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4 CUMULATIVE IMPACTS

4.1 PRINCIPLES OF CUMULATIVE IMPACTS ANALYSIS

The approach taken to analysis of cumulative impacts (or cumulative effects)[1] follows the objectives of the National Environmental Policy Act (NEPA) of 1969, Council on Environmental Quality (CEQ) regulations, and CEQ guidance. CEQ regulations (40 Code of Federal Regulations [C.F.R.] Sections [§§] 1500-1508) provide the implementing procedures for NEPA. The regulations define "cumulative effects" as:

> ". . . the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 C.F.R. 1508.7).

CEQ provides guidance on cumulative impacts analysis in *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997). This guidance further identifies cumulative effects as those environmental effects resulting "from spatial and temporal crowding of environmental perturbations. The effects of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the effects of the first perturbation." Noting that environmental impacts result from a diversity of sources and processes, this CEQ guidance observes that "no universally accepted framework for cumulative effects analysis exists," while noting that certain general principles have gained acceptance. One such principal provides that "cumulative effects analysis should be conducted within the context of resource, ecosystem, and community thresholds—levels of stress beyond which the desired condition degrades." Thus, "each resource, ecosystem, and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters." Therefore, cumulative effects analysis normally will encompass geographic boundaries beyond the immediate area of the Proposed Action, and a time frame including past actions and foreseeable future actions, in order to capture these additional effects. Bounding the cumulative effects analysis is a complex undertaking, appropriately limited by practical considerations. Thus, CEQ guidelines observe, "[i]t is not practical to analyze cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful."

4.1.1 Identifying Geographical Boundaries for Cumulative Impacts Analysis

Geographic boundaries for analyses of cumulative impacts in this Final Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) (hereafter referred to as "EIS/OEIS") vary for different resources and environmental media. For air quality, the potentially affected air quality regions are the appropriate boundaries for assessment of cumulative impacts from releases of pollutants into the atmosphere. For wide-ranging or migratory wildlife, specifically marine mammals and sea turtles, any impacts from the Proposed Action or alternatives might combine with impacts from other sources within the range of the population. Therefore, identification of impacts elsewhere in the range of a potentially affected population is appropriate. For terrestrial biological resources, San Clemente Island (SCI) is the appropriate geographical area for assessing cumulative impacts. For all other ocean resources, the ocean ecosystem of the Southern California Bight (SCB) is the appropriate geographic area for analysis

[1] CEQ Regulations provide that the terms "cumulative impacts" and "cumulative effects" are synonymous (40 C.F.R. § 1508.8[b]); the terms are used interchangeably in this document.

of cumulative impacts. The following table identifies the geographic scope of this cumulative impacts analysis, by resource area.

Table 4-1: Geographic Areas for Cumulative Impacts Analysis

Resource	Area for Impacts Analysis
Geology and Soils	SCI
Air Quality	South Coast Air Basin San Diego Air Basin South Central Coast Air Basin
Hazardous Materials and Hazardous Wastes	SCI and SCB
Water Resources	SCI and SCB
Marine Plants and Invertebrates	SCB
Fish	SCB
Sea Turtles	Pacific Range
Marine Mammals	Pacific Range
Seabirds	SCB
Terrestrial Biological Resources	SCI
Cultural Resources	SCI and SCB
Traffic	SCB
Socioeconomics	SCB
Environmental Justice	SCB
Public Safety	SCB

4.1.2 Past, Present, and Reasonably Foreseeable Future Actions

Identifiable present effects of past actions are analyzed, to the extent they may be additive to impacts of the Proposed Action. In general, the Navy need not list or analyze the effects of individual past actions; cumulative impacts analysis appropriately focuses on aggregate effects of past actions. Reasonably foreseeable future actions that may have impacts additive to the effects of the Proposed Action also are to be analyzed.

4.2 ENVIRONMENT POTENTIALLY AFFECTED BY CUMULATIVE IMPACTS

4.2.1 Air Basins

Three air basins, the South Coast Air Basin (SCAB), South Central Coast Air Basin (SCCAB), and San Diego Air Basin (SDAB), are potentially affected by the Proposed Action.

4.2.1.1 South Coast Air Basin

The SCAB comprises Orange County and substantial portions of Los Angeles, Riverside, and San Bernardino Counties, and includes the largest urban area in the western United States. With 15 million inhabitants, the SCAB encompasses 43 percent of California's population, and accounts for 40 percent of all vehicle miles traveled, and one-third of all air pollutants emitted in the state (California Air Resources Board [CARB] 2006). Motor vehicles are the largest category of emission sources of carbon monoxide (CO), nitrogen oxides (NO_x), and reactive organic gases (ROG). A heavy concentration of industrial facilities, several major airports, two major shipping ports, and a dense freeway and surface street network are located in the SCAB.

The SCAB, which includes waters contiguous to SCI, is classified as: a severe nonattainment area for the 8-hour National Ambient Air Quality Standard (NAAQS) for ozone (O_3), a serious nonattainment area for CO, a maintenance area for nitrogen dioxide (NO_2); a serious nonattainment area for particulate matter under 10 microns (PM_{10}), and a nonattainment area for particulate matter under 2.5 microns ($PM_{2.5}$). It should be noted, however, that in its Draft Final 2007 Air Quality Management Plan (AQMP), the South Coast Air Quality Management District (SCAQMD) states it is seeking redesignation as an extreme nonattainment area for the 8-hour NAAQS for O_3 (SCAQMD Air Quality Management District [2007]).

Air quality in surrounding air basins can be affected and even dominated by pollution transported from the SCAB. Offshore winds cause pollution from the SCAB to impact offshore ocean areas, as winds sweep pollutants out over the sea. Further, pollution from the SCAB can impact San Diego when onshore winds blow these pollutants into San Diego. Pollution from the SCAB is also transported over the ocean into Ventura County (i.e., the SCCAB) by wind blowing to the northwest from the SCAB.

4.2.1.2 San Diego Air Basin

The SDAB comprises San Diego County, and encompasses 8 percent of the state's population; with a growth rate of 54 percent since 1981, San Diego is one of the fastest growing areas of the state. SDAB accounts for about 9 percent of vehicle miles driven in California, and includes industrial facilities, an international airport, and a significant seaport. Presently, 7 percent of California's air pollution is generated within the SDAB (CARB 2006).

Air quality in the SDAB is impacted by transport of air pollutants from the SCAB. The quality of the air in SDAB also is impacted by pollution from Tijuana, a city of over 1.2 million inhabitants immediately adjacent to the City of San Diego. For regulatory purposes, the SDAB includes only the County of San Diego, but Tijuana and San Diego in fact lie within the same geographically bounded air basin, and each city's emissions affect both cities.

The SDAB is classified as a basic nonattainment area for the 8-hour ozone NAAQS, and a maintenance area for CO.

4.2.1.3 South Central Coast Air Basin

The SCCAB encompasses Ventura, Santa Barbara, and San Luis Obispo Counties on California's central coast. Four percent of the state's population lives within the SCCAB. Power plants, oil extraction and refining, transportation, and agricultural operations are the major sources of air pollution in the SCCAB. Motor vehicles in the basin account for about 4 percent of vehicle miles driven in California (CARB 2006).

4.2.2 Southern California Bight

The SCB is the ocean area bounded on the north, east, and southeast by a long curve of the California coastline extending from Point Conception in Santa Barbara County, southeast 357 miles (mi.) (578 kilometers [km]) to Cabo Colnett, Baja California, in Mexico. The western border of the SCB is marked by the California Current, which flows southeastward along the coast, continuing the clockwise transport of water in the North Pacific Ocean.

Oceanography

Water current regimes in the SCB are complex and variable on seasonal and longer time scales. In general, because of the eastward indentation of the coast, a surface counterclockwise gyre, the Southern California Eddy, breaks off the California Current and carries water northward through the central SCB (Jones 1971; Hickey 1979). Closer to the shore along the continental shelf, prevailing onshore winds reverse this flow, resulting in a net along-shore surface flow toward the southeast (Lentz and Winant 1979). There is also a very-nearshore circulation pattern caused by surf along the beaches (Jones, 1971). Below about 500 feet (ft), there is a northwestward current flow inshore of the California Current. This water is of equatorial Pacific origin and has higher temperature, salinity, and phosphate concentrations and a lower oxygen concentration than the deep water in the California Current located at the same depth but farther offshore (Jones 1971).

Surface waters in the bight maintain an annual temperature range of 13 degrees Celsius (°C) to 20°C. Temperature drops with increasing water depth to about 4°C in the deeper basins. Dissolved oxygen concentration also tends to decrease with depth.

An important feature throughout the SCB is that deep water is close to shore. The bathymetry underlying the SCB includes an alternating series of 2,000- to 8,000-ft-deep basins and surfacing mountains that form 9 offshore islands or island groups and several large submerged banks and seamounts. Nearshore, 12 large canyons influence movement of sediments and other materials deposited on the bottom. There are also 32 canyons on the continental slope bordering the United States (U.S.) (Emery 1960). Offshore, there are 18 marine basins, 3 of which (Santa Monica, San Pedro, and Santa Barbara) are essentially devoid of oxygen and are virtually devoid of higher life forms. These canyons and deep basins are important sites of accumulation of fine-grained sediments and particulate materials from land runoff, ocean discharges, and ocean dumping.

El Nino

Many environmental changes in the SCB are connected with long-term, low-frequency, inter-annual oceanographic patterns. Displacement of cool surface waters—and their inhabitants—by clear, nutrient-poor warm water is correlated with periodic warm-water events off the coast of Peru and in the tropical Pacific. These are the El Niño events, which occur several times per decade (e.g., 1976, 1979, 1982-84, 1986-87, 1991-92, 1993, 1994, 1997-98, 2002-03, 2006-07 [NOAA 2007]) and are characterized by warm water, a deeper surface-mixed layer, elevated sea levels, increased abundance of southern planktonic and pelagic organisms, alterations of benthic community structure, and degeneration of coastal kelp beds (Jackson, 1986).

Bays and Wetlands

The most important bays in the SCB are Santa Monica Bay, San Pedro Bay, San Diego Bay, and Todos Santos Bay in Baja, California. There are at least 26 wetland systems in coastal lagoons and at the mouths of transient streams and rivers in the U.S. portion of the SCB (Zedler 1982). The total area of these coastal wetlands is only about 129 square miles ($mi.^2$), an estimated 25 percent of the area they encompassed when the first Europeans arrived in Southern California in the late 1500s.

Drainage Basin

The onshore mainland drainage basin of the SCB is bordered on the north by the Santa Monica, San Gabriel, and San Bernardino mountains; and on the east by coastal ranges that continue southward down the length of the Baja Peninsula. Because of the semiarid nature of the drainage basin and the highly seasonal pattern of annual precipitation, most of the rivers draining into the bight are small and are dry for much of the year. From north to south, the major rivers in the drainage basin are the Santa Clara, Los Angeles, San Gabriel, Santa Ana, Santa Margarita, San Luis Rey, San Diego, and Tijuana rivers. Much of the Los Angeles and San Gabriel river beds and other major drainages are lined with concrete.

Fresh water enters the SCB from a variety of sources. Riverine runoff from rain and melting snow is seasonal. Surface and subterranean runoff including storm drain inputs (nonpoint sources), and discharges of wastewater also are transported into the bight. The volumes of water entering the bight from wastewater discharges are comparable to those from riverine and storm drain inputs. Because storm water flow is more variable than wastewater flow, in dry seasons and years wastewater flow far exceeds that of storm water. Wastewater flows are strictly regulated to protect water quality; however, nonpoint source runoff is more difficult to regulate. Such flows may contain chemical contaminants and pathogens.

Habitats and Other Natural Resources

Natural habitats and resources characteristic of the SCB include abundant deep water close to shore, extensive coastal and offshore oil reserves, commercially or recreationally valuable fish and shellfish stocks, wildlife breeding and overwintering areas, kelp beds, beach and water recreation areas, and a temperate climate. These habitats and resources are described in detail in Chapter 3, and are briefly summarized here.

As a result of the local oceanographic regime, particularly the Southern California Eddy, the SCB is an enclave of communities of marine life specific to the area (although diminished during El Niño years). Numerous types of marine mammals are present, including both regional and migratory populations. Four species of sea turtles may be present, at least periodically. Numerous seabirds are present in the bight, and the Channel Islands provide breeding habitat for some species of seabirds. Commercially exploitable stocks of fish spawn and grow primarily in the bight. Deeper waters of the bight host a diversity of mesopelagic fishes that spend parts of their life cycles in surface waters. The benthic fauna of the continental shelf, especially polychaetes and crustaceans, are diverse and constitute an important food source for many fish species. Rocky intertidal and subtidal areas, which cover large areas of the shoreline of the bight, host diverse epifauna (snails, mussels, crabs, etc.) and attached seaweeds.

Beds of the giant kelp *Macrocystis pyrifera*, which attach to the bottom and can grow to over 164 ft in length, extend along the coast of the bight. There are 33 locations in the bight between Point Conception and San Diego where kelp beds are found at least periodically at water depths ranging from 20 to 65 ft. From the 1930s to 1979, individual kelp beds occupied up to 2,720 acres (ac), with the total area occupied by kelp beds in the range of 12,000 to 15,000 ac (Foster and Schiel 1985). The size and distribution of kelp beds varies spatially and temporally in response to changes in natural and anthropogenic conditions. Natural changes in surface water temperature and nutrient concentrations associated with El Niño events, and possibly with longer-term ocean warming trends, have resulted in declining kelp beds in some areas, and winter storms can devastate large kelp beds. These storms probably are the most important factor influencing the condition and extent of kelp beds, but human activities—such as kelp harvests, boat traffic, and possibly wastewater discharges—have also affected local giant kelp beds.

The SCB contains undersea oil deposits. Oil and tar continuously ooze from undersea seeps, periodically creating large marine oil slicks.

Frequent brush fires on land, fed by northeasterly Santa Ana winds, deposit ash and soot onto the sea.

4.2.3 Anthropogenic Activities

4.2.3.1 Fishing

Commercial and recreational fishing constitutes a significant nonmilitary use of the ocean areas of the Southern California (SOCAL) Range Complex. As discussed in Section 3.7, Fish, the California Department of Fish and Game (CDFG) maintains commercial landings statistics for statistical blocks that are 5 degrees latitude by 5 degrees longitude in area (about 81 square nautical miles [nm^2]) for nearshore areas and larger for offshore waters. Commercial landings were obtained for CDFG statistical blocks within the SOCAL Range Complex (Figure 3.7-1). The annual catch of fish and invertebrates in the SOCAL Range Complex from 2002 to 2005 amounted to approximately 64,000 pounds (see Table 3.7-7). In 1993, landings data represented approximately 50 percent of the actual catch, and landings in other years have represented approximately 80 percent or more of the actual catch. Pelagic species account for approximately 97 percent of the average annual catch within the SOCAL Range Complex. Flatfish, demersal fish, and other fish associated with the bottom account for only about 3 percent of the average annual catch of fish. Other commercial fishing targets include crustaceans (lobster and half spot prawns) and squid.

Fishing can adversely affect fish habitat and managed species. Potential impacts of commercial fishing include over-fishing of targeted species and bycatch, both of which negatively affect fish stocks. Mobile fishing gears such as bottom trawls disturb the seafloor and reduce structural complexity. Indirect effects of trawls include increased turbidity, alteration of surface sediment, removal of prey (leading to declines in predator abundance), removal of predators, ghost fishing (i.e., lost fishing gear continuing to ensnare fish and other marine animals), and generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats. Recreational fishing also has the potential to affect fish habitats because of the large number of participants and the intense, the concentrated use of specific habitats.

Fishing can have a profound influence on individual populations. In a recent study of retrospective data, Jackson et al. (2001) analyzed paleoecological records of marine sediments from 125,000 years ago to present, archaeological records from 10,000 years before the present, historical documents, and ecological records from scientific literature sources over the past century. Examining this longer term data and information, they concluded that ecological extinction caused by overfishing precedes all other pervasive human disturbance to coastal ecosystems including pollution and anthropogenic climatic change.

Natural stresses include storms and climate-based environmental shifts, such as algal blooms and hypoxia. Disturbance from ship traffic and exposure to biotoxins and anthropogenic contaminants may stress animals, weakening their immune systems, and making them vulnerable to parasites and diseases that would not normally compromise natural activities or be fatal.

4.2.3.2 Commercial and Recreational Marine Traffic

A significant amount of ocean traffic, consisting of both large and small vessels, transits through the SCB. The Port of Los Angeles is the busiest port in the U.S. (by volume of cargo). The Port of Long Beach is the second-busiest U.S. port (Port of Long Beach 2008). Taken together, these two ports (which are contiguous) would constitute the fifth-busiest port in the world. The Port of San Diego also is an important commercial cargo port. Cruise ships make daily use of these port facilities. In 2007, San Diego recorded 235 cruise ship calls while Los Angeles recorded 2,730 (Port of San Diego 2007; Port of Los Angeles 2008). For commercial vessels, the major trans-oceanic routes to the southwest pass north and south of SCI (Figure 3.13-2). The approach and departure routes into San Diego and the ports of Los Angeles-Long Beach pass between SCI and Santa Catalina Island.

Commercial vessels are sources of pollutants introduced into the waters and air basin of the SCB. Additionally, commercial vessels are a source of ship strikes on marine mammals, and are implicated, for example, in the deaths of three blue whales in the Santa Barbara Channel in September 2007 (Chawkins 2007). (Information about ship strikes and other marine mammal stranding events, and about introduction of pollutants into the bight, is provided below).

A very substantial volume of small craft traffic, primarily recreational, occurs throughout Southern California. The region’s estimated 40,000 recreational boats are concentrated primarily in marinas on Santa Monica Bay, Alamitos Bay, Long Beach Marina, Huntington Harbor, Balboa-Newport Harbors, San Diego Bay, and Mission Bay; and secondarily in marinas at Oceanside and Dana Point, and in Oxnard, Ventura, and Santa Barbara. Because pleasure boats are sources of fuel leaks and toxins from antifouling paints, they constitute a potential environmental concern that has not been quantified. (Information about pollutants and hazardous wastes introduced into the SCB is provided below).

4.2.3.3 Oil Extraction

Oil extraction has occurred for eight decades offshore of the coast near Goleta, Carpinteria, Ventura, Oxnard, Santa Monica, Redondo Beach, Wilmington, San Pedro, Long Beach, Seal Beach, and Huntington Beach. Offshore oil extraction from shore-based facilities began near the turn of the century along the Santa Barbara Channel and slightly later in southern Los Angeles and Orange counties. Oil production from offshore platforms began 35 years ago on nearby shelves (1 to 3 mi. from shore) and now extends nearly to the shelf break. An extensive shore-based infrastructure exists to support offshore oil production activities, including pipelines, refineries, and oil terminals.

Seventy-nine offshore oil production leases occupying a total of about 400,000 acres are active in the Santa Barbara Channel/Santa Maria Basin area. California has a long-standing moratorium on new oil drilling platforms within the state's 3-mi. jurisdictional limit. A Federal moratorium on new oil drilling platforms expired on September 30, 2008 to open oil and gas development off all of the nation's coastlines (Hulse and Pear 2008). Within Federal waters offshore of Southern California lie 36 undeveloped Federal oil leases. Developing these leases could result in several new oil platforms off of the coast. No specific proposals for new oil platforms are now under consideration.

Oil extraction carries risks of accidental oil spills. In 1969, an industrial accident (pressurized "blowout") on an offshore oil rig caused 3 million gallons of oil to be discharged into the Santa Barbara Channel. Long-term environmental impacts of this event have dissipated.

Natural seeps along the coasts of Santa Barbara, Ventura, Los Angeles, and Orange Counties intermittently or continuously discharge large quantities of oil and tar to nearshore waters of the SCB. Fischer (1978) estimated that as few as 2,000 and as many as 30,000 metric tons (10 million gallons) of oil enter the Santa Barbara Channel each year from natural seeps. (By comparison, the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska, leaked 11 million gallons of oil into marine waters.) The intertidal zone at Goleta is chronically contaminated with oil and tar from this seep. One hundred years ago, the U.S. Fish Commission steamer, *Albatross* dispatched an observer to report on a huge fish kill extending from Santa Barbara to San Diego. He counted thousands of pelagic and demersal fish on the Santa Monica Bay beaches, many of them smelling of petroleum, and suggested that the event was caused by seepage from offshore "oil springs" (Eichbaum et al. 1990).

4.2.3.4 Liquefied Natural Gas Terminals

Liquefied Natural Gas (LNG) facilities have been proposed at several locations on the Pacific coast of North America in recent years in response to the quickly escalating domestic demand for this fuel. Sites under consideration range from British Columbia to Mexico, with at least six locations under consideration within the SCB (see Table 4-2).

Potential environmental impacts include those associated with additional ship traffic generally, and potential releases of LNG. Releases of LNG can result from equipment leaks or spills during operations. Releases can be accidental (e.g., ship collision), or intentional (i.e., from sabotage or terrorist acts). Most accident scenarios are complex or multistage events with cascading impacts: for example, a spill followed by a pool fire, or a leak followed by a vapor cloud ignition. The rate at which the LNG is released, total size of the release, wind speed and direction, and location of the nearest ignition source are all important factors in determining the consequences of the release.

Table 4-2: Liquefied Natural Gas Projects and Proposals

SCB LNG Projects and Proposals[a]	
Proposed LNG Terminals	**Location**
Cabrillo Deepwater Port LNG Facility	Offshore Ventura County
Clearwater Port LNG Project	Offshore Ventura County
Long Beach LNG Facility	Long Beach Harbor
Ocean Way LNG Terminal	Offshore Long Beach
Esperanza Energy LLC	Offshore Long Beach
Terminal GNL Mar Adento de Baja	Offshore Tijuana, Mexico
Moss Maritime LNG	Offshore Rosarito, Mexico

Notes: (a) Excerpted from CA Energy Commission: http://www.energy.ca.gov/lng/projects.html

4.2.3.5 Ocean Pollution

Environmental contaminants in the form of waste materials, sewage, and toxins are present in, and continue to be released into, the oceans off Southern California. Polluted runoff, or nonpoint source pollution, is considered the major cause of impairment of California's ocean waters. Storm water runoff from coastal urban areas and beaches carries waste such as plastics and Styrofoam into coastal waters. Sewer outfalls also are a source of ocean pollution in Southern California. Sewage can be treated to eliminate potentially harmful releases of contaminants; however, releases of untreated sewage occur due to infrastructure malfunctions, resulting in releases of bacteria usually associated with feces, such as *Escerichia coli* and *enterococci*. Bacteria levels are used routinely to determine the quality of water at recreational beaches, and as indicators of the possible presence of other harmful microorganisms.

In the past, toxic chemicals have been released into sewer systems in Southern California. While such dumping has long been forbidden by law, the practice left ocean outflow sites contaminated. In a 1994 report, the U.S. Geological Survey identified elevated levels of dichloro-diphenyl-trichloroethane (DDT) and polychlorinated biphenyls (PCBs), both classified as persistent organic pollutants, in a 17-square-mile area of ocean near Palos Verdes, south of Santa Monica Bay. Sewage treatment facilities generally do not treat or remove persistent organic pollutants. Plastic and Styrofoam waste in the ocean chemically attracts hydrocarbon pollutants such as PCBs and DDT, which accumulate up to 1 million times more in plastic than in ocean water. Fish, other marine animals, and birds consume these wastes containing elevated levels of toxins. DDT mimics estrogen in its effects on some animals, possibly causing the development of female characteristics in male hornyhead turbots and English sole, according to a study by the Southern California Coastal Water Research Project. The California Office of Environmental Health Hazard Assessment currently has consumption warnings for several species including white croaker, corbina, sculpin, rock fish, and kelp bass, primarily due to concerns about DDT and PCBs in the Southern California region.

Regulatory activities have made progress in reducing both nonpoint source pollution such as runoff, and point source pollution such as that which may emanate from sewer outfall sites. In 2000, California received Federal approval of its Coastal Nonpoint Source Pollution Control Program from the U.S. Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA) (the agencies that administer the Clean Water Act [CWA] and Coastal Zone Management Act [CZMA], respectively). The program includes the coordinated participation of the California Coastal Commission (CCC), the State Water Resources Control Board (SWRCB), and the Regional Water Quality Control Boards (RWQCBs). The current plan covers the years 2003 to 2008.

Pollution from vessels is a source of ocean contamination. Sewage, sludge, black water, grey water, bilge water, plastics, and other trash components and waste materials are routinely discharged from vessels into coastal and ocean waters in Southern California. In 2003, the California Legislature passed legislation (Assembly Bills [AB] 121 and 906), which prohibits certain waste discharges from large passenger vessels (cruise ships) into state waters.

4.2.3.6 Coastal Development

Coastal development intensifies use of coastal resources, resulting in potential impacts on water quality, wildlife and fish habitat, air quality, and intensity of land and ocean use. Coastal development is therefore closely regulated in California. (See Section 6.1.1 for a detailed discussion of regulation of activities in the coastal zone.) New development in the coastal zone may require a permit from the California Coastal Commission, or a local government to which permitting authority has been delegated by the Coastal Commission. A Coastal Development Permit is generally required for any project in the coastal zone that includes:

- The placement of any solid material or structure;
- A change in land use density or intensity (including any land division);
- Change in the intensity of water use or access to water; or
- Removal of major vegetation.

Some types of development are exempt from coastal permitting requirements, including in many cases, repairs and improvements to single-family homes, certain “temporary events,” and, under specified conditions, replacement of structures destroyed by natural disaster.

Local Coastal Programs (LCPs) identify the locations, types, densities and other ground rules for future development in the coastal-zone portions of the 73 cities and counties along the coast. Each LCP includes a land use plan and its implementing measures (e.g., zoning ordinances). Prepared by local government and approved by the Coastal Commission, these programs govern decisions that affect the conservation and use of coastal resources. While each LCP reflects the unique characteristics of individual local coastal communities, regional and statewide concerns must also be addressed in conformity with the goals and policies of the State Coastal Act.

LCPs are basic planning tools used by local governments to guide development in the coastal zone, in partnership with the Coastal Commission. LCPs contain the ground rules for future development and protection of coastal resources in the 73 coastal cities and counties, including Los Angeles, Orange, and San Diego counties. The LCPs specify appropriate location, type, and scale of new or changed uses of land and water. Each LCP includes a land use plan and measures to implement the plan (such as zoning ordinances). Following adoption by a city council or county board of supervisors, an LCP is submitted to the Coastal Commission for review for consistency with Coastal Act requirements.

Coastal development in Southern California is both intensive and extensive, and the coast adjacent to the SOCAL Range Complex is densely populated. This development has impacted and continues to impact coastal resources in the SOCAL Range Complex EIS Study Area including through point source and nonpoint source pollution; intensive boating and other recreational use; intensive commercial and recreational sport fishing; intensive ship traffic using major port facilities at Los Angeles, Long Beach, and San Diego; and offshore oil and gas facilities (both existing and proposed). Regulation of these activities through the Coastal Development programs discussed above serves primarily to limit new development; however, the coastal zone is already fully developed in many areas, with associated ongoing impacts.

4.2.3.7 Scientific Research

There are currently 30 scientific research permits and General Authorizations for research issued by the National Marine Fisheries Service (NMFS) for cetacean work in the wild in the North Pacific. The most invasive research involves tagging or biopsy while the remainder focuses on vessel and aerial surveys and close approach for photo-identification. Species covered by these permits and authorizations include small odontocetes, sperm whales, and large mysticetes. One permit issued to the Office of Protected Resources of NMFS allows for responses to strandings and entanglements of listed marine mammals. NMFS has also issued General Authorizations for commercial photography of nonlisted marine mammals, provided that the activity does not rise to Level A harassment of the animals. These authorizations are usually issued for no more than 1 or 2 years, depending on the project.

The impacts of this type of research are largely unmeasured. However, given the analysis and scrutiny given to permit applications, it is assumed that any adverse effects are largely transitory (e.g., inadvertent harassment, biopsy effects, etc.). Data to assess population level effects from research are not currently available, and even if data were available it is uncertain that research effects could be separately identified from other adverse effects on cetacean populations in Southern California waters.

4.2.3.8 Commercial and General Aviation

Southern California is served by several large commercial airports. Los Angeles International (LAX), Long Beach International (Long Beach), John Wayne International (Santa Ana), and Lindbergh Field (San Diego) are situated on or near the coastline, while Los Angeles/Ontario International Airport is situated in San Bernardino County, approximately 50 miles west of LAX. The following airport traffic statistics, developed by Airports Council International (ACI 2006), provide data on “total movements” (landing plus takeoff of one aircraft equals a “movement”) at these five airports:

Table 4-3: Landings / Takeoffs (Total Movements) at Five Regional Airports, 2006

Airport	Total Movements (2006)	National Rank	% Increase over 2005
LAX	656,842	4	1%
Long Beach	369,738	24	4.7%
Santa Ana	347,194	27	(0.8%)
San Diego	220,839	52	0.3%
Ontario	136,261	85	4.9%

The City of San Diego operates two general aviation airports: Montgomery Field, located in northeastern San Diego, and Brown Field, located in southern San Diego near the border with Mexico. San Diego County operates eight general aviation airports. Two general aviation airports are located in Orange County. Los Angeles County operates numerous general aviation airports, including the airport at Avalon, Santa Catalina Island. Numerous municipal landing fields are located in the region.

Aircraft operating under visual flight rules (VFR) can fly along the coast between San Diego and Orange County and out to Santa Catalina Island largely unconstrained, except by safety requirements and mandated traffic flow requirements. Aircraft operating under Instrument Flight Rules (IFR) clearances, authorized by the Federal Aviation Administration (FAA), normally fly on the airway route structures. In Southern California these routes include both high- and low-altitude routes between San Diego and Los Angeles and to Santa Catalina Island. There are two

Control Area Extensions (CAE) from Southern California through or nearby Warning Area (W)-291 to facilitate access to the airways to Hawaii and other trans-Pacific locations. CAE 1177 extends from Santa Catalina Island southwest between W-291 and the Pt. Mugu Sea Range. CAE 1156 extends west from San Diego through the northern portion of W-291. When W-291 is active, CAE 1156 is normally closed. CAE 1177, the more important route through the coastal warning areas, is closed only when weapons hazard patterns extend into the area, and this closure is fully coordinated with the FAA. When W-291 is active, aircraft on IFR clearances are precluded from entering W-291 by the FAA. However, since W-291 is located entirely over international waters, nonparticipating aircraft operating under VFR are not prohibited from entering the area. Examples of aircraft flights of this nature include light aircraft, fish spotters, and whale watchers.

4.2.3.9 Air Quality Factors

In their emission inventories by category (CARB 2000) for 2004 and 2020, the SCAB, SDAB, and the SCCAB include emissions from aircraft, ships, and commercial boats. Emission estimates are based on emissions from onshore or nearshore operations (for example, operations within Los Angeles Harbor for ship emissions). These emissions would account for a small percentage of the overall air emissions budgets for each of the air basins. These emissions are generally not included in the State Implementation Plan (SIP) emissions budget and in air quality planning because they are assumed to have a negligible effect on the ambient air quality, and because reductions in emissions from these sources would not generate a great improvement in the ambient air quality.

4.2.4 San Clemente Island

SCI is the southernmost of the eight California Channel Islands. It lies 55 nm south of Long Beach and 68 nm west of San Diego. The island is approximately 21 nautical miles (nm) long and is 4.5 nm across at its widest point. Since 1934, the island has been owned and operated by the U.S. Navy as a training site, by Presidential Executive Order. Presently, and for the foreseeable future, only activities in support of military training are or will be permitted to occur on SCI. Impacts from these activities generally are confined to the island and its immediate nearshore vicinity. Table 4-4 identifies past and present projects undertaken by the Navy at SCI. These activities are addressed, as appropriate in separate environmental analyses, and impacts from these activities generally are temporary and localized.

Table 4-4: Past, Present, and Planned Projects Associated with San Clemente Island

Number	Project Title	Description
1	Southern California Anti-Submarine Warfare Range (SOAR) Cable Refurbishment	Refurbishment of underwater cable arrays and associated range equipment at SOAR involving the installation of hydrophones, array cables, and associated hardware within the existing coverage of the range. The area of SOAR proposed under this activity is located off of West Cove, in the northwestern portion of SCI. The offshore area proposed for range refurbishment extends seaward from West Cove.
2	Wilson Cove Moorings	Installation of 3 Class "E" 50,000 lb moors, and four 9,000 12,000 lb moors, removal of an existing moor at Wilson Cove at SCI, and repair of two existing moors.
3	Commercial Cell Towers Installation	Construction of three cell towers on SCI has been completed.
4	Waste Water Treatment Plant Upgrades	Construction of an effluent outfall extension to an existing Waste Water Treatment Plant and discharge pipe to allow for an increase in capacity and increase in permit requirements.
5	Tomahawk Missile Launch Facility	Construction of an underwater launch facility for the launch of Tomahawk cruise missiles (one per year) on flight tracks over the Point Mugu Sea Range near Naval Ordnance Test Station (NOTS) Pier at SCI. The missiles would be recovered after landing by parachute on San Nicolas Island.
6	P-763 Military Operations on Urban Terrain (MOUT) Facility	Construction of building shells for a variety of building types from residential to business to industrial for urban special operations training at SCI.
7	P-740 Bachelors Quarters	Construction of two 45-unit bachelors quarters buildings (MILCON Projects P740 and P471) and demolition of five bachelor quarters existing buildings (60111, 60116, 60121, 60133, and 60153) at SCI.
8	P- 493 Ridge Road	Road improvements phased over 5 years consisting of resurfacing and widening, construction of an extended Assault Vehicle Maneuver Road, and quarrying and laydown area to provide materials for and facilitate road projects.
9	SCI Runway Upgrades	Repair of runway, taxiway, and parking apron and provision of various lighting and electrical repairs to support safe aircraft operations at the NALF at SCI.
10	Various Maintenance Projects	Maintenance projects such as hangar door replacement, concrete replacement, exterior painting of buildings, and replacement of lighting fixtures.
11	Live-Fire Training Areas and MOUT Facility	Development of three live-fire training areas on SCI and the construction of a MOUT facility. Training activities include direct action, live-fire over-the-beach tactical training, small arms firing, and land demolition.
12	Tomahawk Land Attack Missile Testing in the SCI Missile Impact Range (MIR)	Testing of live and inert warheads at the MIR and the use of an underwater translator launch site for missiles off the eastern side of SCI.
13	Joint Standoff Weapon (JSOW)	Live-fire testing (scheduled from 1996 to 2007) for the JSOW program at the SCI MIR. The JSOW is launched from an aircraft.
14	Land Attack Standard Missile (LASM)	Inert testing of LASM launched from ships positioned 75 nm west of SCI with missile termination at the MIR. Testing involved four non live-fire launches and was completed in 2000.

Table 4-4: Past, Present, and Planned Projects Associated with San Clemente Island (continued)

Number	Project Title	Description
15	Distributed Explosive Technology (DET)	One-time operational test of DET (used to clear bottom-laid and submerged mines) in littoral waters in Horse Beach Cove off of SCI.
16	Surface Ship Radiated Noise Measurement (SSRNM) Array	Installation of hydrophone array with tri-moor configuration 5,000 yards off eastern shore of SCI, for use in measuring sound from transiting ships.
17	Modular Housing	Construction of two single-story modular buildings to be used as temporary military housing.
18	Unmanned Aerial Vehicle (UAV) Infrastructure Construction	Construction of three buildings (60,000 square feet [sf]), water and fuel storage facilities, and road improvements for use as UAV training center.
19	Storage Facility Construction	Construction of storage facility near North Light pier.
20	Antennae Installation	Install antennae and construct associated small shelter near airfield.
21	Building Demolition	Demolish 17 structures at Wilson Cove (site preparation for boat facility construction).
22	Boat Facility Construction	Construct boat maintenance facility and boat storage facility (two structures) at Wilson Cove
23	Missile Launches	Two launches at VC-3, proposed to occur in the July to October 2007 timeframe. The missile booster impact would occur at the MIR. The missile would then fly preplanned waypoints over the island at an altitude of approximately 330 ft (91 meters [m]) above ground level and over the ocean and then return and impact into the MIR. It is estimated that the first and second missile launches would fly over the ocean at a distance of 21 mi. (18 nm) and 31 mi. (27 nm), respectively, from the SCI shoreline.
24	Deployable Surveillance Group Project X (DSG-X)	Environmental Assessment/Finding of No Significant Impact (EA/FONSI) just completed; testing will occur Sep 2008 through May 2009.
25	P-885 Renovate NOTS Pier	Project will repair problem with mooring hardware due to deck height being too high.

4.2.5 Habitats of Migratory Marine Animals

Migratory or wide-ranging marine mammals and sea turtles that may be present in the SOCAL Range Complex may be affected by natural events and anthropogenic activities that occur in areas far removed from Southern California, on breeding grounds, migration routes, wintering areas, or other habitats within a species' range. Events and activities that affect the habitats of these marine species outside the SCB/SOCAL Range Complex include:

- Disease
- Natural toxins
- Weather and climatic influences
- Navigation errors
- Natural predation
- Fishing

- Hunting (including sea turtle egg predation)
- Ocean pollution
- Habitat modification or destruction
- Ship traffic

These stressors on marine habitats and associated effects on sea turtles and marine mammals are discussed in detail in Sections 4.3.8 and 4.3.9, below.

4.2.6 Neighboring Military Ranges

The SOCAL Range Complex is located adjacent to three military test and training areas; the Naval Air Warfare Center Weapons Division (NAWCWPNS) Point Mugu Sea Range, Marine Corps Base (MCB) Camp Pendleton, and Silver Strand Training Complex (SSTC). While these areas are geographically distinct, it is possible for cumulative impacts to occur for some resources due to the mobile nature of certain resources. Resources with the potential for cumulative impacts associated with neighboring ranges include air quality, water quality, fish, sea turtles, marine mammals, and seabirds.

4.2.6.1 Naval Air Warfare Center Weapons Division Point Mugu Sea Range

Activities at the Point Mugu Sea Range primarily focus on tests to evaluate sea, land, and air weapons systems. In addition to these tests, training at the Point Mugu Sea Range is limited to eight training exercises per year: two Fleet exercises, four small scale amphibious warfare exercises, and two special warfare exercises. Although limited, all sonar operations occurring in the Point Mugu Sea Range are evaluated in this EIS/OEIS; therefore, the cumulative effects of sonar operations are also addressed for the Point Mugu Sea Range and the SOCAL Range Complex.

4.2.6.2 Marine Corps Base Camp Pendleton

This EIS/OEIS includes offshore training activities associated with MCB Camp Pendleton in the Camp Pendleton Amphibious Assault Area (CPAAA) and Camp Pendleton Amphibious Vehicle Training Area (CPAVA); therefore, analysis of cumulative impacts associated with Camp Pendleton is not necessary.

4.2.6.3 Silver Strand Training Complex

The Navy conducts training in the SSTC which is adjacent to the SOCAL Range Complex near the cities of Coronado and Imperial Beach. An EIS has been started to assess the impacts of the training at the SSTC; however, analysis is not complete and it has not been released as a draft document. Due to the fact that we are not sure of the impacts of Navy training at SSTC it is difficult to assess the cumulative effects in detail. In general, training at SSTC does not use as much ordnance as training conducted in the SOCAL Range Complex. This is due in part to the fact that the SSTC is in close proximity to urbanized areas. Furthermore, while some species could occur in both the SSTC and the SOCAL Range Complex, many species would not occur in both locations due to the fact that many species do not enter the waters close to shore, primarily due to habitat differences. Some species of fish and small marine mammals, such as dolphins, could occur in both complexes but it is not expected that there will be impacts to these species as analysis of proposed actions in both EISs indicate no significant impact to marine species, and because very little mixing of species or populations from one range complex to another is expected, cumulative impacts would be negligible. For example coastal bottlenose dolphins are a near shore species (only found within 0.5 nm of the Southern California mainland shore) and are unlikely to travel through both the near shore SSTC and offshore SOCAL areas. California sea lions breed and forage around the California offshore islands within the SOCAL Range Complex but only a few individuals would briefly transit through the near shore SSTC area.

4.3 CUMULATIVE IMPACT ANALYSIS

4.3.1 Geology and Soils

Cumulative impacts on terrestrial SCI geology and soils would consist of the effects of the Proposed Action in concert with other Navy actions that disturbed surface soils, such as new construction (see Table 4-4, above). New or expanded training activities that would increase foot traffic could trample and eliminate vegetation and compact surface soils, which in turn could increase surface runoff during rain storms. New construction could remove ground cover, disturb surface soils, alter surface drainage patterns, and, by increasing the ground coverage of impervious surfaces, increase the volume of surface water flows during storms.

While each new activity or construction project on SCI could contribute locally and incrementally to increased runoff and erosion, the cumulative effects would be negligible. Construction projects would include drainage improvements, road improvements, and revegetation of exposed soils, and impacts would predominantly occur in areas of existing development. In addition, Best Management Practices (BMPs) for soil-disturbing activities would be implemented for any construction activity. Foot traffic would be directed to existing roads and trails to the extent practicable.

4.3.2 Air Quality

Activities affecting air quality in the region include, but are not limited to, mobile sources such as automobiles and aircraft, and stationary sources such as power generating stations, manufacturing operations and other industry, and the like. In CARB emission inventories by category (CARB 2000) for 2004 and 2020, the SCAB, SDAB, and SCCAB include emissions from aircraft, ships, and commercial boats. These emissions are included in the mobile source category. Traditionally, the emission estimates are based on emissions from onshore or nearshore operations (e.g., operations within Los Angeles Harbor for ship emissions). Emission estimates for these sources are summarized in Table 4-5.

These emissions would account for a small percentage of the overall air emissions budgets for each of the air basins. They do not include marine vessel emissions for vessels operating outside of U.S. territorial waters. These emissions are generally not included in the SIP emissions budget and in air quality planning because they are assumed to have a negligible effect on the ambient air quality, and because reductions in emissions from these sources would not generate a great improvement in the ambient air quality.

The trends in Southern California in all three of the air basins onshore indicate that air quality is improving. In 2005, the SCAB measured exceedances of the ozone, PM_{10}, and/or $PM_{2.5}$ NAAQS on a total of 89 days at one or more monitoring locations. This compares to 128 days in 2003 and 94 days in 2004. Despite substantial improvement in air quality over the past few decades, some areas in the SCAB still exceed the NAAQS for ozone more frequently than any other area in the United States. In the SDAB there has been a decrease from a high of 88 exceedances of the 1-hour NAAQS for ozone in 1980 to a total of 7 exceedances of the new 8-hour NAAQS for ozone basinwide in 2007. In the SCCAB, only Ventura County is classified as a nonattainment area for the 8-hour NAAQS for ozone, and the number of exceedances in the SCCAB has decreased from 85 in 1981 to 6 in 2007. These trends indicate that progress is being made toward attainment of the NAAQS for ozone without imposing emission limitations on offshore emissions from ships and aircraft. Accordingly, cumulative impacts on air quality would be less than significant.

Table 4-5: Emissions Estimates for Aircraft and Marine Vessels (CARB 2000)

	South Central Coast		South Coast		San Diego	
	2004	2020	2004	2020	2004	2020
Aircraft						
ROG	2	2	8	9	3	3
CO	16	18	56	76	20	21
NOx	1	1	16	28	5	6
PM_{10}	<1	<1	1	1	2	2
Marine Vessels						
ROG	5	2	39	19	10	5
CO	23	19	192	166	72	67
NOx	4	4	57	87	7	7
PM_{10}	1	1	6	9	1	2

Units: Tons per day
Source: California Air Resource Board, Air Emissions Inventories, Emissions by Category, 2004 and 2020. www.arb.ca.gov.

4.3.3 Hazardous Materials and Wastes

The primary impact of cumulative hazardous materials use in the SOCAL Range Complex would be to increase the amounts of hazardous constituents that are released to the environment. Hazardous materials settling out of the water column would contribute to contamination of ocean bottom sediments. Relevant activities would include releases of hazardous constituents from fishing vessels, other ocean vessels, wastewater treatment plant outfalls, and nonpoint source pollution from terrestrial sources. The effects of these activities in the SOCAL Range Complex are known only in a very general sense.

Commercial ocean industries, such as fishing and ocean transport, are dispersed over broad areas of the ocean. Discharges of hazardous constituents from nonpoint source runoff and treatment plant outfalls mostly affect the waters within 3 nm of the coast, whereas most of the Navy activities occur beyond the 12 nm limit of Federal waters. The quantities of contaminants released, however, would be cumulatively insignificant relative to the volume of the water and the area of bottom sediments affected. The use of hazardous materials by the Navy under the Proposed Action, when added to that of other projects, would not significantly impact resources in the SOCAL Range Complex.

The primary impact of hazardous materials on SCI would be to contribute contaminants to surface soils and to surface runoff into the ocean. Construction projects and maintenance activities on SCI beyond those included in the Proposed Action could also contribute minor amounts of hazardous contaminants to surface soils. The contributions of these other projects would be very minor, however, in comparison to the effects of the training and testing activities. Thus, the cumulative impacts would be substantially the same as the impacts described for the Proposed Action.

The primary impact of increased hazardous waste generation resulting from the Proposed Action would be a need for increased hazardous waste storage, transport, and disposal ashore. Other offshore and SCI Navy activities would also contribute to the Navy's overall hazardous waste streams. The Navy's hazardous waste management system and procedures are adequate to accommodate these increases. Other hazardous waste generators in the region, along with the Navy, would require the services of hazardous waste transporters and treatment, storage, and disposal facilities. While the costs for hazardous waste transport, treatment, storage, and disposal could increase substantially in response to increased cumulative demand, the hazardous waste management industry in the region has sufficient physical capacity to respond to this increased demand. Accordingly, cumulative impacts on hazardous waste management would be less than significant.

4.3.4 Water Resources

The Proposed Action would release water pollutants to the marine environment. It also would release chemical contaminants to surface soils; these contaminants could migrate into groundwater aquifers or via surface flows to the marine environment. These effects of the Proposed Action, however, have been determined not to be significant.

The Proposed Action would affect marine geology and sediments in the SOCAL Range Complex chiefly by depositing training debris on bottom sediments and disturbing previously disturbed surface soils in existing training areas on SCI. In Chapter 3, these effects were determined to be less than significant in the context of the existing environment.

Cumulative impacts on marine geology and sediments would consist of the effects of the Proposed Action in concert with other projects, actions, and processes that deposit sediment or debris, or disturb ocean bottom sediments. Relevant effects would include debris contributions from recreational and commercial fishing, offshore oil and gas development, dredging and sand replenishment projects, and other ocean industries. The effects of these activities on the geology and soils within the SOCAL Range Complex are known only in a very general sense.

Commercial ocean industries, such as fishing, are dispersed over broad areas of the ocean, as are the effects of the Proposed Action. Dredging mostly occurs in nearshore areas, whereas most of the Navy training takes place in remote areas of the open ocean. No major offshore oil and gas or LNG facilities are located in the SOCAL Range Complex, and no permit applications for such facilities are under consideration by state or Federal agencies. Cumulative development projects along the Southern California coast would contribute to increased rates of sediment discharge into nearshore waters, but no substantial changes in bottom contours or sediment deposits are expected. In summary, cumulative effects on marine geology and sediments in the open-ocean portions of the SOCAL Range Complex are less than significant.

SCI's nearshore ocean bottom sediments would be disturbed by projects such as the SOAR Cable Refurbishment, Shallow Water Training Range (SWTR) installation, new moorings at Wilson Cove, and an underwater missile launch facility, in addition to the effects of the Proposed Action. These areas would soon be returned to their previous condition by wave action and currents, but the new structures would permanently alter the bottom topography. The new structures would occupy very small portions of the nearshore ocean bottom. The cumulative impact of these projects, in conjunction with the Proposed Action, would be insignificant.

Cumulative impacts on terrestrial SCI water quality would consist of the effects of the Proposed Action in conjunction with other Navy on-island actions that contributed contaminants to surface soils. On-island maintenance activities would involve the use of potential water pollutants, but facilities and procedures in compliance with Federal and state regulations would limit the release of such contaminants to *de minimis* amounts. New construction similarly would require the use and application of potential water pollutants, but construction procedures in compliance with Federal and state regulations would limit any releases of contaminants. A proposed increase in the capacity (and thus discharge volume) of SCI's wastewater treatment plant would require a discharge permit; the permitting process would assure that ocean water quality objectives would continue to be met. Overall, the cumulative effects would be similar to the effects anticipated for the Proposed Action, and would be less than significant.

4.3.5 Acoustic Environment (Airborne)

The Proposed Action activities in the SOCAL Range Complex were deemed to have insignificant effects on the marine (airborne) noise environment, due in large part to the absence of human sensitive receptors on these sea ranges. Commercial ship and aircraft traffic, oil and gas development, and recreational activities all would contribute occasional, short-term noise to small portions of the ocean operating area of the SOCAL Range Complex. The airborne noises they generate would consist chiefly of short-term intrusive noise events in different locations at different times, similar to those of the Proposed Action. Thus, little or no overlap in location or time of discrete noise events would be expected. Peak and average community noise levels would remain largely unchanged. Additionally, human noise receptors would still be absent. Accordingly, cumulative impacts on the marine noise environment would be less than significant.

Cumulative noise sources on SCI would include range operations, training, and maintenance activities not included in the Proposed Action, along with numerous planned construction projects. Noise from these activities generally would consist of short-term, intrusive noise events in different locations. Because these activities would occur relatively near to each other, some potential exists for an additive effect and a modest increase in average hourly noise levels during the day. The only noise-sensitive receptors, however, would be military personnel and their civilian contractors; members of the general public would not be exposed to this cumulative noise environment.

The noise-sensitive receptors most likely to be exposed to cumulative noise from on-island and nearshore Navy activities would be fishermen, fishing and dive charters, and other commercial and recreational vessels in the nearshore waters around SCI. While these individuals could be exposed to high noise levels from naval training activities, especially the use of live ordnance on SCI, they generally would not be exposed to high noise levels from on-island construction projects. Both distance attenuation and topographic shielding generally would substantially reduce the noise level between its source and the closest receptors. Projects such as the SOAR Cable Refurbishment, new moorings at Wilson Cove, and an underwater missile launch facility would generate very little atmospheric noise, and any construction noise would be short in duration. Thus, the cumulative noise environment would be similar to that for the Proposed Action alone, which has been determined to have less than significant impacts.

Proposed upgrades of SCI's NALF would increase total air operations, expanding the +65-decibel noise contour over portions of the ocean. The increase would be modest and the affected area would be small, however, and the exposure of any one vessel to aircraft noise while traversing the area would be short. In addition, little or no overlap between aircraft noise from NALF and noise from noise-intensive training activities such as ordnance delivery would occur, however, because the air field is located on the northern end of SCI and these noise-intensive training activities are concentrated in the Shore Bombardment Area (SHOBA) on the southern end of the island.

In the area of airborne sound, the primary impacts of proposed Navy activities are geographically isolated from population centers and otherwise will not affect natural resources. There would be no significant cumulative impact from these proposed activities.

4.3.6 Marine Plants and Invertebrates

Potential cumulative impacts on marine plants and invertebrates in the SOCAL Range Complex include releases of chemicals into the ocean, introduction of debris into the water column and onto the seafloor, and mortality and injury of marine organisms near the detonation or impact point of ordnance or explosives. The presence of persistent organic compounds such as DDT and PCBs are of particular concern. In light of these concerns, Navy activities would have small or negligible potential impacts. There would be no long-term changes to species abundance or diversity, no loss or degradation of sensitive habitats, and no effects to threatened and endangered species. None of the potential impacts would affect the sustainability of resources, the regional ecosystem, or the human community.

4.3.7 Fish

Potential cumulative impacts of Navy training exercises include release of chemicals into the ocean, introduction of debris into the water column and onto the seafloor, mortality and injury of marine organisms near the detonation or impact point of ordnance or explosives, and, physical and acoustic impacts of vessel activity. The overall effect on fish stocks would be negligible additions to impacts of commercial and recreational fishing in the SOCAL Range Complex.

Due to the wide geographic separation of most of the operations, Navy activities would have small or negligible potential impact, and their potential impacts are not additive or synergistic. Relatively small numbers of fish would be killed by shock waves from mines, inert bombs, and intact missiles and targets hitting the water surface. These and several other types of activities common to many exercises or tests have less-than-significant effects on fish: aircraft, missile, and target overflights; muzzle blast from 5-inch naval guns; releases of munitions constituents; falling debris and small arms rounds; entanglement in military-related debris; and chaff and flares. There would be no long-term changes in species abundance or diversity, no loss or degradation of sensitive habitats, and no effects to threatened and endangered species. None of the potential impacts would affect Essential Fish Habitat (EFH), sustainability of resources, the regional ecosystem, or the human community.

4.3.8 Sea Turtles

Four species of sea turtles—leatherback, loggerhead, olive ridley, and green—occur in the SOCAL Range Complex. Each of these species is globally distributed, and each is listed as threatened or endangered.

4.3.8.1 Distribution and Conservation Status

Olive ridley turtles are globally distributed in the tropical regions of the South Atlantic, Pacific, and Indian oceans. In the South Atlantic Ocean, they are found along the Atlantic coasts of West Africa and South America. In the Eastern Pacific, they occur from Southern California to Northern Chile. Olive ridleys often migrate great distances between feeding and breeding grounds. In two separate satellite telemetry studies, both male and female olive ridleys leaving the breeding and nesting grounds off the Pacific coast of Costa Rica migrated out to the deep waters of the Pacific Ocean. Both sexes migrated to waters deeper than 9,800 ft (3,000 m). The results did not indicate a directed migration to a specific foraging area; instead it appears the olive ridley forages opportunistically in deep ocean waters (Plotkin et al. 1994). Olive ridley populations are listed as endangered or threatened worldwide (NOAA 2007).

The green turtle is globally distributed and generally found in tropical and subtropical waters along continental coasts and islands between 30 degrees north (°N) and 30 degrees south (°S). Nesting occurs in over 80 countries throughout the year (though not throughout the year at each specific location). Green turtles are thought to inhabit coastal areas of more than 140 countries. In the eastern North Pacific, green turtles have been sighted from Baja California to southern Alaska, but most commonly occur from San Diego south. In the central Pacific, green turtles occur around most tropical islands, including the Hawaiian Islands. Green turtle populations are listed as endangered or threatened throughout their range (NOAA 2007).

Leatherback turtles are globally distributed. Leatherback turtle nesting grounds are located around the world, with the largest remaining nesting assemblages found on the coasts of northern South America and western Africa. The U.S. Caribbean, primarily Puerto Rico and the U.S. Virgin Islands, and southeast Florida support minor nesting colonies, but represent the most significant nesting activity within the United States. Adult leatherbacks are capable of tolerating a wide range of water temperatures, and have been sighted along the entire continental coast of the United States as far north as the Gulf of Maine and south to Puerto Rico, the U.S. Virgin Islands, and into the Gulf of Mexico. The Pacific Ocean leatherback population is generally smaller in size than that in the Atlantic Ocean. Leatherback turtles are endangered throughout their range (NOAA 2007).

Loggerheads turtles are circumglobal, occurring throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian oceans. Loggerheads are the most abundant species of sea turtle found in U.S. coastal waters.

In the eastern Pacific, loggerheads have been reported as far north as Alaska, and as far south as Chile. In the United States, occasional sightings are reported from the coasts of Washington and Oregon, but most records are of juveniles off the coast of California. The west coast of Mexico, including the Baja Peninsula, provides critically important developmental habitats for juvenile loggerheads. The only known nesting areas for loggerheads in the North Pacific are found in southern Japan. Loggerhead turtles are threatened throughout their range (NOAA 2007).

4.3.8.2 Impacts on Sea Turtles

Incidental take in fishing operations, or bycatch, is one of the most serious threats to sea turtle populations (NOAA 2008). In the Pacific, NMFS requires measures (e.g., gear modifications, changes to fishing practices, and time/area closures) to reduce sea turtle bycatch in the Hawaii- and California-based pelagic longline fisheries and the California/Oregon drift gillnet fishery.

Marine debris affects marine turtles, which commonly ingest or become entangled in marine debris (e.g., tar balls, plastic bags, plastic pellets, balloons, and ghost fishing gear) as they feed along oceanographic fronts, where debris and their natural food items converge. Marine pollution from coastal runoff, marina and dock construction, dredging, aquaculture, oil and gas exploration and extraction, increased underwater noise, and boat traffic can degrade marine habitats used by marine turtles. Turtles swimming or feeding at or just beneath the surface of the water are vulnerable to boat and vessel strikes, which can result in serious propeller injuries and death. Disease**,** specifically fibropapillomatosis (FP), is a major threat to green turtles in some areas of the world. In addition, scientists have documented FP in populations of loggerhead, olive ridley, and flatback turtles. The effects of FP at the population level are not well understood. How some marine turtle species function within the marine ecosystem is still poorly understood. Global warming could potentially have an extensive impact on all aspects of a turtle's life cycle, as well as impact the abundance and distribution of prey items. Loss or degradation of nesting habitat resulting from erosion control through beach nourishment and armoring, beachfront development, artificial lighting, and nonnative vegetation is a serious threat affecting nesting females and hatchlings (NOAA 2007).

4.3.8.3 Summary

Sea turtles are generally uncommon in the SOCAL Range Complex and do not nest there, but may forage in or transit through the area. Temporary disturbance incidents associated with SOCAL Range Complex activities could result in an incremental contribution to cumulative impacts on sea turtles. The mitigation measures identified in Sections 3.8.1.2 and 3.8.3 would minimize any potential adverse effects on sea turtles. The impacts of the No Action and Proposed Action alternatives are not likely to affect the species' or stock's annual rates of recruitment or survival. Therefore, the incremental impacts of the No Action and Proposed Action alternatives would not present a significant contribution to the effects on sea turtles when added to effects on sea turtles from other past, present, and reasonably foreseeable future actions.

4.3.9 Marine Mammals

Risks to marine mammals emanate primarily from ship strikes, exposure to chemical toxins or biotoxins, exposure to fishing equipment that may result in entanglements, and disruption or depletion of food sources from fishing pressure and other environmental factors. Potential cumulative impacts of Navy activities on marine mammals would result primarily from possible ship strikes and sonar use.

Stressors on marine mammals and marine mammal populations can include both natural and human-influenced causes, as listed below and described in the following sections:

Natural Stressors

- Disease
- Natural toxins
- Weather and climatic influences
- Navigation errors
- Social cohesion

Human-Influenced Stressors

- Ship strikes
- Pollution and ingestion
- Noise

4.3.9.1 Natural Stressors

Significant natural causes of mortality, die-offs, and stranding discussed below include disease and parasitism, marine neurotoxins from algae, navigation errors that lead to inadvertent stranding, and climatic influences that impact the distribution and abundance of potential food resources (i.e., starvation). Stranding is also caused by predation by other species such as sharks (Cockcroft et al. 1989; Heithaus, 2001), killer whales (Constantine et al. 1998; Guinet et al. 2000; Pitman et al. 2001), and some species of pinniped (Hiruki et al., 1999; Robinson et al. 1999).

4.3.9.1.1 Disease

Like other mammals, marine mammals frequently suffer from a variety of diseases of viral, bacterial, and fungal origin (Visser et al., 1991; Dunn et al., 2001; Harwood, 2002). Gulland and Hall (2005, 2007) provide a summary of individual and population effects of marine mammal diseases.

4.3.9.1.2 Marine Neurotoxins

Some single-celled marine algae common in coastal waters, such as dinoflagellates and diatoms, produce toxic compounds that can bioaccumulate in the flesh and organs of fish and invertebrates (Geraci et al., 1999; Harwood, 2002). Marine mammals become exposed to these compounds when they eat prey contaminated by these naturally produced toxins (Van Dolah, 2005).

4.3.9.1.3 Weather Events and Climate Influences

Severe storms, hurricanes, typhoons, and prolonged temperature extremes may lead to local marine mammal strandings (Geraci et al. 1999; Walsh et al. 2001). Storms in 1982 to 1983 along the California coast led to deaths of 2,000 northern elephant seal pups (Le Boeuf and Reiter 1991). Seasonal oceanographic conditions in terms of weather, frontal systems, and local currents may also play a role in stranding (Walker et al. 2005).

The effect of large-scale climatic changes to the world's oceans and how these changes impact marine mammals and influence strandings are difficult to quantify, given the broad spatial and temporal scales involved, and the cryptic movement patterns of marine mammals (Moore 2005; Learmonth et al. 2006). The most immediate, although indirect, effect is decreased prey availability during unusual conditions. This, in turn, results in increased search effort required by marine mammals (Crocker et al. 2006), potential starvation if not successful, and corresponding stranding due directly to starvation or succumbing to disease or predation while in a weakened, stressed state (Selzer and Payne 1988; Geraci et al. 1999; Moore, 2005; Learmonth et al. 2006; Weise et al. 2006).

4.3.9.1.4 Navigational Error

Geomagnetism – Like some land animals and birds, marine mammals may be able to orient to the Earth's magnetic field as a navigational cue, and areas of local magnetic anomalies may influence strandings (Bauer et al., 1985; Klinowska 1985; Kirschvink et al. 1986; Klinowska 1986; Walker et al., 1992; Wartzok and Ketten 1999).

Echolocation Disruption in Shallow Water – Some researchers believe stranding may result from reductions in the effectiveness of echolocation in shallow water, especially in the pelagic species of odontocetes who may be less familiar with coastlines (Dudok van Heel, 1966; Chambers and James, 2005). For an odontocete, echoes from echolocation signals contain important information on the location and identity of underwater objects and the shoreline. The authors postulate that the gradual slope of a beach may present difficulties to the navigational systems of some cetaceans, since live strandings commonly occur along beaches with shallow, sandy gradients (Brabyn and McLean 1992; Mazzuca et al. 1999; Maldini et al. 2005; Walker et al. 2005). A factor contributing to echolocation interference in turbulent, shallow water is the presence of microbubbles from the interaction of wind, breaking waves, and currents. Additionally, ocean water near the shoreline can have an increased turbidity (e.g., floating sand or silt, particulate plant matter) due to the run-off of fresh water into the ocean, either from rainfall or from freshwater outflows (e.g., rivers and creeks). Collectively, these factors can reduce and scatter the sound energy in echolocation signals and reduce the perceptibility of returning echoes of interest.

4.3.9.1.5 Social Cohesion

Many pelagic species such as sperm whales, pilot whales, melon-head whales, and false killer whales, and some dolphins occur in large groups with strong social bonds between individuals. When one or more animals strand due to any number of causative events, then the entire pod may follow suit out of social cohesion (Geraci et al. 1999; Conner 2000; Perrin and Geraci 2002; NMFS, 2007).

Table 4-6: Marine Mammal Unusual Mortality Events in the Pacific Attributed to or Suspected from Natural Causes, 1978-2005

Year	Species and Number	Location	Cause
1978	Hawaiian monk seals (50)	NW Hawaiian Islands	Ciguatoxin and maitotoxin
1983	Multiple pinniped species	West coast of U.S., Galapagos	El Niño
1984	California sea lions (226)	California	Leptospirosis
1987	Sea otters (34)	Alaska	Saxitoxin
1995	California sea lions (222)	California	Leptospirosis
1997-98	California sea lions (100s)	California	El Nino
1998	California sea lions (70)	California	Domoic acid
1998	Hooker’s sea lions (60% of pups)	New Zealand	Unknown, bacteria likely
2000	California sea lions (178)	California	Leptospirosis
2000	California sea lions (184)	California	Domoic acid
2000	Harbor seals (26)	California	Unknown; Viral pneumonia suspected
2001-02	Hawaiian monk seals	NW Hawaiian Islands	Ecological factors
2002	Multispecies (common dolphins, California sea lions, sea otters) (approx. 500)	California	Domoic acid
2002	Hooker’s sea lions	New Zealand	Pneumonia
2003	Multispecies (common dolphins, California sea lions, sea otters) (approx. 500)	California	Domoic acid
2003	Beluga whales (20)	Alaska	Ecological factors
2003	Sea otters	California	Ecological factors
2004	California sea lions (405)	Canada, U.S. West Coast	Leptospirosis
2005	California sea lions; Northern fur seals	California	Domoic acid

Note: Data from Gulland and Hall (2007); citations for each event contained in Gulland and Hall (2007)

4.3.9.2 Human-Influenced Stressors

During the past few decades there has been an increase in marine mammal mortalities associated with a variety of human activities (Geraci et al. 1999; NMFS, 2007). These activities include fisheries interactions (bycatch and directed catch), pollution (marine debris, toxic compounds), habitat modification (degradation, prey reduction), ship strikes (Laist et al., 2001), and gunshots (see Figure 4-1 for examples of threats).

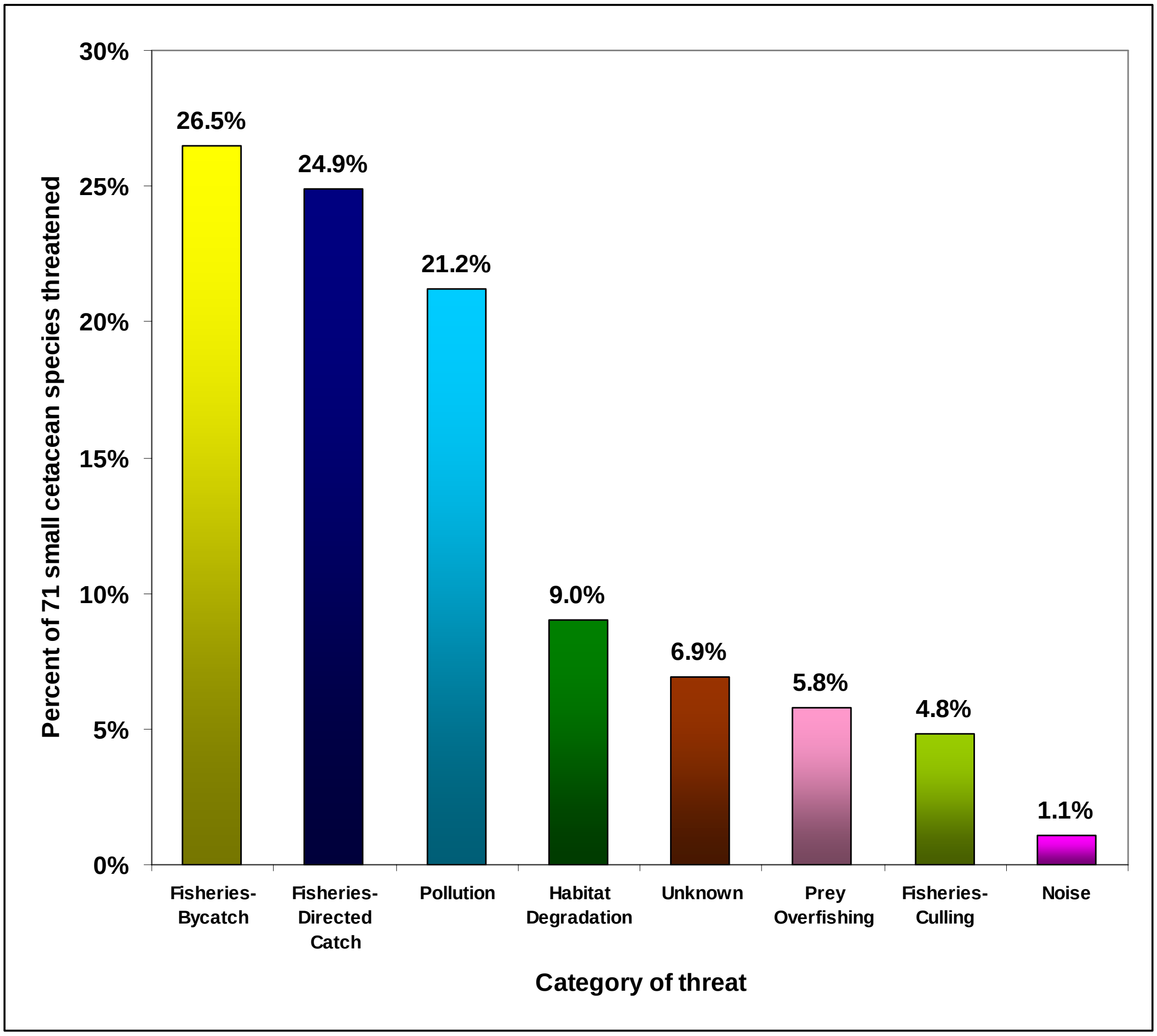

Figure 4-1: Human Threats to Worldwide Small Cetacean Populations

Source: Culik 2002

4.3.9.2.1 Fisheries Interaction: Bycatch, Directed Catch, and Entanglement

The incidental catch of marine mammals in commercial fisheries is a significant threat to the survival and recovery of many populations of marine mammals (Geraci et al. 1999; Baird, 2002; Culik 2002; Carretta et al., 2004; Geraci and Lounsbury 2005; NMFS, 2007). Interactions with fisheries and entanglement in discarded or lost gear continue to be a major factor in marine mammal deaths worldwide (Geraci et al. 1999; Nieri et al., 1999; Geraci and Lounsbury 2005; Read et al., 2006; Zeeberg et al., 2006). For instance, baleen whales and pinnipeds have been found entangled in nets, ropes, monofilament line, and other fishing gear that has been discarded out at sea (Geraci et al., 1999; Campagna et al., 2007).

Bycatch – Bycatch is the catching of nontarget species within a given fishing operation and can include noncommercially used invertebrates, fish, sea turtles, birds, and marine mammals (NRC, 2006). Read et al. (2006) attempted to estimate the magnitude of marine mammal bycatch in U.S. and global fisheries. Within U.S. fisheries, between 1990 and 1999 the mean annual bycatch of marine mammals was 6,215 animals. Eighty-four percent of cetacean bycatch occurred in gill-net fisheries, with dolphins and porpoises constituting most of the cetacean bycatch (Read et al., 2006). Over the decade there was a 40 percent decline in marine mammal bycatch, primarily due to effective conservation measures that were implemented during this time period.

Read et al. (2006) extrapolated data for the same period (1990-1999) and calculated an annual estimate of 653,365 of marine mammals globally, with most of the world's bycatch occurring in gill-net fisheries. With global marine mammal bycatch likely to be in the hundreds of thousands every year, bycatch in fisheries will be the single greatest threat to many marine mammal populations around the world (Read et al. 2006).

Entanglement – Entanglement in active fishing gear is a major cause of death or severe injury among the endangered whales. Entangled marine mammals may die as a result of drowning, escape with pieces of gear still attached to their bodies, or manage to be set free either of their own accord or by fishermen. Many large whales carry off gear after becoming entangled (Read et al. 2006). When a marine mammal swims off with gear attached, the result can be fatal. The gear may become too cumbersome for the animal, or it can be wrapped around a crucial body part and tighten over time. Stranded marine mammals frequently exhibit signs of previous fishery interaction, such as scarring or gear attached to their bodies. For stranded marine mammals, death is often attributed to such interactions (Baird and Gorgone, 2005). Because marine mammals that die due to fisheries interactions may not wash ashore and not all animals that do wash ashore exhibit clear signs of interactions, data probably underestimate fishery-related mortality and serious injury (NMFS, 2005a).

An estimated 78 baleen whales were killed annually in the offshore Southern California/Oregon drift gillnet fishery during the 1980s (Heyning and Lewis 1990). From 1998-2005, based on observer records, 5 fin whales (CA/OR/WA stock), 12 humpback whales (ENP stock), and 6 sperm whales (CA/OR/WA stock) were either seriously injured or killed in fisheries off the west coast of the United States. (California Marine Mammal Stranding Network Database 2006).

4.3.9.2.2 Ship Strike

Ship strikes of marine mammals are another cause of mortality and stranding (Laist et al., 2001; Geraci and Lounsbury, 2005; de Stephanis and Urquiola, 2006). An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or an animal just below the surface could be cut by a vessel's propeller. The severity of injuries typically depends on the size and speed of the vessel and the size of the animal (Knowlton and Kraus, 2001; Laist et al., 2001; Vanderlaan and Taggart, 2007).

The growth in commercial ports and associated commercial vessel traffic is a result of the globalization in trade. The Final Report of the NOAA International Symposium on *Shipping Noise and Marine Mammals: A Forum for Science, Management, and Technology* stated that the worldwide commercial fleet has grown from approximately 30,000 vessels in 1950 to over 85,000 vessels in 1998 (NRC, 2003; Southall, 2005). It is unknown how international shipping volumes and densities will continue to grow. However, current statistics support the prediction that the international shipping fleet will continue to grow at the current rate or at greater rates in the future. Shipping densities in specific areas and trends in routing and vessel design are as, or more, significant than the total number of vessels. Densities along existing coastal routes are expected to increase both domestically and internationally. New routes are also expected to develop as new ports are opened and existing ports are expanded. Vessel propulsion systems are also advancing toward faster ships operating in higher sea states for lower operating costs; and container ships are expected to become larger along certain routes (Southall, 2005).

While there are reports and statistics of whales struck by vessels in U.S. waters, the magnitude of the risks that commercial ship traffic poses to marine mammal populations is difficult to quantify or estimate. In addition, there is limited information on vessel strike interactions between ships and marine mammals outside of U.S. waters (de Stephanis and Urquiola, 2006). Laist et al.

(2001) concluded that ship collisions may have a negligible effect on most marine mammal populations in general, except for regionally-based small populations where the significance of low numbers of collisions would be greater, given smaller populations or populations segments.

U.S. Navy vessel traffic is a small fraction of the overall U.S. commercial and fishing vessel traffic. While U.S. Navy vessel movements may contribute to the ship strike threat, given the lookout and mitigation measures adopted by the U.S. Navy, probability of vessel strikes is greatly reduced. Furthermore, actions to avoid close interaction of U.S. Navy ships and marine mammals and sea turtles, such as maneuvering to keep away from any observed marine mammal and sea turtle are part of existing at-sea protocols and standard operating procedures. Navy ships have dedicated and trained lookouts as well as two to three bridge watchstanders during at-sea movements who would be searching for any whales, sea turtles, or other obstacles on the water surface. Such lookouts are expected to further reduce the chances of a collision.

4.3.9.2.3 Ingestion of Plastic Objects and Other Marine Debris and Toxic Pollution Exposure

For many marine mammals, debris in the marine environment is a great hazard. Not only is debris a hazard because of possible entanglement, animals may mistake plastics and other debris for food (NMFS, 2007). Sperm whales have been known to ingest plastic debris, such as plastic bags (Evans et al. 2003; Whitehead 2003). While this has led to mortality, the scale on which this is affecting sperm whale populations is unknown, but Whitehead (2003) suspects it is not substantial at this time.

High concentrations of potentially toxic substances within marine mammals along with an increase in new diseases have been documented in recent years. Scientists have begun to consider the possibility of a link between pollutants and marine mammal mortality events. NMFS takes part in a marine mammal biomonitoring program not only to help assess the health and contaminant loads of marine mammals, but also to assist in determining anthropogenic impacts on marine mammals, marine food chains, and marine ecosystem health. Using strandings and bycatch animals, the program provides tissue/serum archiving, samples for analyses, disease monitoring and reporting, and additional response during disease investigations (NMFS, 2007).

The impacts of these activities are difficult to measure. However, some researchers have correlated contaminant exposure with possible adverse health effects in marine mammals (Borell 1993; O'Shea and Brownell 1994; O'Hara and Rice 1996; O'Hara et al. 1999).

The manmade chemical PCB (polychlorinated biphenyl), and the pesticide DDT (dichlorodiphyenyltrichloroethane), are both considered persistent organic pollutants that are currently banned in the United States for their harmful effects in wildlife and humans (NMFS, 2007b). Despite having been banned for decades, the levels of these compounds are still high in marine mammal tissue samples taken along U.S. coasts (Hickie et al. 2007; Krahn et al. 2007; NMFS, 2007b). Both compounds are long-lasting, reside in marine mammal fat tissues (especially in the blubber), and can have toxic effects such as reproductive impairment and immunosuppression (NMFS, 2007b).

In addition to direct effects, marine mammals are indirectly affected by habitat contamination that degrades prey species availability, or increases disease susceptibility (Geraci et al., 1999).

U.S. Navy vessel operation between ports and exercise locations has the potential to release small amounts of pollutant discharges into the water column. U.S. Navy vessels are not a typical source, however, of either pathogens or other contaminants with bioaccumulation potential such as pesticides and PCBs. Furthermore, any vessel discharges such as bilgewater and deck runoff associated with the vessels would be in accordance with international and U.S. requirements for eliminating or minimizing discharges of oil, garbage, and other substances, and not likely to contribute significant changes to ocean water quality or to affect marine mammals.

4.3.9.2.4 Anthropogenic Sound

As one of the potential stressors to marine mammal populations, noise and acoustic influences may disrupt marine mammal communication, navigational ability, and social patterns, and may or may not influence stranding. Many marine mammals use sound to communicate, navigate, locate prey, and sense their environment. Both anthropogenic and natural sounds may interfere with these functions, although comprehension of the type and magnitude of any behavioral or physiological responses resulting from man-made sound, and how these responses may contribute to strandings, is rudimentary at best (NMFS, 2007). Marine mammals may respond both behaviorally and physiologically to anthropogenic sound exposure (e.g., Richardson et al., 1995; Finneran et al., 2000; Finneran et al., 2003; Finneran et al., 2005). However, the range and magnitude of the behavioral response of marine mammals to various sound sources is highly variable (Richardson et al., 1995) and appears to depend on the species involved, the experience of the animal with the sound source, the motivation of the animal (e.g., feeding, mating), and the context of the exposure.

Marine mammals are regularly exposed to several sources of natural and anthropogenic sounds. Anthropogenic noise that could affect ambient noise arises from the following general types of activities in and near the sea, any combination of which can contribute to the total noise at any one place and time. These noises include transportation; dredging; construction; oil, gas, and mineral exploration in offshore areas; geophysical (seismic) surveys; sonar; explosions; and ocean research activities (Richardson et al., 1995). Commercial fishing vessels, cruise ships, transport boats, recreational boats, and aircraft all contribute sound into the ocean (NRC, 2003; NRC, 2006). Several investigators have argued that anthropogenic sources of noise have increased ambient noise levels in the ocean over the last 50 years (NRC 1994, 1996, 2000, 2003, 2005; Richardson et al., 1995; Jasny et al., 2005; McDonald et al., 2006). Much of this increase is due to increased shipping due to ships becoming more numerous and of larger tonnage (NRC, 2003; McDonald et al., 2006). Andrew et al. (2002) compared ocean ambient sound from the 1960s with the 1990s for a receiver off the California coast. The data showed an increase in ambient noise of approximately 10 decibels (dB) in the frequency range of 20 to 80 Hertz (Hz) and 200 to 300 Hz, and about 3 dB at 100 Hz over a 33-year period.

Sound emitted from large vessels, particularly in the course of transit, is the principal source of noise in the ocean today, primarily due to the properties of sound emitted by civilian cargo vessels (Richardson et al., 1995; Arveson and Vendittis, 2000). Ship propulsion and electricity generation engines, engine gearing, compressors, bilge and ballast pumps, as well as hydrodynamic flow surrounding a ship's hull and any hull protrusions, contribute to a large vessels' noise emissions in the marine environment. Prop-driven vessels also generate noise through cavitation, which accounts for much of the noise emitted by a large vessel depending on its travel speed. Military vessels underway or involved in naval operations or exercises also introduce anthropogenic noise into the marine environment. Noise emitted by large vessels can be characterized as low frequency, continuous, and tonal. The sound pressure levels at the vessel will vary according to speed, burden, capacity, and length (Richardson et al., 1995; Arveson and Vendittis, 2000). Vessels ranging from 135 to 337 m generate peak source sound levels from 169 to 200 dB between 8 Hz and 430 Hz, although Arveson and Vendittis (2000) documented components of higher frequencies (10-30 kHz) as a function of newer merchant ship engines and faster transit speeds. Given the propagation of low-frequency sounds, a large vessel in this sound range can be heard 139 to 463 km away (Ross 1976 in Polefka 2004). U.S. Navy vessels, however, have incorporated significant underwater ship-quieting technology to reduce their acoustic signature (as compared to a similarly sized vessel) and thus reduce their vulnerability to detection by enemy passive acoustics.

Airborne sound from a low-flying helicopter or airplane may be heard by marine mammals and turtles while at the surface or underwater. Due to the transient nature of sounds from aircraft involved in at-sea operations, such sounds would not likely cause physical effects but have the potential to affect behaviors. Responses by mammals and turtles could include hasty dives or turns, or decreased foraging (Soto et al., 2006). Whales may also slap the water with flukes or flippers, and swim away from the aircraft track. Smultea et al. (2008) reported in a population monitoring study of sperm whales that the majority of whales encountered seemed to exhibit no obvious reaction to aircraft overflight of greater than 360 m (1,200 ft) distance. When approached at closer distances a significant subset of groups that were approached did indeed respond with sudden dives as the plane first appeared, and a fourth group took up group formations that the researchers interpreted as agitation, distress, and/or defense. Although they postulated that such disturbance was transient and likely insignificant in terms of population health, the researchers note that "repeated or prolonged exposure to aircraft overflights have the potential to result in significant disturbance of biological functions, especially in important nursery, breeding or feeding areas." They suggest that such cumulative effects could be possible in areas frequented by military training exercises (Smultea et al., 2008).

Naval sonars are designed for three primary functions: submarine hunting, mine hunting, and shipping surveillance. There are two classes of sonars employed by the U.S. Navy: active sonars and passive sonars. Most active military sonars operate in a limited number of areas, and are most likely not a significant contributor to a comprehensive global ocean noise budget (ICES 2005b).

4.3.9.3 Summary

Both natural and human-induced factors affect the health of marine mammal populations. Temporary disturbance incidents associated with Navy activities on the SOCAL Range Complex could result in an incremental contribution to cumulative impacts on mammals. The mitigation measures identified in Section 3.9.10 would be implemented to minimize any potential adverse effects to marine mammals from Navy activities. Impacts of the alternatives including the Proposed Action are not likely to affect the species through effects on annual rates of recruitment or survival. Therefore, the incremental impacts would not present a significant contribution to the effects on marine mammals when added to effects from other past, present, and reasonably foreseeable future actions.

4.3.10 Seabirds

Seabird populations within the SOCAL Range Complex are affected by direct and indirect perturbations to breeding and foraging locations on the coastal mainland and offshore islands. The single greatest concern is the loss of suitable habitat for nesting and roosting seabirds throughout coastal California due to land development and human encroachment. Historically, seabird populations have sustained numerous impacts from pollution and human activities within the SCB from a variety of sources, including the discharge of hazardous chemicals and sewage. Though the Proposed Action does not directly reduce available seabird habitat within the SOCAL Range Complex, current seabird populations residing within the SOCAL Range Complex become more susceptible to potential impacts due to the concentrated nature of those populations. By default, open space within military installations in coastal locations has become vital to the persistence of seabird breeding and roosting populations.

Land range operations could affect breeding seabirds if the operational footprint encompassed nesting areas during breeding seasons. Current data on breeding seabird populations that overlap with training operations in or near coastal areas, San Clemente Island, or Santa Catalina Island are either unavailable or incomplete, making a comprehensive effects analysis difficult. Though most offshore operations take place in oceanic waters well offshore, are of short duration, and have a small operational footprint, the importance of avoiding sensitive seabird colonies and reducing disturbance should be paramount when accessing new or ongoing training activities.

Training activities concentrated in or near coastal areas or offshore islands, or taking place at regular intervals, would disturb local seabird roosting colonies. The coastal and offshore island areas within the SOCAL Range Complex provide suitable seabird habitat adjacent to training areas, allowing potentially affected seabirds adequate alternative locations to avoid interactions with training operations. Continued expansion of commercial and private aircraft and ocean-going vessels through the SOCAL Range Complex, together with increased SOCAL Range Complex training activities, elevates the potential for direct and indirect impacts on isolated seabird populations. The control of nonnative plants and animals within coastal areas and on islands must continue to be addressed by land owners to ensure further degradation of seabird populations does not occur. Large-scale effects on seabird populations such as global warming, reduced fish populations, and development in other regions or countries are not well defined for individual species but have been attributed to the overall decline of seabirds.

The Proposed Action would not significantly impact any individual seabird population, its overall foraging success, or breeding opportunities within the SOCAL Range Complex.

4.3.11 Terrestrial Biological Resources

The analysis for cumulative impacts to terrestrial biological resources focuses on fire, invasive species, erosion, and habitat degradation.

4.3.11.1 Fire

Numerous activities having the potential to ignite wildfires have been described previously in this EIS/OEIS. These activities have a cumulative contribution to wildfire risk, and various measures identified in this document are intended to address the cumulative impacts of wildfire. The analyses of the individual activities that contribute to wildfire risk concluded that impacts of the individual operations on sensitive species could be mitigated to a less than significant level. This mitigation would be accomplished by implementing the SCI Wildland Fire Management Plan, which builds on recently implemented measures that have been reducing the frequency and size of operations-related fires. After mitigation, there would remain some potential for fire impacts associated with each operation. These remaining potential impacts on sensitive species, including the San Clemente loggerhead shrike, were judged to be less than significant individually. With implementation of the SCI Wildland Fire Management Plan, cumulative impacts of fire would be less than significant.

4.3.11.2 Invasive Species, Erosion, and Habitat Degradation

Several activities contribute cumulatively to habitat degradation, including disturbance to soils and vegetation, spread of invasive nonnative species, erosion and sedimentation, and impacts on native plant species. Although individual impacts may be less than significant, collectively they have the potential to be significant over time and space. Some potential effects of invasive species are difficult to foresee (such as leading to a change in fire frequency or intensity). It is clear, however, that the potential for damage associated with introduction or spread of invasive plant species is high and increases over time with repeated training missions, especially exercises that cover a very large area. This is due to the difficulty in effectively monitoring for invasive establishment and achieving timely control. The Navy is addressing these effects in several important ways including implementation of the SCI Integrated Natural Resources Management Plan (INRMP), the SCI Wildland Fire Management Plan, and continued development and implementation of measures to prevent the establishment of invasive plant species by minimizing the potential for introductions of seed or other plant parts (propagules) of exotic species, and finding and eliminating incipient populations before they are able to spread. Key measures include:

- Minimizing the amount of seed or propagules of nonnative plant species introduced to the island through continued efforts to remove seed and soil from all vehicles, including contractor vehicles, coming to the island by pressure washing on the mainland, and stepped up efforts to ensure that imported construction materials such as sand, gravel, aggregate, or road base material are weed free.
- Regular monitoring and treatment to detect and eliminate exotic species, focusing on areas where equipment and construction materials come ashore (Wilson Cove vicinity, including equipment yards and construction laydown areas, vicinity of beaches where amphibious landings area conducted) and areas within which there is movement of equipment and personnel and soil disturbance which favor the spread and establishment of invasive species (e.g., along roadsides, disturbed areas, including the Assault Maneuver Corridor, and Training Areas and Ranges [TARs]).
- Effective measures to foster the reestablishment of native vegetation in areas where nonnative vegetation is present.
- No living plant material would be brought to the island from the mainland (in order to avoid introduction of inappropriate genetic strains of native plants or exotic species, including weeds, insects, and invertebrates such as snails).
- Continued operation of an on-island nursery to produce all plant material to be used on the island and continued exclusive use of on-island sources of indigenous plants for use in restoration. Because of the site-to-site variability in some of the native species, location-specific sources should be used in propagating many of the native species for use in restoration.
- Measures to correct developing erosion problems, such as correcting drainage from roads and culvert outlets where they contribute to concentration of flow potentially leading to gullying and measures designed to stop the progression of existing gullies associated with developed sites and roads.
- Maintenance of an up-to-date inventory of sensitive plant and wildlife species locations and consulting the inventory in all environmental reviews.

Navy projects at SCI other than the Proposed Action, such as those identified in Table 4-4, also could impact terrestrial biological resources. Any such project at SCI would be required to be in compliance with the established INRMP, SCI Wildland Fire Management Plan, and U.S. Fish and Wildlife Service (USFWS) Biological Opinions (BOs) issued after Endangered Species Act (ESA) Section 7 consultation addressing direct, indirect, and cumulative impacts. As identified in Section 3.11, there are numerous potential impacts of the Proposed Action on terrestrial biology on SCI. These impacts have the potential for significant cumulative impact on such resources. Mitigation measures identified in this EIS/OEIS, considered together with any additional mitigation or conservation measures that might be appropriate after Section 7 consultation, however, will substantially mitigate direct, indirect, and cumulative effects of the Proposed Action.

4.3.12 Cultural Resources

This EIS/OEIS determined that the Proposed Action would have little or no potential to impact underwater cultural resources, primarily because most of the Proposed Action's activities were on or above the surface and cultural resources, if any, are on the ocean bottom. Project activities would not generally disturb areas where cultural resources are known or expected to be present.

For the same reason, most other ongoing and anticipated ocean activities such as commercial ship traffic, fishing, oil and gas development, or scientific research would not substantially affect underwater cultural resources.

This EIS/OEIS also examined the potential for effects on cultural, archaeological, and historic sites on SCI. Due to the large number of known and estimated cultural sites on SCI and the widespread use of the island for training of ground combat forces, Naval Special Warfare, and missile operations, the Proposed Action could increase the potential for adverse effects on cultural resources. Mitigation strategies such as avoidance measures should reduce substantially reduce or eliminate effects on cultural resources that are subject to such measures. To the extent adverse effects to cultural resources are not avoided, any activities with the potential for significant effects will require Section 106 consultation. Adverse-effect determinations resulting from activities identified in the Proposed Action have been or will be resolved in the regulatory Section 106 process.

Other on-island activities (primarily potential construction projects), not addressed in the Proposed Action, have the potential to disturb cultural resources. Such activities would require evaluation of potential effects on a case-by-case basis. To the extent practicable, mitigation measures similar to those described for the Proposed Action would be implemented for such projects. Where the mitigation by avoidance is employed, no cumulative effect would result because no adverse effect on the resource would be likely to occur. Where adverse effects on cultural resources are expected as a result of on-island activities not included in the Proposed Action, such effects would be addressed through the Section 106 consultation process and the resulting resolution of adverse effect (mitigation) practices, usually by data recovery. Adverse effects on cultural resources would result in cumulative impacts, in that, even with mitigation through data recovery, there would be a cumulative loss of the balance of the *in situ* historic properties on SCI.

Cumulative impacts also include those that would result from activities in the SHOBA Impact Areas as these may affect undocumented and unmanageable cultural resources in those areas. The SCI PA provides an alternative approach for addressing CONBC Section 106 compliance responsibilities in the SHOBA Impact Areas; however, even with adverse effects resolved through consultation there will still be cumulative impact.

4.3.13 Traffic (Airspace)

The region that includes the SOCAL Range Complex is one of the busiest areas of the world in terms of air traffic. The Proposed Action does not propose any expansion of military Special Use Airspace (SUA), and would not produce any significant regional cumulative traffic impacts. While hazardous activities in W-291 are in progress, vessel traffic, forewarned through publication of the related Notice to Mariners (NOTMAR), would avoid the affected area. Although the resultant detour might be inconvenient, it would not preclude the affected vessel from arriving at its destination. Similarly for air traffic, when hazardous activities within W-291 close CAE 1156, commercial and general aviation air traffic, operating under IFR enroute to or from San Diego, would be routed to the north to transit CAE 1177. Although this slight detour might be inconvenient, it would not pose an increased safety hazard nor impose an additional burden on the air traffic control system. Coordination with the FAA on all matters affecting airspace would significantly reduce or eliminate the possibility of indirect adverse impacts and associated cumulative impacts on civil aviation and airspace use.

4.3.14 Socioeconomics

Implementation of the Proposed Action would not produce any significant regional employment, income, housing, or infrastructure impacts. Effects on commercial and recreational fishermen, divers, and boaters would be short-term in nature and produce some temporary access limitations. Some offshore operations, especially if coincident with peak fishing locations and periods, could cause temporary displacement and potential economic loss to individual fishermen. However, most offshore operations are of short duration and have a small operational footprint. Effects on fishermen are mitigated by a series of Navy initiatives, including public notification of scheduled activities, near-real time schedule updates, prompt notification of schedule changes, and adjustment of hazardous operations areas. In selected instances where safety requires exclusive use of a specific area, fishermen may be asked to relocate to a safer nearby area for the duration of the exercise. These measures should not significantly impact any individual fisherman, overall commercial revenue, or public recreational opportunities. Therefore, the Proposed Action would not result in significant cumulative socioeconomic impacts.

4.3.15 Environmental Justice and Protection of Children

The Proposed Action would not affect minority or low-income populations, nor would children be exposed to increased noise levels or safety risks.

4.3.16 Public Safety

Environmental pollution (e.g., air pollutants, water pollutants, electromagnetic radiation [EMR]) would have little potential to affect public health because they would be dispersed over large areas of ocean with few human receptors. Project activities (e.g., ship movements, live-firing of weapons) would have little potential to affect public safety because of the general absence of nonparticipating individuals. The same factors—the dispersed nature of the activities and general absence of nonparticipants within the area of effect at the time of the activity—would limit the public health and safety impacts of other ongoing or anticipated activities in the SOCAL Range Complex.

Impacts of the Proposed Action on public health and safety on SCI were determined to be minimal: (a) the public is generally excluded from SCI, and (b) danger zones and exclusion zones have been established in SCI’s nearshore waters to assure that nonparticipants are not exposed to hazardous on-island activities. Other construction, maintenance, and training activities on the island would likewise be isolated from the public. Projects such as the SOAR Cable Refurbishment, SWTR instrumentation, and new moorings at Wilson Cove are not expected to pose any risks to individuals in public use areas around the island. An underwater missile launch facility proposed near NOTS Pier on SCI would be within a restricted zone, and would thus pose no risk to the public.