, 1992; Daan *et al.*, 1996; Bradshaw *et al.*, 1998). However, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a five-day period did not cause any sleep deprivation or stress effects.

Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Disruption of such functions resulting from reactions to stressors such as sound exposure are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.*, 2007). Consequently, a behavioral response lasting less than one day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.*, 2007). Note that there is a difference between multi-day substantive behavioral reactions and multi-day anthropogenic activities. For example, just because an activity lasts for multiple days does not necessarily mean that individual animals are either exposed to activity-related stressors for multiple days or, further, exposed in a manner resulting in sustained multi-day substantive behavioral responses.

Stress responses – An animal's perception of a threat may be sufficient to trigger stress responses consisting of some combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses (*e.g.*, Seyle 1950; Moberg 2000). In many cases, an animal's first and sometimes most economical (in terms of energetic costs) response is behavioral avoidance of the potential stressor. Autonomic nervous system responses to stress typically involve changes in heart rate, blood pressure, and gastrointestinal activity. These responses have a relatively short duration and may or may not have a significant long-term effect on an animal's fitness.

Neuroendocrine stress responses often involve the hypothalamus-pituitary-adrenal system. Virtually all neuroendocrine functions that are affected by stress – including immune competence, reproduction, metabolism, and behavior – are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction, altered metabolism, reduced immune competence, and behavioral disturbance (*e.g.*, Moberg 1987; Blecha 2000). Increases in the circulation of glucocorticoids are also equated with stress (Romano *et al.*, 2004).

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and "distress" is the cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other functions. This state of distress will last until the animal replenishes its energetic reserves sufficient to restore normal function.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well-studied through controlled experiments and for both laboratory and free-ranging animals (*e.g.*, Holberton *et al.*, 1996; Hood *et al.*, 1998; Jessop *et al.*, 2003; Krausman *et al.*, 2004; Lankford *et al.*, 2005). Stress responses due to exposure to anthropogenic sounds or other stressors and their effects on marine mammals have also been reviewed (Fair and Becker 2000; Romano *et al.*, 2002b) and, more rarely, studied in wild populations (*e.g.*, Romano *et al.*, 2002a). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. These and other studies lead to a reasonable expectation that some marine mammals will experience physiological stress responses upon exposure to acoustic stressors and that it is possible that some of these would be classified as "distress." In addition, any animal experiencing TTS would likely also experience stress responses (NRC, 2003).

Masking - Sound can disrupt behavior through masking, or interfering with, an animal's ability to detect, recognize, or discriminate between acoustic signals of interest (*e.g.*, those used for intraspecific communication and social interactions, prey detection, predator avoidance, navigation) (Richardson *et al.* 1995). Masking occurs when the receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity, and may occur whether the sound is natural (*e.g.*, snapping shrimp, wind, waves, precipitation) or anthropogenic (*e.g.*, pile driving, shipping, sonar, seismic exploration) in origin. The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (*e.g.*, signal-to-noise ratio, temporal variability, direction), in relation to each other and to an animal's hearing abilities (*e.g.*, sensitivity, frequency range, critical ratios, frequency discrimination, directional discrimination, age or TTS hearing loss), and existing ambient noise and propagation conditions.

Masking of natural sounds can result when human activities produce high levels of background sound at frequencies important to marine mammals. Conversely, if the background level of underwater sound is high (*e.g.* on a day with strong wind and high waves), an anthropogenic sound source would not be detectable as far away as would be possible under quieter conditions and would itself be masked. POLB is an active, industrialized harbor. POLB is an active port of call for not only cruise ships, but hosts numerous recreational and commercial vessels; therefore, background sound levels in the POLB are already elevated by these activities.

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.*, Clark *et al.*, 2009) and may result in energetic or other costs as animals change their vocalization behavior (*e.g.*, Miller *et* *al.*, 2000; Foote *et al.*, 2004; Parks *et al.*, 2007b; Di Iorio and Clark 2009; Holt *et al.*, 2009). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al.*, 1995), through amplitude modulation of the signal, or through other compensatory behaviors (Houser and Moore 2014). Masking can be tested directly in captive species (*e.g.*, Erbe 2008), but in wild populations it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing real-world masking sounds likely to be experienced by marine mammals in the wild (*e.g.*, Branstetter *et al.*, 2013).

Masking affects both senders and receivers of acoustic signals and can potentially have long-term chronic effects on marine mammals at the population level as well as at the individual level. Low-frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of SPL) in the world's ocean from pre-industrial periods, with most of the increase from distant commercial shipping (Hildebrand 2009). All anthropogenic sound sources, but especially chronic and lower-frequency signals (*e.g.*, from vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking.

Underwater Acoustic Effects

Potential Effects of Dredging Sound

Based on existing reference values, the dredge/tug engine would produce the highest SPLs during dredging activities. Tugboat engine noise was estimated to be 170 ± 5 dB (rms) at 1 m (Veirs *et al.* 2016). As previously described, POLB is an industrialized harbor. POLB is an active port of call for not only cruise ships, but hosts numerous recreational and commercial vessels including tugboats; therefore, background sound levels in the POLB are elevated by sounds produced by these vessels. The sounds produced by tugboat engines are of similar frequencies to the sounds produced by other vessel engines, and are anticipated to diminish to background noise levels (or be masked by background noise levels) in the Port relatively close to the project site. Further, any marine mammals inhabiting the POLB are exposed nearly continuously to the sounds produced by vessels. The dredging area is located close to the dock (See Figure 8 of the application), and the applicants plan to implement a 10 m shutdown zone around dredging activities. Finally, the applicants note that sounds produced by tugboats associated with dredging would primarily occur on the same days as pile driving, and therefore would potentially impact the same individuals. These animals would previously have been ‘taken’ because of exposure to underwater sounds produced by pile driving. Thus, in these cases, behavioral harassment of these animals would already accounted for in these estimates of potential take. Therefore, for the reasons described above, we do not believe that authorization of incidental take resulting from dredging is warranted, and impacts of dredging are not discussed further.

Potential Effects of Pile Driving Sound

The effects of sounds from pile driving might include one or more of the following: temporary or permanent hearing impairment, non-auditory physical or physiological effects, behavioral disturbance, and masking (Richardson *et al.*, 1995; Gordon *et al.*, 2003; Nowacek *et al.*, 2007; Southall *et al.*, 2007). The effects of pile driving on marine mammals are dependent on several factors, including the type and depth of the animal; the pile size and type, and the intensity and duration of the pile driving sound; the substrate; the standoff distance between the pile and the animal; and the sound propagation properties of the environment. Impacts to marine mammals from pile driving activities are expected to result primarily from acoustic pathways. As such, the degree of effect is intrinsically related to the frequency, received level, and duration of the sound exposure, which are in turn influenced by the distance between the animal and the source. The further away from the source, the less intense the exposure should be. The substrate and depth of the habitat affect the sound propagation properties of the environment. In addition, substrates that are soft (*e.g.*, sand) would absorb or attenuate the sound more readily than hard substrates (*e.g.*, rock), which may reflect the acoustic wave. Soft porous substrates would also likely require less time to drive the pile, and possibly less forceful equipment, which would ultimately decrease the intensity of the acoustic source.

In the absence of mitigation, impacts to marine species could be expected to include physiological and behavioral responses to the acoustic signature (Viada *et al.*, 2008). Potential effects from impulsive sound sources like pile driving can range in severity from effects such as behavioral disturbance to temporary or permanent hearing impairment (Yelverton *et al.*, 1973). Due to the nature of the pile driving sounds in the project, behavioral disturbance is the most likely effect from the proposed activity. Marine mammals exposed to high intensity sound repeatedly or for prolonged periods can experience hearing threshold shifts. PTS constitutes injury, but TTS does not (Southall *et al.*, 2007).

Non-auditory Physiological Effects

Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al.*, 2006; Southall *et al.*, 2007). Studies examining such effects are limited. In general, little is known about the potential for pile driving to cause non-auditory physical effects in marine mammals. Available data suggest that such effects, if they occur at all, would presumably be limited to short distances from the sound source and to activities that extend over a prolonged period. The available data do not allow identification of a specific exposure level above which non-auditory effects can be expected (Southall *et al.*, 2007) or any meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in those ways. We do not expect any non-auditory physiological effects because of mitigation that prevents animals from approach the source too closely, as well as source levels with very small Level A harassment isopleths. Marine mammals that show behavioral avoidance of pile driving, including some odontocetes and some pinnipeds, are especially unlikely to incur on-auditory physical effects.

Disturbance Reactions

Responses to continuous sound, such as vibratory pile installation, have not been documented as well as responses to pulsed sounds. With both types of pile driving, it is likely that the onset of pile driving could result in temporary, short term changes in an animal's typical behavior and/or avoidance of the affected area. These behavioral changes may include (Richardson *et al.*, 1995): changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where sound sources are located; and/or flight responses (*e.g.*, pinnipeds flushing into water from haul-outs or rookeries). Pinnipeds may increase their haul out time, possibly to avoid in-water disturbance (Thorson and Reyff 2006). If a marine mammal responds to a stimulus by changing its behavior (*e.g.*, through relatively minor changes in locomotion direction/speed or vocalization behavior), the response may or may not constitute taking at the individual level, and is unlikely to affect the stock or the species as a whole. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on animals, and if so potentially on the stock or species, could potentially be significant (*e.g.*, Lusseau and Bejder 2007; Weilgart 2007).

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be expected to be biologically significant if the change affects growth, survival, or reproduction. Significant behavioral modifications that could potentially lead to effects on growth, survival, or reproduction include:

- Drastic changes in diving/surfacing patterns (such as those thought to cause beaked whale stranding due to exposure to military mid-frequency tactical sonar);
- Longer-term habitat abandonment due to loss of desirable acoustic environment; and
- Longer-term cessation of feeding or social interaction.

The onset of behavioral disturbance from anthropogenic sound depends on both external factors (characteristics of sound sources and their paths) and the specific characteristics of the receiving animals (hearing, motivation, experience, demography) and is difficult to predict (Southall *et al.*, 2007).

Auditory Masking

Natural and artificial sounds can disrupt behavior by masking. The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. Because sound generated from in-water pile driving is mostly concentrated at low frequency ranges, it may have less effect on high frequency echolocation sounds made by porpoises. The most intense underwater sounds in the proposed action are those produced by impact pile driving. Given that the energy distribution of pile driving covers a broad frequency spectrum, sound from these sources would likely be within the audible range of marine mammals present in the project area. Impact pile driving activity is relatively short-term, with rapid pulses occurring for less than fifteen minutes per pile. The probability for impact pile driving resulting from this proposed action masking acoustic signals important to the behavior and survival of marine mammal species is low. Vibratory pile driving is also relatively short-term, with rapid oscillations occurring for approximately 31.5 minutes per pile. It is possible that vibratory pile driving resulting from this proposed action may mask acoustic signals important to the behavior and survival of marine mammal species, but the short-term duration and limited affected area would result in insignificant impacts from masking. Any masking event that could possibly rise to Level B harassment under the MMPA would occur concurrently within the zones of behavioral harassment already estimated for vibratory and impact pile driving, and which have already been taken into account in the exposure analysis. Active pile driving is anticipated to occur for less than four hours per day and for 26 days between November 15, 2019 and April 15, 2020, so we do not anticipate masking to significantly affect marine mammals.

Airborne Acoustic Effects

Pinnipeds that occur near the project site could be exposed to airborne sounds associated with pile driving that have the potential to cause behavioral harassment, depending on their distance from pile driving activities. Cetaceans are not expected to be exposed to airborne sounds that would result in harassment as defined under the MMPA.

Airborne noise would primarily be an issue for pinnipeds that are swimming or hauled out near the project site within the range of noise levels elevated above the acoustic criteria. Based on the location of the construction for the parking garage, levels of expected construction noise, and lack any pinniped haul-outs in the immediate vicinity of the project site, airborne noise associated with parking facility renovation are not expected to have any impact on pinnipeds. We recognize that pinnipeds in the water could be exposed to airborne sound that may result in behavioral harassment when looking with their heads above water. Most likely, airborne sound would cause behavioral responses similar to those discussed above in relation to underwater sound. For instance, anthropogenic sound could cause hauled out pinnipeds to exhibit changes in their normal behavior, such as reduction in vocalizations, or cause them to temporarily abandon the area and move further from the source. However, these animals would previously have been ‘taken’ because of exposure to underwater sound above the behavioral harassment thresholds, which are in all cases larger than those associated with airborne sound. Thus, the behavioral harassment of these animals would already accounted for in these estimates of potential take. Therefore, we do not believe that authorization of incidental take resulting from airborne sound for pinnipeds is warranted, and airborne sound is not discussed further here.

Marine Mammal Habitat Effects

The area likely impacted by the project is relatively small compared to the available habitat for all impacted species and stocks, and does not include any ESA-designated critical habitat. As previously mentioned a migration BIA for gray whales overlaps with the project area, however gray whales are rarely observed in the POLB and the proposed project's in-water activities are not anticipated to propagate large distances outside the POLB. Carnival's proposed construction activities in the POLB are of short duration and would not result in permanent negative impacts to habitats used directly by marine mammals, but could have localized, temporary impacts on marine mammal habitat and their prey by increasing underwater and airborne SPLs and slightly decreasing water quality. Increased noise levels may affect acoustic habitat (see masking discussion above) and adversely affect marine mammal prey in the vicinity of the project area (see discussion below). During pile driving, elevated levels of underwater noise would ensonify the POLB where both fish and mammals occur and could affect foraging success. Airborne sounds produced by construction activities would not be detectable at the nearest known pinniped regular use haul-out site used for basking is along the breakwater (approximately 3 km south of the project site).

There are no known foraging hotspots or other ocean bottom structure of significant biological importance to marine mammals present in the marine waters of the project area. Therefore, the main impact issue associated with the proposed activity would be temporarily elevated sound levels and the associated direct effects on marine mammals, as discussed previously in this document. The primary potential acoustic impacts to marine mammal habitat are associated with elevated sound levels produced by vibratory and impact pile driving in the area. Physical impacts to the environment such as construction debris are unlikely.

In-water pile driving and dredging activities would also cause short-term effects on water quality due to increased turbidity. The POLB is degraded and turbidity levels are generally high in the POLB, particularly in the rainy season. Carnival would employ standard construction best management practices (BMPs; see Section 11 of the application), and deploy silt fences for onshore activities, thereby reducing any potential impacts. Therefore, the impact from increased turbidity levels is expected to be discountable.

In-water Construction Effects on Potential Foraging Habitat

Pile installation and dredging may temporarily increase turbidity resulting from suspended sediments. Any increases would be temporary, localized, and minimal. In general, turbidity associated with pile installation is localized to about a 25-foot (7.6 m) radius around the pile (Everitt *et al.* 1980). Large cetaceans are not expected to be close enough to the project activity areas to experience effects of turbidity, and any small cetaceans and pinnipeds could avoid localized areas of turbidity. Therefore, the impact from increased turbidity levels is expected to be discountable to marine mammals.

Essential Fish Habitat (EFH) for several species or groups of species overlaps with the project area including: groundfish, coastal pelagic species, krill, finfish, dorado, and common thresher shark. NMFS (West Coast Region) reviewed the proposed action for potential effects to EFH pursuant to the Magnuson-Stevens Fishery Conservation and

Management Act. The consultation identified project related activities that may adversely affect EFH including direct impacts to benthic habitat and organisms including dredging, increased turbidity, and underwater noise generation associated with pile installation and related construction work. However, they noted that the proposed project includes adequate conservation measures to address these impacts. For example, surveys for *Caulerpa taxifolia* will be performed in accordance with the *Caulerpa* Control Protocol to avoid the potential spread of that invasive alga. In addition, a "soft start" procedure and the use of bubble curtains will reduce the impacts of underwater acoustic noise associated with pile driving activities. In addition to the adverse effects identified above, the proposed project will increase overwater coverage by 5,340 square feet (1,628 square m) and will increase the amount of artificial hard structure within the marine environment. In general, increased overwater coverage would permanently reduce the quality of EFH and aquatic functions of waters of the United States. NMFS has completed an EFH Programmatic Consultation for Overwater Structures with the USACE Los Angeles District South Coast Branch, which summarizes the various adverse impacts to EFH and aquatic resources. NMFS does not believe the proposed project would result in a substantial adverse effect to EFH on an individual basis. However, NMFS noted in the consultation that the U.S. Army Corps of Engineers should consider the cumulative impacts of the proposed project and explicitly identify the conditions for which compensatory mitigation for lost aquatic functions would be deemed appropriate.

Avoidance by potential prey (*i.e.*, fish) of the immediate area due to the temporary loss of this foraging habitat is also possible. The duration of fish avoidance of this area after pile driving or dredging stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. Any behavioral avoidance by fish of the disturbed area would still leave significantly large areas of fish and marine mammal foraging habitat in the nearby vicinity.

The duration of the construction activities is relatively short. Pile driving activities would occur for 26 days and dredging activities would occur for 30 days during the proposed project dates. These activities are anticipated to overlap, reducing the total number of construction days, and in-water activities will occur during daylight hours only. Impacts to habitat and prey are expected to be minimal based on the short duration of activities.

In-water Construction Effects on Potential Prey (Fish) - Construction activities would produce continuous (*i.e.*, vibratory pile driving and dredging) and pulsed (*i.e.* impact driving) sounds. Fish react to sounds that are especially strong and/or intermittent low-frequency sounds. Short duration, sharp sounds can cause overt or subtle changes in fish behavior and local distribution (summarized in Popper and Hastings 2009). Hastings and Popper (2005) reviewed several studies that suggest fish may relocate to avoid certain areas of sound energy. Additional studies have documented physical and behavioral effects of pile driving on fish, although several are based on studies in support of large, multiyear bridge construction projects (*e.g.*, Scholik and Yan 2001, 2002; Popper and Hastings 2009). Sound pulses at received levels of 160 dB may cause subtle changes in fish behavior. SPLs of 180 dB may cause noticeable changes in behavior (Pearson *et al.* 1992; Skalski *et al.* 1992). SPLs of sufficient strength have been known to cause injury to fish and fish mortality (summarized in Popper *et al.* 2014).

The most likely impact to fish from pile driving activities at the project area would be temporary behavioral avoidance of the area. The duration of fish avoidance of this area after pile driving stops is unknown, but a rapid return to normal recruitment, distribution and behavior is anticipated. In general, impacts to marine mammal prey species are expected to be minor and temporary due to the short timeframe for the project.

In summary, given the short daily duration of sound associated with individual pile driving and dredging events and the relatively small and currently industrialized areas being affected, pile driving and dredging activities associated with the proposed action are not likely to have a permanent, adverse effect on any fish habitat, or populations of fish species. Thus, we conclude that impacts of the specified activity are not likely to have more than short-term adverse effects on any prey habitat or populations of prey species. Further, any impacts to marine mammal habitat are not expected to result in significant or long-term consequences for individual marine mammals, or to contribute to adverse impacts on their populations.

Estimated Take

This section provides an estimate of the number of incidental takes proposed for authorization through this IHA, which will inform both NMFS' consideration of "small numbers" and the negligible impact determination.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines "harassment" as any act of pursuit, torment, or annoyance, which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Authorized takes would primarily be by Level B harassment, as use of the acoustic sources (*i.e.*, pile driving) has the potential to result in disruption of behavioral patterns for individual marine mammals. There is also some potential for auditory injury (Level A harassment) to result, for phocids (harbor seals) because predicted auditory injury zones are larger than for mid-frequency species and otariids. Auditory injury is unlikely to occur for mid-frequency cetaceans and otariids. The proposed mitigation and monitoring measures (see *Mitigation* and *Monitoring and Reporting* sections below) are expected to minimize the severity of such taking to the extent practicable. With implementation of the proposed mitigation and monitoring measures (see *Proposed Mitigation* section), no Level B harassment or Level A harassment is anticipated for low-frequency cetaceans (humpback whales and gray whales). As described previously, no mortality is anticipated or proposed to be authorized for this activity. Below we describe how the take is estimated.

Generally speaking, we estimate take by considering: (1) acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas; and, (4) and the number of days of activities. We note that while these basic factors can contribute to a basic calculation to provide an initial prediction of takes, additional information that can qualitatively inform take estimates is also sometimes available (*e.g.*, previous monitoring results or average group size). Below, we describe the factors considered here in more detail and present the proposed take estimate.

Acoustic Thresholds

Using the best available science, NMFS has developed acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

Level B Harassment for non-explosive sources – Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source (*e.g.*, frequency, predictability, duty cycle), the environment (*e.g.*, bathymetry), and the receiving animals (hearing, motivation, experience, demography, behavioral context) and can be difficult to predict (Southall *et al.*, 2007, Ellison *et al.*, 2012). Based on what the available science indicates and the practical need to use a threshold based on a factor that is both predictable and measurable for most activities, NMFS uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS predicts that marine mammals are likely to be behaviorally harassed in a manner we consider Level B harassment when exposed to underwater anthropogenic noise above received levels of 120 dB re 1 μPa (rms) for continuous (*e.g.*, vibratory pile-driving, drilling) and above 160 dB re 1 μPa (rms) for non-explosive impulsive (*e.g.*, seismic airguns) or intermittent (*e.g.*, scientific sonar) sources. Carnival’s proposed activity includes the use of continuous (vibratory pile driving) and impulsive (impact pile driving) sources, and therefore the 120 and 160 dB re 1 μPa (rms) thresholds are applicable.

Level A harassment for non-explosive sources - NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (Technical Guidance, 2018) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). Carnival's proposed activity includes the use includes the use of continuous (vibratory pile driving) and impulsive (impact pile driving) sources.

These thresholds are provided in Table 3 below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS 2018 Technical Guidance, which may be accessed at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance*.

Table 3 -- Thresholds Identifying the Onset of Permanent Threshold Shift

	PTS Onset Thresholds* **(Received Level)**	
Hearing Group	**Impulsive**	**Non-impulsive**
Low-Frequency (LF) Cetaceans	$L_{p,\text{0-pk,flat}}$: 219 dB $L_{E,p,\text{ LF,24h}}$: 183 dB	$L_{E,p,\text{ LF,24h}}$: 199 dB
Mid-Frequency (MF) Cetaceans	$L_{p,\text{0-pk,flat}}$: 230 dB $L_{E,p,\text{ MF,24h}}$: 185 dB	$L_{E,p,\text{ MF,24h}}$: 198 dB
High-Frequency (HF) Cetaceans	$L_{p,\text{0-pk,flat}}$: 202 dB $L_{E,p,\text{HF,24h}}$: 155 dB	$L_{E,p,\text{ HF,24h}}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	$L_{p,\text{0-pk.flat}}$: 218 dB $L_{E,p,\text{PW,24h}}$: 185 dB	$L_{E,p,\text{PW,24h}}$: 201 dB
Otariid Pinnipeds (OW) (Underwater)	$L_{p,\text{0-pk,flat}}$: 232 dB $L_{E,p,\text{OW,24h}}$: 203 dB	$L_{E,p,\text{OW,24h}}$: 219 dB

* Dual metric thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds are recommended for consideration.

Note: Peak sound pressure level ($L_{p,\text{0-pk}}$) has a reference value of 1 μPa, and weighted cumulative sound exposure level ($L_{E,p}$) has a reference value of 1μPa^{2}s. In this table, thresholds are abbreviated to be more reflective of International Organization for Standardization standards (ISO 2017). The subscript "flat" is being included to indicate peak sound pressure are flat weighted or unweighted within the generalized hearing range of marine mammals (*i.e.*, 7 Hz to 160 kHz). The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The weighted cumulative sound exposure level thresholds could be exceeded in a multitude of ways (*i.e.*, varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these thresholds will be exceeded.

Ensonified Area

Here, we describe operational and environmental parameters of the activity that will feed into identifying the area ensonified above the acoustic thresholds, which include source levels and transmission loss coefficient.

The sound field in the project area is the existing background noise plus additional construction noise from the proposed project. Pile driving generates underwater noise that can potentially result in disturbance to marine mammals in the project area. The maximum (underwater) area ensonified is determined by the topography of the POLB including hard structure breakwaters which bound the southern portion of the POLB and preclude sound from transmitting beyond the outer harbor of the POLB (see Figure 5 of the application). Additionally, vessel traffic and other commercial and industrial activities in the project area may contribute to elevated background noise levels which may mask sounds produced by the project.

Transmission loss (TL) is the decrease in acoustic intensity as an acoustic pressure wave propagates out from a source. TL parameters vary with frequency, temperature, sea conditions, current, source and receiver depth, water depth, water chemistry, and bottom composition and topography. The general formula for underwater TL is:

$TL = B * Log_{10} (R_1/R_2)$, where

TL = transmission loss in dB

B = transmission loss coefficient; for practical spreading equals 15

R_1= the distance of the modeled SPL from the driven pile, and

R_2= the distance from the driven pile of the initial measurement

This formula neglects loss due to scattering and absorption, which is assumed to be zero here. The degree to which underwater sound propagates away from a sound source is dependent on a variety of factors, most notably the water bathymetry and presence or absence of reflective or absorptive conditions including in-water structures and sediments. Spherical spreading occurs in a perfectly unobstructed (free-field) environment not limited by depth or water surface, resulting in a 6 dB reduction in sound level for each doubling of distance from the source (20*log[range]). Cylindrical spreading occurs in an environment in which sound propagation is bounded by the water surface and sea bottom, resulting in a reduction of 3 dB in sound level for each doubling of distance from the source (10*log[range]). A practical spreading value of fifteen is often used under conditions, such as the project site at Pier H in the POLB where water increases with depth as the receiver moves away from the shoreline, resulting in an expected propagation environment that would lie between spherical and cylindrical spreading loss conditions. Practical spreading loss is assumed here.

The intensity of pile driving sounds is greatly influenced by factors such as the type of piles, hammers, and the physical environment in which the activity takes place. In order to calculate distances to the Level A harassment and Level B harassment thresholds for the 36 inch steel piles proposed in this project, NMFS used acoustic monitoring data from other locations. In their application, Carnival presented several reference sound levels based on underwater sound measurements documented for other pile driving projects of the west coast of the U.S. (see Tables 1.3 and 1.5 of the application).

Empirical data from a recent sound source verification (SSV) study conducted as part of the Anacortes Ferry Terminal Project, in the state of Washington were used to estimate the sound source levels (SSLs) for impact pile driving and vibratory pile driving. The Anacortes Ferry Terminal Project were generally assumed to best approximate the construction activities and environmental conditions found in the Carnival's proposed project in that the Anacortes Ferry Terminal Project also involved driving 36 inch piles into a similar substrate type (sand and silt) with a diesel hammer of similar power (ft-lbs) (WSDOT 2018). Carnival also presented several references for the number of piles installed per day and the number of strikes (impact pile driving) or minutes (vibratory pile driving) required to install each pile from similar projects on the U.S. west coast. As the Anacortes Ferry Terminal Project was assumed to be most similar to Carnival's proposed project (and generally had the highest values), number of strikes (impact pile driving) or minutes (vibratory pile driving) required to install each pile from this Anacortes Ferry Terminal Project were used to calculate Level A harassment and Level B harassment isopleths (WSDOT 2018). Based on data from these projects, the applicant anticipates that a maximum of 5 piles could be installed via impact pile driving per day and 5 piles could be installed via vibratory pile driving per day.

Carnival used NMFS' Optional User Spreadsheet, available at *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance*, to input project-specific parameters and calculate the isopleths for the Level A harassment and Level B harassment zones for impact and vibratory pile driving. When the NMFS Technical Guidance (2016) was published, in recognition of the fact that ensonified area/volume could be more technically challenging to predict because of the duration component in the new thresholds, we developed a User Spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to help predict takes. We note that because of some of the assumptions included in the methods used for these tools, we anticipate that isopleths produced are typically going to be overestimates of some degree, which may result in some degree of overestimate of Level A harassment take. However, these tools offer the best way to predict appropriate isopleths when more sophisticated 3D modeling methods are not available, and NMFS continues to develop ways to quantitatively refine these tools, and will qualitatively address the output where appropriate. For stationary sources pile driving, the NMFS User Spreadsheet predicts the distance at which, if a marine mammal remained at that distance the whole duration of the activity, it would incur PTS.

Table 4 provides the sound source values and input used in the User Spreadsheet to calculate harassment isopleths for each source type. For the impact pile driving source level, Carnival used levels measured at the Anacortes Ferry Terminal Project (peak SPL [SPLpk]: 207 dB re: 1 μPa at 10 m and single strike sound exposure level [SELs-s]: 175 dB re: 1 μPa at 10 m at the 90th percentile) as reported in WSDOT (2019, Table 7-14). For the vibratory pile driving source level, Carnival also used levels measured at the Anacortes Ferry Terminal Project (SPL: 170 dB re: 1 μPa (rms) at 11 m 175 dB) as reported in WSDOT (2019, Table 7-15). Carnival has proposed to implement bubble curtains (*e.g.* pneumatic barrier typically comprised of hosing or PVC piping that disrupts underwater noise propagation; see *Proposed Mitigation* section below) and has reduced the source levels of both impact and vibratory pile driving by 7 dB (a conservative estimate based on several studies including Austin *et al.* 2016). For impact pile driving, isopleths calculated using the cumulative SEL metric (SELs-s) will be used as it produces larger isopleths than SPLpk. Isopleths for Level B harassment associated with impact pile driving (160 dB) and vibratory pile driving (120 dB) were also calculated and are can be found in Table 5.

Table 4 -- User Spreadsheet Input Parameters Used for Calculating Harassment Isopleths

User Spreadsheet Parameter	Impact Pile Driving	Vibratory Pile Driving
Spreadsheet Tab Used	E.1) Impact pile driving	A. 1) Drilling/ Vibratory pile driving
Source Level (SELs-s or SPL rms)	168 SELs-s[a,b]	163 dB SPL rms[a,b]
Source Level (SPLpk)	207	N/A
Weighting Factor Adjustment (kHz)	2	2.5
Number of piles	5	5
Number of strikes per pile	675	N/A
Number of strikes per day	2,700	N/A
Estimate driving duration (min) per pile	N/A	31.5
Activity Duration (h) within 24-h period	N/A	2.625
Propagation (xLogR)	15 Log R	15 Log R
Distance of source level measurement (meters)	10	11
Other factors	Using bubble curtain	Using bubble curtain

a. WSDOT (2019)
b. Austin *et al.* 2016

Table 5 -- Calculated Distances to Level A Harassment and Level B Harassment Isopleths During Pile Driving

Source	**Level A Harassment Zone (meters)**					**Level B Harassment Zone (meters)**	**Level B Harassment Zone Ensonified Area (km^2)**
	Low-frequency cetacean	Mid-frequency cetacean	High-frequency cetacean	Phocid pinniped	Otariid pinniped	Cetaceans & Pinnipeds	Cetaceans & Pinnipeds

Impact Pile Driving	224.7	8.0	267.6	120.2	8.8	292.7	0.39
Vibratory Pile Driving	19.4	1.7	28.7	11.8	0.8	8,092.1	27.42
Source	**PTS Onset Isopleth – Peak (meters)**						
Impact Pile Driving	1.6	N/A	21.5	1.8	N/A		

Marine Mammal Occurrence

In this section we provide the information about the presence, density, or group dynamics of marine mammals that will inform the take calculations. Marine mammal densities were obtained from MBC Applied Environmental Sciences (2016) and Jefferson *et al.* (2013). MBC Applied Environmental Sciences (2016) conducted marine mammal and bird visual surveys in the POLB over a 12-month period from September, 2013 to August, 2014. The survey area included a substantial portion of the project action area. MBC Applied Environmental Sciences (2016) conducted point count surveys on one day each month within a number of distinct study units including one encompassing approximately half of the existing Carnival dock. These data are relatively recent, and occurred in the POLB in the habitats and locations potentially impacted by the proposed activity, and as such as they are the best available survey data for the project action area. MBC Applied Environmental Sciences (2016) reported raw sightings numbers per month per species. To estimate density from the MBC Applied Environmental Sciences (2016) data, the two-dimensional area of their combined survey area (based on their sampling quadrants) was calculated using GIS and graphics in their report showing the limits of each sampling quadrant. The maximum monthly observed number of observations for each species observed and the total study area (30.35 km^2) was used to calculate density

(Table 6). During POLB surveys, MBC Applied Environmental Sciences (2016) observed common dolphins (not identified to species, however to be conservative, this number was used for both species), common bottlenose dolphins, California sea lions, and harbor seals.

Jefferson *et al.* (2013) reported the results of aerial visual marine mammal surveys from 2008-2013 in the Southern California Bight, including areas around the Channel Islands. Although the survey area did not include the POLB, it did include nearshore waters not far to the south of the Port. Density estimates were based on airborne transects and utilized distance sampling methods. Jefferson *et al.* (2013) provided data for all observed marine mammal species including some not likely to occur nearshore or in the project area; however it represents the most detailed, recent, and comprehensive long term dataset for the region and the best information available on densities for gray and humpback whales in southern California (Jefferson *et al.* 2013) (Table 6). The density estimates for the remaining species for which take is anticipated were higher in the POLB MBC Applied Environmental Sciences (2016) surveys, and these higher density estimates were used to estimate takes (presented in bold in Table 6).

Table 6 -- Marine Mammal Density Information (species densities used for take calculations are denoted by astericks *)

Common Name	Stock	POLB Max Monthly Number 2013-2014 (MBC Applied Environmental Sciences 2016)	Max Density (km^2) (MBC Applied Environmental Sciences 2016)[1]	Max Density (km^2) (Jefferson *et al.* 2013)
Gray whale	Eastern North Pacific	0	0	0.00142*
Humpback whale	CA/OR/WA	0	0	0.01162*
Short-beaked common dolphin	CA/OR/WA	40[2]	1.32*	1.26097
Long-beaked common dolphin	California	40[2]	1.32*	0.50897

Common bottlenose dolphin	Coastal California	5	0.17*	0.02584
California sea lion	U.S.	95	3.13*	0.10345
Harbor seal	California	42	1.38*	0

1 Surface area of MBC Applied Environmental Sciences survey region estimated as 30.35 km^2 via GIS. Density as # marine mammals/km^2.
2 Only identified as "Common Dolphin" and not identified to the species level.

Take Calculation and Estimation

Here we describe how the information provided above is brought together to produce a quantitative take estimate.

Level B Harassment Calculations

The following equation was used to calculate potential take due to Level B harassment per species: *Level B harassment zone/pile installation method * density * # of pile driving days*. As described above, there will be a maximum of 26 days of pile driving and it is anticipated that a maximum of 5 piles could be installed via impact pile driving per day and 5 piles could be installed via vibratory pile driving per day. We used the maximum density estimate reported by either MBC Applied Environmental Sciences (2016) or Jefferson *et al.* (2013) (Table 6). Therefore, the resulting take estimates assume all pile driving conducted when species are in their highest densities in the POLB producing conservative estimates (see Table 7). We present the number of estimated takes due to Level B harassment by impact and vibratory pile driving separately in Table 7, however as these activities are anticipated to occur on the same day (but not at the same time), individuals impacted by impact pile driving are also impacted by vibratory pile driving. As each individual can only be taken once in 24 hours, we conservatively propose to authorize the larger estimate of takes due to vibratory pile driving. Note that while a small number of takes by Level B harassment are estimated using these calculations for gray whales and humpback whales, no takes are proposed for authorization as the applicants have proposed mitigation measures (shutdowns; see *Proposed Mitigation* section below) that would preclude take of these species.

Level A Harassment Calculations

Carnival intends to avoid Level A harassment take by shutting down pile driving activities at approach of any marine mammal to the representative Level A harassment (PTS onset) ensonification zone up to a practical shutdown monitoring distance. As small and cryptic harbor seals may enter the Level A harassment zone (120.2 m for impact pile driving) before shutdown mitigation procedures can be implemented, and some animals may occur between the maximum Level A harassment ensonification zone (120.2 m for impact pile driving) and the maximum shutdown zone (50 m, see *Proposed Mitigation* section), we conservatively estimate that 5 of the Level B harassment takes calculated above for harbor seals have the potential to be takes by Level A harassment (Table 7).

Table 7 -- Estimated Take by Level A and Level B Harassment, by Species and Stock, Resulting from Proposed Carnival Project Activities

Common Name	Stock	Density (km^2)	Activity	Level B Harassment zone (km^2)	Estimated Take Daily	Days of Activity	Total Level B Take	Level A Take	Total Proposed Take	Pr T Pe o
Gray whale	Eastern North Pacific	0.00142	Impact pile driving	0.39	<0.01	26	0.01	0	0	
			Vibratory pile driving	27.42	0.04	26	1.01			
Humpback whale	CA/OR/WA	0.01162	Impact pile driving	0.39	0.00	26	0.12	0	0	
			Vibratory pile driving	27.42	0.32	26	8.28			
Short-beaked common dolphin	CA/OR/WA	1.32	Impact pile driving	0.39	0.51	26	13.38	0	942	
			Vibratory pile driving	27.42	36.19	26	941.05			
Long-beaked	California	1.32	Impact pile driving	0.39	0.51	26	13.38	0	942	

common dolphin			Vibratory pile driving	27.42	36.19	26	941.05			
Common bottlenose dolphin	Coastal California	0.17	Impact pile driving	0.39	0.07	26	1.72	0	122	
			Vibratory pile driving	27.42	4.66	26	121.20			
California sea lion	U.S.	3.13	Impact pile driving	0.39	1.22	26	31.74	0	2,232	
			Vibratory pile driving	27.42	85.82	26	2231.44			
Harbor seal	California	1.38	Impact pile driving	0.39	0.54	26	13.99	5	984	
			Vibratory pile driving	27.42	37.84	26	983.83			

There are a number of reasons why the estimates of potential incidents of take are likely to be conservative. We used conservative estimates of density to calculate takes for each species. Additionally, in the context of stationary activities such as pile driving, and in areas where resident animals may be present, this number represents the number of instances of take that may occur to a small number of individuals, with a notably smaller number of animals being exposed more than once. While pile driving can occur any day throughout the in-water work window, and the analysis is conducted on a per day basis, only a fraction of that time is actually spent pile driving. The potential effectiveness of mitigation measures in reducing the number of takes is also not quantified in the take estimation process. For these reasons, these take estimates may be conservative, especially if each take is considered a separate individual animal.

Proposed Mitigation

In order to issue an IHA under Section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses (latter not applicable for this action). NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, we carefully consider two primary factors:

(1) the manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat. This considers the nature of the potential adverse impact being mitigated (likelihood, scope, range). It further considers the likelihood that the measure will be effective if implemented (probability of accomplishing the mitigating result if implemented as planned), the likelihood of effective implementation (probability implemented as planned), and;

(2) the practicability of the measures for applicant implementation, which may consider such things as cost, impact on operations, and, in the case of a military readiness activity, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

In addition to the measures described later in this section, Carnival will employ the following standard mitigation measures:

- Conduct briefings between construction supervisors and crews and the marine mammal monitoring team prior to the start of all pile driving activity, and when new personnel join the work, to explain responsibilities, communication procedures, marine mammal monitoring protocol, and operational procedures;
- For in-water heavy machinery work other than pile driving (*e.g.*, standard barges, etc.), if a marine mammal comes within 10 m, operations shall cease and vessels shall reduce speed to the minimum level required to maintain steerage and safe working conditions. This type of work could include the following activities: (1) movement of the barge to the pile location; or (2) positioning of the pile on the substrate via a crane (*i.e.*, stabbing the pile);
- Work may only occur during daylight hours, when visual monitoring of marine mammals can be conducted;
- For those marine mammals for which Level B harassment take has not been requested, in-water pile driving will shut down immediately if such species are observed within or entering the monitoring zone (*i.e.*, Level B harassment zone); and
- If take reaches the authorized limit for an authorized species, pile installation will be stopped as these species approach the Level B harassment zone to avoid additional take.

The following measures would apply to Carnival's mitigation requirements:

Establishment of Shutdown Zone for Level A Harassment - For all pile driving activities, Carnival would establish a shutdown zone. The purpose of a shutdown zone is generally to define an area within which shutdown of activity would occur upon sighting of a marine mammal (or in anticipation of an animal entering the defined area).

Conservative shutdown zones of 300 m and 8,100 m for impact and vibratory pile driving respectively would be implemented for low-frequency cetaceans to prevent incidental harassment exposure for these activities. Monitoring of such a large area is practicable in the POLB because the jetties create confined entrances to the Port and Protected Species Observers (PSOs) monitoring at these entrances can ensure no animals enter to Port and shutdown zones (see Figures 3 and 4 of the applicant's Marine Mammal Mitigation and Monitoring Plan for proposed location of PSOs). For impact and vibratory pile driving, Carnival would implement shutdown zones of 10 m for mid-frequency cetaceans and otariid pinnipeds and 50 m for phocid pinnipeds. These shutdown zones would be used to prevent incidental Level A harassment exposures from impact pile driving for mid-frequency cetaceans and otariid pinnipeds, and to reduce the potential for such take for phocid pinnipeds (Table 8). The placement of PSOs during all pile driving activities (described in detail in the *Monitoring and Reporting Section*) will ensure shutdown zones are visible. The 50 m zone is the practical distance Carnival anticipates phocid pinnipeds can be effectively observed in the project area.

Table 8. Monitoring and shutdown zones for each project activity.

Source	Monitoring Zone (m)	Shutdown Zone (m)
Impact Pile Driving	300	Low-frequency cetaceans: 300 Phocid pinnipeds: 50 Mid-frequency cetaceans and otariid pinnipeds: 10
Vibratory Pile Driving	8,100	Low-frequency cetaceans: 8,100 Phocid pinnipeds: 50 Mid-frequency cetaceans and otariid pinnipeds: 10

Establishment of Monitoring Zones for Level B Harassment - Carnival would establish monitoring zones to correlate with Level B harassment zones which are areas where SPLs are equal to or exceed the 160 dB re: 1 µPa (rms) threshold for impact pile driving and the 120 dB re: 1 µPa (rms) threshold during vibratory pile driving. Monitoring zones provide utility for observing by establishing monitoring protocols for areas adjacent to the shutdown zones. Monitoring zones enable observers to be aware of and communicate the presence of marine mammals in the project area outside the shutdown zone and thus prepare for a potential cease of activity should the animal enter the shutdown zone. Carnival would implement a 300 m monitoring zone for impact pile driving and an 8,100 m monitoring zone for vibratory pile driving (Table 8). Placement of PSOs on vessels at entrances to POLB outside the breakwaters will allow PSOs to observe marine mammals traveling into the POLB (see Figures 3 and 4 of the applicant’s Marine Mammal Mitigation and Monitoring Plan for proposed location of PSOs). As the applicants anticipate impact and vibratory pile driving to occur in close temporal succession, the applicants propose to use a total of 7 observers for all pile driving activities.

Soft Start - The use of soft-start procedures are believed to provide additional protection to marine mammals by providing warning and/or giving marine mammals a chance to leave the area prior to the hammer operating at full capacity. For impact pile driving, contractors would be required to provide an initial set of strikes from the hammer at reduced energy, with each strike followed by a 30-second waiting period. This procedure would be conducted a total of three times before impact pile driving begins. Soft start would be implemented at the start of each day’s impact pile driving and at any time following cessation of impact pile driving for a period of 30 minutes or longer. Soft start is not required during vibratory pile driving activities.

Pile driving energy attenuator - Use of a marine pile-driving energy attenuator (*i.e.*, air bubble curtain system) would be implemented by Carnival during impact and vibratory pile driving of all steel pipe piles. The use of sound attenuation will reduce SPLs and the size of the zones of influence for Level A harassment and Level B harassment. Bubble curtains would meet the following requirements:

- The bubble curtain must distribute air bubbles around 100 percent of the piling perimeter for the full depth of the water column.
- The lowest bubble ring shall be in contact with the mudline for the full circumference of the ring, and the weights attached to the bottom ring shall ensure 100 percent mudline contact. No parts of the ring or other objects shall prevent full mudline contact.
- The bubble curtain shall be operated such that there is proper (equal) balancing of air flow to all bubblers.
- The applicant shall require that construction contractors train personnel in the proper balancing of air flow to the bubblers and corrections to the attenuation device to meet the performance standards. This shall occur prior to the initiation of pile driving activities.

Pre-Activity Monitoring **-** Prior to the start of daily in-water construction activity, or whenever a break in pile driving of 30 minutes or longer occurs, PSOs will observe the shutdown and monitoring zones for a period of 30 minutes. The shutdown zone will be cleared when a marine mammal has not been observed within the zone for that 30-minute period. If a marine mammal is observed within the shutdown zone, a soft-start cannot proceed until the animal has left the zone or has not been observed for 15 minutes. If the

Level B harassment zone has been observed for 30 minutes and non-permitted species are not present within the zone, soft start procedures can commence and work can continue even if visibility becomes impaired within the Level B harassment monitoring zone. When a marine mammal permitted for take by Level B harassment is present in the Level B harassment zone, activities may begin and Level B harassment take will be recorded. If work ceases for more than 30 minutes, the pre-activity monitoring of both the Level B harassment and shutdown zone will commence again.

Timing and Environmental Restrictions - Carnival would only conduct pile driving activities during daylight hours. To ensure the monitoring zone for low-frequency cetaceans can be adequately monitored to preclude all incidental take of these species, pile driving activities may not be conducted in conditions with limited visibility (heavy fog, heavy rain, and Beaufort sea states above 4) that would diminish the PSOs ability to adequately monitor this zone.

Based on our evaluation of the applicant's proposed measures, NMFS has preliminarily determined that the proposed mitigation measures provide the means effecting the least practicable impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Proposed Monitoring and Reporting

In order to issue an IHA for an activity, Section 101(a)(5)(D) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

- Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.*, presence, abundance, distribution, density).
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) action or environment (*e.g.*, source characterization, propagation, ambient noise); (2) affected species (*e.g.*, life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.*, age, calving or feeding areas).
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors.
- How anticipated responses to stressors impact either: (1) long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks.
- Effects on marine mammal habitat (*e.g.*, marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat).
- Mitigation and monitoring effectiveness.

Marine Mammal Visual Monitoring

Monitoring shall be conducted by NMFS-approved observers. Trained observers shall be placed from the best vantage point(s) practicable to monitor for marine mammals and implement shutdown or delay procedures when applicable through communication with the equipment operator. Observer training must be provided prior to project start, and shall include instruction on species identification (sufficient to distinguish the species in the project area), description and categorization of observed behaviors and interpretation of behaviors that may be construed as being reactions to the specified activity, proper completion of data forms, and other basic components of biological monitoring, including tracking of observed animals or groups of animals such that repeat sound exposures may be attributed to individuals (to the extent possible).

Monitoring would be conducted 30 minutes before, during, and 30 minutes after pile driving activities. In addition, observers shall record all incidents of marine mammal occurrence, regardless of distance from activity, and shall document any behavioral reactions in concert with distance from piles being driven. Pile driving activities include the time to install a single pile or series of piles, as long as the time elapsed between uses of the pile driving equipment is no more than 30 minutes.

A total of seven PSOs would be based on land and vessels. During all pile driving activities observers will be stationed at the project site (Pier H) and six other locations in the POLB and at the entrance to the POLB (see Figures 3 and 4 of the applicant's Marine Mammal Mitigation and Monitoring Plan for proposed location of PSOs). These stations will allow full monitoring of the impact and vibratory pile driving monitoring zones.

PSOs would scan the waters using binoculars, and/or spotting scopes, and would use a handheld GPS or range-finder device to verify the distance to each sighting from the project site. All PSOs would be trained in marine mammal identification and behaviors and are required to have no other project-related tasks while conducting monitoring. In addition, monitoring will be conducted by qualified observers, who will be placed at the best vantage point(s) practicable to monitor for marine mammals and implement shutdown/delay procedures when applicable by calling for the shutdown to the hammer operator. Carnival would adhere to the following PSO qualifications:

(i) Independent observers (*i.e.*, not construction personnel) are required.

(ii) At least one observer must have prior experience working as an observer.

(iii) Other observers may substitute education (degree in biological science or related field) or training for experience.

(iv) Where a team of three or more observers are required, one observer shall be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer.

(v) Carnival shall submit observer CVs for approval by NMFS.

Additional standard observer qualifications include:

- Ability to conduct field observations and collect data according to assigned protocols

Experience or training in the field identification of marine mammals, including the identification of behaviors;

- Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations;
- Writing skills sufficient to prepare a report of observations including but not limited to the number and species of marine mammals observed; dates and times when

in-water construction activities were conducted; dates and times when in-water construction activities were suspended to avoid potential incidental injury from construction sound of marine mammals observed within a defined shutdown zone; and marine mammal behavior; and

- Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

Observers will be required to use approved data forms (see proposed data collection forms in the applicant's Marine Mammal Mitigation and Monitoring Plan). Among other pieces of information, Carnival will record detailed information about any implementation of shutdowns, including the distance of animals to the pile and description of specific actions that ensued and resulting behavior of the animal, if any. In addition, Carnival will attempt to distinguish between the number of individual animals taken and the number of incidences of take. We require that, at a minimum, the following information be collected on the sighting forms:

- Date and time that monitored activity begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters (*e.g.*, percent cover, visibility);
- Water conditions (*e.g.*, sea state, tide state);
- Species, numbers, and, if possible, sex and age class of marine mammals;
- Description of any observable marine mammal behavior patterns, including bearing and direction of travel and distance from pile driving activity, and if possible, the correlation to SPLs;

- Distance from pile driving activities to marine mammals and distance from the marine mammals to the observation point;
- Description of implementation of mitigation measures (*e.g.*, shutdown or delay);
- Locations of all marine mammal observations; and
- Other human activity in the area.

A draft report would be submitted to NMFS within 90 days of the completion of marine mammal monitoring, or 60 days prior to the requested date of issuance of any future IHA for projects at the same location, whichever comes first. The report will include marine mammal observations pre-activity, during-activity, and post-activity during pile driving days (and associated PSO data sheets), and will also provide descriptions of any behavioral responses to construction activities by marine mammals and a complete description of all mitigation shutdowns and the results of those actions and an extrapolated total take estimate based on the number of marine mammals observed during the course of construction. A final report must be submitted within 30 days following resolution of comments on the draft report.

In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by the IHA (if issued), such as an injury, serious injury or mortality, Carnival would immediately cease the specified activities and report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the West Coast Regional Stranding Coordinator. The report would include the following information:

- Description of the incident;
- Environmental conditions (*e.g.*, Beaufort sea state, visibility);

- Description of all marine mammal observations in the 24 hours preceding the incident;
- Species identification or description of the animal(s) involved;
- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if equipment is available).

Activities would not resume until NMFS is able to review the circumstances of the prohibited take. NMFS would work with Carnival to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. Carnival would not be able to resume their activities until notified by NMFS via letter, email, or telephone.

In the event that Carnival discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (*e.g.*, in less than a moderate state of decomposition as described in the next paragraph), Carnival would immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the NMFS West Coast Stranding Hotline and/or by email to the West Coast Regional Stranding Coordinator. The report would include the same information identified in the paragraph above. Activities would be able to continue while NMFS reviews the circumstances of the incident. NMFS would work with Carnival to determine whether modifications in the activities are appropriate.

In the event that Carnival discovers an injured or dead marine mammal and the lead PSO determines that the injury or death is not associated with or related to the activities authorized in the IHA (*e.g.*, previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), Carnival would report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the NMFS West Coast Stranding Hotline and/or by email to the West Coast Regional Stranding Coordinator, within 24 hours of the discovery. Carnival would provide photographs, video footage (if available), or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network.

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.*, population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be "taken" through harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.*, intensity, duration), the context of any responses (*e.g.*, critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS' implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.*, as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

Pile driving activities associated with the Port of Long Beach Cruise Terminal Improvement Project, as outlined previously, have the potential to disturb or displace marine mammals. Specifically, the specified activities may result in take, in the form of Level B harassment (behavioral disturbance) or Level A harassment (auditory injury), incidental to underwater sounds generated from pile driving. Potential takes could occur if individuals are present in the ensonified zone when pile driving occurs. Level A harassment is only anticipated for harbor seals.

No serious injury or mortality is anticipated given the nature of the activities and measures designed to minimize the possibility of injury to marine mammals. The potential for these outcomes is minimized through the construction method and the implementation of the planned mitigation measures. Specifically, vibratory and impact hammers will be the primary methods of installation. Piles will first be installed using vibratory pile driving. Vibratory pile driving produces lower SPLs than impact pile driving. The rise time of the sound produced by vibratory pile driving is slower, reducing the probability and severity of injury. Impact pile driving produces short, sharp pulses with higher peak levels and much sharper rise time to reach those peaks. When impact pile driving is used, implementation of soft start and shutdown zones significantly reduces any possibility of injury. Given sufficient "notice" through use of soft starts (for impact driving), marine mammals are expected to move away from a sound source that is annoying prior to it becoming potentially injurious. Carnival will use seven PSOs stationed strategically to increase detectability of marine mammals, enabling a high rate of success in implementation of shutdowns to avoid injury for most species.

Carnival's proposed activities are localized and of relatively short duration (a maximum of 26 days of pile driving for 49 piles). The project area is also very limited in scope spatially, as all work is concentrated on a single pier. Localized and short-term noise exposures produced by project activities may cause short-term behavioral modifications in pinnipeds and mid-frequency cetaceans. Moreover, the proposed mitigation and monitoring measures are expected to further reduce the likelihood of injury, as it is unlikely an animal would remain in close proximity to the sound source, as well as reduce behavioral disturbances.

Effects on individuals that are taken by Level B harassment, on the basis of reports in the literature as well as monitoring from other similar activities, will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring) (*e.g.*, Thorson and Reyff 2006; HDR, Inc. 2012; Lerma 2014; ABR 2016). Most likely, individuals will simply move away from the sound source and be temporarily displaced from the areas of pile driving, although even this reaction has been observed primarily only in association with impact pile driving. The pile driving activities analyzed here are similar to, or less impactful than, numerous other construction activities conducted in Southern California, which have taken place with no known long-term adverse consequences from behavioral harassment. Level B harassment will be reduced to the level of least practicable adverse impact through use of mitigation measures described herein and, if sound produced by project activities is sufficiently disturbing, animals are likely to simply avoid the area while the activity is occurring. While vibratory pile driving associated with the proposed project may produce sounds above ambient at greater distances from the project site, thus intruding on some habitat, the project site itself is located in an industrialized port, the majority of the ensonified area is within in the POLB, and sounds produced by the proposed activities are anticipated to quickly become indistinguishable from other background noise in port as they attenuate to near ambient SPLs moving away from the project site. Therefore, we expect that animals annoyed by project sound would simply avoid the area and use more-preferred habitats.

In addition to the expected effects resulting from authorized Level B harassment, we anticipate that a small number of harbor seals may sustain some limited Level A harassment in the form of auditory injury. However, animals that experience PTS would likely only receive slight PTS, *i.e.* minor degradation of hearing capabilities within regions of hearing that align most completely with the energy produced by pile driving (*i.e.*, the low-frequency region below 2 kHz), not severe hearing impairment or impairment in the regions of greatest hearing sensitivity. If hearing impairment occurs, it is most likely that the affected animal's threshold would increase by a few dBs, which in most cases is not likely to meaningfully affect its ability to forage and communicate with conspecifics. As described above, we expect that marine mammals would be likely to move away from a sound source that represents an aversive stimulus, especially at levels that would be expected to result in PTS, given sufficient notice through use of soft start.

The project also is not expected to have significant adverse effects on affected marine mammal habitat. The project activities would not modify existing marine mammal habitat for a significant amount of time. The activities may cause some fish to leave the area of disturbance, thus temporarily impacting marine mammal foraging opportunities in a limited portion of the foraging range. However, because of the short duration of the activities, the relatively small area of the habitat that may be affected, the impacts to marine mammal habitat are not expected to cause significant or long-term negative consequences.

In summary and as described above, the following factors primarily support our preliminary determination that the impacts resulting from this activity are not expected to adversely affect the species or stock through effects on annual rates of recruitment or survival:

- No mortality is anticipated or authorized.
- The Level A harassment exposures (harbor seals only) are anticipated to result only in slight PTS, within the lower frequencies associated with pile driving;
- The anticipated incidents of Level B harassment consist of, at worst, temporary modifications in behavior that would not result in fitness impacts to individuals;
- The specified activity and ensonification area is very small relative to the overall habitat ranges of all species and does not include habitat areas of special significance (BIAs or ESA-designated critical habitat); and
- The presumed efficacy of the proposed mitigation measures in reducing the effects of the specified activity to the level of least practicable adverse impact.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from the proposed activity will have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under Sections 101(a)(5)(A) and (D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities.

Table 7 demonstrates the number of animals that could be exposed to received noise levels that could cause Level B harassment and Level A harassment (harbor seals only) for Carnival's proposed activities in the project area site relative to the total stock abundance. Our analysis shows that less than one-third of each affected stock could be taken by harassment(Table 7). The numbers of animals proposed to be taken for these stocks would be considered small relative to the relevant stock's abundances even if each estimated taking occurred to a new individual – an extremely unlikely scenario.

Based on the analysis contained herein of the proposed activity (including the proposed mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS preliminarily finds that small numbers of marine mammals will be taken relative to the population size of the affected species or stocks.

Unmitigable Adverse Impact Analysis and Determination

There are no relevant subsistence uses of the affected marine mammal stocks or species implicated by this action. Therefore, NMFS has determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act (ESA)

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA: 16 U.S.C. 1531 *et seq*.) requires that each Federal agency insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat.

No incidental take of ESA-listed species is proposed for authorization or expected to result from this activity. Therefore, NMFS has determined that formal consultation under section 7 of the ESA is not required for this action.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to Carnival for conducting Port of Long Beach Cruise Terminal Improvement Project in Port of Long Beach, California from November 15, 2019 to November 14, 2020, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. A draft of the proposed IHA can be found at *https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act*.

Request for Public Comments

We request comment on our analyses, the proposed authorization, and any other aspect of this Notice of Proposed IHA for the proposed Port of Long Beach Cruise Terminal Improvement Project. We also request at this time comment on the potential renewal of this proposed IHA as described in the paragraph below. Please include with your comments any supporting data or literature citations to help inform decisions on the request for this IHA or a subsequent Renewal.

On a case-by-case basis, NMFS may issue a one-year IHA renewal with an additional 15 days for public comments when (1) another year of identical or nearly identical activities as described in the Specified Activities section of this notice is planned or (2) the activities as described in the Specified Activities section of this notice would not be completed by the time the IHA expires and a Renewal would allow for completion of the activities beyond that described in the Dates and Duration section of this notice, provided all of the following conditions are met:

- A request for renewal is received no later than 60 days prior to expiration of the current IHA.
- The request for renewal must include the following:

(1) An explanation that the activities to be conducted under the requested Renewal are identical to the activities analyzed under the initial IHA, are a subset of the activities, or include changes so minor (*e.g.*, reduction in pile size) that the changes do not affect the previous analyses, mitigation and monitoring requirements, or take estimates (with the exception of reducing the type or amount of take because only a subset of the initially analyzed activities remain to be completed under the Renewal).

(2) A preliminary monitoring report showing the results of the required monitoring to date and an explanation showing that the monitoring results do not indicate impacts of a scale or nature not previously analyzed or authorized.

Upon review of the request for Renewal, the status of the affected species or stocks, and any other pertinent information, NMFS determines that there are no more than minor changes in the activities, the mitigation and monitoring measures will remain the same and appropriate, and the findings in the initial IHA remain valid.

Dated: October 7, 2019.

Catherine G. Marzin,

Acting Director, Office of Protected Resources,

National Marine Fisheries Service.

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