
4 Cumulative Impacts

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4 CUMULATIVE IMPACTS

4.1 INTRODUCTION

The analysis of cumulative impacts (or cumulative effects)¹ presented in this section follows the requirements of the National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) guidance (Council on Environmental Quality 1997). The CEQ regulations (40 Code of Federal Regulations [C.F.R.] §§ 1500-1508) provide the implementing regulations for NEPA. The regulations define cumulative impacts as:

“...the impact on the environment which results from the incremental impact of the action when added to the 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).”

While a single project may have minor impacts, overall impacts may be collectively significant when the project is considered together with other projects on a regional scale. A cumulative impact is the additive effect of all actions in the geographic area. The CEQ provides guidance on cumulative impact analysis in *Considering Cumulative Impacts under the National Environmental Policy Act* (Council on Environmental Quality 1997). This guidance further identifies cumulative impacts as those environmental impacts resulting “from spatial and temporal crowding of environmental perturbations. The impacts of human activities will accumulate when a second perturbation occurs at a site before the ecosystem can fully rebound from the impacts of the first perturbation.” This guidance observes that “no universally accepted framework for cumulative impacts analysis exists...” while noting that certain general principles have gained acceptance. The CEQ provides guidance on the extent to which agencies of the federal government are required to analyze the environmental impacts of past actions when they describe the cumulative environmental effect of an action. This guidance provides that an analysis of cumulative impacts might encompass geographic boundaries beyond the immediate area of an action and a timeframe that includes past actions and foreseeable future actions. Thus, the CEQ guidelines observe, “[it] is not practical to analyze cumulative impacts of an action on the universe; the list of environmental impacts must focus on those that are truly meaningful.”

4.2 APPROACH TO ANALYSIS

4.2.1 OVERVIEW

Cumulative impacts were analyzed for each resource addressed in Chapter 3 (Affected Environment and Environmental Consequences) for the Proposed Action in combination with past, present, and reasonably foreseeable future actions. The cumulative impacts analysis included the following steps, described in more detail below:

1. Identify appropriate level of analysis for each resource.
2. Define the geographic boundaries and timeframe for the cumulative impacts analysis.
3. Describe current resource conditions and trends.
4. Identify potential impacts of the Proposed Action that might contribute to cumulative impacts.

¹ Council on Environmental Quality regulations provide that the terms “cumulative effects” and “cumulative impacts” are synonymous (40 C.F.R. § 1508.8[b]); the terms are used interchangeably by various sources, but the term “cumulative impacts” will be used in this document except for quotations, for continuity.

5. Identify past, present, and other reasonably foreseeable future actions that affect each resource.
6. Analyze potential cumulative impacts.

4.2.2 IDENTIFY APPROPRIATE LEVEL OF ANALYSIS FOR EACH RESOURCE

In accordance with guidance set forth by the CEQ, the cumulative impacts analysis focused on impacts that are “truly meaningful,” (Council on Environmental Quality 1997). The level of analysis for each resource was commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences). The rationale for the level of analysis applied to each resource is described in Section 4.4 (Resource-Specific Cumulative Impacts).

4.2.3 DEFINE THE GEOGRAPHIC BOUNDARIES AND TIMEFRAME FOR ANALYSIS

The geographic boundaries for the cumulative impacts analysis included the entire Gulf of Alaska (GOA) Navy Training Activities Supplemental Environmental Impact Statement (EIS)/Overseas EIS (OEIS) Study Area (Study Area) (Figure 2.1-1). The geographic boundaries for cumulative impacts analysis for marine mammals were expanded to include activities outside the GOA Supplemental EIS/OEIS Study Area that might impact migratory marine mammals. Primary considerations from outside the Study Area include impacts associated with maritime traffic (e.g., vessel strikes and underwater noise) and commercial fishing (e.g., bycatch and entanglement).

Determining the timeframe for the cumulative impacts analysis requires estimating the length of time the impacts of the Proposed Action would last and considering the specific resource in terms of its history of degradation (Council on Environmental Quality 1997). The Proposed Action includes ongoing and anticipated future training activities. While the United States (U.S.) Department of the Navy (Navy) training requirements change over time in response to global events, geopolitical events, or other factors, the general types of activities addressed by this Supplemental EIS/OEIS are expected to continue into the reasonably foreseeable future, along with the associated impacts. Likewise, some non-military activities addressed in this cumulative impacts analysis (e.g., oil and gas production, maritime traffic, commercial fishing) are expected to continue into the reasonably foreseeable future. Therefore, the cumulative impacts analysis is not bounded by a specific future timeframe. For past actions, the cumulative impacts analysis only considers those actions or activities that have ongoing impacts.

While the cumulative impacts analysis is not limited by a specific timeframe, it should be recognized that available information, uncertainties, and other practical constraints limit the ability to analyze cumulative impacts for the indefinite future. Navy environmental planning and compliance for training activities is an ongoing process. The Navy intends to submit applications to the National Marine Fisheries Service (NMFS) for Marine Mammal Protection Act (MMPA) authorizations supported by this Supplemental EIS/OEIS. The anticipated effective dates for these MMPA authorizations would be a 5-year period from April 2016 through April 2021. Future environmental planning documents will include cumulative impacts analysis based on information available at that time.

4.2.4 DESCRIBE CURRENT RESOURCE CONDITIONS AND TRENDS

In Chapter 3 (Affected Environment and Environmental Consequences), the Navy describes current resource conditions and trends, and discusses how past and present human activities influence each resource. The current aggregate impacts of past and present actions are reflected in the baseline information presented in Chapter 3 (Affected Environment and Environmental Consequences). This

information is used in the cumulative impacts analysis to understand how past and present actions are currently impacting each resource and to provide the context for the cumulative impacts analysis.

4.2.5 IDENTIFY POTENTIAL IMPACTS OF THE PROPOSED ACTION THAT MIGHT CONTRIBUTE TO CUMULATIVE IMPACTS

Direct and indirect impacts of the Proposed Action, presented in Chapter 3 (Affected Environment and Environmental Consequences), were reviewed to identify impacts relevant to the cumulative impacts analysis. Key factors considered included the current status and sensitivity of the marine mammal species and the intensity, duration, and spatial extent of the impacts for each stressor related to training activities. In general, long-term rather than short-term impacts and widespread rather than localized impacts were considered more likely to contribute to cumulative impacts. For example, for biological resources, population-level impacts were considered more likely to contribute to cumulative impacts than were individual-level impacts. Negligible impacts were not considered further in the cumulative impacts analysis. For marine mammals, any training activity that can be estimated by NAEMO and is expected to result in Level A harassment or Level B harassment, as defined by MMPA, was considered in the cumulative impacts analysis. For Endangered Species Act (ESA)-listed species, any training activity that may affect and is likely to adversely affect the species was considered in the cumulative impacts analysis. Training activities that were determined by the Navy to have no effect or that may affect but are not likely to adversely affect ESA-listed species were not analyzed in detail in the cumulative impacts analysis.

4.2.6 IDENTIFY OTHER ACTIONS AND OTHER ENVIRONMENTAL CONSIDERATIONS THAT AFFECT EACH RESOURCE

A list of other actions was compiled for the Study Area and surrounding areas based on information obtained during the scoping process (Appendix C, Public Participation), communications with other agencies, a review of other military activities, literature review, previous NEPA analyses for actions not included in this document, and other available information. Identified future actions were reviewed to determine if they should be considered further in the cumulative impacts analysis. Factors considered when identifying other actions to be included in the cumulative impacts analysis included the following:

- Whether the other action is reasonably foreseeable, rather than merely possible or speculative
- The timing and location of the other actions in relation to proposed training activities
- Whether the other action and the Proposed Action would affect the same resources
- The current conditions, trends, and vulnerability of resources affected by the other action
- The duration and intensity of the impacts of the other action
- Whether the impacts have been truly meaningful, historically significant, or identified previously as a cumulative impact concern

In addition to identifying reasonably foreseeable future actions, other environmental considerations for the cumulative impacts analysis were identified and described. These other considerations include major stressors or issues (e.g., ocean pollution, ocean noise, coastal development, etc.) that tend to be widespread and arise from routine human activities and multiple past, present, and future actions. Including these other environmental considerations allows an analysis of the current aggregate impacts of past and present actions, as well as reasonably foreseeable future actions.

4.2.7 ANALYZE POTENTIAL CUMULATIVE IMPACTS

The current impacts of past and present actions and the anticipated impacts of reasonably foreseeable future actions were characterized and summarized. The incremental impacts of the Proposed Action were then added to the combined impacts of all other actions to describe the cumulative impacts that would result if the Proposed Action were implemented. The cumulative impacts analysis considered additive, synergistic, and antagonistic impacts. A qualitative analysis was conducted in most cases based on the available information.

4.3 OTHER ACTIONS ANALYZED IN THE CUMULATIVE IMPACTS ANALYSIS

4.3.1 OVERVIEW

Table 4.3-1 lists the other actions and other environmental considerations identified for the cumulative impacts analysis, including activities presented in the 2011 GOA Final EIS/OEIS with updated information. Descriptions of each action and environmental consideration carried forward for analysis are provided in the following sections.

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis

#	Name of Action	Lead Agency or Proponent	Location in the Study Area	Timeframe	Retained or Dismissed for Further Analysis
Offshore Power Generation					
1	Marine Hydrokinetic Projects	Federal Energy Regulatory Commission	Turnagain Arm of Cook Inlet	Present and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
2	Feasibility Study for the Yakutat Alaska Wave Energy Project	Resolute Marine Energy	Yakutat, Alaska	Future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
Restoration, Research, and Conservation Projects and Programs					
3	Alaska Groundfish Harvest Specifications EIS***	NMFS	Bering Sea, Aleutian Islands, and Gulf of Alaska groundfish fisheries	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
4	Alaska Groundfish Fisheries Programmatic Supplemental EIS***	NMFS	Bering Sea, Aleutian Islands, and Gulf of Alaska groundfish fisheries	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
5	Alaska Predator Ecosystem Experiment ***	NMFS	Prince William Sound, Cook Inlet, and northern Gulf of Alaska	Past	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
6	Cook Inlet Beluga Whale Subsistence Harvest – Supplemental EIS***	NMFS	Cook Inlet, Alaska	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
7	Final Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska	NMFS, Alaska Regional Office	Entire Study Area	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
8	GulfWatch Alaska Monitoring Plan	Alaska Ocean Observing System	Prince William Sound, lower Cook Inlet, outer Kenai Peninsula coast	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
9	Alaska Aerospace Corporation Kodiak Launch Complex***	Alaska Aerospace Corporation	Kodiak, Alaska	Past, present, and future	Retained
10	Alaska Region promotion of safety, protection of the environment, and conservation of resources through vigorous regulatory oversight and enforcement	Bureau of Safety and Environmental Enforcement	Arctic Ocean, Bering Sea and the northern Pacific Ocean	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

#	Name of Action	Lead Agency or Proponent	Location in the Study Area	Timeframe	Retained or Dismissed for Further Analysis
Other Military Activities					
11	Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar***	U.S. Department of the Navy	Pacific-Indian and Atlantic-Mediterranean Ocean areas	Past, present, and future	Retained
12	JPARC Master Plan**	Alaskan Command	JPARC	Past, present, and future	Retained
13	Environmental Impact Statement for the Modernization and Enhancement of Ranges, Airspace, and Training Areas in the Joint Pacific Alaska Range Complex in Alaska*	U.S. Department of the Army U.S. Department of the Air Force	JPARC	Past, present, and future	Retained
14	Naval Special Warfare Maritime Training Activities***	U.S. Department of the Navy	Kodiak Island	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
15	U.S. Navy Climate Change Roadmap	U.S. Department of the Navy	All of Study Area	Present and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
U.S. Coast Guard					
16	North Pacific Regional Fisheries Training Center	U.S. Coast Guard	Kodiak, Alaska	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
17	Draft Programmatic Environmental Assessment Arctic Operations and Training Exercises Alaska	U.S. Coast Guard	Above the Arctic Circle – Proposed Forward Operating Locations are Barrow, Nome, Kotzebue, and Port Clarence, Alaska	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
Environmental Regulations and Planning					
18	Coastal and Marine Spatial Planning	Regional Ocean Commissions	All of Study Area	Future	Dismissed because action involves only planning and policy-related activities (discussed in Chapter 6, Additional Regulatory Considerations).

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

#	Name of Action	Lead Agency or Proponent	Location in the Study Area	Timeframe	Retained or Dismissed for Further Analysis
Other Environmental Considerations					
19	Commercial and Recreational Fishing	NMFS and private industry	All of Study Area and open ocean areas	Past, present, and future	Retained
20	Maritime Traffic	Not applicable	All of Study Area and open ocean areas	Past, present, and future	Retained
20a	Knik Arm Crossing***	Knik Arm Bridge and Toll Authority	Cook Inlet Knik Army	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
20b	Port MacKenzie Development***	Matanuska-Susitna Borough	Cook Inlet along the Knik Arm	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
20c	Port of Anchorage Expansion***	U.S. Army Corps of Engineers, Alaska District	Port of Anchorage	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
21	Shoreline Development	Local regulatory agencies	Northern coastline of Gulf of Alaska	Past, present, and future	Dismissed because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action
22	ShoreZone – Shoreline Mapping of the North Slope of Alaska	Bureau of Ocean Energy Management	Beaufort Sea, Chukchi Sea	Past, present, and future	Dismissed because action primarily involves collection and interpretation of aerial imagery of the intertidal zone, nearshore, and estuarine environments, which are outside the Study Area.
23	Oceanographic Research	Numerous	All of Study Area and open ocean areas	Past, present, and future	Retained
24	Academic Research	Numerous	All of Study Area and open ocean areas	Past, present, and future	Retained
25	Ocean Noise	Not applicable	All of Study Area and open ocean areas	Past, present, and future	Retained
26	Ocean Pollution, Tsunami Debris, and Other Marine Debris in Alaska	Not applicable	All of Study Area and open ocean areas	Past, present, and future	Retained

Table 4.3-1: Other Actions and Other Environmental Considerations Identified for the Cumulative Impacts Analysis (continued)

#	Name of Action	Lead Agency or Proponent	Location in the Study Area	Timeframe	Retained or Dismissed for Further Analysis
Other Environmental Considerations					
27	Non-Point Sources, Point Sources, and Atmospheric Deposition	Not applicable	All of Study Area and open ocean areas	Past, present, and future	Retained
28	Marine Tourism	Not applicable	All of Study Area and open ocean areas	Past, present, and future	Retained

* indicates this activity was found in the 2011 GOA Final EIS/OEIS; ** indicates this activity was found in the JPARC EIS; *** indicates this activity was found in both the JPARC EIS and the 2011 GOA Final EIS/OEIS

Notes: EIS = Environmental Impact Statement, GOA = Gulf of Alaska, JPARC = Joint Pacific Alaska Range Complex, LFA = Low Frequency Active, NMFS = National Marine Fisheries Service, OEIS = Overseas Environmental Impact Statement, SURTASS = Surveillance Towed Array Sensor System, U.S. = United States

4.3.2 ACTIONS CONSIDERED BUT DISMISSED

4.3.2.1 Offshore Power Generation

4.3.2.1.1 Marine Hydrokinetic Projects

As of April 2014, the Federal Energy Regulatory Commission (FERC) has issued 5 preliminary permits for marine and hydrokinetic projects and 16 pending preliminary permits; there are also three in pre-filing status for license. Four licenses have been issued for pilot projects. In Alaskan waters, one hydrokinetic preliminary permit has been issued at Yakutat and will expire in December 2015; there are no pending permits. (Federal Energy Regulatory Commission 2014a, 2014b). Marine hydrokinetic projects were dismissed from consideration because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action and distance from the Study Area.

4.3.2.1.2 Feasibility Study for the Yakutat Alaska Wave Energy Project

The FERC issued a preliminary permit in 2013 to Resolute Marine Energy, Inc. to develop a wave power project outside of Yakutat, Alaska. The conceptual project is a 500–750 kilowatt (kW) project consisting of several 50–100 kW units to be located near shore. The 2013 permit allows Resolute Marine Energy, Inc. to conduct pilot studies and assess the technical and economic feasibility of the project (National Marine Fisheries Service 2013a). The Feasibility Study for the Yakutat Alaska Wave Energy Project was dismissed from consideration because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action and distance from the Study Area.

4.3.2.2 Restoration, Research, and Conservation Projects and Programs

4.3.2.2.1 Alaska Groundfish Harvest Specifications Environmental Impact Statement

Analysis for the NMFS Alaska Groundfish Harvest Specifications Environmental Impact Statement is provided in the 2011 GOA Final EIS/OEIS, Chapter 4 (Cumulative Impacts). The effects and analysis have not changed.

4.3.2.2.2 Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement

Analysis for the NMFS Alaska Groundfish Fisheries Programmatic Supplemental EIS is provided in the 2011 GOA Final EIS/OEIS, Chapter 4 (Cumulative Impacts). The effects and analysis have not changed.

4.3.2.2.3 Alaska Predator Ecosystem Experiment

Analysis for the Alaska Predator Ecosystem Experiment is provided in the 2011 GOA Final EIS/OEIS, Chapter 4 (Cumulative Impacts). The effects and analysis have not changed, and additional studies from 2007 to the present are focused on specific and direct research on Steller sea lion and large whale foraging ecology and population dynamics around the Kodiak archipelago (National Marine Fisheries Service 2013b), which supports the original analysis in the 2011 GOA Final EIS/OEIS.

4.3.2.2.4 Cook Inlet Beluga Whale Subsistence Harvest – Supplemental Environmental Impact Statement

Analysis for the NMFS Supplemental EIS to assess the environmental impacts associated with National Oceanic and Atmospheric Administration's (NOAA's) implementation of a management plan to govern the subsistence harvest of Cook Inlet beluga whales is provided in the 2011 GOA Final EIS/OEIS, Chapter 4 (Cumulative Impacts). The effects and analysis have not changed.

4.3.2.2.5 Final Environmental Impact Statement for Essential Fish Habitat Identification and Conservation in Alaska

The Final EIS for Essential Fish Habitat (EFH) Identification and Conservation in Alaska was completed in 2005. The Record of Decision (ROD) documented the selection of three actions:

- Describe and identify EFH as the revised general distribution;
- Adopt the site-based approach for identifying Habitat Areas of Particular Concern;
- Establish expanded closures in the Aleutian Islands and Gulf of Alaska to minimize the effects of fishing on EFH.

Additionally, the ROD documented the decision to proceed with associated fishery management plan amendments and rulemaking, and an EFH 5-year review by NOAA Fisheries and the North Pacific Marine Fisheries Commission resulted in revisions of the Fishery Management Plans. The EFH Omnibus Amendments were approved in October 2012.

Analysis for the NMFS reexamination of the effects of fishing on EFH is provided in the 2011 GOA Final EIS/OEIS, Chapter 4 (Cumulative Impacts). The effects and analysis have not changed.

4.3.2.2.6 GulfWatch Alaska Monitoring Plan

The Exxon Valdez Oil Spill Trustee Council and state and federal agencies are supporting a 5-year, \$12 million long-term monitoring program in the Gulf of Alaska region affected by the 1989 Exxon Valdez oil spill. This monitoring effort is dismissed from further cumulative analysis because the monitoring plan will not alter regulations to Navy actions within the Study Area, and therefore results in negligible to minor impacts on resources in the area affected by the activity and the Proposed Action (Alaska Ocean Observing System 2013).

4.3.2.2.7 Alaska Region Promotion of Safety, Protection of the Environment, and Conservation of Resources Through Vigorous Regulatory Oversight and Enforcement (Alaska Region Bureau of Safety and Environmental Enforcement Activities)

The Bureau of Safety and Environmental Enforcement, Alaska Region, has regulatory oversight and enforcement responsibility for more than one billion acres on the Outer Continental Shelf and more than 6,000 miles (mi.) of coastline. Historically, lease sales have occurred in Cook Inlet, the Gulf of Alaska, Norton Sound, and in the Bering, Beaufort, and Chukchi Seas. Currently there are active leases in the Chukchi and Beaufort Seas. The Alaska Region Promotion of Safety, Protection of the Environment, and Conservation of Resources Through Vigorous Regulatory Oversight and Enforcement is dismissed from consideration because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action.

4.3.2.3 Other Military Activities

4.3.2.3.1 Naval Special Warfare Maritime Training Activities – Kodiak Island

Analysis of Naval Special Warfare (NSW) activities on Kodiak Island is provided in the 2011 GOA Final EIS/OEIS, Chapter 4 (Cumulative Impacts). The effects and analysis have not changed, although a new Environmental Assessment is currently being conducted for training activities at Kodiak. Cumulative impacts will be re-analyzed upon completion of that document and incorporated into this Supplemental EIS/OEIS when available. Until that time, NSW training on Kodiak Island is dismissed from consideration because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action.

4.3.2.3.2 United States Department of the Navy Climate Change Roadmap

The Navy Climate Change Roadmap outlines the Navy's approach to observing, predicting, and adapting to climate change by providing a chronological list of Navy-associated action items, objectives, and desired effects for Fiscal Year (FY) 2010–2014. The Navy Climate Change Roadmap focuses on strategy, policy, and plans; operations and training; investments in capability and infrastructure; strategic communications and outreach; and environmental assessment and prediction. The Roadmap has five main objectives.

1. The Navy is fully mission-capable through changing climatic conditions, while actively contributing to national requirements for addressing climate change.
2. The Naval force structure and infrastructure are capable of meeting combatant commander requirements in all probable climatic conditions over the next 30 years.
3. The Navy understands the timing, severity, and impact of current and projected changes in the global environment.
4. The media, public, government, Joint, interagency, and international community understand how and why the Navy is effectively addressing climate change.
5. For the Navy to be recognized as a valuable joint, interagency, and international partner in responding to climate change (U.S. Department of the Navy 2010).

Every 4 years, the director of Task Force Climate Change will review and revise the roadmap following promulgation of the Quadrennial Defense Review, and will incorporate the review's guidance as appropriate. The U.S. Navy Climate Change Roadmap is dismissed from consideration because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action.

4.3.2.4 United States Coast Guard

4.3.2.4.1 North Pacific Regional Fisheries Training Center

The United States Coast Guard (USCG) training center located in Kodiak, Alaska, instructs 13 different courses to 750–1,000 students per year. Instruction includes fisheries-related topics, both international and domestic.

4.3.2.4.2 Draft Programmatic Environmental Assessment Arctic Operations and Training Exercises

The Proposed Action is to conduct increased operations and training exercises in the Arctic to meet Coast Guard mission responsibilities due to the increase of national and international activities in the area. This would provide a shore, air, and sea Coast Guard presence to meet the seasonal surge mission requirements, typically mid-March through mid-November. The Preferred Alternative consists of five main elements:

1. **Shore Operations:** Forward Operating Locations and logistics/staging locations would serve as temporary Coast Guard homebases for sea and air support during the seasonal surge of Arctic activities. The locations include Barrow, Nome, Kotzebue, Port Clarence, and various air strips and Distant Early Warning line sites. The Coast Guard would conduct inspections of commercial and non-commercial vessels in major ports in Alaska to ensure compliance with law and further the missions of drug and migrant interdiction and marine safety.
2. **Air Operations:** The Coast Guard would execute air searches to locate missing persons and vessels. Routine patrols and Arctic Domain Awareness Flights serve to locate, identify, and document human contacts north of the Arctic Circle.

3. Sea Operations: The Coast Guard would search for missing vessels, and operate two icebreakers to support oceanographic and meteorological research, search and rescue, and law enforcement missions. Conducting routine patrols, establishing safety zones around offshore oil exploration, and providing at-sea berthing and support facilities are being considered.
4. Training Exercises: Rescue exercises, flight crew training, small boat training, and oil recovery training exercises would be conducted.
5. Building Partnerships: Tribal/Local Government Engagement: Formal and informal government-to-government and community engagement with tribes and local community leadership is vital to all of the Coast Guard's missions (U.S. Homeland Security 2014).

The proposed Coast Guard operations and training exercises are dismissed from consideration because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action.

4.3.2.5 Environmental Regulations and Planning

4.3.2.5.1 Coastal and Marine Spatial Planning

Dismissed because action involves only planning and policy-related activities.

4.3.2.6 Other Environmental Considerations

4.3.2.6.1 Knik Arm Crossing

Analysis for the Knik Arm Crossing is provided in the 2011 GOA Final EIS/OEIS, Chapter 4 (Cumulative Impacts). The effects and analysis have not changed although construction was originally expected to begin in 2013 and be completed in 2017. Construction is currently expected to begin in 2014 and be completed in 2018 (Knik Arm Bridge and Toll Authority 2013a, b).

4.3.2.6.2 Port MacKenzie Development

Analysis for the Port MacKenzie Development is provided in the 2011 GOA Final EIS/OEIS, Chapter 4 (Cumulative Impacts). The effects and analysis have not changed.

4.3.2.6.3 Port of Anchorage Expansion

Analysis for the Port of Anchorage Expansion is provided in the 2011 GOA Final EIS/OEIS, Chapter 4 (Cumulative Impacts). The effects and analysis have not changed.

4.3.2.6.4 Shoreline Development

Shoreline development adjacent to the Study Area is prompted for commercial, industrial, transportation, and residential purposes. Development has impacted and continues to impact coastal resources through point and nonpoint source pollution, concentrated recreational use, and ship traffic using major port facilities. The Study Area also includes coastal tourism development (e.g., hotels, resorts, restaurants, food industry, and residential homes) and the infrastructure supporting coastal development (e.g., retail businesses, marinas, fishing tackle stores, dive shops, fishing piers, recreational boating harbors, beaches, and recreational fishing facilities). However, the Study Area is greater than 12 nautical miles off the coast of Alaska, and therefore shoreline development will have minimal impact on resources in the Study Area. Shoreline development is dismissed from consideration because of negligible to minor impacts on resources in the area affected by this activity and the Proposed Action.

4.3.2.6.5 ShoreZone-Shoreline Mapping of the North Slope of Alaska

ShoreZone-Shoreline Mapping of the North Slope of Alaska is dismissed from consideration because of negligible to minor impacts on resources in the Temporary Maritime Activities Area (TMAA). The action primarily involves collection and interpretation of aerial imagery of the intertidal zone, nearshore, and estuarine environments, which are outside the TMAA.

4.3.3 ACTIONS CONSIDERED AND RETAINED

4.3.3.1 Restoration, Research, and Conservation Projects and Programs

4.3.3.1.1 Alaska Aerospace Corporation Kodiak Launch Complex

Kodiak Launch Complex is the nation's only high-latitude, full-service spaceport. It was specifically designed to provide support for space launches to polar orbit and is an all-indoor, all-weather processing facility (Alaska Aerospace Corporation 2013). In 2011, a Letter of Authorization was issued to the Alaska Aerospace Corporation to take species of seals and sea lions incidental to space vehicle and missile launch operations at the Kodiak Launch Complex (National Marine Fisheries Service 2011 – Federal Register 76(91), 27308-27309).

4.3.3.2 Other Military Activities

4.3.3.2.1 Surveillance Towed Array Sensor System Low Frequency Active Sonar

In August 2011, the Navy released a Draft Supplemental EIS/Supplemental OEIS that evaluated the potential environmental impacts of employing the Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) Sonar (U.S. Department of the Navy 2011). The Navy currently plans to operate up to four SURTASS-LFA Sonar systems for routine training, testing, and military operations. Based on current Navy national security and operational requirements, routine training, testing, and military operations using these sonar systems could occur in the Pacific Ocean, although outside the TMAA.

4.3.3.2.2 Joint Pacific Alaska Range Complex Master Plan

The master plan defines military requirements for the Joint Pacific Alaska Range Complex (JPARC). The plan identifies both short-term and funded actions as well as possible long-range capabilities. The master plan serves as the basis for development of the subsequent Proposed Action and Alternatives in the JPARC Modernization and Enhancement EIS.

4.3.3.2.3 Environmental Impact Statement for the Modernization and Enhancement of Ranges, Airspace, and Training Areas in the Joint Pacific Alaska Range Complex in Alaska

The Army and Air Force, through Alaskan Command, proposed to modernize and enhance the JPARC to enable realistic joint training for the Army, Navy, Marine Corps, and Air Force. The JPARC Modernization and Enhancement EIS analyzed potential environmental consequences associated with expanding and establishing new Military Operations Areas, restricted airspace, airspace corridors, ground maneuver training areas, and training complexes. The Final EIS was published in June 2013, for which a Record of Decision (U.S. Departments of the Army and Air Force 2013) was approved and signed on 6 August 2013. The Army decision is to implement Battle Area Complex Restricted Area (R) Addition Alternative B (Preferred Alternative), Restricted Area Expansion of R-2205 including the Digital Multi-Purpose Training Range Proposed Action (Preferred Alternative), and Unmanned Aerial Vehicle Access Alternative A (Preferred Alternative). The Air Force decision is to implement Fox 3 Military Operations Area (MOA) Expansion and New Paxon MOA Alternative E (Preferred Alternative), Realistic Live Ordnance Delivery (Alternative A), and Night Joint Training Alternative B (Preferred Alternative).

4.3.3.3 Other Environmental Considerations

4.3.3.3.1 Commercial and Recreational Fishing

Commercial and recreational fishing constitutes an important and widespread use of the ocean resources throughout the Study Area. Fishing can adversely affect fish populations, other species, and habitats. Potential impacts of fishing include overfishing of targeted species, bycatch, entanglement, and habitat destruction, all of which negatively affect fish stocks and other marine resources. Bycatch is the capture of fish, marine mammals, sea turtles, seabirds, and other nontargeted species that occur incidentally to normal fishing operations. Use of mobile fishing gear, such as bottom trawls, disturbs the seafloor and reduces habitat structural complexity. Indirect impacts 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), habitat destruction, and the generation of marine debris. Lost gill nets, purse seines, and long-lines may foul and disrupt bottom habitats and have the potential to entangle or be ingested by marine animals.

Fishing can also have a profound influence on individual targeted species populations. In a study of retrospective data, Jackson et al. (2001) analyzed paleo-ecological 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 of coastal ecosystems, including pollution and anthropogenic climatic change. Fisheries bycatch has been identified as a primary driver of population declines in several marine species, including sharks, mammals, seabirds, and sea turtles (Wallace et al. 2010).

4.3.3.3.2 Maritime Traffic

In 2012, 28 cruise ships were scheduled to make 450 voyages through Southeast Alaska. Cruise ships comprise 19 percent of the vessel activity in Southeast Alaska. Ferries, passenger vessels with overnight accommodations, and cruise ships comprise 67 percent of the vessel activity, although cruise ships only operate during the 5-month period from May through September. Dry freight cargo barges, tank barges, and freight ships (log and ore carriers) comprise another 30 percent of the vessel activity (Alaska Department of Environmental Conservation 2012).

The Alaska Marine Highway is a ferry service operated by the State of Alaska, headquartered in Ketchikan, Alaska. The Highway is composed of 3,500 mi. of routes that go as far south as Bellingham, Washington and as far west as Unalaska/Dutch Harbor, Alaska. The highway system operates along the south-central coast of the state, the eastern Aleutian islands, and the inside passage of Alaska and British Columbia. There are 32 terminals located in Washington, British Columbia, and Alaska. Primary concerns for the cumulative impacts analysis include vessels striking marine mammals, introduction of non-native species through hull fouling and ballast water, and underwater sound from ships and other vessels.

Figure 4-1 depicts the commercial vessel density provided by the automated identification system data for the area from Alaska to the Pacific Northwest in 2011. As evident from the graphic, commercial vessel use is highest in the U.S. Exclusive Economic Zone, at straits and passages, and along least-distance line routes between ports. As is evident from the figure, some of those commercial vessel

routes pass through the TMAA. Navy vessels during a Carrier Strike Group exercise are a small, infrequent, and short duration component of overall vessel traffic in Gulf of Alaska.

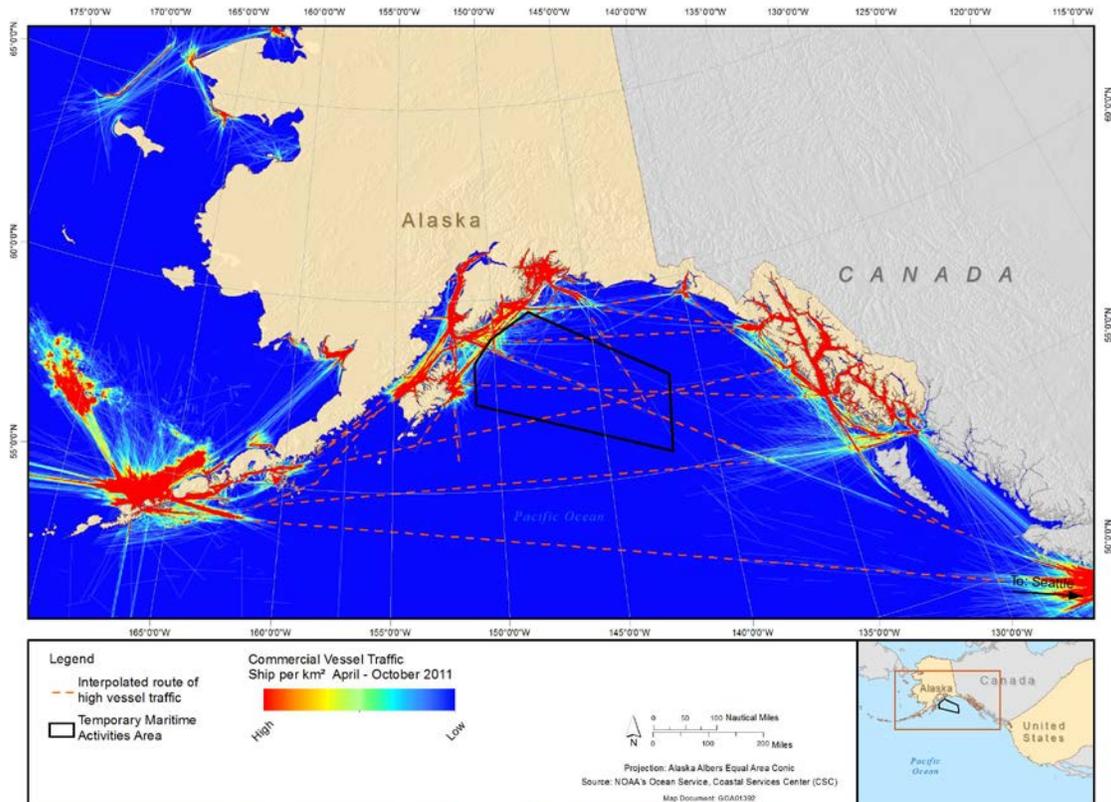


Figure 4-1: Commercial Vessel Density Involving the Study Area in 2011

4.3.3.3 Oceanographic Research

There are currently scientific research permits and General Authorizations for research issued by NMFS for cetacean work 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 non-listed 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 Bureau of Ocean Energy Management (BOEM) awarded one seismic survey permit in 2013 to Norwegian geosciences company TGS. In October 2013, TGS completed an open water marine seismic survey to acquire 2D data, using an airgun array as the energy source, and collected magnetic and gravity data in the Chukchi Sea Outer Continental Shelf Planning Area (Bureau of Ocean Energy Management 2013). For 2014 SAEExploration Inc. has submitted an application for a permit to conduct an on-ice seismic survey to acquire 3D seismic data, using vibrators as the energy source, in the Beaufort Sea Outer Continental Shelf Planning Area. The proposed program is planned to start on or after 1 January 2014.

A typical seismic survey lasts 2–3 weeks and covers a range of about 300–600 mi. The intensity of sound waves produced by the firing of seismic airguns can reach up to 250 decibels (dB) near the source and can be as high as 117 dB over 20 mi. away. Additionally, Russian and Canadian exploration permits on the Outer Continental Shelf are anticipated although there is no collaboration between governments. Since 1973, BOEM has spent \$425 million studying the Outer Continental Shelf environment off Alaska and subsequently generated more than 500 technical reports. In the last decade, more than \$15 million has been focused on marine acoustic studies. Based upon that data, BOEM has concluded that multiple seismic surveys could yield some likelihood of cumulative effects on marine life, but these effects are expected to be temporary and unlikely to cause population level effects (National Marine Fisheries Service and Bureau of Ocean Energy Management 2013; Heimbruch 2013).

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 it is uncertain that research effects could be separately identified from other adverse effects on cetacean populations in the Study Area.

4.3.3.3.4 Academic Research

The University of Alaska Fairbanks is ranked in the top 150 of nearly 700 institutions in the United States that conduct research, and is listed in the top 11 of more than 10,000 institutions worldwide for number of citations in climate change publications and fourth among United States universities. It is associated with research centers that include a wide array of interests (e.g., air and space, climate change, environmental and natural disasters, energy and mineral extraction, health and biomedical sciences, and national security sustainable management).

The University of Alaska Anchorage devotes sponsored programs and research to special concerns and opportunities associated with northern populations. Research areas include public decision making, ecosystem studies and conservation biology, earth and climate processes, human ecology and coupled human-environment interactions, health research, behavioral and physical health, biomedical programs, and rural health issues.

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 it is uncertain that research effects could be separately identified from other adverse effects on cetacean populations in the Study Area.

4.3.3.3.5 Ocean Noise

Noise is generally described as unwanted sound—sound that clutters and masks other sounds of interest (Richardson et al. 1995). Anthropogenic sources of noise that are most likely to contribute to increases in ocean noise are vessel noise from commercial shipping and general vessel traffic, oceanographic research, oil and gas exploration, underwater construction, and naval and other use of sound navigation and ranging (sonar).

Any potential for cumulative impact should be put into the context of recent changes to ambient sound levels in the world's oceans as a result of anthropogenic activities. However, there is a large and variable natural component to the ambient noise level as a result of events such as earthquakes, rainfall, waves

breaking, and lightning hitting the ocean as well as biological noises such as those from snapping shrimp and the vocalizations of marine mammals.

Sound emitted from large vessels, such as shipping and cruise ships, is the principal source of low frequency noise in the ocean today (Hatch and Wright 2007; Hildebrand 2005; Richardson et al. 1995). Acoustic monitoring conducted under Navy funding in the TMAA has detected ship noise with some regularity at a recording site mid-shelf off of the Kenai Peninsula site and relatively infrequently at a site farther offshore near the shelf-break (for the locations of these passive acoustic monitoring buoys, see Baumann-Pickering et al. 2012).

Andrew et al. (2002) compared ocean ambient sound from the 1960s to the 1990s from a receiver approximately 25 mi. (40 kilometers [km]) west of Point Sur, California. The data showed an increase in ambient noise of approximately 10 dB in the frequency ranges of 20–80 Hertz (Hz) and 200–300 Hz, and about 3 dB at 100 Hz over a 33-year period. Each 3 dB increase is noticeable to the human ear as a doubling in sound level. A possible explanation for the rise in ambient noise is the increase in shipping noise. There are approximately 11,000 supertankers worldwide, each operating 300 days per year, producing constant broadband noise at source levels of 198 dB (Hildebrand 2004). Navy vessels during a Carrier Strike Group exercise are a small, infrequent, and short duration component of overall vessel noise in Gulf of Alaska. In addition, Navy combatant vessels have been designed to generate minimal noise and use ship quieting technology to elude detection by enemy passive acoustic devices (Mintz and Filadelfo 2011; Southall et al. 2005).

Appendix D (Acoustic Primer) provides additional information about sources of anthropogenic sound in the ocean and other background information about underwater noise. This appendix describes the different types of effects that are possible and the potential relationships between sound stimuli and long-term consequences for individual animals and populations. A variety of impacts may result from exposure to sound-producing activities. The severity of these impacts can vary greatly between minor impacts that have no real cost to the animal, to more severe impacts that may have lasting consequences. The major categories of potential impacts are: behavioral reactions, physiological stress, auditory fatigue, auditory masking, and direct trauma.

4.3.3.3.5.1 Ocean Acidification Affects on Noise in the Ocean

Since the Industrial Revolution in the mid-19th century, the world's oceans have become increasingly acidic as a result of anthropogenic emissions of carbon (e.g., carbon dioxide [CO₂]) from the burning of fossil fuels (Reeder and Chiu 2010). Public comments received by the Navy on recently published Environmental Impact Statements (EISs) have expressed concerns that the increase in the acidity of ocean waters could potentially lead to an increase in the propagation of underwater sound associated with Navy activities (e.g., ship noise, sonar) and then have a greater potential to acoustically impact marine species (e.g., marine mammals, fish, turtles).

Although an increase in the acidity of seawater reduces the availability of boron ions that absorb sound (see Urlick 1983), the effect that ionic absorption has on sound propagation is very small and overall transmission loss is dominated by other mechanisms (see Hester et al. 2008; Ilyina et al. 2010; Reeder and Chiu 2010). Reeder and Chiu (2010) demonstrated that even if there is a continual increase in ocean acidity over decades, there would still be no significant changes to average background noise levels in the ocean. Furthermore, they conclude that even with a large increase in acidity, there would be no change in ocean noise levels in shallow water and in near surface habitats frequented by marine mammals. The Navy's proposed actions in the GOA Study Area would not significantly contribute to

ocean acidification, and the potential cumulative effects of ocean acidification would not perceptively change ocean noise levels; therefore, the effect of ocean acidification need not be considered further in this analysis.

4.3.3.3.6 Ocean Pollution, Tsunami Debris, and Other Marine Debris in Alaska

Pollution is the introduction of harmful contaminants that are outside the norm for a given ecosystem. Ocean pollution has and will continue to have serious impacts on marine ecosystem. Common ocean pollutants include toxic compounds such as metals, pesticides, and other organic chemicals; excess nutrients from fertilizers and sewage; detergents; oil; plastics; and other solids. Pollutants enter oceans from non-point sources (i.e., storm water runoff from watersheds), point sources (i.e., wastewater treatment plant discharges), other land-based sources (i.e., windblown debris), spills, dumping, vessels, and atmospheric deposition.

The Government of Japan estimates that 5 million tons of debris was swept into the Pacific Ocean after the March 2011 earthquake and tsunami that struck Japan. An estimated 70 percent sank right away and 1.5 million tons were left floating off the coast. While there are no estimates of how much is still floating, some debris has already reached the Alaskan coast. Marine debris is typically non-hazardous material; however, the tsunami debris is composed of materials found in urban areas (e.g., bottles, building fragments, boats, plastics, and docks). The National Oceanic and Atmospheric Administration works closely with state agencies and local authorities to systematically survey Alaska's coast. NOAA models predict an increase in debris in the next several years; however, very little is anticipated to be hazardous.

Marine debris is any anthropogenic object intentionally or unintentionally discarded, disposed of, or abandoned in the marine environment. Common types of marine debris include various forms of plastic and abandoned fishing gear, as well as clothing, metal, glass, and other debris. Marine debris degrades marine habitat quality and poses ingestion and entanglement risks to marine life and birds (National Marine Fisheries Service 2006).

Plastic marine debris is a major concern because it degrades slowly and many plastics float, allowing the debris to be transported by currents throughout the oceans. Currents in the oceanic convergence zone in the North Pacific Subtropical Gyre act to accumulate the floating plastic marine debris. These debris carrying currents include the south-flowing California Current, and the north-flowing Gulf of Alaska Current. These currents distribute debris throughout the Study Area.

Additionally, plastic waste in the ocean chemically attracts hydrocarbon pollutants such as PCB and DDT, which accumulate up to one million times more in plastic than in ocean water (Mato et al. 2001). Fish, marine animals, and birds can mistakenly consume these wastes containing elevated levels of toxins instead of their prey. In the North Pacific Subtropical Gyre, it is estimated that the fishes in this area are ingesting 12,000 to 24,000 U.S. tons (10,886,216 to 21,772,433 kilograms) of plastic debris a year (Davison and Asch 2011).

Marine mammals have been documented ingesting marine debris from commercial and recreation sources, sometimes with fatal effects (Barco et al. 2010, Good et al. 2010, Jacobsen et al. 2010, Allen et al. 2011, Cassoff et al. 2011, Denuncio et al. 2011, Williams et al. 2011, Baulch and Perry 2012, de Stephanis et al. 2013, Jauniaux et al. 2013).

Debris that sinks to the seafloor is also a concern for ingestion and entanglement by fish, invertebrates, sea turtles, marine mammals, and marine vegetation. In addition, sunken debris contributes to marine

habitat degradation. In the U.S. west coast Groundfish Bottom Trawl Surveys of 2007 and 2008, anthropogenic debris was observed at depths of 55 to 1,280 meters (180.5 to 4,199.5 feet). The density of debris increased with depth, and the majority of the debris was plastic and metallic, while the rest of it was fabric and glass (Keller et al. 2010).

4.3.3.3.7 Non-Point Sources, Point Sources, and Atmospheric Deposition

Storm water runoff, wastewater, and nonpoint source pollution, are considered major causes of impairment of 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. Sewage can be treated to eliminate potentially harmful releases of contaminants; however, releases of untreated sewage occur due to malfunctions or overloads to the infrastructure, resulting in releases of bacteria usually associated with feces, such as *Escherichia coli* and *Enterococci spp.* 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. While such dumping has long been forbidden by law, the practice left ocean outflow sites contaminated. Sewage treatment facilities generally do not treat or remove persistent organic pollutants, such as polychlorinated biphenyl (PCB) and dichlorodiphenyltrichloroethane (DDT), or other toxins.

Hypoxia (low dissolved oxygen concentration) is a major impact associated with point and non-point sources of pollution. Hypoxia occurs when waters become overloaded with nutrients from pesticides such as nitrogen and phosphorus, which enter oceans from non-point source runoff, wastewater treatment plants, and atmospheric deposition. Too many nutrients can stimulate algal blooms—the rapid expansion of microscopic algae (phytoplankton). When excess nutrients are consumed, the algae population dies off and the remains are consumed by bacteria. Bacterial consumption causes dissolved oxygen in the water to decline to the point where marine life that depends on oxygen can no longer survive (Boesch et al. 1997).

Almost 200 million tons of criteria pollutants (sulfur dioxide, nitrogen dioxide, carbon monoxide, lead, volatile organic compounds, and particulate matter) were emitted into the U.S. atmosphere in 1997 (U.S. Environmental Protection Agency 1998). Through the process of wet and dry atmospheric deposition, these and other pollutants can return to the earth and the waters. Wet deposition removes gases and particles from the atmosphere and deposits them on the surface of the earth through rain, sleet, snow, and fog. Dry deposition is a process through which particles and gases are deposited in the absence of precipitation, such as through dust (U.S. Geological Survey 2000). This atmospheric deposition also contributes to the buildup of pollutants in the Study Area. Non-point sources, point sources, and atmospheric deposition also contribute toxic pollutants such as metals, pesticides, and other organic compounds to the marine environment. Toxic pollutants may cause lethal or sublethal effects if present in high concentrations, and can build up in tissues over time and suppress immune system function, resulting in disease and death for marine organisms. The main causes of water pollution in the Study Area are predation by invasive species, discharges of oil products (refined oil products, crude oil, and hazardous substances), and industrial and agricultural contaminants (Encyclopedia of Earth 2013).

4.3.3.3.8 Marine Tourism

Tourism is Alaska's second biggest industry in terms of employment, and is the main industry of many small and isolated communities. The coast and some major rivers are the center of Alaska's tourism. Sport fishing is one of the biggest industries along with the growing number of ecotourists visiting the

state. In the summer of 2011 alone, there were a total of 1,556,800 visitors to the state. Cruise ship visitors make up a majority of 57 percent or 883,000 of those visitors. The second-most popular activity of tourists in Alaska is wildlife viewing (52 percent), much of which occurs on the coast. Between 2006 and 2011, the percentage of visitors from the United States fell by 2 percent, while Canada and the other international categories each increased by 1 percent.

4.4 RESOURCE-SPECIFIC CUMULATIVE IMPACTS

4.4.1 RESOURCE AREAS DISMISSED FROM CUMULATIVE IMPACTS ANALYSIS

In accordance with CEQ guidance (Council on Environmental Quality 2010), the cumulative impacts analysis focused on impacts that are “truly meaningful.” The level of analysis for each resource was commensurate with the intensity of the impacts identified in Chapter 3 (Affected Environment and Environmental Consequences). The analysis focused on marine mammals. Detailed analysis of cumulative impacts on the following resources was not necessary as the incremental contribution of the Proposed Action to cumulative impacts would be low and was assessed in the 2011 GOA Final EIS/OEIS. Further analysis of cumulative impacts is not warranted on the following resources:

- Air quality
- Expended materials
- Water resources
- Acoustic environment (airborne)
- Marine plants and invertebrates
- Fish
- Birds
- Cultural resources
- Transportation and circulation
- Socioeconomics
- Environmental justice and protection of children
- Public safety

4.4.2 MARINE MAMMALS

4.4.2.1 Impacts of The Proposed Action That May Contribute to Cumulative Impacts

Based on the analysis presented in Section 3.8 (Marine Mammals), impacts of the Proposed Action that might contribute to cumulative impacts on marine mammals include injury (Level A harassment under the MMPA) and disturbance or behavioral modification (MMPA Level B harassment). Injury could be caused by underwater explosions, or in the form of Permanent Threshold Shift (PTS) could also be caused by sonar use. Underwater explosions and sonar use would result in disturbance that meets the definition of MMPA Level A and B harassment. Other relatively short-term activities that might inadvertently harass marine mammals meet the definition of MMPA Incidental Harassment Authorizations. The remaining stressors analyzed in Section 3.8 (Marine Mammals) are not expected to result in mortality or Level A or B harassment. The incremental contribution of these remaining stressors, discussed in Section 3.8.3 (Environmental Consequences), to cumulative impacts on marine mammals, would be negligible.

4.4.2.2 Impacts of Other Actions

4.4.2.2.1 Overview

The potential impacts of other actions that are relevant to the cumulative impact analysis for marine mammals include the following:

- Mortality associated with non-Navy vessel strikes, bycatch in fisheries, and entanglement in fishing and other gear
- Injury associated with non-Navy vessel strikes, bycatch, entanglement, and underwater sound
- Disturbance, behavioral modifications, and reduced animal fitness associated with underwater noise
- Reduced animal fitness associated with water pollution

Most of the other actions and considerations retained for analysis in Table 4.3-1 would include operation of marine vessels. Exceptions include the actions listed under environmental regulations and permitting. Stressors associated with marine vessel operations that are of primary concern for the cumulative impacts analysis includes vessel strikes and underwater noise. Many of the actions would also result in underwater noise from sources other than vessels, seismic surveys, and construction activities. Rather than discussing these stressors for individual actions, their aggregate impacts are considered below as “other environmental considerations” in the maritime traffic and ocean noise subsections. Similarly, many of the actions would result in water pollution. The aggregate impacts of water pollution are addressed in the ocean pollution section (Section 4.4.2.2.5). Bycatch is associated with commercial fishing, and the primary cause of entanglement is commercial fishing. Therefore, these stressors are discussed in the commercial fishing section (Section 4.4.2.3.1).

4.4.2.2.2 Surveillance Towed Array Sensor System Low Frequency Active Sonar

Although operation of SURTASS-LFA Sonar would not occur within or near the TMAA, marine mammals could be exposed to that sound source and migrate into the TMAA. Potential impacts on marine mammals from SURTASS-LFA Sonar operations include (1) nonauditory injury,² (2) permanent loss of hearing, (3) temporary loss of hearing, (4) behavioral change, and (5) masking. The potential effects from Surveillance Towed Array Sensor System Low Frequency Active Sonar operations on any stock of marine mammals from injury (nonauditory or permanent loss of hearing) are considered negligible, and the potential effects on the stock of any marine mammal from temporary loss of hearing or behavioral change (significant change in a biologically important behavior) are considered minimal. Any auditory masking in marine mammals due to low-frequency active sonar signal transmissions is not expected to be severe and would be temporary. The operation of SURTASS-LFA Sonar with monitoring and mitigation would result in no mortality. The likelihood of low-frequency active sonar transmissions causing marine mammals to strand is negligible (U.S. Department of the Navy 2012).

4.4.2.2.3 Maritime Traffic and Vessel Strikes

Vessel strikes have been and will continue to be a cause of marine mammal mortality and injury throughout the Study Area. A review of the impacts of ship strikes on marine mammals is presented in Section 3.8.2.4 (General Threats). In particular, certain large whales, such as the blue whale, are more prone to vessel strikes (Berman-Kowalewski et al. 2010; Betz et al. 2011). The most vulnerable marine

² Nonauditory injury can be defined as not relating to or functioning in hearing (Merriam-Webster 2012); this includes mortality, strike, and lung injury.

mammals are thought to be those that spend extended periods at the surface or species whose unresponsiveness to vessel sound makes them more susceptible to vessel collisions (Gerstein 2002; Laist and Shaw 2006; Nowacek et al. 2004). Marine mammals such as dolphins, porpoises, and pinnipeds that can move quickly throughout the water column are not as susceptible to vessel strikes. Most vessel strikes of marine mammals reported involve commercial vessels and occur over or near the continental shelf (Laist et al. 2001). The literature review by Laist et al. (2001) concluded that vessel strikes likely have a negligible impact on the status of most whale populations, but that for small populations, vessel strikes may have considerable population-level impacts. The conservation status and abundance of the species struck would determine in large part whether the injury would have population-level impacts on that species (Laist et al. 2001; Vanderlaan and Taggart 2009). There has never been a Navy vessel strike to a marine mammal in the Study Area during any previous training activities. In *Summary of Reported Whale-Vessel Collisions in Alaskan Waters* (Neilson et al. 2012), the research article reports 108 whale-vessel collisions occurred from 1978 to 2011. In 19 cases the vessel type is unknown, but of the 89 that the vessel type is known, 35 percent were private recreational, 35 percent were commercial recreational, 8 percent were cruise ships, 7 percent were commercial fishing vessels, 4 percent were USCG cutters, 3 percent were research, and 1 percent was the state ferry system.

Mysticetes

Virtually all of the rorqual whale species have been documented to have been hit by vessels. This includes blue whales (Berman-Kowalewski et al. 2010; Van Waerebeek et al. 2007; Calambokidis 2012), fin whales (as recently as November 2011 in San Diego) (Van Waerebeek et al. 2007; Douglas et al. 2008), sei whales (Felix and Van Waerebeek 2005; Van Waerebeek et al. 2007), minke whales (Van Waerebeek et al. 2007), and humpback whales (Lammers et al. 2003; Van Waerebeek et al. 2007; Douglas et al. 2008).

Odontocetes

Sperm whales may be exceptionally vulnerable to vessel strikes as they spend extended periods of time “rafting” at the surface in order to restore oxygen levels within their tissues after deep dives (Jaquet and Whitehead 1996; Watkins et al. 1999). There were also instances in which sperm whales approached vessels too closely and were cut by the propellers (Aguilar de Soto et al. 2006). In general, odontocetes move quickly and seem to be less vulnerable to vessel strikes than other cetaceans; however, most small whale and dolphin species have at least occasionally suffered from vessel strikes including: killer whales (Visser and Fertl 2000; Van Waerebeek et al. 2007) and short-finned pilot whales (Aguilar et al. 2000; Van Waerebeek et al. 2007).

Pinnipeds

Pinnipeds in general appear to suffer fewer impacts from ship strikes than do cetaceans. This may be due, at least in part, to the large amount of time they spend on land (especially when resting and breeding), and their high maneuverability in the water. However, California sea lions are often attracted to fishing vessels or when food is available onboard or nearby (Hanan et al. 1989), and this may make them somewhat more at risk of being hit by a vessel during these times. Ship strikes are not a major concern for pinnipeds in general (Antonelis et al. 2006; Marine Mammal Commission 2002; National Marine Fisheries Service 2007).

4.4.2.2.4 Ocean Noise

Noise is generally described as unwanted sound—sound that clutters and masks other sounds of interest (Richardson et al. 1995). Anthropogenic sources of noise that are most likely to contribute to increases in ocean noise are vessel noise from commercial shipping and general vessel traffic,

oceanographic research, oil and gas exploration, underwater construction, and naval and other use of sound navigation and ranging (sonar).

Any potential for cumulative impact should be put into the context of recent changes to ambient sound levels in the world's oceans as a result of anthropogenic activities. However, there is a large and variable natural component to the ambient noise level as a result of events such as earthquakes, rainfall, waves breaking, and lightning hitting the ocean as well as biological noises such as those from snapping shrimp and the vocalizations of marine mammals.

Andrew et al. (2002) compared ocean ambient sound from the 1960s to the 1990s from a receiver approximately 25 mi. (40 km) west of Point Sur, California. The data showed an increase in ambient noise of approximately 10 dB in the frequency ranges of 20–80 Hz and 200–300 Hz, and about 3 dB at 100 Hz over a 33-year period. Each 3 dB increase is noticeable to the human ear as a doubling in sound level. A possible explanation for the rise in ambient noise is the increase in shipping noise. There are approximately 11,000 supertankers worldwide, each operating 300 days per year, producing constant broadband noise at source levels of 198 dB (Hildebrand 2004).

Appendix D (Acoustic Primer) provides additional information about sources of anthropogenic sound in the ocean and other background information about underwater noise. This appendix describes the different types of effects that are possible and the potential relationships between sound stimuli and long-term consequences for individual animals and populations. A variety of impacts may result from exposure to sound-producing activities. The severity of these impacts can vary greatly between minor impacts that have no real cost to the animal, to more severe impacts that may have lasting consequences. The major categories of potential impacts are: behavioral reactions, physiological stress, auditory fatigue, auditory masking, and direct trauma.

4.4.2.2.5 Ocean Pollution

As discussed in Section 3.8.3 (Environmental Consequences), pollutants from multiple sources are present in, and continue to be released into, the oceans. Elevated concentrations of certain compounds have been measured in tissue samples from marine mammals. Long-term exposure to pollutants poses potential risks to the health of marine mammals, although for the most part, the impacts are just starting to be understood (Reijnders et al. 2008). Section 3.8.3 (Environmental Consequences) provides an overview of these potential impacts, which include organ anomalies and impaired reproduction and immune function (Reijnders et al. 2008).

If the health of an individual marine mammal were compromised by long-term exposure to pollutants, it is possible that this condition could alter the animal's expected response to stressors from training activities associated with the Proposed Action. The behavioral and physiological responses of any marine mammal to a specific stressor, such as underwater sound, could be influenced by a number of other factors, including disease, dietary stress, body burden of toxic chemicals, energetic stress, percentage body fat, age, reproductive state, size, and social position. Synergistic impacts are also possible. For example, animals exposed to some chemicals may be more susceptible to noise-induced loss of hearing sensitivity (Fechter 2005). While the response of a previously stressed animal might be different than the response of an unstressed animal, there are no data available at this time to accurately predict how stress caused by various ocean pollutants would alter a marine mammal's response to a particular stressor associated with the Proposed Action.

4.4.2.3 Coastal Development

Coastal development and increased human populations in coastal areas will continue to have impacts on marine mammals such as increased tourism, non-point source pollution and runoff, power plant entrainment, and degradation of nearshore water quality and seagrass beds (see Section 3.8, Marine Mammals, for more information on impacts on marine mammals).

4.4.2.3.1 Commercial Fishing

Several commercial fisheries operate in the Study Area. Potential impacts from these activities include marine mammal injury and mortality from bycatch and entanglement. Fisheries have also resulted in profound changes to the structure and function of marine ecosystems that adversely affect marine mammals.

Numerous ports in or near the Study Area contain both commercial and commercial passenger fishing vessel (i.e., recreational) fishing fleets that use the ocean areas within the Study Area.

In 1994, the MMPA was amended to formally address bycatch. Estimates of bycatch in the Pacific declined by a total of 96 percent from 1994 to 2006 (Geijer and Read 2013). Cetacean bycatch declined by 85 percent from 342 in 1994 to 53 in 2006, and pinniped bycatch declined from 1,332 to 53 over the same time period. However, fishery bycatch is likely the most impactful problem presently and may account for the deaths of more marine mammals than any other cause (Northridge 2008, Read 2008, Hamer et al. 2010; Geijer and Read 2013).

As discussed in Section 3.8.3.9 (Entanglement Stressors), entanglement in fishing gear is another major threat to marine mammals in the Study Area. In addition, overfishing of many fish stocks has resulted in significant changes in trophic structure, species assemblages, and pathways of energy flow in marine ecosystems (Jackson et al. 2001; Myers and Worm 2003; Pauly et al. 1998). These ecological changes may have important and likely adverse consequences for populations of marine mammals (DeMaster et al. 2001).

In summary, future commercial fishing activities in the Study Area are expected to result in significant impacts on some marine mammal species based on the relatively high injury and mortality rates associated with bycatch and entanglement. This mortality could result in or contribute to population declines for some species. Ecological changes brought about by commercial fishing are also expected to adversely impact marine mammals in the Study Area.

Entanglement of humpback whales in Alaska occur mainly in Southeast Alaska and involve crab, shrimp, unidentified pot gear, and gillnet fisheries. Humpback whales have been identified in Hawaii entangled in gear from Alaska. The number of events of identified entanglement has increased from less than 5 in 1990 to almost 15 in 2011 (Jackson et al. n.d.). The Alaska Network is permitted by NOAA Fisheries to attempt animal disentanglement. Since the Network began in 1998, there have been over 130 reports of large whale entanglements in local fishing gear, marine debris, and mooring gear (National Marine Fisheries Service n.d.).

4.4.2.4 Cumulative Impacts on Marine Mammals

The aggregate impacts of past, present actions and reasonably foreseeable future actions are expected to result in significant impacts on some marine mammal species in the Study Area. The impacts are considered significant because vessel strikes, bycatch, and entanglement associated with other actions are expected to result in relatively high rates of injury and mortality that could cause population

declines in some species. The Proposed Action could also result in injury to individuals of some marine mammal species from underwater explosions, sonar, and vessel strikes. Injury that might occur under the Proposed Action would be additive to injury and mortality associated with other actions. However, the relative contribution of the Proposed Action to the overall injury and mortality would be low compared to other actions. The Navy does not anticipate mortalities to marine mammals within the Study Area as a result of training activities under the Proposed Action. While quantitative estimates of marine mammal mortality from other actions are not available, the total bycatch estimate (lethal takes and serious injuries) for marine mammals for 39 fisheries and 54 marine mammal stocks throughout the United States was 1,887 individual animals in 2005 (National Oceanic and Atmospheric Administration 2011). Some of these mortalities likely occurred in the Study Area or affected individuals that used the Study Area seasonally.

Ocean noise associated with other actions (see Section 4.4.2.2.4, Ocean Noise), such as underwater explosions and sonar associated with the Proposed Action, could also result in additive behavioral impacts on marine mammals. However, in the Study Area, it is unlikely that these actions and underwater explosions or sonar use would overlap in time and space because these activities are dispersed and the sound sources are intermittent. The Navy takes appropriate coordination and scheduling steps (described in Section 3.12, Socioeconomic Resources) to avoid activities that interfere with or are not compatible with training.

It is likely that distant shipping noise, which is more universal and continuous, and sound associated with underwater explosions and sonar would overlap in time and space. However, there is no evidence indicating that the co-occurrence of shipping noise and sounds associated with underwater explosions and sonar use would result in harmful additive impacts on marine mammals.

As discussed in Section 4.4.2.2.5 (Ocean Pollution), the potential also exists for the impacts of ocean pollution and acoustic stressors associated with the Proposed Action to be additive or synergistic. It is possible that the response of a previously stressed animal would be more severe than the response of an unstressed animal.

4.5 SUMMARY OF CUMULATIVE IMPACTS

Marine mammals are the primary resources of concern for cumulative impacts analysis:

- Past human activities have impacted these resources to the extent that several marine mammal species occurring in the Study Area are ESA-listed.
- These resources would be impacted by multiple ongoing and future actions.
- Explosive detonations and vessel strikes under the Proposed Action have the potential to disturb, injure, or kill marine mammals.

In summary, based on the analysis presented in Section 3.8 (Marine Mammals), the current aggregate impacts of past, present, and other reasonably foreseeable future actions are not significantly different than the assessment in the 2011 GOA Final EIS/OEIS. No new information or circumstances are significant enough to warrant further cumulative impact review.

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