PROPOSED ACTION:	Issuance of Regulations to Take Marine Mammals by Harassment Incidental to U.S. Navy Missile Launch Activities at San Nicolas Island, California
TYPE OF STATEMENT:	Environmental Assessment
LEAD AGENCY:	U.S. Department of Commerce National Oceanic and Atmospheric Administration National Marine Fisheries Service
RESPONSIBLE OFFICIAL:	Donna S. Wieting, Director Office of Protected Resources, National Marine Fisheries Service
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LOCATION:	Southern California: San Nicolas Island, West End
ABSTRACT:	This Environmental Assessment analyzes the environmental impacts of the National Marine Fisheries Service, Office of Protected Resources proposal to issue 5-year regulations and subsequent Letter of Authorization pursuant to Section 101(a)(5) of the Marine Mammal Protection Act for the unintentional taking, by Level B harassment, of marine mammals incidental to U.S. Navy missile launches from San Nicolas Island, California, from June 2014 to June 2019.
DATE:	May 2014

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ABL	Airborne Laser
AGS	Advanced Gun System
ATAR	Autonomous Terrestrial Acoustic Recorder
C	Celsius
CCA	California Coastal Act
CCC	California Coastal Commission
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CINMS	Channel Islands National Marine Sanctuary
cm	Centimeter
Commission	Marine Mammal Commission
CPA	Closest Point of Approach
CZMA	Coastal Zone Management Act
dB	Decibel (re 20 Pa)
DR	Ducted Rocket (pertains to GQM-163A "Coyote" SSST)
EA	Environmental Assessment
EELV	Evolved Expendable Launch Vehicle
EIS	Environmental Impact Statement
EPT	Elevating Platform Transporter
ESA	Endangered Species Act
F	Fahrenheit
FEIS	Final Environmental Impact Statement
FES	Front End Subsystem
FR	Federal Register
ft	Foot (feet)
FY	Fiscal Year
IHA	Incidental Harassment Authorization
in	Inch
ITA	Incidental Take Authorization
JATO	Jet-assisted Take-off
kg	Kilogram
km	Kilometer(s)
lbs	Pounds
LOA	Letter of Authorization
m	meter(s)
mi	Mile(s)
MMPA	Marine Mammal Protection Act
Mpa	Frequency Weighting Appropriate for Pinnipeds in Air (Southall et al., 2007)
MSL	Mean Sea Level

Acronym	Definition
NAWCWD	Naval Air Warfare Center Weapons Division
Navy	U.S. Navy
NCI	Northern Channel Islands
NDAA	National Defense Authorization Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
OEIS	Overseas Environmental Impact Statement
ONMS	Office of National Marine Sanctuaries
OPAREAs	Ocean Operating Areas
PL	Public Law
PTS	Permanent Threshold Shift
RAM	Rolling Airframe Missile
SCB	Southern California Bight
SEL	Sound Exposure Level
SEL-f	Sound Exposure Level flat-weighted
SMI	San Miguel Island
SNI	San Nicolas Island
SOCAL	Southern California
SPL	Sound Pressure Level
SPL-A	Sound Pressure Level A-weighted
SSL	Steller Sea Lion
SSST	Supersonic Sea-Skimming Target
TTS	Temporary Threshold Shift
Pa	microPascal
U.S.	United States
USAF	United States Air Force
USC	United States Code
USFWS	United States Fish and Wildlife Service
VAFB	Vandenberg Air Force Base

Chapter 1 INTRODUCTION AND PURPOSE AND NEED

1.1 Proposed Action

Pursuant to the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*), this Environmental Assessment (EA) analyzes the potential impacts to the human environment that may result from the proposed action of the National Marine Fisheries Service (NMFS) to promulgate 5-year regulations and subsequently to issue a Letter of Authorization (LOA) covering the entire period of regulations pursuant to Section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA; 16 U.S.C. 1361 *et seq.*) to the U.S. Navy (Navy), Naval Air Warfare Center Weapons Division (NAWCWD), for the harassment of marine mammals incidental to missile launch activities at San Nicolas Island (SNI), California. These activities are considered military readiness activities.

1.2 Background

On July 23, 2013, NMFS received an application from the Navy requesting authorization for the "take"[1] by "Level B harassment"[2] of three species of marine mammals incidental to missile launches conducted by the NAWCWD from the western part of SNI, which would impact pinnipeds hauled out on the island. Aircraft and helicopter flights between the Point Mugu airfield on the mainland, the airfield on SNI, and the target sites in the Point Mugu Sea Range will be a routine part of a planned launch operation. The application was determined to be complete on November 18, 2013. A notice of receipt of the application and request for comments and information from the public regarding the Navy's application published in the *Federal Register* on November 26, 2013 (78 FR 70537). NMFS published proposed regulations in the *Federal Register* on March 7, 2014 (79 FR 13022), which included a request for comments from the public. NMFS' proposed action is to promulgate 5-year regulations and subsequently issue a single LOA covering the entire period of regulations to the Navy to take three species of marine mammals, by harassment, incidental to missile launch activities at SNI. The three species of marine mammals that would be authorized for taking are: Pacific harbor seals (*Phoca vitulina richardii*); California sea lions (*Zalophus californianus*); and northern elephant seals (*Mirounga angustirostris*).

The Navy has previously conducted missile launch activities in accordance with the MMPA under Incidental Harassment Authorizations (IHAs) issued in 2001 and 2002 by NMFS pursuant to Section 101(a)(5)(D) of the MMPA and regulations and LOAs issued by NMFS pursuant to Section 101(a)(5)(A) of the MMPA that addressed specific activities for the period October 2, 2003, through October 2, 2008, and the period June 2, 2009, through June 2, 2014.

[1] "Take" under the MMPA means to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal. 16 U.S.C. 1362(13).

[2] "Harassment" under the MMPA is defined as any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

1.3 Purpose and Need

1.3.1 Purpose of Action

The primary purpose of our proposed action—the issuance of an ITA to the Navy—is to authorize (pursuant to the MMPA) the take of marine mammals incidental to the Navy's proposed activities. The ITA, if issued, would exempt the Navy from the take prohibitions contained in the MMPA

Sections 101(a)(5)(A) and (D) of the MMPA direct the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review. See 16 U.S.C. 1371(a)(5)(A), (D).

Permission may be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not (where relevant) have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring, and reporting of such takings are set forth. NMFS has defined "negligible impact" in 50 CFR 216.103 as "...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival."

The National Defense Authorization Act (NDAA) of Fiscal Year (FY) 2004 (Public Law [PL] 108-136) removed the MMPA's "small numbers" and "specified geographical region" limitations and amended the definition of "harassment" as applied to military readiness activities. Military readiness activities, as defined in PL 107-314, Section 315(f), include "training and operations of the Armed Forces that relate to combat" and constitute "adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use." These two definitions apply to the Navy's activities at SNI. For purposes of "military readiness activities," harassment is defined as:

> (i) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B harassment].

1.3.2 Need for Action

The Navy determined that conducting missile launch activities at SNI might potentially disturb marine mammals and, accordingly, submitted an application demonstrating the need for

regulations and subsequent LOA under the MMPA. The primary concern related to potential take of marine mammals incidental to the Navy's activities relates to airborne noise levels associated with certain launch and associated activities that may disturb marine mammals on nearby haul-out sites. If the actions proposed in the application will have no more than a negligible impact on the species or stocks, will not have an unmitigable adverse impact on the availability of the species or stock for subsistence uses, and the permissible methods of taking and required monitoring are set forth, then NMFS shall promulgate regulations and issue an LOA pursuant to the MMPA. For military readiness activities (as described in the MMPA), a determination of least practicable adverse impacts on a species or stock includes consideration, in consultation with the Department of Defense, of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

The current action is needed to achieve MMPA compliance for Navy activities proposed for the period June 2, 2014, through June 2, 2019. In the past, LOAs for missile launch activities on the Point Mugu Sea Range were issued annually by NMFS. However, in order to alleviate some of the administrative and financial burdens associated with processing annual LOAs, the Navy is currently seeking the issuance of a single LOA for the entire period of the requested 2014-2019 regulations.

NMFS' decision of whether or not to issue the Navy an incidental take authorization (ITA—i.e., LOA or IHA) is a major Federal action that requires an analysis of its effect on the human environment pursuant to the NEPA. This EA contains that analysis and is intended to inform NMFS' decision on whether or not to issue an LOA authorizing the incidental take of marine mammals associated with the Navy missile launches activities at SNI from 2014 through 2019.

1.4 Description of the Specified Activity

As described above, Section 101(a)(5)(A) of the MMPA requires that an applicant indicate the specified activity sought for authorization. This applicant's activity is evaluated by NMFS and informs NMFS' development of a proposed action and range of alternatives to be considered by NMFS in accordance with NEPA. The specified activity is summarized in this subsection and is also described in more detail in the Navy's application for authorization pursuant to Section 101(a)(5)(A) of the MMPA, which is available on the NMFS Office of Protected Resources (OPR) website at: http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications. Additionally, a description of the Navy's full range of activities at the Naval Air Station at Point Mugu and on SNI can be found in the Navy's *Point Mugu Sea Range Final Environmental Impact Statement/Overseas Environmental Impact Statement* (FEIS/OEIS; NAWCWD, 2002).

1.4.1 Project Location

Located approximately 65 mi (104.6 km) southwest of Point Mugu, SNI is owned and operated by the Navy as a major element of the NAWCWD Point Mugu Sea Range (Figure 1). The Sea Range is used by the U.S. and allied military services to test and evaluate sea, land, and air weapons systems, to provide realistic training opportunities, and to maintain operational readiness of these forces. Because of its strategic location offshore, SNI is important to the Sea Range because it can be used to simulate shipboard launches of missiles and targets. The island

is nine miles (14.5 km) long by 3.6 mi (5.8 km) wide, encompassing approximately 21 mi^2 (54.4 km^2) (Figure 2). An airfield is located at the southeastern edge of the island's central mesa. The landing area consists of one 10,000-ft (3,048 m) concrete and asphalt runway. The island is extensively instrumented with metric tracking radar, electro-optical devices, telemetry, and communications equipment necessary to support long-range and over-the-horizon weapons testing and fleet training. It houses facilities that support all aspects of range operations, such as missile launches and missile impacts and scoring.

There are two locations on SNI established for launching missiles and targets in support of NAWCWD Point Mugu Sea Range test and training operations: (1) the Building 807 Launch Complex located on the west end of the island near the coast approximately 36 ft (11 m) above sea level; and (2) the Alpha Launch Complex located approximately 623 ft (190 m) above sea level (see Figure 2). The Building 807 Launch Complex typically is used to launch small missiles and targets (e.g., the Rolling Airframe Missile [RAM]) while the Alpha Launch Complex is used for launching larger vehicles; the largest target currently launched from the island is the Coyote missile (GQM-163A). The vehicles fly generally westward through the Point Mugu Sea Range.

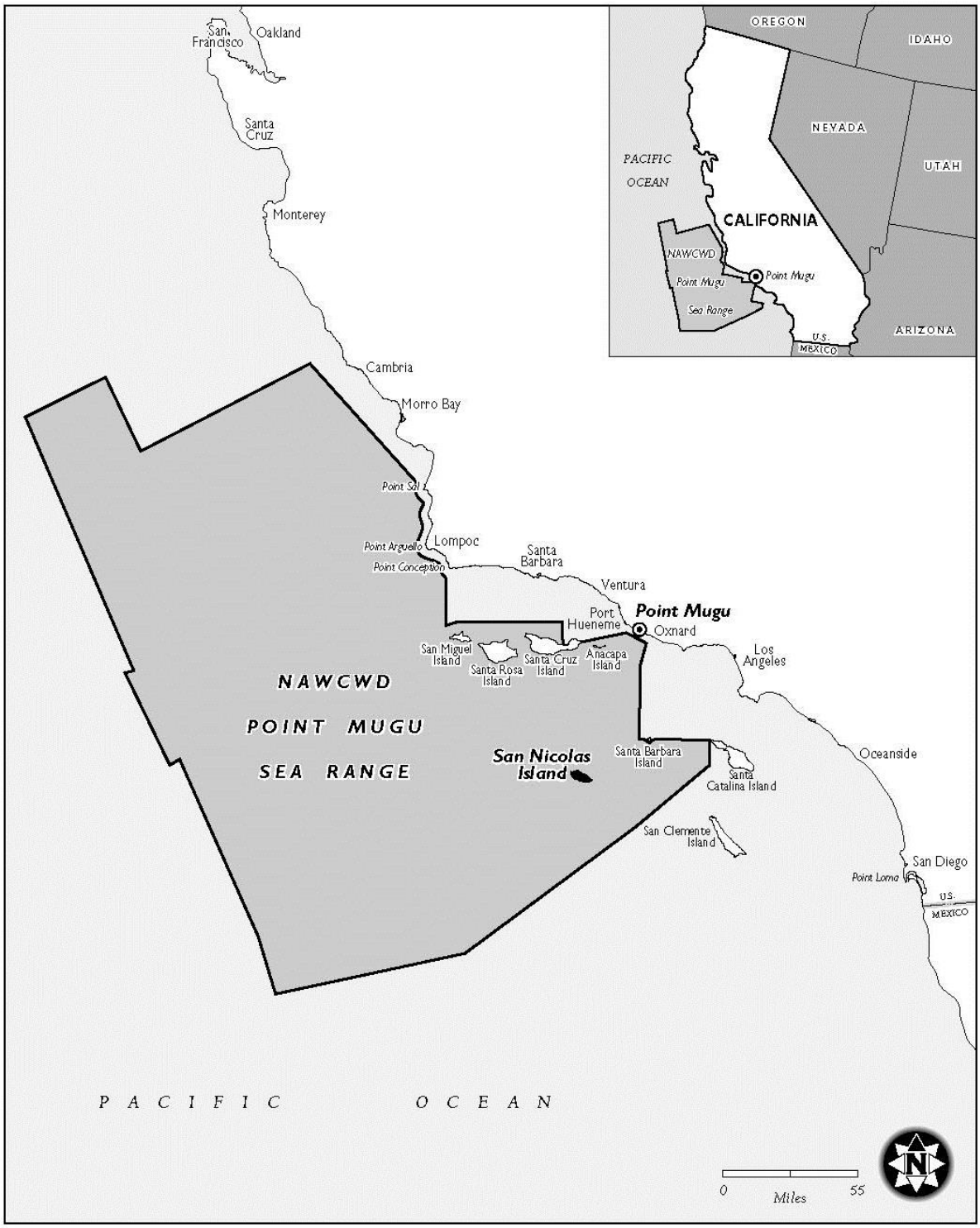

Figure 1. Regional site map of the Point Mugu Sea Range and SNI.

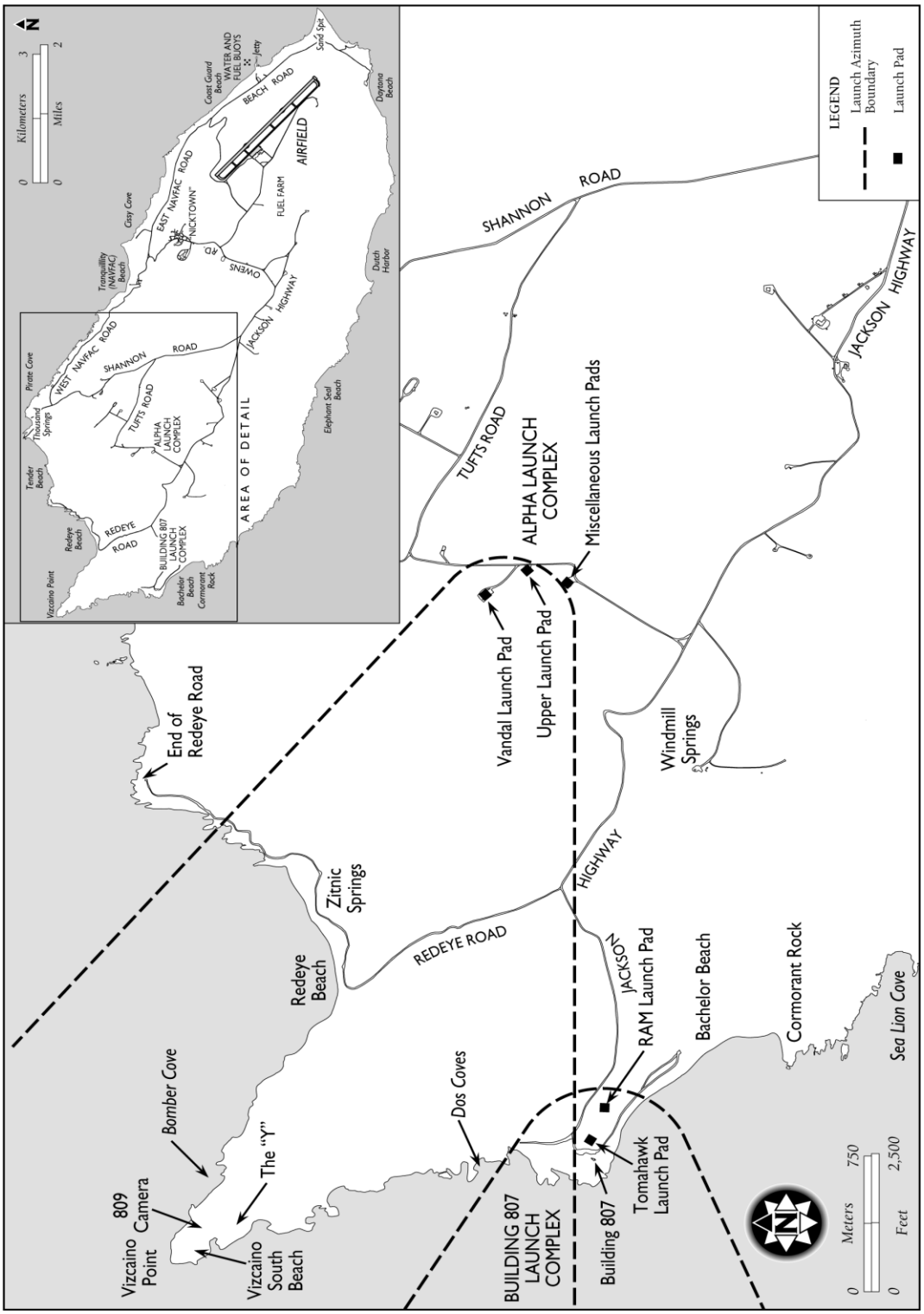

Figure 2. Map of SNI, showing the Alpha Launch Complex, Building 807 Launch Complex, and the names of adjacent beaches on which pinnipeds are known to haul out. Also depicted are the anticipated launch azimuths (dashed lines) for each launch complex. These launch azimuths are typical, although occasionally launch paths could pass outside these boundaries.

1.4.2 Launch Activities

NAWCWD plans to continue a launch program for missiles from several launch sites on SNI. Missiles vary from tactical and developmental weapons to target missiles used to test defensive strategies and other weapons systems. The Navy may launch as many as 200 vehicles from SNI over a 5-year operations program, with up to 40 launches per year, but this number can vary depending on operational requirements. Launch timing will be determined by operational, meteorological, and logistical factors. Up to 10 launches per year may occur at night. Nighttime launches will only take place when required by the test objectives, e.g., when testing the Airborne Laser system (ABL). For this system, missiles must be launched at night when the laser is visible. Some launch events involve a single vehicle, while others involve the launch of multiple vehicles either in quick succession or at intervals of a few hours. The number of launches per month varies depending on operational needs.

The purpose of these launches is to support testing and training activities associated with operations on the NAWCWD Point Mugu Sea Range. The Sea Range is used by the U.S. and allied military services to test and evaluate sea, land, and air weapon systems; to provide realistic training opportunities; and to maintain operational readiness of these forces. Some of the launches are used for practicing defensive drills against the types of weapons simulated by these missiles and some launches are conducted for the related purpose of testing new types of targets.

The Coyote Supersonic Sea-skimming Target (SSST) is anticipated to be the primary launch vehicle. However, the Navy states that it may become necessary to substitute similar vehicles or different equipment in some cases. While other vehicles may be launched in the future, the largest contemplated in the Navy's application and this EA is 23,000 kg (50,706 lbs). These larger vehicles would be launched up to three times per year.

<u>Coyote</u>
The Coyote, designated GQM-163A, is an expendable SSST powered by a ducted-rocket ramjet (Figure 3). It has replaced the Vandal, which was used as the primary vehicle during launches from 2001-2005. The Coyote is similar in size and performance to the Vandal. (A description of the Vandal can be found in NMFS' 2003 EA on the issuance of LOAs to the NAWCWD for the incidental take of pinnipeds on SNI during missile and target launch operations [NMFS, 2003].) Table 1 outlines some of the basic features of both the Vandal and Coyote missiles for comparison.

Table 1. Physical characteristics of a Vandal and a Coyote missile.

Physical Characteristic	Vandal	Coyote
Length	7.7 m (25.2 ft) (does not include booster rocket)	5.5 m (18 ft) (does not include booster rocket)
Diameter	71 cm (28 in)	36 cm (14 in)
Maximum Speed	Mach 2.125 in sea-skimming mode	Mach 2.5 in sea-skimming mode
Flight Propulsion	Single ramjet engine	Ducted Rocket ramjet subsystem

The Coyote is capable of flying at low altitudes (4 m [13 ft] cruise altitude) and supersonic speeds (Mach 2.5) over a flight range of 83 km (51.6 mi). This vehicle is designed to provide a ground launched aerial target system to simulate a supersonic, sea-skimming Anti-Ship Cruise Missile threat. The SSST assembly consists of two primary subsystems: MK 70 solid propellant booster and the GQM-163A target vehicle. The solid-rocket booster is approximately 46 cm (18 in) in diameter and is of the type used to launch the Navy's "Standard" surface-to-air missile. The GQM-163A target vehicle is 5.5 m (18 ft) long and 36 cm (14 in) in diameter, exclusive of its air intakes. It consists of a solid-fuel Ducted Rocket (DR) ramjet subsystem, Control and Fairing Subassemblies, and the Front End Subsystem (FES). Included in the FES is an explosive destruct system to terminate flight if required.

The Coyote utilizes the Vandal launcher, currently installed at the Alpha Launch Complex on SNI with a Launcher Interface Kit. A modified AQM-37C Aerial Target Test Set is utilized for target checkout, mission programming, verification of the vehicle's ability to perform the entire mission, and homing updates while the vehicle is in flight.

Figure 3. View of the Coyote with booster and launcher at the Alpha Launch Complex on SNI (photograph by U.S. Navy).

During a typical launch, booster separation occurs approximately 5.5 s after launch and approximately 2.6 km (1.6 mi) downrange, at which time the vehicle has a speed of approximately Mach 2.35 (Orbital Sciences Corp; www.orbital.com). Following booster separation, the GQM-163A's DR ramjet ignites, the vehicle reaches its apogee, and then dives to 5 meters (16.4 ft) altitude while maintaining a speed of Mach 2.5. During launches from SNI, the low-altitude phase occurs over water west of the island. The target performs pre-programmed maneuvers during the cruise and terminal phases, as dictated by the loaded mission

profile, associated waypoints, and mission requirements. During the terminal phase, the Coyote settles down to an altitude of four meters (13 ft) and Mach 2.3 until DR burnout.

Previous Coyote launches produced SPL-f of 125–134 dB re 20 μPa2·s at distances of 0.8–1.7 km from the CPA of the vehicle, and 82–93 dB at CPAs of 2.4–3.2 km (Holst et al. 2005a, 2008). SEL-f ranged from 87 to 119 dB re 20 μPa2·s. M-weighted SELs ranged from 60 to 114 dB re 20 μPa2·s, and peak pressures ranged from 100 to 144 dB re 20 μPa. Appendix D in the Navy's 2002 FEIS/OEIS contains an overview of airborne and underwater acoustics (NAWCWD, 2002).

Rolling Airframe Missile (RAM)

The Navy/Raytheon RAM is a supersonic, lightweight, quick-reaction missile (Figure 4). This relatively small missile, designated RIM 116, uses the infrared seeker of the Stinger missile and the warhead, rocket motor, and fuse from the Sidewinder missile. It has a high-tech radio-to-infrared frequency guidance system. The RAM is a solid-propellant rocket 12.7 cm (5 in) in diameter and 2.8 m (9.2 ft) long. Its launch weight is 73.5 kg (162 lbs), and operational versions have warheads that weigh 11.4 kg (25 lbs).

At SNI, RAMs are launched from the Building 807 Launch Complex, near the shoreline. Previous RAM launches have resulted in flat-weighted sound pressure levels (SPL-f) up to 126 dB near the launcher and 99 dB at a nearshore site located 1.6 km from the three-dimensional (3-D) closest point of approach (CPA) (Holst et al. 2005a, 2008). Flat weighted Sound Exposure Level (SEL-f) ranged from 84 to 97 decibels reference 20 micropascals (dB re 20 μPa), and SELs M-weighted for pinnipeds in air (Mpa) were 76 to 96 dB re 20 μPa2·s. Peak pressure ranged from 104 to 117 dB re 20 μPa. The reference sound pressure (20 μPa) used here and throughout the document, is standard for airborne sounds.

Figure 4. View of the RAM launcher at the Building 807 Launch Complex on SNI (photograph by U.S. Navy).

Multi-Stage Sea Skimming Target (MSST)

The MSST is a subsonic cruise missile with a supersonic terminal stage that approaches its target at low-level at Mach 2.8. The MSST is expected to replace the Coyote as the primary target missile launched from SNI in the future. It consists of a subsonic winged "cruise bus," which releases a supersonic "sprint vehicle" for terminal approach. The "sprint vehicle" is based on the Coyote target missile.

The MSST is launched from the Alpha Launch Complex on SNI. Previous MSST Launches had SPL-f values of 78.7–96.6 dB re 20 μPa and SEL-M values of 62.3–83.3 re 20 μPa2·s at sites 1.3-2.7 km from the CPA (Holst et al., 2011; Ugoretz and Greene, 2012).

Terrier (Black Brant, Lynx, Orion)

The Terrier class missiles consist of the Terrier Mark 70 booster with a variety of second stage rockets (e.g., Terrier-Black Brant, Figure 5). The solid-rocket booster is ~46 cm in diameter, 394 cm long, and weighs 1,038 kg. The three most likely Terrier class missiles that would be launched include the Terrier-Black Brant, Terrier-Lynx and Terrier-Orion. The Black Brant has a diameter of 44 cm, is 533 cm long, and weighs 1,265 kg. This missile reaches an altitude of 203 km and has a range of 264 km. Terrier burnout occurs after 6.2 s at an altitude of 3 km, and Black Brant burnout occurs after 44.5 s at an altitude of 37.7 km. The Lynx is 36 cm in diameter and 279 cm long. This missile reaches an altitude of 84 km and has a range of 99 km. Terrier burnout occurs after 6.2 s at an altitude of 2.3 km, and Lynx burnout occurs after 58.5 s at 43.5 km. The Improved Orion motor is 36 cm in diameter and 280 cm long. On SNI, this class of missile target will typically be launched vertically or near-vertically from the Building 807 Launch Complex. Since these missiles use the same Terrier Mk 70 booster as the Coyote, launch sound levels are generally similar to those from that Coyote. Given the near-vertical launch elevation, sounds in the immediate vicinity may be prolonged, though the missile reaches high altitude very quickly after launch.

Terrier class missiles are launched from the Building 807 Launch Complex on SNI. A Terrier-Orion produced an SPL-f of 91 dB re 20 μPa, an SEL-f of 96 dB re 20 μPa2·s, and an Mpa-weighted SEL of 92 dB re 20 μPa2·s at a distance of 2.4 km from the CPA; the peak pressure was 104 dB re 20 μPa (Holst et al. 2005a, 2008). During previous Terrier-Black Brant launches, SPL-f ranged from 102.7–115.0 dB, and SEL-M ranged from 106.5 to 118.4 dB at pinniped haul-out sites located 0.6–1.3 km from the CPA. Sounds near the launcher reached 134 dB SPL-f and 132.3 dB re 20 μPa2·s SEL-M. During previous Terrier-Lynx launches, SPL-f measured 85.9–114.4 dB re 20 μPa at sites located 0.6–5.1 km from the CPA of the launched vehicle and SEL-M values ranged from 90.5 to 118.0 dB re 20 μPa (Holst et al., 2010; Ugoretz and Greene, 2012).

Figure 5. View of the Terrier-Black Brant target missile (photograph by U.S. Navy).

RIM-161 Standard Missile 3 (SM-3)

The SM-3 is a ship-based missile system used to intercept short- to intermediate-range ballistic missiles as a part of Aegis Ballistic Missile Defense System. Although primarily designed as an antiballistic missile defensive weapon, the SM-3 has also been employed in an anti-satellite capacity against a satellite at the lower end of low Earth orbit. The SM-3 evolved from the proven SM-2 Block IV design. The SM-3 uses the same booster and dual thrust rocket motor as the Block IV missile for the first and second stages and the same steering control section and midcourse missile guidance for maneuvering in the atmosphere. To support the extended range of an exo-atmospheric intercept, additional missile thrust is provided in a new third stage for the SM-3 missile, containing a dual pulse rocket motor for the early exo-atmospheric phase of flight. Testing of SM-3 missiles may begin during this IHA period and launch sounds are expected to be within the range of existing missiles.

Other Missile Launches

The Navy may also launch other missiles to simulate various types of threat missiles and aircraft, and to test other systems. For example, on August 23, 2002, a Tactical Tomahawk was launched from Building 807 Launch Complex. The Tomahawk produced an SPL-f of 93 dB re 20 μPa, an SEL-f of 107 dB re 20 μPa2·s, and an mpa-weighted SEL of 105 dB re 20 μPa2·s at a distance of 539 m from the CPA; the peak pressure was 111 dB re 20 μPa. A Falcon was launched from the Alpha Launch Complex on April 6, 2006; it produced an SPL-f of 84 dB re 20 μPa, an SEL-f of 88 dB re 20 μPa, and an mpa-weighted SEL of 82 dB re 20 μPa at a beach located north of the launch azimuth. Near the launcher, the SPL-f was 128 dB re 20 μPa, SEL-f was 126 dB re 20 μPa, and mpa-weighted SEL was 125 dB re 20 μPa.

Missiles of the BQM-34 or BQM-74 type could also be launched. These are small, unmanned aircraft that are launched using jet-assisted take-off (JATO) rocket bottles; they then continue

offshore powered by small turbojet engines. The larger of these, the BQM-34, is 7 m long and has a mass of 1,134 kg plus the JATO bottle. The smaller BQM-74 is up to 420 cm long and has a mass of 250 kg plus the solid propellant JATO bottles. Burgess and Greene (1998) reported that A-weighted SPLs (SPL-A) ranged from 92 dBA re 20 μPa at a CPA of 370 m to 145 dB at 15 m for a launch on 18 November 1997.

If launches of other missile types occur, they would be included within the total of 40 launches anticipated per year. It is possible that launch trajectories could include a wider range of angles than shown on Figure 2.

1.4.3 General Launch Operations

Aircraft and helicopter flights between the Point Mugu airfield on the mainland, the airfield on SNI, and the target sites in the Sea Range will be a routine part of a planned launch operation. These flights generally do not pass at low level over the beaches where pinnipeds are expected to be hauled out.

Movements of personnel are restricted near the launch sites at least several hours prior to a launch for safety reasons. No personnel are allowed on the western end of SNI during launches. Movements of personnel or vehicles near the island's beaches are also restricted at other times of the year for purposes of environmental protection and preservation of cultural resource sites.

Launch monitoring equipment (e.g., portable video cameras and Autonomous Terrestrial Acoustic Recorders or ATARs) will be deployed and activated prior to the launches.

1.4.4 Launch Timing

The timing of these launch activities is variable and subject to test and training requirements, and meteorological and logistical limitations. To meet the Navy's operational testing and training requirements, launches may be required at any time of year. Thus, launches could occur at any time during day or night and at any time during the 5-year period when the regulations are anticipated to be in place (2014-2019).

Launches of this type have been occurring at SNI for many years and are expected to continue indefinitely into the future. The total number of launches that have occurred since 2001 include: 69 launches from August 2001 to October 2005, 15 launches from February 2006 to December 2010, and 24 launches from January 2011 to January 2014 (Holst et al., 2005a, b, 2008; Holst and Greene 2010; Ugoretz 2013). Although no more than 25 launches have occurred in any single year since 2001, it is anticipated that there could be up to 40 missile launches from SNI per year depending on operational requirements. On occasion, two or more launches may occur in quick succession on a single day.

Given the launch acceleration and flight speed of the missiles, most launch events are of extremely short duration. Strong launch sounds are typically detectable near the beaches at western SNI for no more than a few seconds per launch (Holst et al., 2005a, 2008, 2011).

As described in Section 1.3.1, the launches will occur from the western part of SNI (Figure 2). SNI is one of the eight Channel Islands in the Southern California Bight (SCB), located ~105 km southwest of Point Mugu (Figure 1). The missiles fly generally southwest, west, or northwest through the Point Mugu Sea Range. The Alpha Launch Complex is ~2 km from the nearest beach where pinnipeds are known to haul out. The Building 807 Launch Complex accommodates several fixed and mobile launchers, where the nearest is 30 m from the shoreline and the farthest is 150 m. However, few pinnipeds are known to haul out on the shoreline immediately adjacent to this launch site.

1.5 History of Incidental Take Authorizations for Navy Missile Launch Activities at SNI

On February 5, 2001, NMFS received an application from the NAWCWD Point Mugu, requesting a small take authorization for takings incidental to target missile launch operations on SNI. The request anticipated the incidental harassment of pinnipeds as a result of up to 15 Vandal (or similar sized vehicles) launches from the Alpha Launch Complex and up to 5 launches of smaller subsonic targets from either the Alpha Launch Complex or Building 807 for a one-year period, commencing as early in 2001 as possible. NMFS notified the public of this request and offered 30 days for public comment (66 FR 20435, April 23, 2001). Comments were received from the Marine Mammal Commission (Commission) and SRS Technologies. These comments and NMFS' responses are contained in the *Federal Register* notice of issuance of an IHA (66 FR 41834, August 9, 2001). On July 31, 2001, NMFS issued a one-year IHA to the NAWCWD to harass marine mammals incidental to target missile launch operations on SNI.

On April 9, 2002, NMFS received a new application from the NAWCWD to continue the launch program that began in summer 2001 on SNI. The application requested the authorization of the take of three pinniped species by harassment incidental to target missile launch operations on SNI. Although there were only nine Vandal launches and three launches of subsonic targets from SNI under the previous IHA, the NAWCWD again requested that they be permitted to conduct a maximum of 15 Vandal launches and 5 launches of smaller subsonic targets from the facilities on SNI during the validity of the IHA. On July 1, 2002, NMFS notified the public of this request and offered 30 days for public comment. The only comments received were from the Commission and were addressed in the *Federal Register* notice of issuance (67 FR 56271, September 3, 2002). On August 26, 2002, NMFS issued its second one-year IHA to the NAWCWD for its launch program.

On October 23, 2002, NMFS received a new application from the Navy for the taking of marine mammals incidental to target missile launch operations conducted by the NAWCWD on SNI for a period of 5 years. It was planned that these regulations would replace annual IHAs issued to the Navy under Section 101(a)(5)(D) of the MMPA. On March 11, 2003 (68 FR 11527), and May 9, 2003 (68 FR 24905), NMFS notified the public of this request and offered a total of 75 days for public comment. Several comments were received from the public, which were addressed in the proposed rule (68 FR 24905, May 9, 2003) and the final rule (68 FR 52132, September 2, 2003) authorizing the taking of seals and sea lions incidental to missile launch operations on SNI for a period of 5 years. These regulations were effective from October 2, 2003, through October 2, 2008.

On September 3, 2008, NMFS received a new application from the Navy requesting issuance of new regulations and LOAs for the taking of marine mammals incidental to target missile launch operations conducted by the NAWCWD on SNI for a period of 5 years. On September 16, 2008 (73 FR 53408), and March 20, 2009 (74 FR 11891), NMFS notified the public of this request and offered a total of 60 days for public comment. NMFS received comments from the Marine Commission and a private citizen, which were addressed in the proposed rule (74 FR 11891, March 20, 2009) and the final rule (74 FR 26580, June 3, 2009) authorizing the taking of seals and sea lions incidental to missile launch operations on SNI for a period of 5 years. These regulations were effective from June 2, 2009, through June 2, 2014.

On July 24, 2013, NMFS received a new application from the Navy seeking issuance of regulations for the taking of marine mammals incidental to target missile launch operations conducted by the NAWCWD on SNI for a period of 5 years, from June 2014 through June 2019. In that application, the Navy requested that the regulations allowing these takes specify that a single LOA covering the entire period of regulations be allowed. On November 26, 2013 (78 FR 70537), and March 7, 2014 (79 FR 13022), NMFS notified the public of this request and offered a total of 75 days for public comment. NMFS received comments on the proposed rule from the Commission and a private citizen, which will be published in the final rule *Federal Register* notice.

1.6 Other EA/EIS that Influence the Scope of this EA

The Navy released a FEIS/OEIS in 2002 for the Point Mugu Sea Range (NAWCWD, 2002). Additionally, in 2003, NMFS prepared an EA and issued a Finding of No Significant Impact (FONSI) as the NEPA analysis for the promulgation of 5-year regulations and subsequent issuance of annual LOAs to the Navy to conduct its missile launch program at SNI for the period of 2003-2008. In 2009, NMFS prepared an updated EA and issued a new FONSI as the NEPA analysis for the promulgation of 5-year regulations and subsequent issuance of annual LOAs to the Navy to conduct its missile launch program at SNI for the period of 2009-2014. Where referenced herein, portions of these NEPA documents are incorporated by reference, as authorized by 40 CFR 1502.21 of NEPA. This EA updates the information contained in the Navy's 2002 FEIS/OEIS and NMFS' 2003 and 2009 EAs to include the new launch vehicles described in Section 1.3 of this EA, new information on the abundance and distribution of pinnipeds on SNI, and new information on potential impacts to marine mammals based on the twelve years of monitoring that has taken place since the Navy began these activities.

NMFS is the lead agency for the purposes of this EA to evaluate the impact of the proposed action to authorize the incidental harassment of marine mammals at SNI. This EA applies to both the current (2014-2019) Navy application and NMFS issuance of the LOA for activities at SNI that have the potential to incidentally harass marine mammals.

1.7 Scoping and Public Involvement

The purpose of scoping is to identify the issues to be addressed and the significant issues related to the proposed action, as well as identify and eliminate from detailed study the issues that are

not significant or that have been covered by prior environmental review. An additional purpose of the scoping process is to identify the concerns of the affected public and Federal agencies, states, and Indian tribes. The Council on Environmental Quality (CEQ) regulations implementing NEPA do not require that a draft EA be made available for public comment as part of the scoping process. However, comments received during the 75-day public comment period for the notice of receipt of application (30 days) and the proposed rule (45 days) for NMFS to authorize the harassment of marine mammals incidental to Navy missile launch activities at SNI for 2014-2019, were considered as part of the scoping for this EA.

On November 26, 2013, NMFS published a notice of receipt of application for an LOA with a 30-day public comment period in the *Federal Register* (78 FR 70537). No comment letters were received at this stage. On March 7, 2014, NMFS published a proposed rule in the *Federal Register* (79 FR 13022) and requested comments from the public for the consideration of implementation of regulations and issuance of authorization, and for the development of this EA. During the 45-day public comment period NMFS received comments from the Commission and a private citizen. The Commission's comments concerned how takes of sea lions were estimated. The Commission recommended issuance of the final rule, subject to the inclusion of proposed mitigation, monitoring, and reporting requirements. NMFS agreed with the Commission's recommendations and has incorporated their comments into this EA. The private citizen recommended that the Navy submit annual reports describing non-adherence, if any, with required mitigation measures—including frequency of occurrence, date of occurrence, and reason for occurrence of non-adherence. The Commission's and private citizen's comments, and NMFS' responses, will be published in the final rule *Federal Register* notice.

1.8 Applicable Laws and Regulations

1.8.1 National Environmental Policy Act

NEPA is applicable to all "major" Federal actions significantly affecting the quality of the human environment. A major Federal action is an activity that is fully or partially funded, regulated, conducted, or approved by a Federal agency. NMFS issuance of ITAs represents approval and regulation of activities. The procedural provisions outlining Federal agency responsibilities under NEPA are provided in the CEQ's implementing regulations (40 CFR Parts 1500-1508). NMFS has, through NOAA Administrative Order (NAO) 216-6, established agency procedures for complying with NEPA and the implementing regulations issued by the CEQ. This EA is prepared in accordance with NEPA, its implementing regulations, and NOA 216-6 to determine whether the direct, indirect and cumulative impacts related to the proposed issuance of an ITA could be significant. If we deem the potential impacts to be not significant, this analysis, in combination with other analyses incorporated by reference—may support the issuance of a FONSI for the proposed authorization.

1.8.2 Marine Mammal Protection Act

Under the MMPA, the taking of marine mammals without an authorization from NMFS is prohibited. 16 U.S.C. § 1371. The term "take" under the MMPA means "to harass, hunt,

capture, or kill, or attempt to harass, hunt, capture, or kill." 16 U.S.C. § 1362(13). For purposes of "military readiness activities," harassment is defined as:

> (i) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B harassment].

16 U.S.C. § 1362(18)(B).

In order to obtain an exemption from the MMPA's prohibition on taking marine mammals, for military readiness activities, the applicant must obtain an ITA under Section 101(a)(5)(A) or (D) of the MMPA. In such cases, an ITA shall be granted if NMFS finds that the taking will have a negligible impact on the affected species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses. NMFS will prescribe, where applicable the permissible methods of taking and other means of affecting the least practicable adverse impact on the species or stock and its habitat (i.e., mitigation, monitoring and reporting of such takings). ITAs may be issued as either (1) LOAs or (2) IHAs, the latter applicable when there is no potential for serious injury and/or mortality or where any such potential can be negated through required mitigation measures.

As part of the MMPA authorization process, applicants are required to provide detailed mitigation plans that outline what efforts will be taken to reduce negative impacts to marine mammals and their availability for subsistence use to the lowest level practicable. In addition, ITAs require that operators conduct monitoring, which should be designed to result in an increased knowledge of the species and an understanding of the level and type of takings that result from the authorized activities. Under the MMPA, NMFS further requires that monitoring be designed to provide information and data verifying (or disputing) that the taking of marine mammals are, in fact, negligible and there are no unmitigable adverse impacts on the availability of marine mammals for subsistence uses.

1.8.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) states:

> "Each Federal agency shall, in consultation with and with the assistance of the Secretary [of the Interior/Commerce "Secretary"], insure that any action authorized, funded, or carried out by such agency…is not likely to jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of habitat of such species, which is determined by the Secretary…to be critical…"

16 U.S.C. § 1536(a)(2).

Since no species listed as either threatened or endangered under the ESA are expected to be affected by the specified activities, NMFS has determined that a Section 7 consultation is not

required. It should be noted however that SNI is the location to which southern sea otters have been translocated in an attempt to establish a population separate from that in central California. This experimental population may be affected by the target and missile launch activities at SNI. Sea otters are under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS). Under Public Law 99-625, this experimental population of sea otters is treated as a proposed species for purposes of Section 7 when the action (as here) is defense related. Proposed species require an action agency to confer with NMFS or the USFWS under Section 7 of the ESA when the action is likely to jeopardize the continued existence of the species. The information available for the Navy's proposed activities described in Section 1.3 of this EA or for NMFS' proposed action of promulgating 5-year regulations and the subsequent issuance of an LOA to the Navy for those activities does not indicate that sea otters are likely to be jeopardized. Therefore, a consultation is not required.

1.8.4 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA), 16 U.S.C. § 1451 *et seq.*, provides assistance to states, in cooperation with Federal and local agencies, for developing land and water use programs for their respective coastal zones. A state's coastal zone extends seaward to 5.6 km (3 nm; except for the Texas and Florida Gulf Coasts). Federal license or permit activities and Federal financial assistance activities that have reasonably foreseeable coastal effects must be fully consistent with the enforceable policies of state coastal management programs. As part of the National Oceanic and Atmospheric Administration's (NOAA) approval of a State's coastal management program, the State prepares a list of Federal license or permit activities which affect coastal uses or resources which the State wishes to review for Federal consistency purposes.

On February 14, 2001, by a unanimous vote, the California Coastal Commission (CCC) concluded that, with the monitoring and mitigation commitments the Navy has incorporated into their various testing and training activities on the Point Mugu Sea Range, including activities on SNI, and including the commitment to enable continuing CCC staff review of finalized monitoring plans and ongoing monitoring results, the activities are consistent with the marine resources, environmentally sensitive habitat, and water quality policies (Sections 30230, 30240, and 30231) of the California Coastal Act. The activities described in the proposed MMPA regulations and this EA are analogous to those reviewed by the CCC in 2001.

1.8.5 National Marine Sanctuaries Act

The National Marine Sanctuaries Act (NMSA) prohibits the destruction of, loss of, or injury to any sanctuary resource, and any violation of regulations or permits issued pursuant to the statute or accompanying regulations. 16 U.S.C. 1436. In addition, Section 304(d) of the NMSA requires Federal agencies to consult with the Secretary of Commerce, through NOAA, on Federal agency actions, internal or external, to any national marine sanctuary that are likely to destroy, cause the loss of, or injure any sanctuary resource. 16 U.S.C. § 1434(d). Under Section 304(d), if NOAA determines that the action is likely to destroy, cause the loss of, or injure sanctuary resources, NOAA shall recommend reasonable and prudent alternatives that can be taken by a Federal agency to protect sanctuary resources. The Federal agency may choose not to follow these alternatives provided the reasons are submitted in writing. However, if the head of

a Federal agency takes an action other than an alternative recommended by NOAA and such action results in the destruction of, loss of, or injury to a sanctuary resource, the head of the agency shall promptly prevent and mitigate further damage and restore or replace the sanctuary resource in a manner approved by NOAA. Regulations for each designated national marine sanctuary specifically address military and defense activities.

According to the Navy, except for aircraft and vessel traffic transiting the area, none of the Navy's proposed activities would take place within the Channel Islands National Marine Sanctuary (CINMS). On December 8, 2008, NMFS contacted the National Ocean Service's Office of National Marine Sanctuaries (ONMS) regarding NMFS' action of promulgating regulations and issuing LOAs for Navy activities similar to those described in the Navy's 2013 application and this EA to determine whether or not NMFS' action is likely to destroy, cause the loss of, or injure any sanctuary resources. On December 12, 2008, the ONMS determined that no further consultation with NMFS was required on its proposed action as this action is not likely to destroy, cause the loss of, or injure any national marine sanctuary resources.

1.9 Scope of the Analysis

This EA analyzes the environmental effects of reissuance of authorization and regulations under Section 101(a)(5)(A) of the MMPA and the alternatives to the proposed action. These regulations, if issued, would authorize the take by Level B harassment of three species of marine mammals incidental to missile launch activities conducted by the Navy at SNI. These regulations, if implemented, for the period between approximately June 2014 and June 2019, would allow NMFS to issue a single 5-year LOA to the Navy. Given the limited scope of the decision for which we are responsible, this EA intends to provide more focused information on the primary issues and impacts of environmental concern related specifically to our issuance of the take authorization.

Chapter 2 ALTERNATIVES

A total of three alternatives, including the No Action Alternative, were described in detail in Section 2.2.2 of the Navy's 2002 FEIS/OEIS (NAWCWD, 2002). For information supporting the Navy's proposed action and the alternatives to that proposed action and the impacts on marine and terrestrial life and the human environment that would result from implementation of the proposed action and alternatives, please refer to the Navy's 2002 FEIS/OEIS (NAWCWD, 2002). However, for the promulgation of MMPA regulations and subsequent issuance of an LOA to the Navy, NMFS considered and analyzed the following four alternatives.

2.1 Alternative 1—Issuance of 5-year Regulations and LOA to the Navy with Required Mitigation, Monitoring, and Reporting Measures (Preferred Alternative)

Under this alternative, NMFS would issue regulations under Section 101(a)(5)(A) of the MMPA to the Navy, NAWCWD, allowing the incidental take by Level B harassment of three pinniped species incidental to conducting missile launch activities at SNI from June 2014, through June 2019. These regulations would allow NMFS to issue a single LOA to the Navy for the entire period of the requested regulations, which would alleviate some of the administrative and financial burden associated with processing annual LOAs. In order to reduce the incidental harassment of marine mammals to the lowest level practicable, under this alternative, the Navy would implement the mitigation, monitoring, and reporting measures described in Chapters 5 and 6 of this EA. The impacts to marine mammals that could be anticipated from implementing this alternative are addressed in Chapter 4 of this EA. Since the MMPA requires holders of LOAs to reduce impacts on marine mammals to the lowest level practicable, implementation of this alternative would meet NMFS' purpose and need as described in this EA. NMFS' evaluation of these mitigation, monitoring, and reporting requirements are considered in the context of the least practicable adverse impact standards specific to military readiness activities, which includes consideration, in consultation with the Department of Defense, of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity. Implementation of the measures described in Chapters 5 and 6 of this EA would meet both NMFS' and the Navy's purpose and need.

2.2 Alternative 2—No Action Alternative

We are required to evaluate the No Action Alternative per CEQ NEPA regulations. The No Action Alternative serves as a baseline to compare the impacts of the Preferred and other Alternatives.

Under the No Action Alternative, NMFS would not promulgate regulations or issue an ITA (LOA or IHA) to the Navy, NAWCWD, for the potential harassment of marine mammals incidental to conducting missile launch activities at SNI. Under this alternative, the Navy could choose not to proceed with their missile launch activities or proceed without an ITA. If they choose the latter, the Navy would not be exempt from the MMPA prohibitions against the take of marine mammals and would be in violation of the MMPA if take of marine mammals occurs.

For purposes of this EA, we characterize the No Action Alternative as the Navy not receiving an ITA and the Navy conducting their missile launch activities on San Nicolas Island without the protective measures and reporting requirements required by an ITA under the MMPA. We take this approach to meaningfully evaluate the primary environmental issues—the impact on marine mammals from these activities in the absence of protective measures.

2.3 Alternative 3: Issuance of 5-year Regulations and Annual LOAs to the Navy with Required Mitigation, Monitoring, and Reporting Measures

Under Alternative 3, NMFS would promulgate regulations for a period of 5 years and issue annual LOAs to the Navy for the specified activities. All of the mitigation, monitoring, and reporting requirements that would be implemented under Alternative 1 would be included in the authorizations issued if Alternative 3 were selected. While this alternative would meet NMFS' purpose and need as described in this EA, it would most likely lead to increased costs and administrative burden for both NMFS and the Navy because of the need to process and issue LOAs on a more frequent basis. The impacts to physical, biological, and socioeconomic resources from this alternative are analyzed in Chapter 4 of this EA.

2.4 Alternative 4: Issuance of Regulations for a Period of Time Less than 5 years or Issuance of Annual IHAs under Section 101(a)(5)(D) of the MMPA

Under Alternative 4, NMFS would promulgate regulations for a period of less than 5 years or issue annual IHAs to the Navy for the specified activities. All of the mitigation, monitoring, and reporting requirements that would be implemented under Alternative 1 would be included in the authorizations issued if Alternative 4 were selected. While this alternative would meet NMFS' purpose and need as described in this EA, it would most likely lead to increased costs and administrative burden for both NMFS and the Navy because of the need to process and issue ITAs (in this case, IHAs) on a more frequent basis. The impacts to physical, biological, and socioeconomic resources from this alternative are analyzed in Chapter 4 of this EA.

2.5 Alternatives Considered but Eliminated from Further Consideration

NMFS considered whether other alternatives could meet NMFS' purpose and need and support the Navy's required mission. An alternative that would allow for the issuance of regulations or an IHA with no required mitigation was considered but eliminated from consideration, as it would not be in compliance with the MMPA. For that reason, this alternative is not analyzed further in this document.

Chapter 3 AFFECTED ENVIRONMENT

The purpose of this chapter is to provide baseline information for consideration of the alternatives and to describe the environment that might be affected by the proposed action and alternatives. This chapter describes the physical, biological, and socioeconomic environments in the action area.

3.1 Physical Environment

We are required to consider impacts to the physical environment under NAO 216-6. As discussed in Chapter 1, our proposed action and alternatives relate only to the authorization of incidental take of marine mammals. Certain aspects of the physical environment are not relevant to our proposed action. Because of the requirements of NAO 261-6, we briefly summarize the physical components of the environment here.

SNI lies approximately 65 mi (105 km) southwest of Point Mugu and covers 13,370 acres (5,411 hectares). The island is a mesa with the topography sloping gently upward from the northern end of the island. The average surface elevation is 500 ft (152 m) above mean sea level (MSL), with a maximum elevation of 908 ft (277 m) above MSL. SNI is arid; total precipitation averages 8.4 in (21.3 cm) per year. The dry season occurs between May and September, and the wet season occurs between November and February when the island receives 74 percent of its total rainfall. The bathymetry surrounding SNI is irregular in shape. The island is basically a pinnacle that is surrounded by water depths of 2,000 ft (610 m) which slope to approximately 3,900 ft (1,190 m) within 6 nautical mi (nm.; 11 km) of the island. The subtidal area nearest the island is much shallower (less than 100 ft [30 m]) and is characterized by either sand, bedrock, or boulder.

SNI has few coves and is located far from the wave shadow of the other Channel Islands. Consequently, species that typically occur in calm waters are rare or absent (Engle, 1994). Surface water temperature in the vicinity of SNI typically ranges between 57° F (14° C) and 64° F (18° C). Ocean currents on the north shore of the island flow along its contours in a northwest to southeast direction at a speed of approximately 0.5 knots (0.9 km/hr). Since the island presents an obstruction to the prevailing flow of wind and swell, the southeastern shore is the most sheltered portion of the island.

SNI is far enough offshore to receive cold water from the California Current, yet far enough south to receive warm water from the California Countercurrent. Therefore, the subtidal species are considered to be intermediate (a combination of both northern and southern species) in relation to the other Channel Islands (Engle, 1994). Another major influence on marine species distribution at SNI is the geologic composition of the marine habitat. Bedrock is the dominant habitat type in shallow water around the Channel Islands, followed by boulder and sand. SNI's shoreline consists of about 61 percent bedrock and 33 percent sandy beach (Engle, 1994). SNI is almost completely surrounded by marine flora. This is primarily due to the large amounts of rocky subtidal and intertidal habitat that surrounds the island. The rocky habitat is ideal for giant kelp (*Macrocystis pyrifera*) and numerous species of red, green, and brown algae. Rocky habitat is common off SNI.

The CINMS encompasses the waters within six nautical miles (11 km) of San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara Islands. The CINMS was established in 1980 for the purpose of protecting areas off the southern California coast that contain significant marine resources. The CINMS is located over the continental shelf, with water depths usually less than 360 ft (110 m). SNI is not part of the CINMS. The activities described in this EA for which NMFS proposes to issue MMPA Section 101(a)(5)(A) regulations to the Navy will not occur in the CINMS. The Navy's 2002 FEIS/OEIS (NAWCWD, 2002) contains more detailed information about the CINMS. Please refer to that document for additional information. Since the issuance of the proposed MMPA authorizations would not impact CINMS resources, they are not discussed further in this document.

3.1.1 Marine Mammal Habitat

Marine mammals haul out on the shoreline or in the intertidal areas of SNI. During the period of the proposed activity, three species of pinnipeds will use various beaches around SNI as places to rest, molt, and breed. These beaches consist of sand, rock ledges, and rocky cobble. Pinnipeds continue to use beaches around SNI, and are expanding their use of some beaches, despite ongoing launch activities for many years.

3.2 Biological Environment

3.2.1 Marine Mammals

The Southern California Bight (SCB), including the Channel Islands, supports a diverse assemblage of marine mammals: at least 34 species of cetaceans (whales, dolphins, and porpoises), six species of pinnipeds (seals and sea lions), and the southern sea otter (*Enhydra lutris*). General information on the current status of marine mammal species found in the waters off California can be found in Carretta et al. (2013), which is hereby incorporated by reference and available on the Internet at: http://www.nmfs.noaa.gov/pr/pdfs/sars/po2012.pdf. Please refer to that document for general information on these species.

Many of the beaches around the perimeter of SNI are pinniped resting, molting, or breeding sites. Three species can be expected to occur on land in the area of proposed activity either regularly or in large numbers during certain times of the year: northern elephant seals, harbor seals, and California sea lions.

Three additional pinniped species that can found on the Point Mugu Sea Range are far less common at SNI and include the northern fur seal (*Callorhinus ursinus*), the Guadalupe fur seal (*Arctocephalus townsendi*), and the Steller sea lion (*Eumetopias jubatus*). The northern fur seal is occasionally sighted on SNI in small numbers (Stewart and Yochem 2000); a single female with a pup was sighted on the island in July of 2007 (G. Smith, NAWCWD, pers. comm.). It is also possible that individual Guadalupe fur seals may be sighted on the beaches. The Guadalupe fur seal is an occasional visitor to the Channel Islands, but breeds mainly on Guadalupe Island, Mexico, which is ~463 km south of the Sea Range. A lone adult male Guadalupe fur seal established a territory on the south side of SNI each year between 2006 and 2009 and again in 2012 (J. Laake, NOAA pers. comm.). This individual has never been seen in the area impacted

by missile launch sounds. The Steller sea lion was once abundant in these waters, but numbers have declined since 1938. A sub-adult male Steller sea lion was sighted at San Clemente Island on April 27, 2013 and individuals have been sighted at San Miguel Island and one adult male at SNI in 2010 (M. Lowry, NOAA, pers. comm.). Although it is possible that another Steller sea lion could haul out at SNI, it would be an extremely rare occurrence. Steller sea lions do not pup and breed at SNI and while they used to pup at SMI they no longer do so. Thus, it is very unlikely that Steller sea lions will be seen on or near SNI beaches. Information contained in this section of the EA updates the information contained in the Navy's FEIS/OEIS (NAWCWD, 2002) and NMFS' 2003 EA (NMFS, 2003) and 2009 EA (NMFS 2009) for the three species most likely to be affected by the Navy's activities.

3.2.1.1 Harbor Seal

The harbor seal is not listed under the ESA, and the California stock, which occurs on SNI, is not considered a strategic stock under the MMPA. Harbor seals haul out at various sites around SNI, including the western part of the island. Peak counts on SNI are several hundred seals, representing approximately two percent of the seals hauling out along all California shorelines. Pupping occurs on the beaches from late February to early April, with nursing of pups extending into May. Harbor seals also haul out during the molting period in late spring, and smaller numbers haul out at other times of the year.

Harbor seals are considered abundant throughout most of their range from Baja California to the eastern Aleutian Islands. They are common and widely scattered in coastal waters and along coastlines in California. Approximately 400–600 haul-out sites are distributed along the mainland and offshore islands of California, including sandbars, rocky shores, and beaches (Hanan, 1996; Lowry et al., 2005). The SCB is near the southern limit of the range of the harbor seal (Bonnell and Dailey, 1993). Harbor seals haul out and breed on all of the southern Channel Islands.

Most information on harbor seals comes from the periods when they are hauled out on land; however, over the period of a year they spend more time in the water than they do on land. Their distribution and movements while at sea are poorly known. The few sightings during aerial and ship-based surveys indicate that harbor seals are primarily found in coastal or nearshore areas. Studies using satellite-linked transmitters (deployed on only a few seals) have confirmed their primarily nearshore distribution and their tendency to remain near their haul-out sites (Stewart and Yochem, 1994).

In California, individual harbor seals remain relatively close to their haul-out sites throughout the year. A small number of seals (primarily juveniles) occasionally move between haul-out sites on different Channel Islands and on the mainland (Stewart and Yochem, 1985). There are seasonal differences in the proportion of time that seals haul out and in the durations of foraging trips. The latter factor probably influences the distance that harbor seals can travel to and from their haul-out sites. There is age and sex segregation at haul-out sites, and this may be true while they are at sea as well. Data obtained from radio-tagged seals from the mainland and San Miguel Island (SMI) indicate that most adult harbor seals leave haul-out areas daily even during the periods of peak haul-out (Hanan, 1996).

The best estimate of the California stock of harbor seals is 30,196 (Carretta et al. 2013); this estimate was determined by applying Harvey and Goley's (2011) correction factor to the most recent harbor seal counts on shore (19,608 in May-July 2009; NMFS unpublished data). In 2010, the total count for the Channel Islands was just under 5,000 individuals (Carretta et al. 2013). Koski et al. (1998) provided estimates of 914, 2,860, 927, and 2,065 harbor seals in the Point Mugu Sea Range in winter, spring, summer, and autumn, respectively. Lowry et al. (2008) counted 3,878 and 4,344 harbor seals hauled out at the Channel Islands in 2002 and 2004 respectively, with 584 and 784 on San Nicolas in those same years (Figure 6).

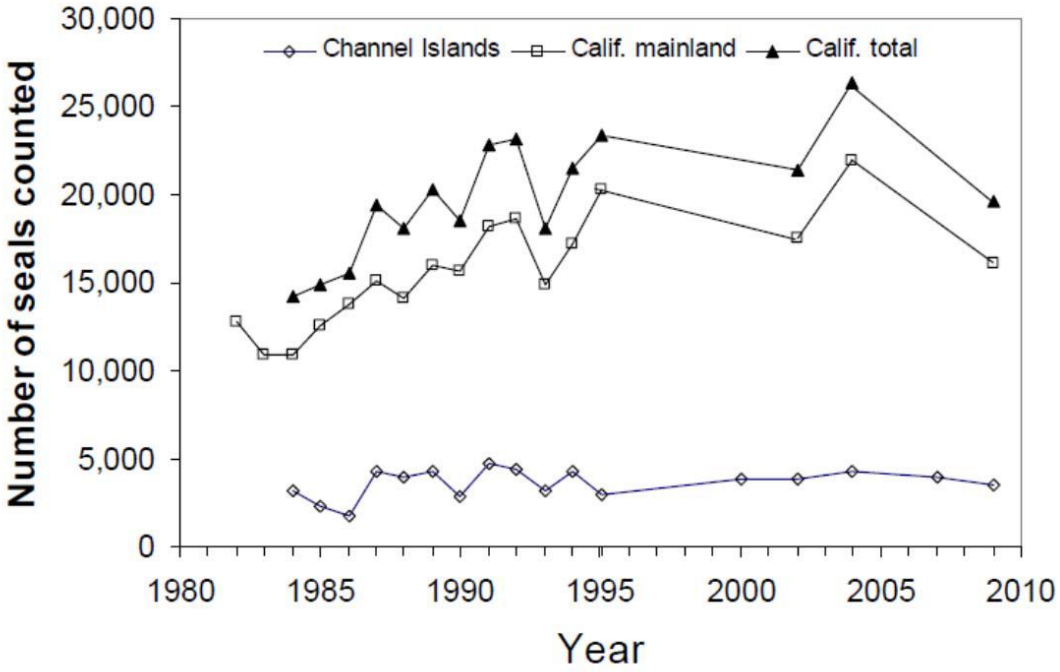

Figure 6. Harbor seal haul-out counts in California during May/June (Hanan 1996; R. Read, CDFG unpubl. data; Lowry et al. 2008, NMFS unpubl. data from 2009 surveys). From Carretta et al. (2013).

The California population of harbor seals increased between 1981 and 2004, but this increase has slowed since 1995 (Figure 6, Carretta et al. 2013). The net productivity rate may be decreasing; from 1983–1994, the rate averaged 9.2 percent (Carretta et al. 2013). Hanan (1996) noted that southern California has the lowest mean annual population growth rate of the three regions (i.e., southern, central, and northern) within California; for California, the realized rate of increase from 1982–1995 was 3.5 percent (not taking into account fisheries mortality), and for southern California, it was 1.9 percent. Hanan (1996) reported that the overall population within the Point Mugu Sea Range is relatively stable. This indicates that either harbor seal populations may be approaching the carrying capacity of the environment (Hanan 1996; Carretta et al. 2013), or harbor seals are being displaced by northern elephant seals (Mortenson and Follis 1997). Populations of the latter species are expanding into areas that were previously occupied solely by harbor seals. Hanan (1996) noted that, on islands where elephant seal populations had increased, harbor seal populations remained stable or declined; until 1996, reproductive rates were -1.2 percent per year at San Miguel Island, 0.02 percent at SNI, and -1.0 percent at Santa Barbara Island. On islands where elephant seals were not found, harbor seal populations continued to

grow; until 1996, reproductive rates were +11.2 percent per year at Santa Catalina Island and +5.7 percent at Santa Cruz Island.

At SNI, harbor seal abundance has shown a generally increasing trend since the early 1960's. The mean annual increase from 1982–1995 was 0.02 percent (±0.036 SE; Hanan 1996). Counts from 1975 to 2012 fluctuated between 128 and 858 harbor seals based on peak counts (Figure 7, Le Boeuf, et al., 1978, Fluharty, 1999 and Lowry, et al., 2008 and pers. comm.). During May-July 2002, 2004, 2007, and 2009, 584, 784, 858 and 754 harbor seals were hauled out on SNI respectively, representing between about 15 and 18 percent of the harbor seals in the Channel Islands (Lowry et al., 2008). The SNI harbor seal population may be approaching carrying capacity. Alternatively, Stewart and Yochem (1994) hypothesized that counts may not always reflect the true population; seals may be spending more time at sea feeding and/or part of the population may have changed its haul-out behavior and may be hauling out at night.

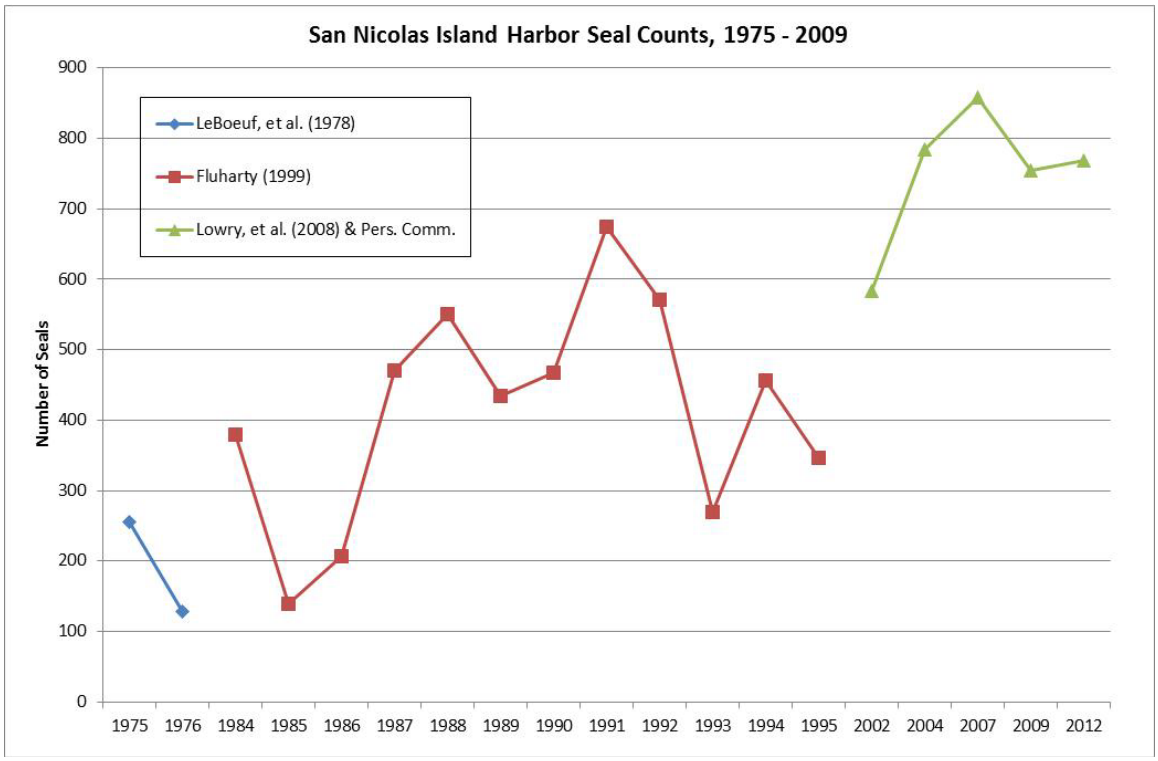

Figure 7. Counts of harbor seals at SNI, 1975–94. Data from 2009 and 2012 aerial counts are from Lowry, pers. comm.

On SNI, most harbor seals haul out at several specific traditionally used beaches and onshore and offshore ledges and reefs (Figure 8). Lowry and Carretta (2002) noted 17 different haul-out sites at SNI in 2002, with a mean of 34.3 seals per haul-out site. The greatest number of seals (154) was hauled out at Pirate's Cove (Figure 8; Lowry and Carretta 2002). Stewart and Yochem (1984) reported that harbor seals hauled out and gave birth at seven sites and used 13 others sporadically. Sites 231 (Sea Lion Cove) and 266 (Dutch Harbor) were the most consistently used haul-out sites throughout the year, and site 270 (Pirate's Cove) had significant numbers of seals during the pupping and molting periods (Figures 8 and 9). Two of these sites (231 and 270) were also the most heavily used sites during the 1975–78 surveys of Bonnell et al. (1981).

The latter site is still used heavily (e.g., NAWCWD 1996; Holst et al., 2008; Lowry and Carretta 2002). During 2001–2012, Navy biologists monitored 11 different haul-out sites on western SNI during missile launches; the greatest number of animals seen at any one site exceeded 80 individuals at Phoca Reef (just east of site 270) on 29 July 2004 (Holst et al., 2005).

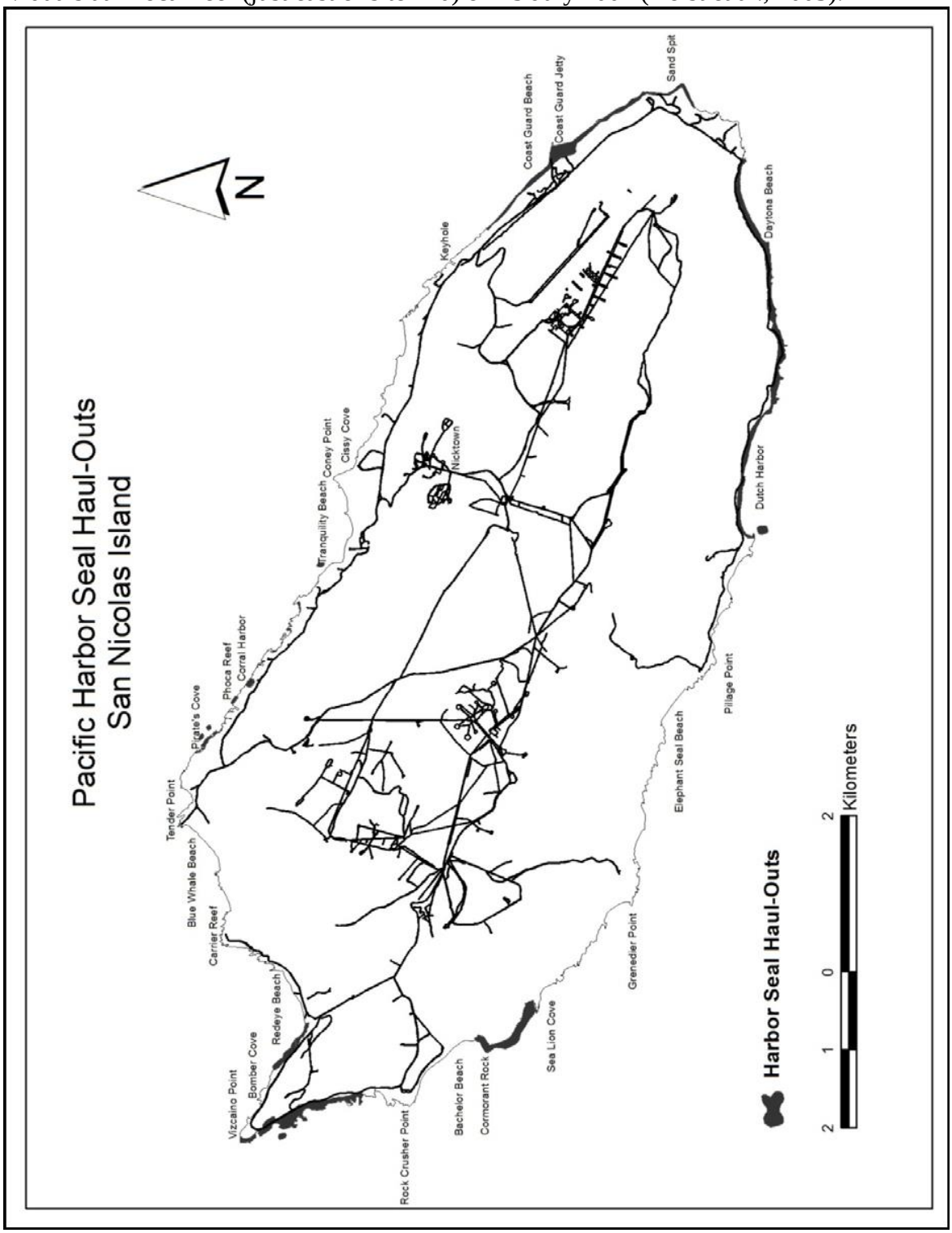

Figure 8. Map of SNI showing beaches on which harbor seals are known to haul out. Updated in 2013 by J. Ugoretz (NAWCWD, pers. comm.).

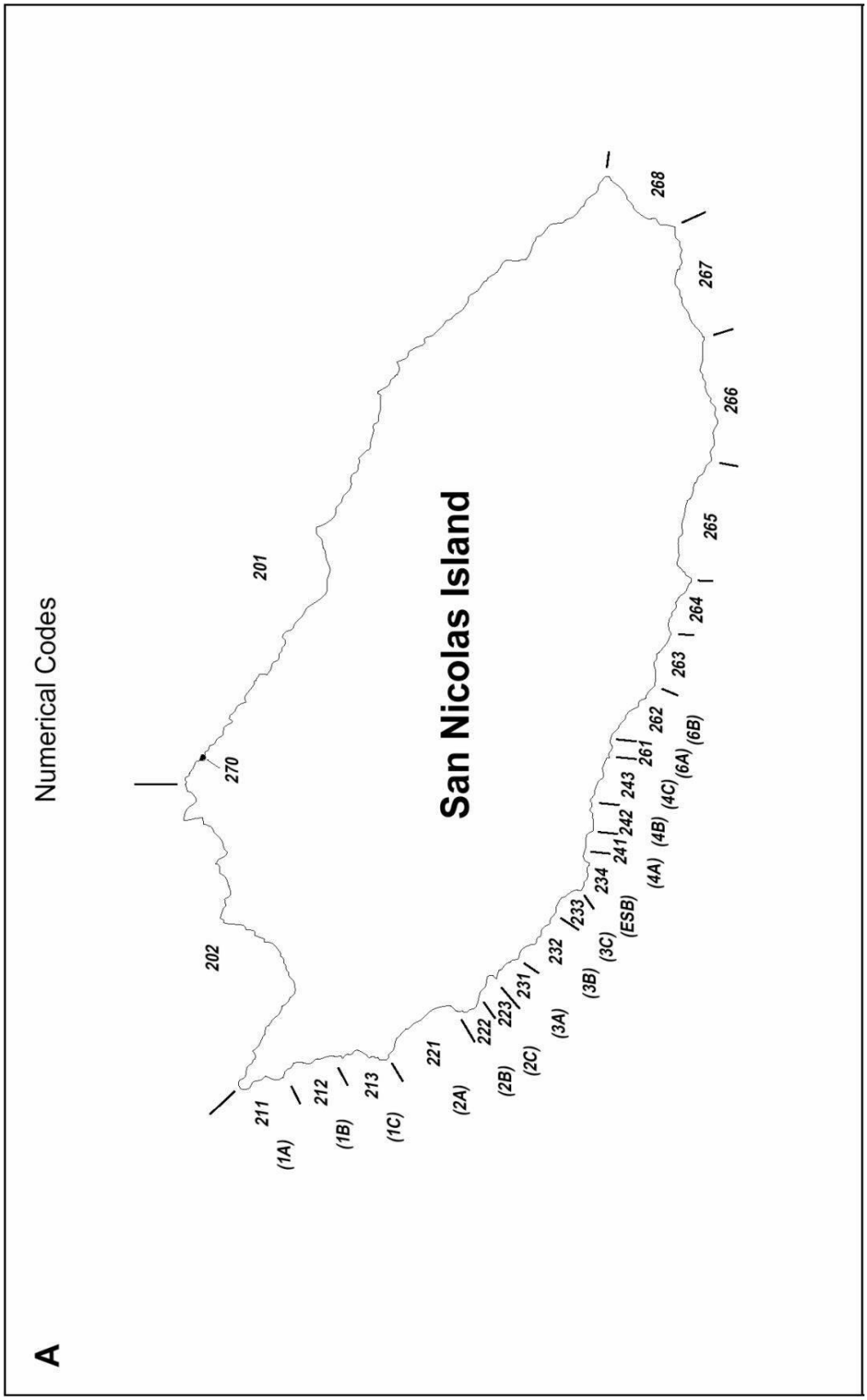

Figure 9. SNI census areas and associated numerical codes used by Stewart and Yochem (1984) to identify census areas

Harbor seals remain near their terrestrial haul-out sites and frequently haul out on land throughout the year, at least for brief periods (Figure 10). However, at most haul-out sites, large numbers of seals are seen on land only during the pupping, nursing, and molting periods. In southern California, the harbor seal pupping period extends from late February to early April, with a peak in pupping in late March. The nursing period extends from late February to early May; females and pups haul out for long periods at this time (Figure 10). The molting period is in late May to June, and all ages and sexes of harbor seals haul out at this time. Further details of the general biology of harbor seals are described in Section 3.7.2.3 of the Marine Mammal Technical Report (Koski et al., 1998) accompanying the Navy's 2002 FEIS/OEIS (NAWCWD, 2002).

During August to February, smaller numbers of seals are seen hauled out at any given time. Due to differences in timing of the molt by different age and sex groups, and due to differences in haul out patterns of different individual seals, not all seals are hauled out at the same time, even at the peak of the haul-out season. Thus, peak counts represent, at most, 65–83 percent of the individual seals that use a haul-out site (Huber, 1995; Hanan, 1996). During winter, when seals spend most of their time feeding at sea, the number of seals hauled out at most sites is approximately 15 percent of the maximum count during the peak of haul-out (i.e., 10–12 percent of those using the site). The typical seasonal pattern is reflected in harbor seal counts on SNI (Figure 11).

There is sex and age segregation at many of the sites, although there are no specific data of this type for western SNI sites. Some sites are used primarily by adult females and pups, others by weaned pups and juveniles, and still others by adult and subadult males. Unlike locations farther north where many factors contribute to the daily pattern of haul-out behavior, highest numbers of harbor seals haul out on the Channel Islands during the late afternoon (1500–1600 hours), with other environmental factors apparently causing little variation in haul-out behavior (Figure 12, Stewart and Yochem, 1994).

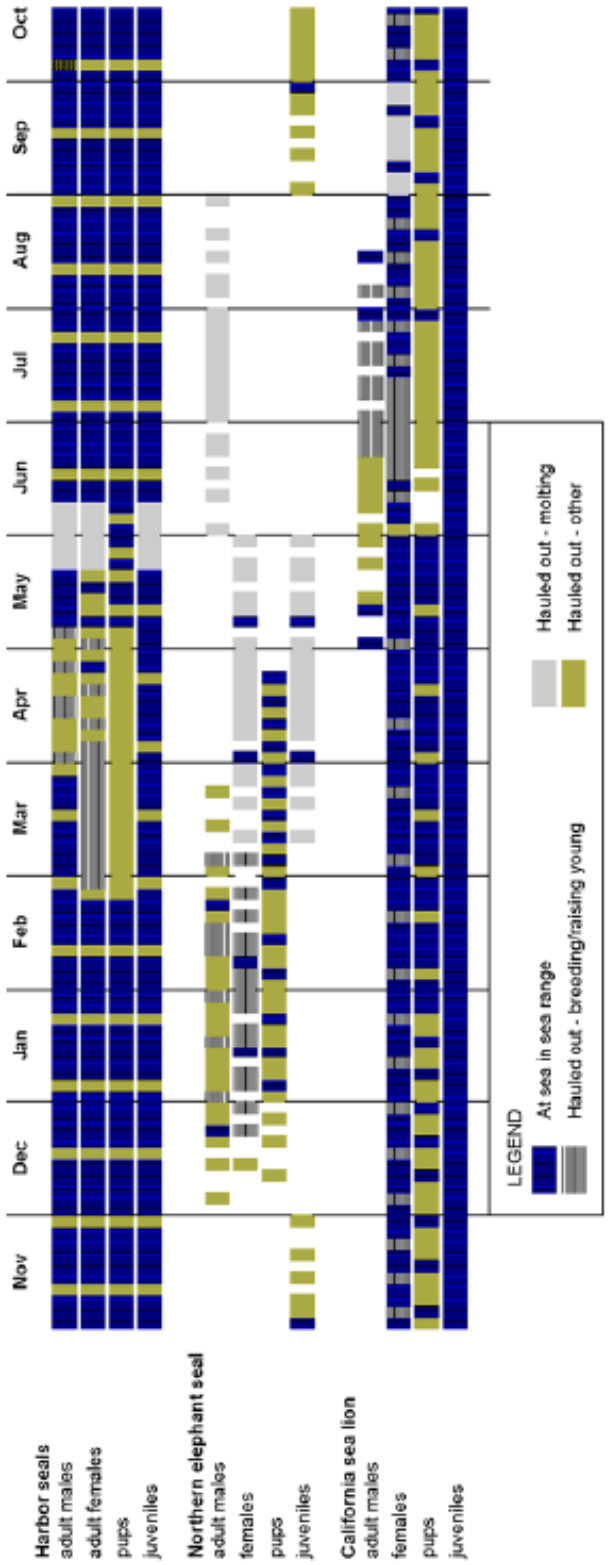

Figure 10. Annual activities of three pinniped species common to SNI. Activities include hauling out on land for breeding, pupping, or molting, and feeding at sea. Gaps in the bars indicate that not all animals are engaged in that activity. The size of the gap indicates approximate proportions of animals or time not engaged in that activity.

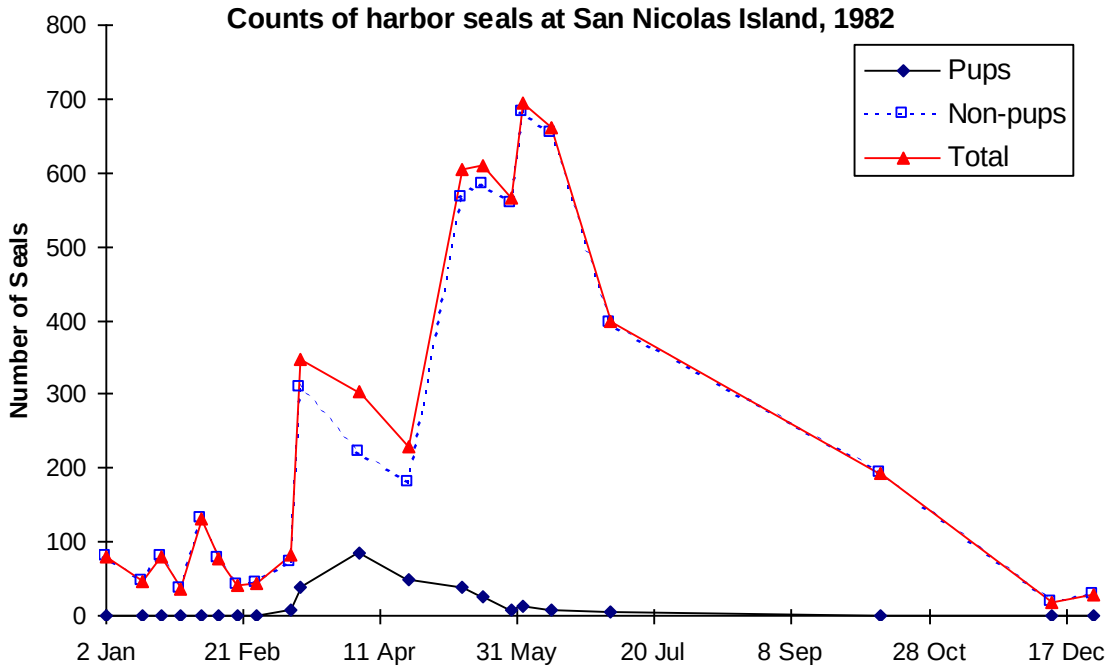

Figure 11. Counts of harbor seals throughout the year on SNI, 1982. From Stewart and Yochem (1984).

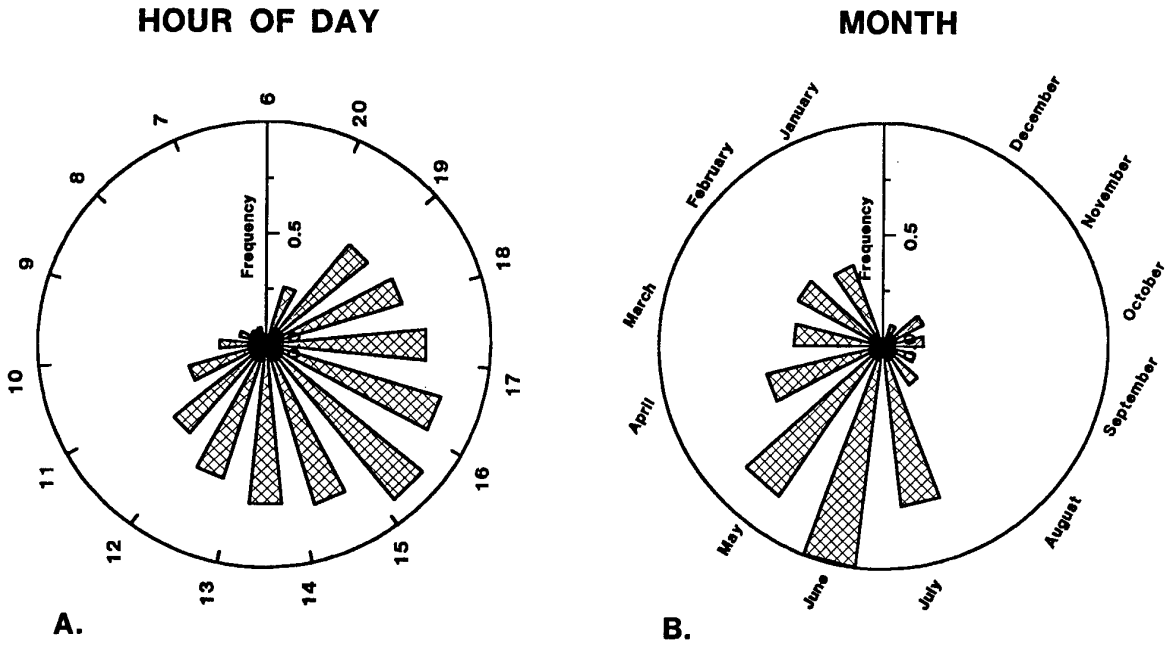

Figure 12. Abundance of harbor seals at terrestrial haul-out sites on the Channel Islands on (A) an hourly basis during the day and (B) a monthly basis during the year. From Stewart and Yochem (1994).

3.2.1.2 Northern Elephant Seal

The northern elephant seal is not listed under the ESA, and the California stock, which occurs on SNI, is not considered a strategic stock under the MMPA. Large and increasing numbers of elephant seals haul out at various sites around SNI, including some on the western part of the island. Over the course of the year, approximately 32,186 elephant seals may use SNI (see Lowry, 2002; Barlow et al., 1993), representing approximately 32 percent of the elephant seals hauling out along all California shorelines. Pupping occurs on the beaches from January to early February, with nursing of pups extending into March. Northern elephant seals also haul out during the molting periods in the spring and summer, and smaller numbers haul out at other times of year.

Historically, northern elephant seals are believed to have hauled out by the thousands along the coast of California and Baja California (Scammon, 1874 cited in Bonnell and Dailey, 1993), but there is little or no documentation of their actual distribution and breeding range before exploitation (Stewart et al., 1993). They were heavily hunted during the nineteenth century and were subsequently reduced to a single breeding colony numbering perhaps as few as 100 animals on Isla de Guadalupe, Mexico (Barlow et al., 1993). Now, northern elephant seals molt, breed, and give birth primarily on offshore islands in Baja California and California. Rookeries are found as far north as South Farallon Islands and Point Reyes (Barlow et al., 1993). The California population is demographically isolated from the Baja California population and is considered to be a separate stock (Carretta et al., 2009).

The California population has recovered from near extinction in the early 1900s and has continued to grow through 2005 (Figures 13 and 14). The population is currently estimated at 124,000 individuals, based on a pup count of 35,549 in 2005 and a 3.5 multiplier (Carretta et al., 2013). In the Channel Islands, including SNI, northern elephant seal abundance has also increased since the mid-1960s (Figure 15; Barlow et al., 1993). Most pups in California are born on the Channel Islands. In 2005, approximately 28,000 pups were born or approximately 79 percent of the total number (35,549) of pups in California (Figure 13; see Carretta et al., 2007). Applying the multiplier of 3.5 times to this pup count (see Barlow et al., 1993; Carretta et al., 2007), the northern elephant seal population in the Sea Range was approximately 98,000 individuals in 2005. Koski et al. (1998) estimated that approximately 26,623, 6,495, 7,409, and 11,356 northern elephant seals are present in coastal and offshore waters of the Sea Range during winter, spring, summer, and autumn, respectively. These estimates exclude the seals that are on land within the Sea Range and those that have migrated outside the Sea Range. These estimates are quite imprecise given the limitations of aerial and ship surveys in detecting elephant seals at sea—elephant seals are below the surface approximately 90 percent of the time (Le Boeuf et al., 1988, 1996; Stewart and DeLong, 1993, 1995). Given that elephant seals forage far away from SNI and the Sea Range, with adult males foraging as far north as the Aleutian Islands, and adult females in the north-central Pacific Ocean, it is unlikely that large numbers are in Sea Range waters at any time.

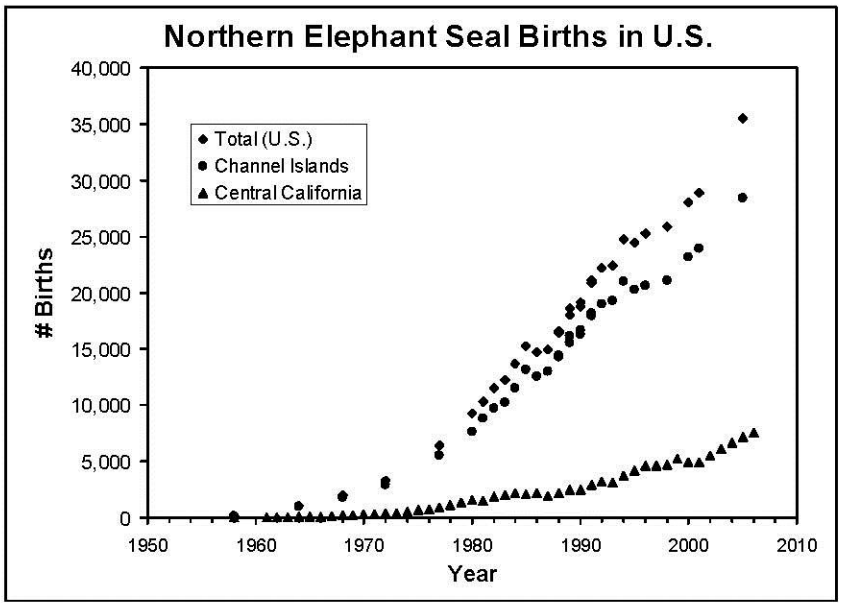

Figure 13. Estimated number of northern elephant seal births in California 1958–2005. Multiple independent estimates are presented for the Channel Islands 1988–1991. Estimates are from Stewart et al. (1994a), Lowry et al. (1996), Lowry (2002) and unpublished data from S. Allen, D. Crocker, B. Hatfield, R. Jameson, B. Le Boeuf, M. Lowry, P. Morris, G. Oliver, D. Lee and W. Sydeman. From Carretta et al. (2007).

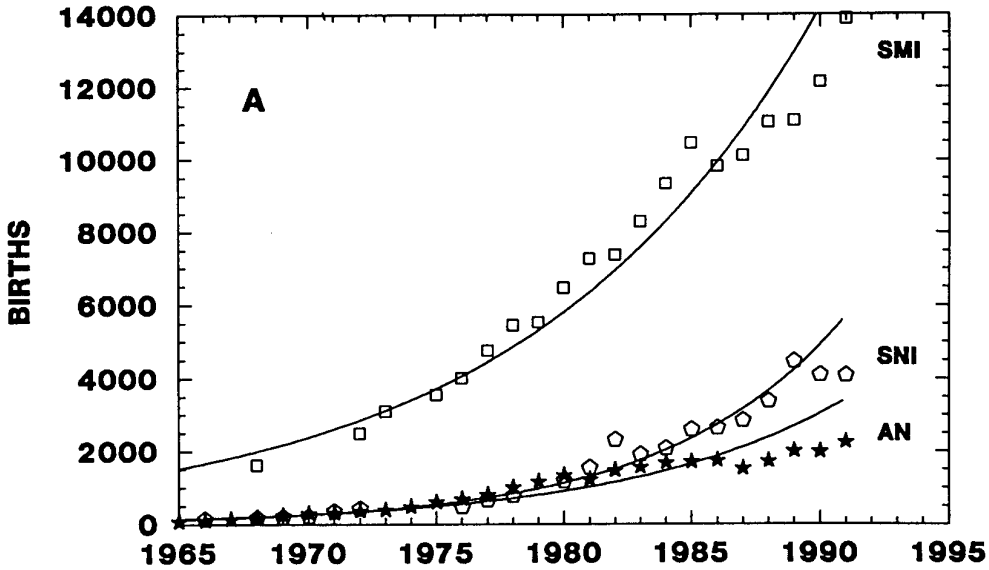

Figure 14. Growth of the northern elephant seal population as indicated by births at San Miguel Island (SMI), SNI, and Año Nuevo Island (AN). From Stewart et al. (1994a).

SNI is currently the second largest elephant seal rookery and haul-out in Southern California. Within the Point Mugu Sea Range, ~67 percent of elephant seals haul out on San Miguel Island, ~32 percent on SNI, and small numbers on Santa Rosa (1 percent), Santa Cruz, Anacapa, and Santa Barbara islands. Surveys for northern elephant seals at SNI have been conducted by NMFS' Southwest Fisheries Science Center (SWFSC) since 1988. Surveys take place during the peak of the breeding season (when numbers ashore are greatest) in late January to early February, and late in the breeding season in mid-to-late February. Total counts on the island for

the years 1988–2010 are given in Table 2. Table 3 presents the numbers of pups counted during the late breeding season for the years 2000-2010 in each count area (Figure 15). Pup counts are used to estimate total elephant seals hauled out for the purpose of impact analysis in Section 7.7.1 below. The numbers in these tables only provide an estimate of the total number of seals using each haul-out site because:

- only part of the breeding population is present at the rookeries even during the peak of the breeding season (some early-arriving adult females have already departed), and
- there is different timing of occupation of the haul-out sites by different age and sex cohorts during different haul-out phases (see Figure 10).

Table 2. Counts of northern elephant seals at SNI obtained from aerial color photographs 1988 – 2010 (augmented with visual counts from sites that were not photographed during the survey). From Lowry et al. (1996), Lowry (2002), and Lowry, pers. comm.

	Pups			Subadults and Adults			
Survey Date	Alive and Unk.	Decomposed Carcasses	Juveniles	Adult Female[1]	Subadult & Adult Male	Unk. Sex	Total Live
Peak season							
28 Jan 1989	4,124	50	16	4,313	549	3	9,005
3 Feb 1990	4,092	55	5	3,439	475	3	8,014
2 Feb 1991	4,053	67	2	4,019	502	0	9,026
3 Feb 1992	5,482	78	5	4,745	634	1	10,867
29 Jan 1993	4,940	63	23	4,878	554	0	10,395
28 Jan 1995	5,218	62	27	6,232	724	0	12,201
29 Jan 1996	5,306	49	15	5,853	638	0	11,812
29 Jan 2010	9,808	172	6	9,537	1,084	0	20,435
Late season							
15 Feb 1988	3,120	34	0	1,732	430	0	5,282
16 Feb 1989	4,688	63	0	1,649	537	0	6,874
19 Feb 1990	4,079	52	2	976	425	2	5,475
18 Feb 1991	4,547	51	3	1,316	469	0	6,335
17 Feb 1992	5,387	63	1	1,614	575	0	7,356
15 Feb 1993	5,171	37	8	1,973	602	0	7,754
13 Feb 1994	5,727	63	7	2,998	648	3	9,383
15 Feb 1995	6,486	89	2	3,590	673	0	10,751
23 Feb 1996	6,188	44	0	1,237	569	0	7,994
13 Feb 1998	6,200	167	8	3,856	595	0	10,659
11 Feb 2000	9,713	81	2	7,560	667	0	17,942
16 Feb 2001	9,121	75	2	4,111	647	0	13,881
25 Feb 2005	9,591	174	1	910	799	0	11,301
17 Feb 2010	10,089	211	2	2,838	929	0	13,858

1 The count of adult females may contain an extremely small percentage (estimated to be ≤1%) of males that are of similar size as adult females.

Table 3. Counts of northern elephant seal pups during the late breeding season, 1998–2010. Figure 16 shows the locations of count areas (A-Q). All seals were counted from aerial photographs (Lowry, 2002 and Lowry, pers. com.).

	Count Area																
Year	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
2000	820	349	1591	1423	970	804	438	539	619	577	1029	22	305	52	2	0	173
2001	889	126	1617	1411	863	735	552	427	666	326	1112	6	227	37	5	0	122
2005	1186	106	1091	1019	839	709	666	337	606	372	1120	13	522	99	60	1	845
2010	1103	111	1227	990	813	631	575	265	471	227	818	10	712	306	237	247	1346

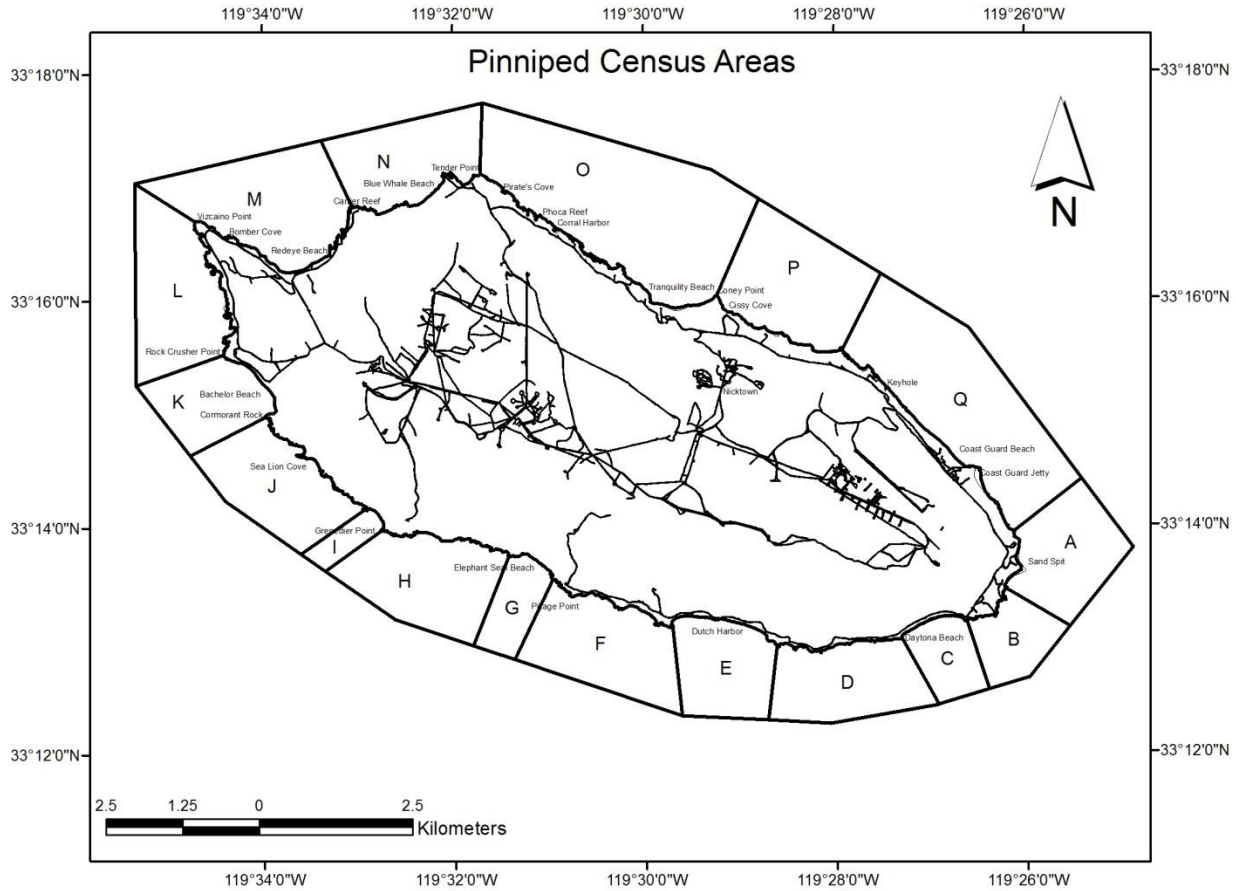

Figure 15. Census areas on SNI and associated alphabetic codes used by Lowry (NMFS) to identify census areas.

The total count of elephant seals at SNI for 2010 was 20,435; the total pup count was 10,453 (Lowry, pers. comm.). The southern coast has the greatest numbers of elephant seals, with areas C, D, and K being the most populated areas on the island (Figure 15). A multiplication factor of 3.5 times the annual pup production can be used to estimate the size of growing elephant seal populations (Barlow et al. 1993). Based on this, an estimated 36,585 seals of all ages and both sexes used SNI over the course of the year in 2010. This represents ~30 percent of the California stock.

From 1988 to 1995, the pup counts on SNI increased at an average rate of 15.4 percent per year (Figure 14). From 1988 to 2001, the number of births increased at an average annual rate of 7.3 percent (Lowry 2002). However, the growth rate of the California population as a whole appears to have slowed in recent years. For all of California, the rate of growth was 14.9 percent for 1964 to 1979, 10.2 percent for 1980 to 1985, and 8.41 percent for 1987 to 1991; slopes for these periods are significantly different (Barlow et al. 1993). It is possible that the elephant seal population is approaching the carrying capacity of its environment. If so, the continued high rate of increase on SNI, while other populations are growing more slowly or stabilizing, suggests that suitable haul-out habitat, rather than abundance of food, is limiting population growth elsewhere, because animals from the different haul-out sites all feed in the same general area. This theory is also supported by the observed expansion of rookery sites and occupation of formerly unused

sites on SNI (Lowry 2002; G. Smith, NAWCWD, pers. comm.). Elephant seals began using Daytona Beach (area C) as a pupping area in 1988 when 144 elephant seal pups were born there (Lowry 1995 *in* NAWCWD 1996); in 2001, ~1,617 pups were born there (Lowry 2002). During 2001–2012 Navy biologists monitored elephant seals during missile launches at 11 locations on SNI, including areas J, K, L, M, and O; the greatest number of seals observed exceeded 1,000 at Bachelor Beach in area K during the molt (May 5, 2004) and during the breeding/pupping season (January 27, 2005) (Holst et al., 2005).

Northern elephant seals haul out at beaches twice annually along almost the entire shoreline of SNI, except the north side (Figure 16): once to breed and give birth, and a second time to molt. They prefer gradually sloping, sandy beaches, or sand spits. If sandy beaches are not available, they will haul out on pebbles, or as a last resort, on boulders and rocky shores.

Adult northern elephant seals spend from 8 to 10 months at sea and undertake two annual migrations between haul-out and feeding areas (Stewart and DeLong, 1995). Their movements between these areas are rapid. They spend little time in coastal or nearshore waters, as evidenced by the relatively few sightings during marine mammal surveys of these areas. They haul out on land to give birth and breed and after spending time at sea to feed (postbreeding migration), they generally return to the same areas to molt (Odell, 1974; Stewart and Yochem, 1984; Stewart, 1989; Stewart and DeLong, 1995). However, they do not necessarily return to the same beach. In the South Farallon Islands, female northern elephant seals often molt on one island and breed on another (Huber et al., 1991). After molting, they undertake a second prolonged foraging migration. Elephant seal activities while hauled out are described in greater detail in Section 3.7.4.3 of the Marine Mammal Technical Report (Koski et al., 1998) accompanying the Navy's 2002 FEIS/OEIS (NAWCWD, 2002).

While at sea, elephant seals are usually found well offshore and north of SNI. Females feed between 40º and 45º north latitude, and males range as far north as the Gulf of Alaska (Stewart and DeLong, 1995). Pups are weaned and abandoned on the beaches when they are about one month old (Odell, 1974; Le Boeuf and Laws, 1994); they go to sea at one to three months old.

The timing of haul-out by various age and sex categories of seals is shown in Figure 10 and is reflected in the bi-modal peak pattern in the counts of hauled-out elephant seals on the island (Figure 17). Haul-out for the breeding season starts in early December with the arrival of adult males. Older bulls tend to arrive the earliest. By the end of December, all bulls are hauled out at the rookeries. Elephant seals are highly polygynous. Males establish a dominance hierarchy and defend harems on the beach during the mating season. Vocalization is important in maintaining social structure and appears to be greatest following sunset (Shipley and Strecker 1986). Pregnant females begin to arrive in mid-December and peak numbers are present at the end of January and in early February. Numbers of females then begin to decline until the first week in March when they have left the rookery. Younger adult males begin to leave the rookery in late February, but some of the older males remain there until late March (Clinton, 1994).

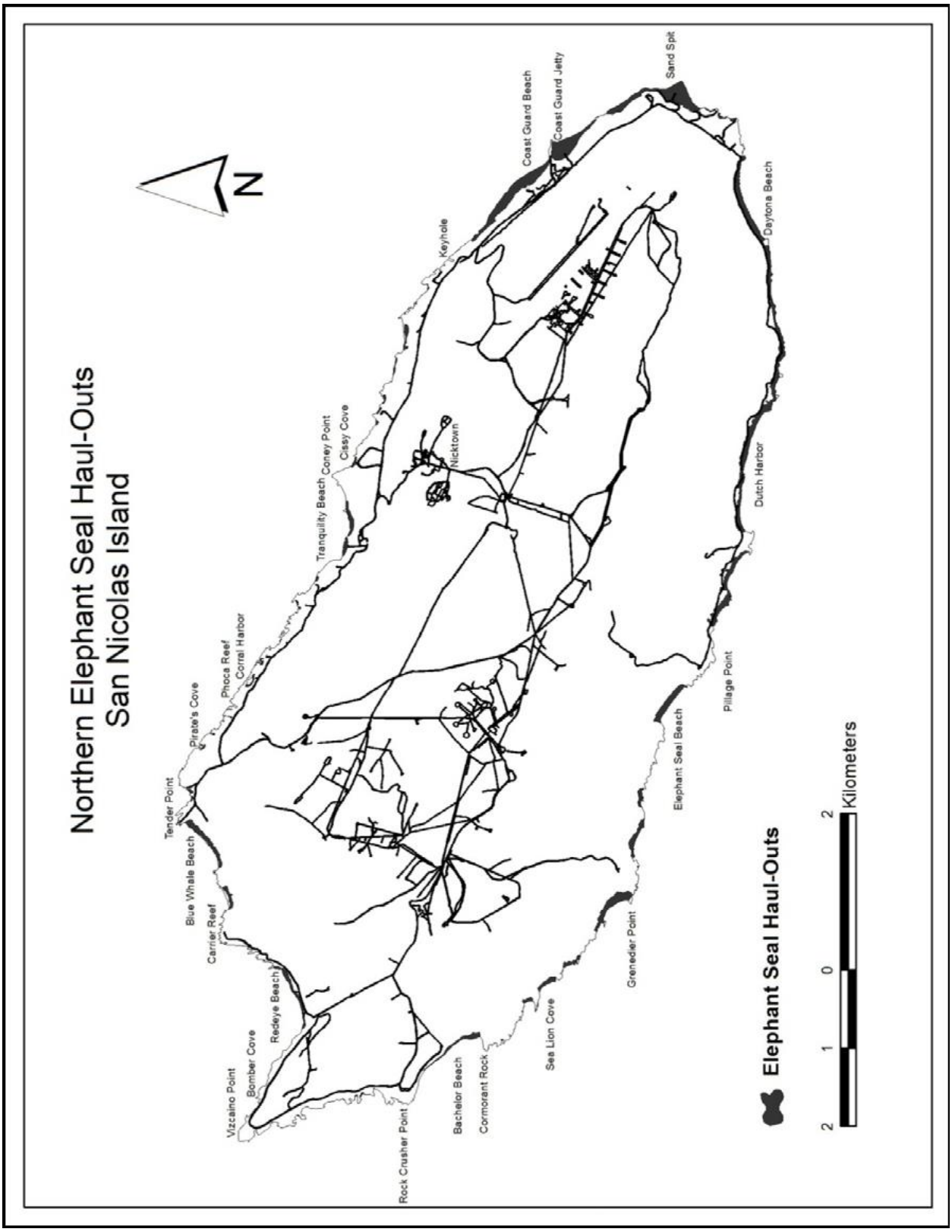

Figure 16. Map of SNI showing beaches on which northern elephant seals are known to haul out. From Lowry et al. (1992) and updated in 2000 by G. Smith (NAWCWD, 2008).

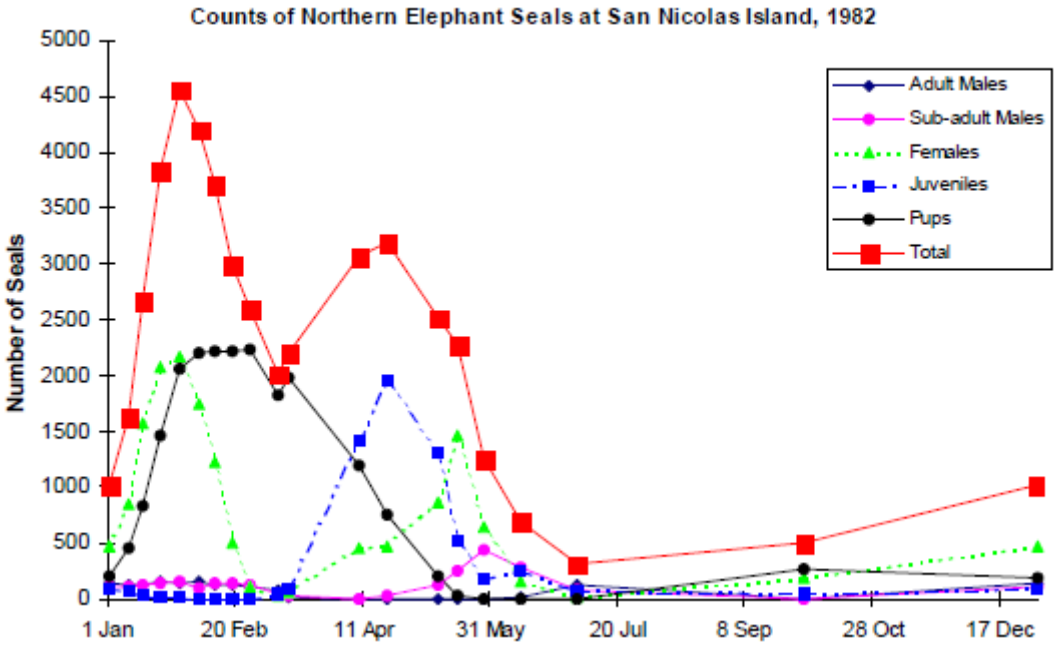

Figure 17. Counts of northern elephant seals throughout the year at SNI, 1982. Plotted from Table 1 in Stewart and Yochem (1984).

Females have their pups shortly after arriving at the rookery. Pupping occurs from the third week in December until the end of the first week in February. Pups are weaned at 24–28 days old, and they are abandoned on the rookery where they remain for 2–2.5 months. During this period, they undergo their first molt (Le Boeuf and Laws, 1994). Breeding occurs from the first week in January through the first week in March and peaks in mid-February. Females return to sea to feed once they have bred and their pups have been weaned.

The female and juvenile molt period starts in mid-March and extends through May. Most females that weaned their pups 6–8 weeks earlier return from northern feeding areas to molt. However, some females and juveniles from the Sea Range rookeries apparently molt farther north (i.e., at Año Nuevo) rather than return to their natal rookeries (Le Boeuf and Laws, 1994). The molt takes approximately one month to complete, after which time the animals return to northern feeding areas until the next pupping/breeding season. Juveniles (one to four years old) also molt at this time. By the end of April, 80 percent of pups have left the rookery, and the remainder leaves in May.

The male molt period occurs from June through August when only adult males are present at haul-out sites. These are the same animals that were present at the rookeries during December to March. They return to their breeding rookeries to molt after feeding at sea for three to four months. Unlike the sequence during the breeding season, the younger males arrive at the molting sites first, and the older males arrive later in the summer (Clinton, 1994). The juvenile haul-out phase extends from September through November with pubertal subadult (capable of copulating but not old enough to hold a breeding colony) males arriving in November and remaining until December. The peak of juvenile haul-out is in October and most (except for

pubertal subadult males) have left by the time that adult males arrive in early December (Le Boeuf and Laws, 1994).

3.2.1.3 California Sea Lion

The California sea lion is not listed under the ESA, and the U.S. stock, which occurs on SNI, is not considered a strategic stock under the MMPA. The California sea lion is by far the most common pinniped on SNI. This species hauls out at many sites along the south side of SNI and at some sites on the western part of the island. Over the course of the year, over 100,000 sea lions use SNI. Pupping occurs on the beaches from mid-June to mid-July. Females nurse their pups for about eight days before beginning an alternating pattern of foraging at sea vs. attending and nursing the pup on land; this pattern may last for eight months (with some pups nursing up to one year after birth). California sea lions also haul out during the molting period in September, and smaller numbers of females and young animals haul out during most of the year (Figure 10).

The California sea lion is a distinct species, separated from the Galapagos sea lion (*Z. wollebaeki*) and the extinct Japanese sea lion (*Z. japonicus*) (Brunner 2003, Wolf et al 2007, Schramm et al. 2009). *Z. californianus* is subdivided into three stocks (U.S., Western Baja California, and Gulf of California) based on genetic differences and geographic separation. Although there has been some interchange between the U.S. and Western Baja California populations, the breeding locations are far apart, and they are considered separate stocks for management purposes. Most of the U.S. stock (more than 95 percent) breeds and gives birth to pups on San Miguel, San Nicolas, and Santa Barbara islands. Smaller numbers of pups are born on San Clemente Island (southeast of SNI) and the Farallon Islands and Año Nuevo Island, north of SNI (Carretta et al. 2007).

The California sea lion is the most commonly sighted pinniped species at sea near SNI. Sea lions made up 84 percent (2,137 of 2,538) of identified pinniped sightings at sea during previous studies (see Koski et al., 1998). They have been sighted during all seasons and in all areas with survey coverage from nearshore to offshore areas.

Bonnell and Ford (1987) analyzed survey data from 1975–1978 to describe the seasonal shifts in the offshore distribution of California sea lions. They attributed these seasonal changes in the center of distribution to changes in the distribution of the prey species. If California sea lion distribution is determined primarily by prey abundance, these same areas might not be the center of sea lion distribution every year.

The distribution and habitat use of California sea lions vary with the sex of the animals and their reproductive phase. Adult males haul out on land to defend territories and breed from mid-to-late May until late July. Individual males remain on territories for 27–45 days without going to sea to feed.

During August and September, after the mating season, the adult males migrate northward to feeding areas as far away as Washington (Puget Sound) and British Columbia (Lowry et al., 1992). They remain there until spring (March to May), when they migrate back to the breeding colonies. Thus, adult males are present in areas offshore of SNI only briefly as they move to and from rookeries.

The distribution of immature California sea lions is poorly known but some make northward migrations that are shorter in length than the migrations of adult males (Huber, 1991). However, most immature animals are presumed to remain near the rookeries and thus remain in or near the Channel Islands (Lowry et al., 1992).

Adult females remain near the rookeries throughout the year. They return to the rookery to give birth to their pups and breed. Most births occur from mid-June to mid-July (peak in late June). Females nurse their pups for about eight days before going to sea to feed for two days. Subsequent feeding trips range from 1.7–3.9 days in duration, and subsequent nursing periods are 1.7–1.9 days long. Females mate two to four weeks postpartum, usually in the water or at the water's edge. Weaning has been reported to occur at four to eight months (Lowry et al., 1992) and 10–12 months (Ono, 1991), but there have been records of females nursing yearling pups. Pups begin to forage on their own when about seven months old to supplement their mother's milk.

The entire population cannot be counted directly, because different age and sex classes do not come ashore at the same time or places. The size of the sea lion population is estimated by:

- counting pups late in the breeding season,
- multiplying pup counts by 1.15 to account for 15 percent pup mortality between birth and the counting period, and
- multiplying the number of pups by 4.317 to account for other age and sex components of the population (see Carretta et al., 2013).

In 2008, 59,774 pups were counted in California; this number was adjusted for a 15 percent mortality rate and the percentage of pups in the population to come up with an estimate of 296,750 (Carretta et al. 2013). California sea lion populations have increased steadily since 1950 (Carretta et al. 2007 and 2013). For the U.S. stock of California sea lions, the number of pups showed an annual increase of 5.4 percent between 1975 and 2008, when pup counts for El Niño years (1983, 1984, 1992, 1993, 1998, and 2003) – which caused substantial reductions in numbers of pups produced and in counts of non-pups at the rookeries – were removed from the 1975-2005 time series (Figure 18; Carretta et al. 2013). In contrast, the population on SNI increased at nearly 6.8 percent per year during 1975-2011 (M. Lowry, pers. comm.). In 2000, the largest sea lion rookery in the U.S. was SNI with 24,167 pups counted (Lowry and Maravilla-Chavez, 2005).

Barlow et al. (1997) reported that 47 percent of the U.S. stock or 49 percent of the Point Mugu Sea Range population used the shoreline of SNI to breed, pup, or haul out in 1994. Based on extrapolations from a total count of 29,052 pups at SNI for 2008 (Table 4) and assuming that about half of the U.S. stock hauls out at SNI, more than 100,000 sea lions of all ages and sexes might be associated with the haul-out sites and rookeries on SNI over the course of the year. At the peak of the breeding season, about half of these animals may be hauled out on land at one time (see below).

The population of California sea lions at SNI generally grew from 1975–2011 with inter-annual variability (Figure 19 and Table 4). Sea lions have occupied new areas on SNI over the last several years. During the 1980s, California sea lions were rarely found east of Elephant Seal Beach, but now, they are found on most beaches along the entire southern shore and east and west ends of the island (Figure 20). Sea lions were counted in all but two survey areas in 2007, 2008, and 2011 ("O" and "P") and all but three survey areas ("N", "O", and "P") since 2000 (Table 4). To date, there is no indication that California sea lions on SNI have reached the carrying capacity of the surrounding habitat, except during El Niño years when sea lions may have to spend more time feeding and may have to forage farther from rookeries. During 2001–2012 launch monitoring at SNI (Holst et al. 2005a, 2008; Ugoretz and Greene, 2012), the greatest number of sea lions seen at any one site exceeded 1,000 individuals towards the end of the breeding season (July–August) in 2005 in area L.

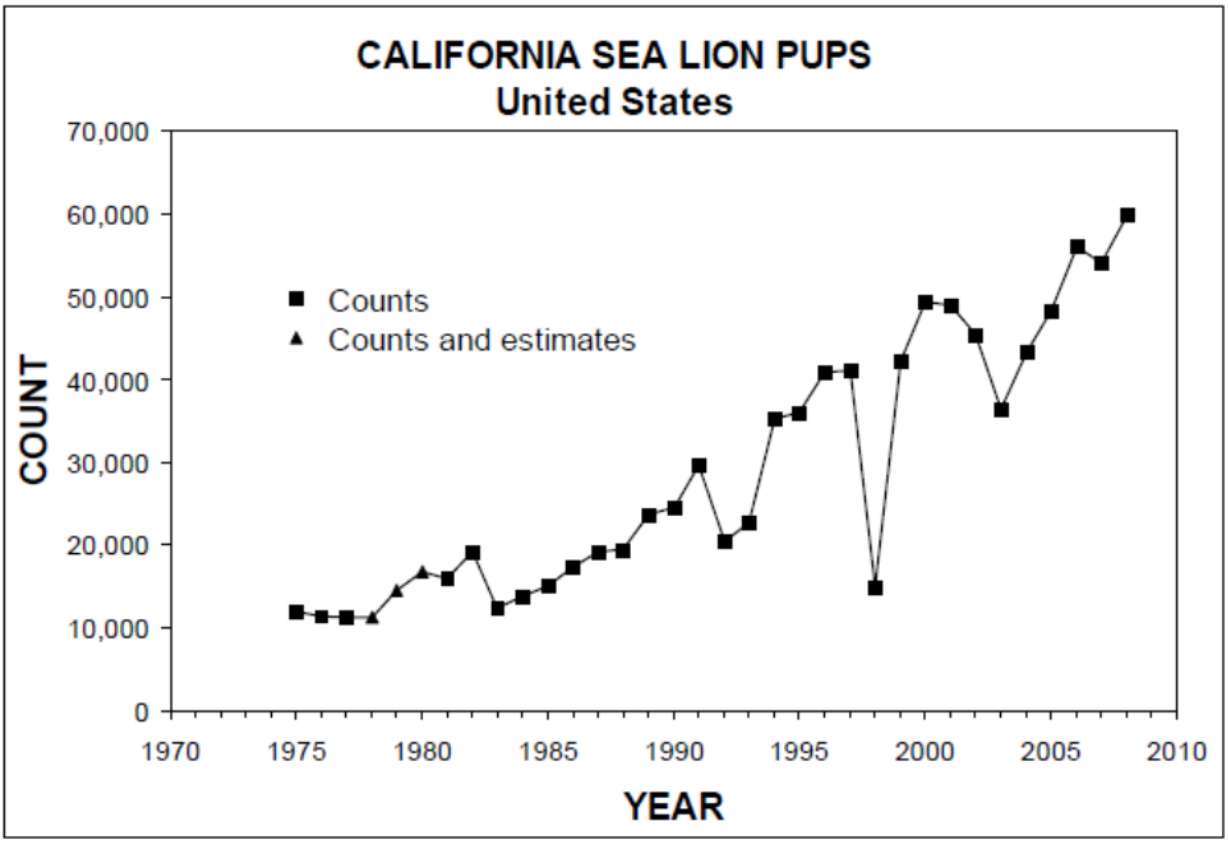

Figure 18. U.S. pup count index for California sea lions (1975–2008). From Carretta et al. (2013).

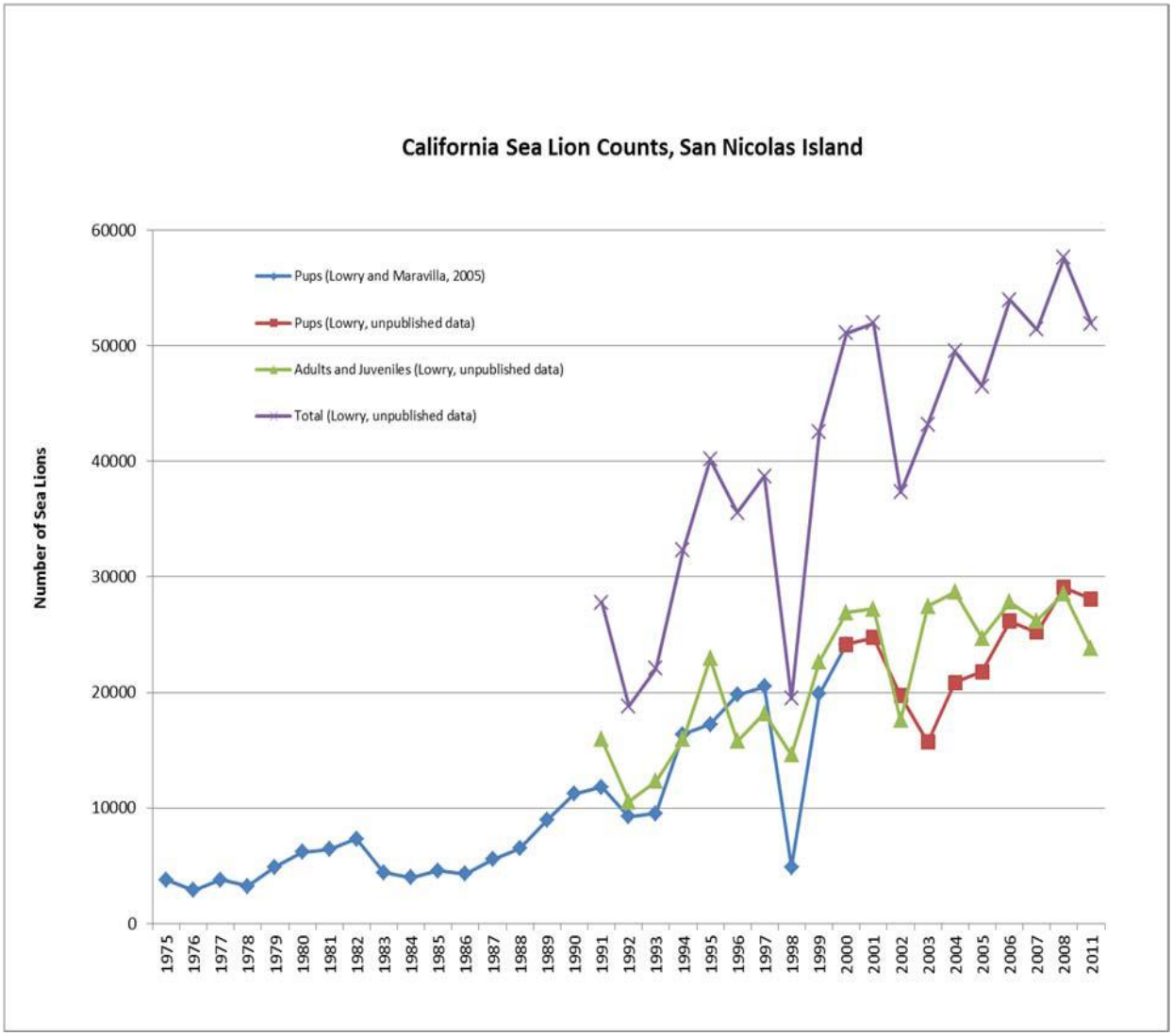

Figure 19. Counts of California sea lions at SNI, 1975–2011. No data from 2009, 2010. Plotted from Table 3 in Lowry and Maravilla-Chavez (2005) and Lowry unpublished data.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2011
Subdivision									
A	926	412	1121	1342	829	756	870	848	1389
B	551	494	638	518	599	842	984	1017	1115
C	1547	1121	1613	1543	903	1304	1537	1338	1478
D	5529	4702	5108	7080	7369	8049	8028	8289	7409
E	2165	1409	1691	2035	1734	2143	2164	2377	2443
F	5900	4532	4561	5033	4530	5572	5131	5396	4741
G	874	691	974	1140	832	1182	1306	1473	1069
H	9881	7206	7326	8406	7893	9282	8865	9504	8066
I	3829	2864	3131	3415	2850	3236	2968	3253	2572
J	7027	5076	5889	6264	6123	7054	6384	7059	5975
K	683	376	625	518	255	480	426	545	289
L	7607	5541	5759	7655	8599	9461	8205	9967	8843
M	2860	1580	2414	2971	3030	3699	3339	4284	3764
N	0	0	0	0	0	0	2	2	6
O	0	0	0	0	0	0	0	0	0
P	0	0	0	0	0	0	0	0	0
Q	2584	1315	2320	1603	954	895	1188	2260	2743
Total	51963	37319	43170	49523	46500	53955	51397	57612	51902

Table 4. Total counts of California sea lions at SNI in July (during late breeding season), 2001-2011. Figure 14 shows the locations of areas A to Q. Data are from Lowry (unpublished data).

3.3 Socioeconomic Environment

Socioeconomic resources found in and around the Point Mugu Sea Range include recreation, tourism, commercial shipping, commercial and sport fishing, and military activities. A full description of these resources is addressed in Section 3.12 of the Navy's 2002 FEIS/OEIS (NAWCWD, 2002). That information is incorporated herein by reference. The socioeconomic environment in the vicinity of the Point Mugu Sea Range is briefly summarized below. Impacts to the social and economic environment on SNI are expected to be insignificant, as the Navy's proposed missile launch activities there are generally confined to military personnel and contractors. All development on the island is considered military-support or open space. The

island has one minor population center, Nicktown, which is located on the north side of the island. No permanent residences are established on the island; however, approximately 200 people live as part-time residents at Nicktown.

Military Activity

Military activities are conducted throughout the Point Mugu Sea Range. Naval restricted areas are located at Navy-owned SNI out to 3 nautical miles. These areas are used on an "as-required" basis only, and public access is restricted only at those times when military exercises are being conducted.

Commercial Shipping

Commercial shipping in the Point Mugu Sea Range is dominated by cargo transports, oil tankers, and barges. The Sea Range is used by commercial vessels traveling between northern pacific ports and those situated in southern California. The Sea Range is also transited by vessels to and from the Panama Canal, Indonesia, or other western ports.

Commercial Fishing

Economic activity associated with commercial fishing is compiled by the California Department of Fish and Game (CDFG) through required reporting procedures. Catch totals are reported by commercial fleets within each district. According to the CDFG, in 2012, the three top commercial finfish species by landing in the Santa Barbara area were Pacific sardine (2,121,258 pounds), sablefish (370,908 pounds), and white seabass (207,027 pounds). The total commercial landings for all species brought into the Santa Barbara area in 2012 were valued at over 10 million dollars, with dockside landings totaling almost 7 million pounds (CDFG, 2013).

Recreational Fishing

Southern California is the leading recreational fishing area along the Pacific coast of the U.S. The area encompassed by the Sea Range is fished year round due to favorable prevailing weather and sea conditions. Modes of recreational fishing include shore and pier activities, as well as private and charter boats. Kelp beds and reefs provide opportunities to catch kelp bass, yellowtail, bonito, rockfish, barracuda, and others.

Other Recreational Activities/Tourism

The Channel Islands are used for recreational purposes other than sport fishing (e.g., boating, recreational diving, swimming, bird watching, and whale watching). These activities originate from harbors, coves, and marinas along the mainland coast.

Chapter 4 ENVIRONMENTAL CONSEQUENCES

This chapter outlines the effects or impacts to the aforementioned resources at SNI and the Point Mugu Sea Range from the proposed action and alternatives. Significance of those effects is determined by considering the context in which the action will occur and the intensity of the action. The context in which the action will occur includes the specific resources, ecosystem, and the human environment affected. The intensity of the action includes the type of impact (beneficial versus adverse), duration of impact (short versus long term), magnitude of impact (minor versus major), and degree of risk (high versus low level of probability of an impact occurring).

The impacts on the human environment from the full suite of the Navy's activities in and around Point Mugu, the Point Mugu Sea Range, and SNI, including target and missile launch activities from SNI, were addressed in the Navy's 2002 FEIS/OEIS (NAWCWD, 2002). This EA specifically addresses the environmental consequences of the promulgation of 5-year regulations and the issuance of an LOA for 2014-2019 and the alternatives to that proposed action. A discussion of noise levels at SNI can be found in Section 3.3.4 of the Navy's 2002 FEIS/OEIS, and a description of the characteristics of airborne and underwater noise and the methods of measurement are contained in Appendix D of the FEIS/OEIS (NAWCWD, 2002). Additional discussion on noise impacts on marine resources can be found in the Navy's 2002 FEIS/OEIS, which was reviewed by NMFS as background for this EA, and this EA augments that analysis to specifically address the impacts associated with NMFS' proposed action. Impacts other than noise on atmospheric and biological resources due to missile launch activities, including dispersion of hazardous materials, hazardous wastes, and non-hazardous materials have been addressed in the Navy's 2002 FEIS/OEIS. Please refer to that document for the complete discussion.

The terms "effects" and "impacts" are used interchangeably in preparing these analyses. The CEQ's regulations for implementing the procedural provisions of NEPA, also state, "Effects and impacts as used in these regulations are synonymous" (40 CFR §1508.8). The terms "positive" and "beneficial", or "negative" and "adverse" are likewise used interchangeably in this analysis to indicate direction of intensity in significance determination.

4.1 Effects of Alternative 1 (Preferred Alternative)

Under this alternative, NMFS would promulgate regulations and issue a single 5-year LOA for the same period of regulations to the Navy, NAWCWD, for its missile launch activities at SNI with required mitigation, monitoring, and reporting requirements as discussed in Chapters 5 and 6 of this EA. As part of NMFS' action, the mitigation and monitoring described later in this EA would be undertaken as required by the MMPA, and, as a result, no serious injury or mortality of marine mammals is expected and correspondingly no impact on the reproductive or survival ability of affected species would occur. Affected species are: Pacific harbor seals, California sea lions, and northern elephant seals. No marine mammals listed as threatened or endangered under the ESA are likely to be impacted by either the Navy action or NMFS' proposed action.

4.1.1 Effects on the Physical Environment

4.1.1.1 Marine Mammal Habitat

No impacts to marine mammal habitat are expected from NMFS' proposed action of promulgation of regulations and issuance of the LOA. Overall, the Navy's proposed action, vehicle launch activity, is not expected to cause significant impacts on habitats used by pinnipeds on SNI. Pinnipeds continue to use beaches and other shoreline habitat around SNI, and are expanding their use of some beaches, despite ongoing launch activities for many years. A full description of the effects of the Navy's proposed action on the physical environment can be found in the 2002 FEIS/OEIS (NAWCWD, 2002). Impacts to those aspects of the physical environment relevant to our proposed action (i.e., marine mammal habitat) are summarized below.

During the period of the proposed activity, pinnipeds will use various beaches around SNI as places to rest, molt, and breed. These beaches consist of sand (e.g., Red Eye Beach), rock ledges (e.g., Phoca Reef), and rocky cobble (e.g., Vizcaino Beach). It is anticipated that the only effects will be short-term behavioral disturbance to the pinnipeds themselves. The pinnipeds do not feed when hauled out on these beaches, and the airborne launch sounds directly under the vehicle launch path will not persist in the water near SNI for more than a few seconds. (Vehicle launch noise not directly under the vehicle will be deflected from the water surface and not penetrate the water surface.) Therefore, it is not expected that the launch activities will have any impact on the food or feeding success of marine mammals.

Boosters from vehicles (e.g., JATO bottles for BQM drone vehicles) may be jettisoned shortly after launch and fall on the island but not on the beaches. Fuel contained in these boosters is consumed rapidly and completely, so there would be no risk of contamination even in the very unlikely event that a booster did land on a beach.

4.1.2 Effects on the Biological Environment

4.1.2.1 Effects to Marine Mammals

Potential impacts of the planned vehicle launch operations at SNI (that would be covered under proposed regulations) on marine mammals involve both acoustic and non-acoustic effects. Acoustic effects relate to sound produced by the engines of all launch vehicles, and, in some cases, their booster rockets. Potential non-acoustic effects could result from the physical presence of personnel during placement of video and acoustical monitoring equipment. However, careful deployment of monitoring equipment is not expected to result in any disturbance to pinnipeds hauled out nearby. Any visual disturbance caused by passage of a vehicle overhead is likely to be minor and brief as the launch vehicles are relatively small, move at great speed, and are generally at high altitudes when crossing over haul-outs. There is a small chance that a pup might be injured or killed during a stampede of pinnipeds on the shore during a vehicle launch.; however, this has not been documented in videotaped records of pinniped groups during launches at SNI from 2001-2012 (Holst et al., 2005a, b, 2008; Ugoretz and Greene, 2012), and based on this on-going monitoring, such an impact is not anticipated here.

In order to properly assess the impacts of the proposed action on marine mammals, this section of the EA contains: (1) a summary of noise characteristics and effects; (2) a brief review of pinniped sound production and hearing abilities; (3) a summary of behavioral reactions, the possibility of hearing impairment, and non-auditory physiological responses of pinnipeds to vehicle launches; and (4) take estimates for those species likely to be harassed during Navy missile launch activities.

Noise Characteristics and Effects

The effects of noise on marine mammals are highly variable and can be categorized as described later in this section (based on Richardson et al., 1995). As described in the following subsections, not all of these categories of effect (e.g., hearing damage, stress) will occur as a result of the planned vehicle launches; sound levels are sufficiently low and transitory to make some of these effects unlikely. Some others (e.g., masking) are not expected to occur for sufficient time to cause biologically important effects.

1. The noise may be too weak to be heard at the location of the animal (i.e., lower than the prevailing ambient noise level, the hearing threshold of the animal at relevant frequencies, or both);

2. The noise may be audible but not strong enough to elicit any overt behavioral response;

3. The noise may elicit reactions of variable conspicuousness and variable relevance to the well-being of the marine mammal; these can range from temporary alert responses to active avoidance reactions, such as stampedes into the sea from terrestrial haul-out sites;

4. Upon repeated exposure, a marine mammal may exhibit diminishing responsiveness (habituation), or disturbance effects may persist; the latter is most likely with sounds that are highly variable in characteristics, infrequent and unpredictable in occurrence (as are vehicle launches), and associated with situations that a marine mammal perceives as a threat;

5. Any anthropogenic noise that is strong enough to be heard has the potential to reduce (mask) the ability of a marine mammal to hear natural sounds at similar frequencies, including calls from conspecifics, and underwater environmental sounds such as surf noise;

6. If mammals remain in an area because it is important for feeding, breeding, or some other biologically important purpose even though there is chronic exposure to noise, it is possible that there could be noise-induced physiological stress; this might in turn have negative effects on the well-being or reproduction of the animals involved; and

7. Very strong sounds have the potential to cause temporary or permanent reduction in hearing sensitivity. In terrestrial mammals, and presumably marine mammals, received sound levels must far exceed the animal's hearing threshold for there to be any temporary threshold shift (TTS) in its hearing ability. For transient sounds, the sound level

necessary to cause TTS is inversely related to the duration of the sound. Received sound levels must be even higher for there to be risk of permanent hearing impairment.

Launch Sound

The extremely rapid departure of the missiles means that pinnipeds are exposed to increased sound levels for only very short time intervals (up to 5 s however, durations can be as long as 16 s or shorter than 1 s.). Nonetheless, most launches would be considered to produce prolonged rather than impulsive sounds (unless they produce a sonic boom), as measured durations are typically several seconds long. The sonic booms from some supersonic missile flights are very short, on the order of 0.05 s. However, the definition of duration as the time interval associated with receipt of 90 percent of the cumulative energy (interval between receipt of 5 percent and 95 percent) effectively extends the duration because the propulsion noise following the sonic boom includes a substantial portion of the total energy. Consideration of these longer times results in lower SPLs, because the SPL is an average over the defined duration, including the portion with comparatively low-level sounds. Another measure of each launch sound (SEL) represents the total received energy, and that measure is little-affected by the measurement duration.

During the 2001–2012 period, the strongest sounds originating from a missile in flight over the beaches at SNI were produced by Vandal and Coyote launches (Table 5; Figures 20 and 21). Coyotes are expected to be the primary large missile launched from SNI during the period of applicability of the regulations now sought. SELs during Coyote launches ranged from 115 dBA re 20 μPa2·s (123 dB mpaweighted) near the launcher, to 96–107 dBA (105–114 dB mpa-weighted) at beaches 0.8–1.7 km from the CPA, and 46–87 dBA (60–91 dB mpa-weighted) at CPAs of 2.4–3.2 km (Figure 22; Holst et al. 2008). (All dBA values are referenced to 20 μPa.) Coyotes are launched from an inland location, so no pinnipeds occur near the launcher. The closest pinnipeds to the Coyotes are pinnipeds on beaches directly below the flight trajectory, for which the CPA distance is about 0.9 km. SELs at the same locations were typically higher for Vandals (which will not be launched again from SNI) and lower for smaller missiles (Figures 20 and 21). Stronger sounds were also recorded at the launcher when small or large missiles were launched. Although launches of smaller missiles, such as AGS missiles and slugs, occur from Building 807 Complex near the beach, the closest pinniped haul-outs (elephant seals and California sea lions) are located about 0.3 km from the CPA. Harbor seal haul-outs are located at least 1 km from the CPA of missiles launched from Building 807 Complex.

Table 5. The range of sound levels (maximum in bold) recorded near the launcher and at nearshore locations for all vehicle types launched at SNI from 2001-2008. Units for peak and SPL are in dB re 20 µPa; SEL is shown in dB re 20 µPa^2·s.

	CPA (m)	Peak	SPL-f	SPL-A	SPL-M	SEL-f	SEL-A	SEL-M
Launcher[1]								
AGS Slug	12	**166**	**154**	**143**	**149**	**142**	**130**	**136**
AGS Missile	12-22	157-**165**	148-**156**	133-**143**	139-**150**	136-**143**	122-**131**	127-**137**
RAM	2-4	146-**147**	124-**126**	122-**125**	124-**125**	129-**131**	128-**130**	129-**130**
Vandal	27	**156**	**137**	**119**	**129**	**136**	**118**	**128**
Coyote	72	**142**	**126**	**113**	**122**	**128**	**115**	**123**
Nearshore[2]								
AGS Slug								
Min	1578	104	100	53	75	88	43	62
Max	461-1268	**139**	**133**	**107**	**117**	**120**	**92**	**103**
AGS Missile								
Min	1492-2115	107	97	53	71	90	48	64
Max	265-462	**135**	**126**	**104**	**114**	**113**	**92**	**103**
RAM								
Min	581-2013	104	86	72	83	84	64	76
Max	580-1555	**117**	**99**	**87**	**93**	**97**	**92**	**96**
Vandal								
Min	2139-2909	104	85	51	65	92	48	64
Max	399-421	**150**	**142**	**131**	**135**	**129**	**118**	**122**
Coyote								
Min	2413-3236	100	82	54	60	87	46	60
Max	883-1311	**144**	**134**	**119**	**126**	**119**	**107**	**114**
Arrow								
Min	2262-2656	100	84	72	81	96	82	92
Max	1821	**107**	**90**	**83**	**90**	**102**	**92**	**99**
Terrier-Orion	2433	**104**	**91**	**78**	**87**	**96**	**83**	**92**
Tomahawk	529	**111**	**93**	**92**	**92**	**107**	**102**	**105**

Note: - means no launch sounds were recorded near the launcher.
[1] No acoustic data were recorded near the launcher during Arrow, Terrier-Orion, or Tomahawk launches. RAMs and, as of July 2004, AGS vehicles, are launched from Building 807 Complex near the beach.
[2] Acoustic data were only recorded at a single nearshore site during Terrier-Orion and Tomahawk launches.

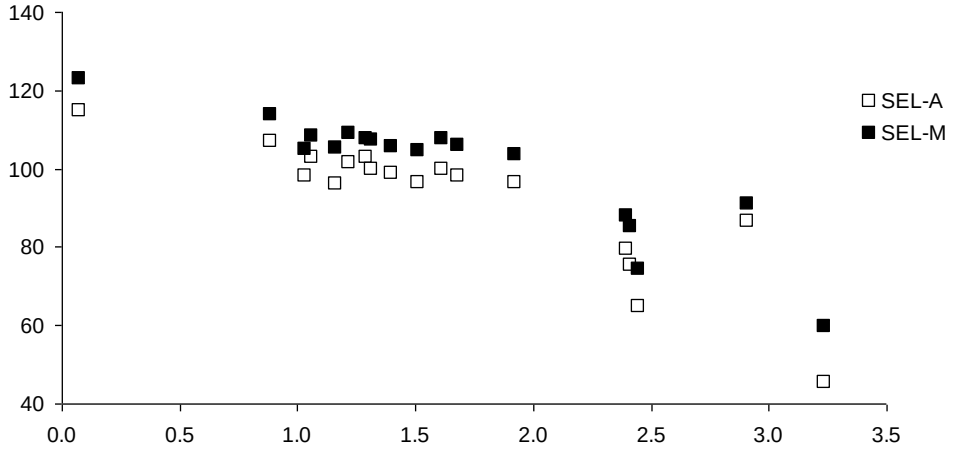

Figure 20. SELs (A- and Mpa-weighted) for Coyote launches at SNI relative to the 3-D CPA distance, 2003-2007.

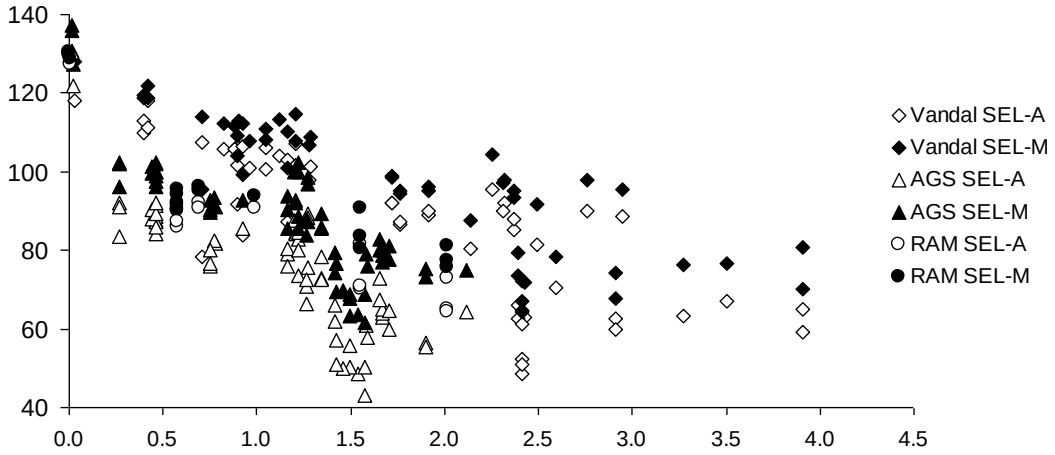

Figure 21. SELs (A- and Mpa-weighted) for Vandal, AGS, and RAM launches relative to the 3-D CPA distance, 2003-2007.

Ambient Noise

Ambient noise is background sound of physical and biological origin, excluding sounds from specific identifiable sources. Marine mammals are able to detect man-made noise and sounds from other mammals only if (as a first approximation) these signals exceed the ambient noise levels at corresponding frequencies. Natural ambient noise can mask weak sound signals of either natural or human origin. Marine mammals must be adapted to the natural ambient noise levels that prevail in their environment. Ambient levels are thus important for understanding the natural environmental restraints on an animal's ability to detect mammal calls, anthropogenic sounds, and other relevant sounds.

Ambient noise levels in air at SNI are expected to be dominated by breaking waves at the shoreline and the strong winds that are common on the west end of SNI, both of which will be further elevated during storms. Ambient noise measurements are an important component of acoustic monitoring of vehicle launches on SNI.

Background sounds have been (and will be) recorded on a second audio channel of the Autonomous Terrestrial Acoustic Recorder (ATAR; see Chapter 6) using a higher sensitivity microphone and higher gain setting. This channel will overload during the brief periods when it receives the vehicle flight sounds. At other times, including immediately before and after the launch, it can record the background environmental sounds.

The background sounds recorded before or after launches during 2001–2012 were generally relatively quiet, ranging from 22 to 72 dBA re 20 μPa or 23 to 91 dB re 20 μPa flat-weighted (Holst et al. 2005a, b, 2008; Ugoretz and Greene, 2012). These sounds are comparable to sound levels expected in residential areas. Further sound measurements during launches will be used to better characterize the range of ambient noise levels on the western end of SNI.

Sound Propagation

In-air sound propagation from vehicle launch sources at SNI had not been well studied prior to the monitoring work during 2001–2012. Measured sound levels of several vehicle types as related to CPA distance are shown in Figures 20 and 21. Additional data are needed for a full characterization of the sounds produced by the launches; the monitoring program described in Chapter 6 of this EA will provide additional information.

In addition to normal spreading losses as a function of distance, atmospheric absorption is a natural phenomenon that will limit airborne sound propagation, especially at higher frequencies. Kinsler et al. (1982) present the physics of this topic. At middle frequencies, sound absorption has more influence on sound transmission in the atmosphere than in the ocean. Only low-frequency sound is transmitted well in air.

Pinniped Sound Production and Hearing Abilities

Pinniped call characteristics are relevant in assessing potential masking effects of man-made sounds and the likely frequency range of best hearing in species whose hearing has not been tested. (In fact, the hearing abilities of the three species of concern here have all been measured directly.) Except for harbor seals, the species of pinnipeds present in the study area are very vocal during their mating seasons. In each species, the calls are at frequencies from several hundred to several thousand hertz—above the frequency range of the dominant noise components from most of the proposed launch activities.

In air, harbor seals are not as vocal as California sea lions or northern elephant seals, even during their breeding season. However, harbor seal pups do have a call that mothers can use to locate and perhaps identify their offspring (Renouf, 1984; 1985). This call (and perhaps other low-frequency threat vocalizations) may be audibly recognizable up to 459 ft (140 m) away and detectable by the mother up to 3,281 ft (1,000 m) away under good conditions over water (Reiman and Terhune, 1993). These values may be lower on land, but these data suggest that harbor seal mothers should be able to detect the calls of their pups despite higher ambient noise levels or when separated.

Unlike harbor seals, California sea lions and northern elephant seals make extensive use of in-air vocalizations to maintain mother-pup bonds and facilitate interactions between adult pinnipeds

(e.g., Peterson and Bartholomew, 1967; Petrinovich, 1974; Shipley et al., 1981; 1986; Riedman, 1990; Gisiner and Schusterman, 1991). These vocalizations can be of high amplitude and can propagate substantial distances across haul-out groups. Pup attraction calls of California sea lions, in particular, have evolved to facilitate mother-pup reunions after separations due to natural foraging or resulting from disturbances.

While vocalizations of pups and other conspecifics could be masked by broadband launch noise of high amplitude, this would be brief. Brief masking would not interfere with subsequent functions of the calls, even in a startled group of pinnipeds that might be vocalizing at a higher rate or amplitude than normal.

In-air audiograms have been obtained using behavioral methods for the three common species of pinnipeds on SNI. In-air hearing of phocid seals (e.g., northern elephant and harbor seals) is less sensitive than underwater hearing, and the upper frequency limit is lower. California sea lions are similar to phocid seals with regard to underwater hearing sensitivity at moderate frequencies (Kastak and Schusterman, 1998, 1999). In air, however, otariids apparently have slightly greater sensitivity and a higher high-frequency cutoff than do phocids—especially northern elephant seals. Northern elephant seals have lower aerial hearing sensitivity than harbor seals or California sea lions, but better underwater sensitivity than the other species, at least at low frequencies (Figure 22; Kastak and Schusterman, 1998, 1999). These hearing sensitivity data, coupled with outer and middle ear adaptations not found in other phocids (Kastak and Schusterman, 1999), suggest that the northern elephant seal is adapted for underwater rather than aerial hearing. These differences in in-air hearing sensitivity may at least in part explain why northern elephant seals are less reactive to strong sounds from vehicle launches (see below).

Behavioral Reactions of Pinnipeds to Vehicle Launches

Noises with sudden onset or high amplitude relative to the ambient noise level may elicit a behavioral response from pinnipeds resting on shore. Some pinnipeds tolerate high sound levels without reacting strongly, whereas others may react strongly when sound levels are lower. Available literature describing behavioral responses of pinnipeds to the types of sound recorded near haul-out sites on SNI indicates variability in the responses (see Figure 23). Responses can range from momentary startle reactions to animals fleeing into the water or otherwise away from their resting sites (i.e., stampede). Studies of pinnipeds during vehicle launch events have demonstrated that different pinniped species, and even different individuals in the same haul-out group, can exhibit a range of response from alert to stampede. An acoustic stimulus with sudden onset (such as a sonic boom) may be analogous to a looming visual stimulus (Hayes and Saif, 1967), which can be especially effective in eliciting flight or other responses (Berrens et al., 1988). Vehicle launches are unlike many other forms of disturbance because of their sudden sound onsets, high peak levels in some cases, and short durations (Cummings, 1993). Strong launch sounds are typically detectable near the beaches at western SNI for no more than a few seconds per launch (Holst et al., 2005a, 2008).

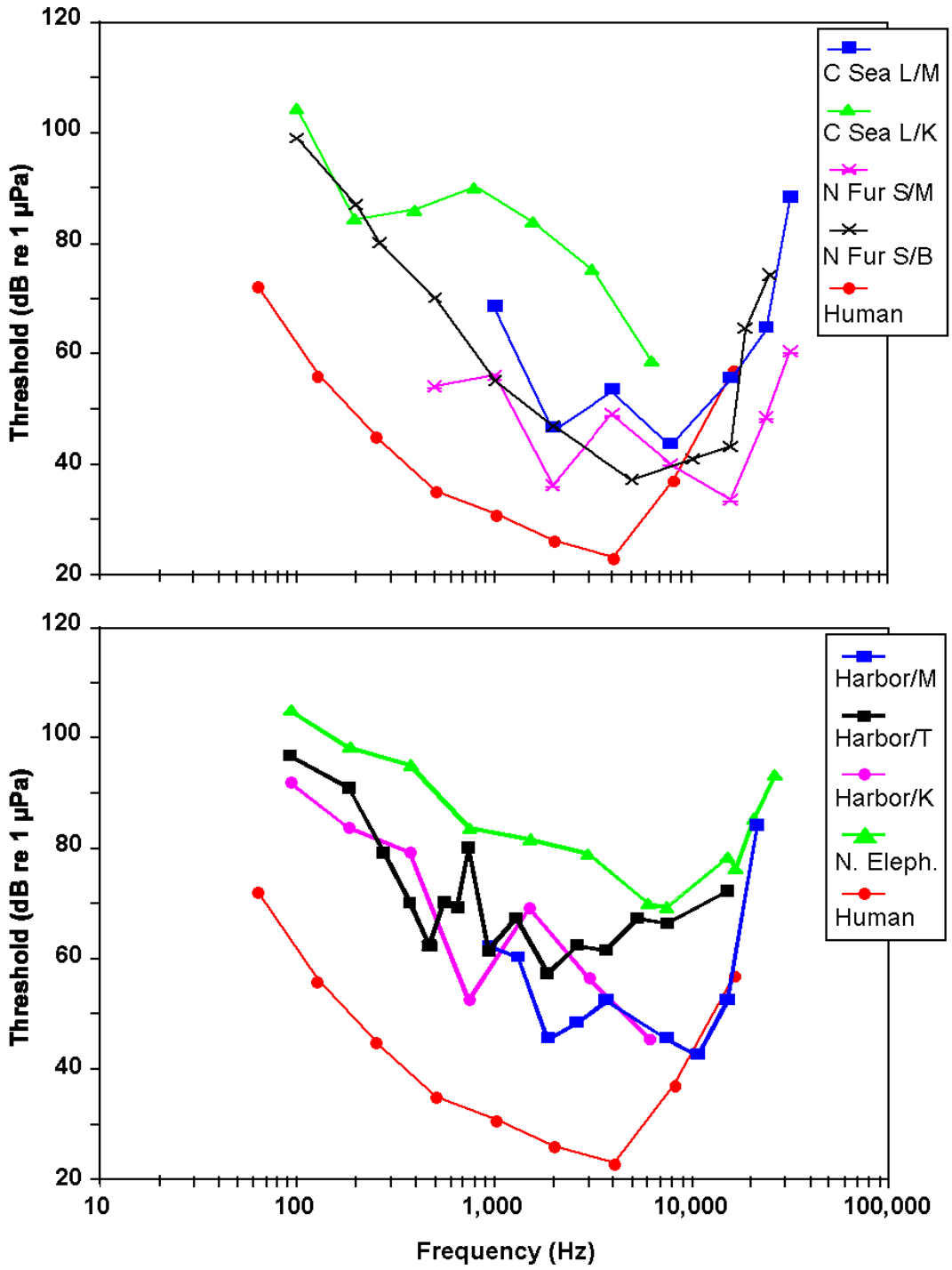

Figure 22. In-air hearing thresholds for selected otariid and phocid pinnipeds and the sensitivity thresholds for humans for comparison. (Subtract 26 dB from these values to obtain the equivalent levels in dB re 20 µPa, the usual units for in-air hearing thresholds.) Adapted from Richardson et al. (1995) with the addition of data from Kastak and Schusterman (1998, 1999).

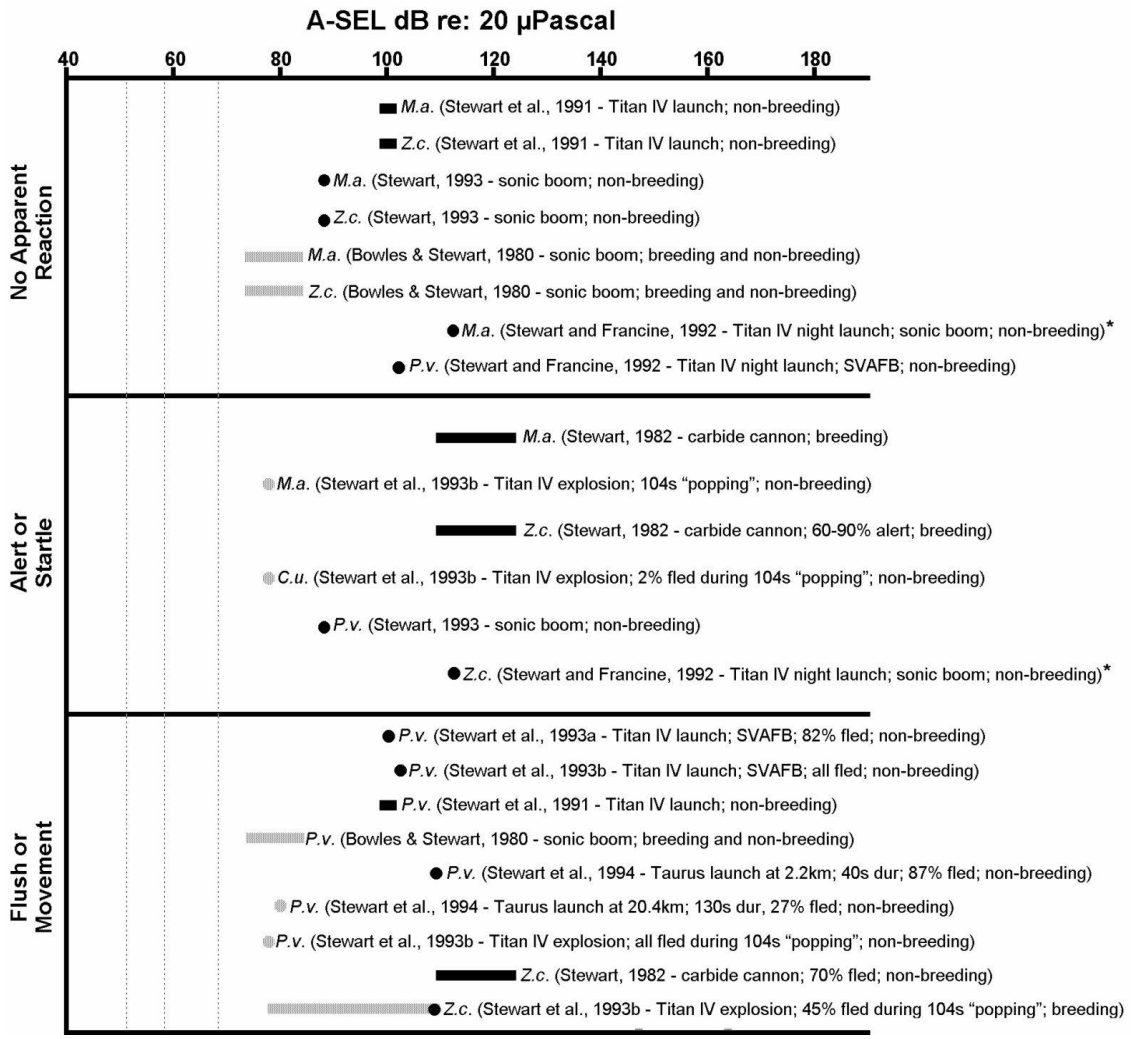

Figure 23. Behavioral responses by pinnipeds hauled out within the Point Mugu Sea Range to transient anthropogenic acoustic stimuli of varying sources and intensity. C.u.= *Callorhinus ursinus*, M.a.= *Mirounga angustirostris*, P.v.= *Phoca vitualina*, Z.c.= *Zalophus californianus*.

Holst et al. (2005a, 2008, 2010, 2011) summarize the systematic monitoring results from SNI from mid-2001 through February 2011. Ugoretz and Green (2012) summarize results from 2011-2012. In particular, northern elephant seals seem very tolerant of acoustic disturbances (Stewart 1981b; Holst et al., 2008) and were removed from the list of target species for monitoring on SNI in 2010 (FR Vol. 75, No. 226). In contrast, harbor seals are more easily disturbed. Based on SNI launch monitoring results from 2001 to 2007, most pinnipeds—especially northern elephant seals—would be expected to exhibit no more than short-term alert or startle responses (Holst et al., 2005a, 2008, 2011). Any localized displacement would be of short duration, although some harbor seals may leave their haul-out site until the following low tide. However, Holst and Lawson (2002) noted that numbers occupying haul-out sites on the next day were similar to pre-launch numbers.

The most common type of reaction to missile launches at SNI is expected to be a momentary "alert" response. When the animals hear or otherwise detect the launch, they are likely to become alert, and (at least momentarily) to interrupt prior activities in order to pay attention to the launch. Animals that are well to the side of the launch trajectory will likely not show any additional reaction. Animals that are closer to the trajectory may show a momentary alert response, or they may react more strongly. Previous observations indicate that elephant seals, in particular, will rarely if ever show more than a momentary alert reaction (Stewart 1981b; Stewart et al. 1994b; Holst et al., 2005a, b, 2008)—even when exposed to noise levels or types that caused nearby harbor seals and California sea lions to flee.

Video recordings of pinnipeds around the periphery of western SNI during launches on SNI in 2001–2012 have shown that some pinnipeds react to a nearby launch by moving into the water or along the shoreline (Holst et al., 2005a, 2008, 2010, 2011; Ugoretz and Greene 2012). Pinniped behavioral responses to launch sounds were usually brief and of low magnitude, especially for northern elephant seals. California sea lions (especially the young animals) exhibited more reaction than elephant seals, and harbor seals were the most responsive of the three species.

Northern elephant seals exhibited little reaction to launch sounds (Holst et al., 2005a, 2008, 2010, 2011). Most individuals merely raised their heads briefly upon hearing the launch sounds and then quickly returned to their previous activity pattern (usually sleeping). During some launches, a small proportion of northern elephant seals moved a short distance on the beach, away from their resting site, but settled within minutes. Because of this, elephant seals are no longer targeted for monitoring during launches, but are often in the field of view when monitoring other species.

Responses of California sea lions to the launches varied by individual and age group (Holst et al., 2005a, b, 2008, 2010, 2011). Some exhibited brief startle responses and increased vigilance for a short period after each launch. Others, particularly pups that were previously playing in groups along the margin of the haul-outs, appeared to react more vigorously. A greater proportion of hauled-out sea lions typically responded and/or entered the water when launch sounds were louder (Holst et al., 2005a, b, 2008, 2010, 2011). Adult sea lions already hauled out would mill about on the beach for a short period before settling, whereas those in the shallow water near the beach did not come ashore like the aforementioned pups.

During the majority of launches at SNI, most harbor seals left their haul-out sites on rocky ledges to enter the water and did not return during the duration of the video-recording period (which sometimes extended up to several hours after the launch ended) (Holst et al., 2005a, b, 2008, 2010, 2011; Ugoretz and Greene 2012). During monitoring the day following a launch, harbor seals were usually hauled out again at these sites (Holst and Lawson, 2002).

The type of vehicle being launched is also important in determining the nature and extent of pinniped reactions to launch sounds. Holst et al. (2008) showed that significantly more California sea lions responded during Coyote launches than during other vehicle launches. AGS launches caused the fewest reactions. Elephant seals showed significantly less reaction during launches involving vehicles other than Vandals (Holst et al., 2008). The BQM-34 and especially the BQM-74 subsonic drone vehicles that may be launched from SNI are smaller and less noisy

than Coyotes. Launches of BQM-34 drones from Point Mugu have not normally resulted in harbor seals leaving their haul-out area at the mouth of Mugu Lagoon approximately two miles (3.2 km) to the side of the launch track (Lawson et al., 1998).

In addition to noise, the night launches will also emit light. Haul-out beaches near Building 807 Launch Complex in particular may be affected by light during ABL launches. No additional pinniped responses to the light, above and beyond those that are elicited by the launch sounds are anticipated. Continuation of the proposed launch monitoring program (see Chapter 6 later in this document) will enable further documentation of pinniped responses to various launch vehicles with different acoustic characteristics and to nighttime launches.

Since the launches are relatively infrequent, and of such brief duration, it is unlikely that pinnipeds near the launch sites will become habituated to the sounds. Additionally, the infrequent launches (up to 40 per year, of which some will be of small vehicles) will cause masking for no more than a very small fraction of the time during any single day (i.e., usually less than two seconds and rarely more than five seconds during a single launch). It is anticipated that these occasional brief episodes of masking will have minimal effects on the abilities of pinnipeds to hear one another or to detect natural environmental sounds that may be relevant to the animals.

It is possible that launch-induced stampedes could have adverse impacts on individual pinnipeds on the west end of SNI. However, during vehicle launches in 2001-2012, there was no evidence of launch-related injuries or deaths (Holst et al., 2005a, b, 2008, 2010, 2011; Ugoretz and Greene 2012). On several occasions, harbor seals and California sea lion adults moved over pups as the animals moved in response to the launches, but the pups did not appear to be injured (Holst et al., 2005a, 2008, 2010, 2011; Ugoretz and Greene 2012). Given the large numbers of pinnipeds giving birth on SNI, it is expected that injuries and deaths will occur as a result of natural causes. For example, during the 1997-98 El Niño event, pup mortality reached almost 90 percent for northern fur seals at nearby SMI, and some adults may have died as well (Melin et al., 2005). Pup mortality also increased during this period for California sea lions.

Indirect evidence that launches have not caused significant, if any, mortality comes from the fact that populations of northern elephant seals and especially California sea lions on SNI are growing rapidly despite similar launches for many years. Harbor seal numbers have remained stable, but new harbor seal haul-out sites have been established at locations directly under and near the launch tracks of vehicles (see Figure 9).

Hearing Impairment of Pinnipeds from Vehicle Launches

Although it is possible that some pinnipeds (particularly harbor seals) may incur TTS (and possibly, although highly unlikely, even slight permanent threshold shift (PTS)) during launches from SNI, hearing impairment has not been shown for pinniped species exposed to launch sounds. Thorson et al. (1998, 1999) used measurements of auditory brainstem response to demonstrate that harbor seals did not exhibit loss in hearing sensitivity following launches of large vehicles at Vandenberg Air Force Base (VAFB), California.

There are few published data on TTS thresholds for pinnipeds in air exposed to impulsive or brief non-impulsive sounds. J. Francine, quoted in 66 FR 41837 (August 9, 2001), has mentioned evidence of mild TTS in captive California sea lions exposed to a 0.3-s transient sound with an SEL of 135 dBA re 20 $\mu Pa^2 \cdot s$ (see also Bowles et al., 1999). However, mild TTS may occur in harbor seals exposed to SELs lower than 135 dB SEL (A. Bowles, pers. comm., 2003 in NAWCWD, 2008). Data indicate that the TTS threshold on an SEL basis may actually be around 129-131 dB re 20 $\mu Pa^2 \cdot s$ for harbor seals, within their frequency range of good hearing (Kastak et al., 2004; Southall et al., 2007). The same research teams have found that the TTS thresholds of California sea lions and elephant seals exposed to strong sounds are higher as compared to the harbor seal (Kastak et al., 2005; see Table 6). Based on these studies and other available data, Southall et al. (2007) propose that single impulsive sounds, such as those from a sonic boom, may induce mild TTS if the received peak pressure is approximately 143 dB re 20 µPa (peak) or if received frequency weighting appropriate for pinnipeds in air (Mpa-weighted) SEL is approximately 129 dB re 20 $\mu Pa^2 \cdot s$. Those levels apply specifically to harbor seals; those levels are not expected to elicit TTS in elephant seals or California sea lions (Southall et al., 2007). Less is known about levels that may cause PTS, but in order to elicit PTS, a single sound pulse would probably need to exceed the TTS threshold by at least 15 dB or more, on an SEL basis (Southall et al., 2007; see Table 6).

Table 6. Assumed in-air sound pressure criteria for significant disturbance and for TTS and PTS in pinnipeds.

	Criterion Level		
Criterion Type	**A-weighted (re 20 $\mu Pa^2 \cdot s$ SEL)**	**M_{pa}-weighted (re 20 $\mu Pa^2 \cdot s$ SEL)**	**Peak pressure (flat) [f] (re 20 µPa)**
Disturbance by prolonged sound	Harbor seals: 90 dB [a] Sea lions & elephant seals: 100 dB [b]	Pinnipeds in air: 100 dB [f]	Pinnipeds in air: 109 dB
TTS for transient sound	California sea lions: 135 dB [c]	-	-
TTS for pulses	-	Pinnipeds in air: 129 dB [d, f, g]	Pinnipeds in air: 143 dB [g]
TTS for non-pulse sound	-	Harbor seals: 131 dB [e, f] California sea lion: 154 dB [e] Elephant seal: 163 dB [e]	Pinnipeds in air: 143 dB [g]
PTS for pulses [f]	-	Pinnipeds in air: 144 dB [g]	Pinnipeds in air: 149 dB [g]
PTS for non-pulse sound [f]	-	Pinnipeds in air: 144.5 dB [g]	Pinnipeds in air: 149 dB [g]

[a] Based on observations during the 2001–2007 SNI launch monitoring program (Holst et al., 2008).
[b] Based on a review of published and reported behavioral responses to prolonged sound (lasting several seconds) by pinnipeds hauled out in the Sea Range (Lawson et al. 1998). Monitoring work at SNI has found that typically only a small fraction (approx. 10-20 percent) of elephant seals respond to these levels.
[c] For transient sounds based on J. Francine, quoted in NMFS (2001:41837).
[d] For simulated sonic booms (Bowles et al. pers. comm.).
[e] For non-pulse noise (Kastak et al. 2004).
[f] Southall et al. (2007).
[g] Applies specifically to harbor seal; values for California sea lion and northern elephant seal probably are higher (Southall et al. 2007:444-445).

Available evidence from launch monitoring at SNI in 2001-2012 suggests that only a small minority (if any) of the pinnipeds at SNI are exposed to levels of launch sound levels that could elicit TTS or (Holst et al., 2008, 2011; Ugoretz and Greene 2012). The assumed TTS threshold

for the species with the most sensitive hearing (harbor seal) is 129–131 dB re 20 μPa2·s (Mpa-weighted), with higher values applying to other species (Table 6). The measured SEL values near pinniped beaches during missile launches at SNI during 2001–2007 were <129 dB re 20 μPa2·s (A- or mpa-weighted). In fact, few if any pinnipeds were exposed to SELs >122 dB re 20 μPa2·s on an mpa-weighted basis and >118 dBA, even on beaches near Building 807 Launch Complex (Holst et al., 2008). Sounds at these levels are not expected to cause TTS or PTS. However, small numbers of northern elephant seals and California sea lions may have been exposed to peak pressures as high as 150 dB re 20 μPa when Vandals flying over the beach created a sonic boom. That peak-pressure level would not be expected to elicit PTS in elephant seals or California sea lions. While it might be near the minimum level that could elicit PTS in harbor seals if any harbor seals at SNI had been exposed to such high levels, Vandal missiles are no longer launched from SNI (Holst et al., 2008). Harbor seals were not hauled out on beaches were such high sound levels were measured, and they do not haul out near the Building 807 Launch Complex. However, it is possible that some harbor seals, and perhaps elephant seals and California sea lions, did incur TTS during launches at SNI, as peakpressure levels at haul-out sites sometimes reached ≥143 dB re 20 Pa when a sonic boom occurred. This same potential would exist for future launches. In the event that TTS did occur, it would typically be mild and reversible.

Non-auditory Physiological Responses

Wolski (1999) examined the physiological responses of pinnipeds to simulated sonic booms. He noted that harbor seals responded with bradycardia, reduced movement, and brief apneas (indicative of an orienting response). Northern elephant seals responded similarly, and the response of California sea lions was variable. Perry et al. (2002) examined the effects of sonic booms from Concorde aircraft on harbor seals and gray seals (*Halichoerus grypus*). The authors noted that observed effects on heart rate were generally minor and not statistically significant; gray seal heart rates showed no change in response to booms, whereas harbor seals showed slightly elevated heart rates.

Humans and terrestrial mammals subjected to prolonged exposure to noise can sometimes show physiological stress. However, even in well-studied human and terrestrial mammal populations, noise-induced stress is not easily demonstrated. There have been no studies to determine whether noise-induced stress occurs in pinnipeds. If noise-induced stress does occur in marine mammals, it is expected to occur primarily in those exposed to chronic or frequent noise. It is very unlikely that it would occur in animals exposed to only a few, very brief noise events over the course of a year, as would be the case with these proposed activities.

Summary of Potential Effects on Marine Mammals

Vehicle launches are characterized by sudden sound onsets, moderate to high peak sound levels (depending on the type of vehicle and distance), and short sound duration. Effects of vehicle launches on some pinnipeds in the Channel Islands have been studied. In most cases, where pinnipeds have been exposed to the sounds of large vehicle launches (such as the Titan IV from Vandenburg Airforce Base [VAFB]), animals did not flush into the sea unless the sound level to which they were exposed was relatively high or of an unusual duration or quality (e.g., the

explosion of a Titan IV). Similarly, at SNI, the proportion of responding California sea lions and elephant seals to vehicle launches are significantly higher with increasing SELs; harbor seal reactions to launch sounds are more variable.

Thus, responses of pinnipeds on beaches to acoustic disturbance arising from launches are highly variable. In addition, some species (such as harbor seals) are more reactive when hauled out than are other species (e.g., northern elephant seals). Responsiveness also varies with time of year and age class, with juvenile pinnipeds being more likely to react strongly and leave the haul-out site. While the reactions are variable and can involve occasional stampedes or other abrupt movements by some individuals, biological impacts of these responses appear to be limited. The responses are not likely to result in significant injury or mortality or long-term negative consequences to individuals or pinniped populations on SNI.

Based on measurements of received sound levels during previous launches at SNI (e.g., Holst et al., 2005a, b, 2008, 2010, 2011; Ugoretz and Greene, 2012), the Navy and NMFS expect that there may be some effects on hearing sensitivity (TTS) for a few of the pinnipeds present, but these effects are expected to be mild and reversible. Although it is possible that some launch sounds as measured close to the launchers may exceed the PTS criteria, it is unlikely that any pinnipeds would be close enough to the launchers to be exposed to sounds strong enough to cause PTS. Therefore, NMFS anticipates only minor direct and indirect impacts to pinnipeds, as pinnipeds hauled out during launches on SNI will only incur short-term, minimal Level B harassment.

Estimation of Take

The marine mammal species NMFS believes likely to be taken by Level B harassment incidental to vehicle launch operations from SNI are harbor seals, California sea lions, and northern elephant seals. Any takes are most likely to result from operational noise as launch vehicles pass near haul-out sites and/or associated visual cues. As noted earlier, sightings of northern fur seals, SSLs, and Guadalupe fur seals have been extremely rare or low on SNI. Therefore, no takes are anticipated for these three species incidental to the proposed activities.

For purposes of evaluating the potential significance of the takes by harassment, an estimation of the number of potential takes is used here to discuss in terms of the populations present. Note that the specific number of takes that are considered for authorization is developed via the MMPA process, and the analysis in this EA provides a summary of the anticipated numbers that would be authorized to give a relative sense of the nature of impact of the proposed action. The Navy and NMFS provisionally estimate, based on past monitoring, that the following numbers of pinnipeds may be taken by Level B harassment annually: 492 elephant seals (approx. 10 percent of the SNI elephant seal population and < 1 percent of the California stock); 686 harbor seals (approx. 80 percent of the SNI harbor seal population and 2.3 percent of the California stock); and 4,872 California sea lions (approx. 20% of the SNI California sea lion population and 1.6 percent of the California stock). The animals affected may be the same individual animals or may be different individuals, depending on site fidelity. Based on the results of the marine mammal monitoring conducted by the Navy during the 2009-2014 launch program, the estimated number of potential Level B harassment takes would actually be less than estimated or

previously authorized. The criteria used by the Navy and NMFS to estimate take numbers for the 2014-2019 program were developed specifically for the launches identified in the specified activity and are based on Navy monitoring data collected during the 2009-2014 launch program at the same location and involving the same rocket types. Section 7.7 of the Navy's 2013 application contains a full description of how take estimates were initially derived.

With the incorporation of mitigation measures proposed later in this document, the Navy and NMFS expect that only Level B incidental harassment may occur as a result of the proposed activities and that these events represent only minor impacts that will result in no detectable impact on marine mammal species or stocks or on their habitats.

4.1.3 Effects on the Socioeconomic Environment

It is not expected that promulgating regulations and issuing an LOA to the Navy for the specified activity will negatively impact any of the socioeconomic resources on and around SNI. The Navy would be negatively impacted if the regulations were not issued, as it would be difficult for them to conduct the activities without violating the MMPA. If the missile launch activities were not conducted, that could have a negative impact on military preparedness and national security, as well as on the socioeconomic environment if the mission at SNI were curtailed. Implementation of the launch program on SNI would result in a short-term, temporary increase of personnel on the island. This is consistent with staffing fluctuations that normally occur on SNI. In addition to direct and indirect beneficial impacts on regional economic activity, such personnel changes can affect the quality and availability of community services and utilities. Section 4.12 of the Navy's 2002 FEIS/OEIS (NAWCWD, 2002) contains a complete discussion on the impacts to the socioeconomic environment.

4.2 Effects of Alternative 2 (No Action)

Under the No Action Alternative, NMFS would not promulgate regulations or issue an IHA or LOA (either annual LOAs or a single LOA covering the 5-year period) to the Navy for the proposed activities. In this case, the Navy would decide whether or not it would want to continue with the missile launch activities, which are authorized by the Secretary of Defense and the Secretary of the Navy, not NMFS.

If the Navy decides to conduct some or all of the activities without an ITA from NMFS, they would not be exempt from the MMPA prohibitions against the take of marine mammals and would be in violation of the MMPA if take of marine mammals occurs. In the absence of required protective mitigation measures, the impacts to elements of the human environment resulting from the No Action Alternative would likely be greater than those impacts resulting from Alternative 1, the Preferred Alternative (see Section 4.1). If missile activities occur when marine mammals are present in the action area, there is the potential for behavioral disturbance, injury, or mortality of marine mammals, especially if the launches occur during the pupping season.

4.2.1 Effects on the Physical Environment

4.2.1.1 Marine Mammal Habitat

Under the No Action Alternative, impacts to marine mammal habitat are expected to be similar to those discussed for Alternative 1. The only potential difference in impacts to marine mammal habitat under the No Action Alternative would be the possibility of additional pedestrian traffic and other activities near the beaches in advance of launches, since there would be no requirement to limit these types of activities as is the case with Alternative 1.

4.2.2 Effects on the Biological Environment

4.2.2.1 Effects to Marine Mammals

Under the No Action Alternative, the Navy's activities would likely result in increased amounts of Level B harassment to marine mammals and possibly takes by injury (Level A harassment), serious injury, or mortality—specifically related to acoustic stimuli—due to the absence of mitigation and monitoring measures required under an ITA. While it is difficult to provide an exact number of takes that might occur under the No Action Alternative, the numbers would be expected to be larger than those estimated for Alternative 1 since the Navy would not be required to abide by mitigation measures, such as seasonal restrictions (e.g., avoidance or limiting of launch activities during pinniped pupping seasons) and other launching restrictions (e.g., not launching missiles at low elevations [< 305 m] when launch azimuths pass close to pinniped haul-out sites when occupied; avoiding launching missiles in quick succession over haul-out sites, especially when young pups are present; maintaining a minimum altitude for aircraft and helicopter flight paths of 305 m from pinniped haul-outs and rookeries except in emergencies or real-time security incidents) to reduce the number of takes. Finally, marine mammals may be indirectly affected by missile launch activities due to NMFS' inability to obtain from the Navy the monitoring and reporting data needed to assess the anticipated impact of these activities upon the species or stock, and increased knowledge of the species as required under MMPA.

4.2.3 Effects on the Socioeconomic Environment

Under the No Action Alternative, impacts to socioeconomic resources are expected to be similar to those discussed for Alternative 1.

4.3 Effects of Alternative 3

Under Alternative 3, NMFS would promulgate regulations for a period of 5 years and issue annual LOAs to the Navy for the specified activities. All of the mitigation, monitoring, and reporting requirements that would be implemented under Alternative 1 would be included in the authorization issued if Alternative 3 were selected. Impacts to marine mammals, socioeconomics, and the physical environment would be the same as that discussed for Alternative 1. However, there would most likely be increased costs to both the Navy and NMFS if this alternative were selected because of the need to process LOAs on a more frequent basis (i.e., annually). This would require that staff spend additional time each year to issue the authorizations and could cause delays in the launch schedule.

4.4 Effects of Alternative 4

Under Alternative 4, NMFS would promulgate regulations for a period of less than 5 years or issue annual IHAs to the Navy, NAWCWD, for the specified activities. All of the mitigation, monitoring, and reporting requirements that would be implemented under Alternative 1 would be included in the authorization issued if Alternative 3 were selected. Impacts to marine mammals, socioeconomics, and the physical environment would be the same as that discussed for Alternative 1. However, there would most likely be increased costs to both the Navy and NMFS if this alternative were selected because of the need to process ITAs on a more frequent basis. This would require that staff spend additional time each year to issue the authorizations and could cause delays in the launch schedule.

4.5 Compliance With Necessary Laws

We have determined that the issuance of regulations and subsequent LOA is consistent with the applicable requirements of NEPA, MMPA, ESA, CZMA, NMSA, and our regulations.

4.6 Unavoidable Adverse Impacts

The Navy's application for 5-year regulations and an LOA, NMFS' notice of a proposed incidental take authorization, and other environmental analyses identified previously, summarize unavoidable impacts to marine mammals or the population to which they belong or on their habitats occurring in the affected area. NMFS incorporates these documents by reference. Generally speaking, unavoidable adverse impacts consist of some Level B harassment (in the form of short-term changes in behavior, temporary displacement from haul-out sites, or TTS) of three (non-ESA-listed) pinniped species. The take is anticipated to have a negligible impact on the affected species or stock.

NMFS acknowledges that the incidental take authorized would potentially result in unavoidable adverse impacts. However, NMFS does not expect the Navy's activities to have adverse consequences on the viability of marine mammals in southern California nor does NMFS expect the marine mammal population in the area to experience reductions in reproduction, numbers, or distribution that might appreciably reduce their likelihood of surviving and recovering in the wild. NMFS expects that the number of individuals of all species taken by harassment would be small (relative to species or stock abundance), and that the take resulting from the proposed activities would have a negligible impact on the affected species or stocks of marine mammals.

4.7 Cumulative Impacts

Cumulative impact is defined 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" (40 CFR §1508.7). Cumulative impacts may occur when there is a relationship between a proposed action and other actions expected to occur in a similar location or during a similar

time period, or when past or future actions may result in impacts that would additively or synergistically affect a resource of concern. These relationships may or may not be obvious. Actions overlapping within close proximity to the proposed action can reasonably be expected to have more potential for cumulative effects on "shared resources" than actions that may be geographically separated. Similarly, actions that coincide temporally will tend to offer a higher potential for cumulative effects.

Actions that might permanently remove a resource would be expected to have a potential to act additively or synergistically if they affected the same population, even if the effects were separated geographically or temporally. Note that the proposed action considered here would not be expected to result in the removal of individual pinnipeds from the population or to result in harassment levels that might cause animals to permanently abandon preferred haul-out locations, so concerns related to removal of viable members of the populations are not implicated by the proposed action. This cumulative effects analysis considers these potential impacts, but more appropriately focuses on those activities that may temporally or geographically overlap with the proposed activity such that repeat harassment effects warrant consideration for potential cumulative impacts to the affected three marine mammal species and their habitats.

Past, present, and reasonably foreseeable projects and human activities that are likely to affect the human environment near SNI include scientific research activities, geophysical related seismic surveys, commercial and recreational fishing, commercial marine traffic, and military training and testing activities. These activities account for cumulative impacts to regional and worldwide populations of marine mammals, many of whom are a small fraction of their former abundance. However, quantifying the biological costs for marine mammals within an ecological framework is a critical missing link to our assessment of cumulative impacts in the marine environment and assessing cumulative effects on marine mammals (Clark et al., 2009). Despite these regional and global anthropogenic and natural pressures, available trend information indicates that most local populations of marine mammals in the Pacific Ocean are stable or increasing (Carretta, et al., 2013).

The following describes projects and activities based in and along the coast of California at or near SNI that may, but would not necessarily, result in potential cumulative adverse impacts to the biological and physical environment.

4.7.1 Climate Change

Climate change has the potential to indirectly impact marine mammals in southern California in several different ways including: loss of suitable breeding habitat and food resources; a reduction in the foraging or breeding ranges; and a decrease in the overall population size in the region. Climate change would likely alter the ecosystem's food web which could affect marine mammals on San Nicolas Island. Increased temperatures could push populations to a more suitable climate and impact adult survival and breeding.

A primary threat to marine mammals on San Nicolas Island is from loss of habitat and potential changes in food supply due to climate change. Sea level rise due to climate change could flood pinniped haul-out sites negatively impacting breeding success. Moreover, there is the potential

for long-term impacts to marine mammals resulting from climate change that could alter their composition and distribution on San Nicolas Island.

With the large degree of uncertainty on the impact of climate change to marine mammals in southern California, we recognize that warming of this region could affect the prey base and habitat quality for marine mammals. Nonetheless, we expect that ongoing and future Navy missile launch activities in southern California and the issuance of an ITA to the Navy would not result in any noticeable contributions to climate change.

4.7.2 Marine Mammal Research and Geophysical Seismic Surveys

Marine mammal research and geophysical seismic survey cruises operate within the Pacific Ocean along the California coast. While some marine mammal surveys introduce no more than increased vessel traffic impacts to the environment, seismic surveys use various methods (e.g., airgun arrays) to conduct research. The use of airguns during seismic surveys does not impact pinnipeds while they are hauled out, only when they are in the water. Other studies that involve biopsy sampling and tagging might result in Level B or even Level A harassment to marine mammals. There are several active research permits along the California coastline that allow activities that have the potential to result in either Level A or Level B harassment[3] (e.g., vessel/aerial surveys, photo-identification, collection of sloughed skin, tagging, capture and handling, etc.). Many of these permits only allow the incidental harassment of California sea lions, Pacific harbor seals and northern elephant seals during studies of other marine mammal species in the vicinity. While there are currently no active geophysical seismic surveys occurring in southern California waters, NMFS has authorized seismic surveys along the Pacific in the past and it is reasonable to assume that some level of similar survey activity might occur over the proposed 5-year duration of the Navy proposed regulations. Results from research studies conducted in the area indicate that the activities only have temporary, short-term impacts on the behavior of the animals. The activities do not result in the injury or mortality of the animals.

4.7.3 Other Scientific Research Activities

Research on other animal species, such as seabirds, has historically occurred along the California coastline. There is currently only one active IHA for the incidental harassment of pinnipeds during scientific research studies for seabird research; however, these research activities do not occur in the vicinity of SNI. NMFS has issued IHAs in the past for the incidental harassment of pinnipeds hauled out on SNI during black abalone research. The most recent IHA for this activity expired in February, 2013. The most common responses of the pinnipeds noted to date include brief startle reactions as noted by lifting of the head or movement of less than one meter

[3] The definition of harassment is slightly different for scientific research than for military readiness activities. For non-military readiness activities, the MMPA defines harassment as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [“Level A harassment”]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [“Level B harassment”].

(three feet) and flushing into the water. These activities have not resulted in any injury or mortality of pinnipeds.

4.7.4 Commercial and Recreational Fishing

Commercial and recreational fishing constitute a significant use of the ocean area near SNI. There are 519 recognized California marine fish species. According to the California Department of Fish and Game (CDFG), in 2012, the three top commercial finfish species by landing in the Santa Barbara area were Pacific sardine (2,121,258 pounds), sablefish (370,908 pounds), and white seabass (207,027 pounds). The total commercial landings for all species brought into the Santa Barbara area in 2012 were valued at over 10 million dollars, with dockside landings totaling almost 7 million pounds (CDFG, 2013). In addition, recreational and charter fishing activities are popular along the waters of southern California. These activities could result in by-catch of marine mammals, entanglement in fishing gear, and reduce prey availability for marine mammals.

4.7.5 Commercial Marine Traffic

There are three major ports near or just south of the proposed action area. 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. Taken together, these two ports (which are contiguous) would constitute the fifth busiest port in the world. The Port of San Diego is also an important commercial cargo port. Cruise ships make daily use of these port facilities. In 2006, San Diego recorded 219 cruise ship calls (619,000 passengers), while Los Angeles recorded 1.2 million cruise passengers served. Together, these three ports recorded about 8,500 vessel (cargo and cruise ship) calls in 2006. Ship strikes are potential sources of serious injury or mortality to large whales; however, the occurrence of ship strikes of pinnipeds is rare to nonexistent. Effects to pinnipeds from large commercial vessels are believed to be primarily potential effects from sound, which could decrease foraging success and predator detection.

4.7.6 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 non-point 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. Marine mammals sometimes mistake plastics and other marine debris as food and ingest the garbage, which can ultimately lead to mortality because of malnutrition, choking, or other problems.

4.7.7 Delta IV/Evolved Expendable Launch Vehicle Support Activities

In order to support the Delta IV/Evolved Expendable Launch Vehicle (EELV) launch activity from Space Launch Complex-6 at VAFB, the U.S. Air Force (USAF) hired a contractor to conduct harbor maintenance dredging at VAFB. Other harbor activities in support of the Delta IV/EELV include *Delta Mariner* operations, cargo unloading activities, and kelp habitat mitigation. Pacific harbor seals and California sea lions may be taken by Level B behavioral harassment incidental to these activities. Northern elephant seals also have the potential to be taken but in even smaller numbers than harbor seals and sea lions.

Delta Mariner associated noise sources are ventilating propellers used for maneuvering vessel into position and a popping sound the cargo bay door makes when disengaged (no actual measurements have been taken outside the vessel). Dredging the harbor involves considerable activity and the use of noisy, heavy equipment. Noise intensity decreases proportional to the square root of the distance from the source. A dredging crane at the end of the dock producing 88 dBA of noise would still be quite noisy (approximately 72 dBA) at the nearest beach or the end of the breakwater, roughly 76 m (250 ft) away. Cargo unloading activities create sound when the common booster core is removed from the *Delta Mariner* through use of the Elevating Platform Transporter (EPT). The EPT produces approximately 85 dBA, measured less than 6.1 m (20 ft) from the engine exhaust, when the engine is running at mid speed. Prior to movement, the EPT operator sounds the horn to alert personnel in close proximity to the EPT that it is about to operate. The EPT operation procedure requires two short beeps of the horn (approx. 1/3 sec. each) prior to starting the ignition. Sound level measurements for the horn ranged from 84-112 dBA at 7.6 m (25 ft) away and 62-70 dBA at 61 m (200 ft) away. To accommodate the *Delta Mariner*, the harbor will need to be dredged, removing up to 5,000 cubic yards of sediment per dredging. Dredging will involve the use of heavy equipment, including a clamshell dredge, dredging crane, a small tug, dredging barge, dump trucks, and a skip loader. Measured sound levels from this equipment are roughly equivalent to those estimated for the wharf modification equipment: 43-81 dBA at 76 m (250 ft).

NMFS has issued annual IHAs for these activities every year, beginning in 2002. The most recent IHA was effective from September 26, 2012, through September 25, 2013. On February 4, 2014, the *Delta Mariner* operations were incorporated into the rulemaking for the VAFB Launch Activities and Aircraft and Helicopter Operations (79 FR 10016) for the period March 26, 2014, through March 26, 2019. The primary impacts to marine mammals from these activities are expected to be short-term behavioral reactions in response to the acoustic and visual stimuli produced by the heavy machinery used. The activities are short-term in nature and would not disturb or displace marine mammals for long periods of time. NMFS anticipates that no injury or mortality will result from these actions. No cargo unloading or *Delta Mariner* operations have occurred since 2004. The last harbor dredging activity occurred in December, 2002. Monitoring of harbor seals and sea lions during two previous dredging events and wharf modification activities showed that they responded to sudden noises or unexpected visual stimuli with a head alert initially and occasionally would flush from the haul-out. Sea lions appeared to be much less sensitive to disturbance, even when they were close to the activity. Visual events that invoked harbor seal responses included the crane boom swinging suddenly and shadows caused by equipment that was backlit during nighttime dredging activities. The seals and sea

lions continued to frequent the harbor area during the construction activities despite the presence of noise and activity.

4.7.8 Military Readiness Activities

The term "military readiness activities", as defined in PL 107-314, Section 315(f), includes "training and operations of the Armed Forces that relate to combat" and constitute "adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use." The NDAA of FY 2004 (PL) amended the MMPA definition of "harassment" as applied to military readiness activities, and discussions of potential Level A and Level B harassment in this subsection are in accordance with those specific definitions.

In addition to the proposed target and missile launch activities at SNI, the USAF is conducting activities within the vicinity of the proposed action area. Additionally, the Navy is also conducting training activities in the Southern California (SOCAL) Range Complex. These activities are described below.

<u>Missile Launch Operations from VAFB and the Northern Channel Islands (NCI)</u>
VAFB is headquarters to the 30th Space Wing, USAF Space Command unit that operates VAFB and the Western Range. VAFB operates as a missile test base and aerospace center, supporting west coast space launch activities for the USAF, Department of Defense, National Aeronautics and Space Administration, and commercial contractors. VAFB is the main west coast launch facility for placing commercial, government, and military satellites into polar orbit on expendable (unmanned) launch vehicles and for testing and evaluation of intercontinental ballistic missiles and sub-orbital target and interceptor missiles. In addition to space vehicle and missile launch activities at VAFB, there are helicopter and aircraft operations for purposes such as search-and-rescue, delivery of space vehicle components, launch mission support, and security reconnaissance. There are currently six active space launch vehicle facilities at VAFB, used to launch satellites into polar orbit. These facilities support the launch programs for space vehicles including the Atlas V, Delta II, Delta IV, Falcon, Minotaur, and Taurus.

The USAF activities create two types of noise: continuous/intermittent (but short-duration) noise, due mostly to combustion effects of aircraft and launch vehicles, and impulsive noise, due to sonic boom effects. Launch operations, particularly the operation of launch vehicle engines, are the major source of noise considered to have a potential to affect pinnipeds that are hauled out on or in the vicinity of VAFB. Generally, noise is generated from four sources during launches: (1) Combustion noise from launch vehicle chambers; (2) jet noise generated by the interaction of the exhaust jet and the atmosphere; (3) combustion noise from the post-burning of combustion products; and (4) sonic booms. Launch noise levels are highly dependent on the type of first-stage booster and the fuel used to propel the vehicle. Therefore, there is similarity in launch noise production within each class size of launch vehicles.

The noise generated by VAFB activities will result in the incidental harassment of pinnipeds, both behaviorally and in terms of physiological (auditory) impacts. The noise and visual disturbances from space launch vehicle and missile launches and aircraft and helicopter operations may cause the animals to move towards the water or enter the water. However, these

reactions are usually short-term and minimal. The main concern on the NCI is potential impacts from sonic booms created during launches of space vehicles from VAFB. Sonic booms are impulse noises, as opposed to continuous (but short-duration) noise such as that produced by aircraft and rocket launches. In the pinnipeds observed, small sonic booms between 1 to 2 pounds per square foot usually elicited a heads up response or slow movement toward and entering the water, particularly for pups. With respect to impacts on pinniped hearing, NMFS previously determined that VAFB launch and missile activities, including sonic booms, could have an impact on the hearing of pinnipeds (63 FR 39055, July 21, 1998). These impacts would be limited to TTS, lasting between minutes and hours, depending on exposure levels. Subsequent information from Auditory Brainstem Response testing on harbor seals following Titan IV, Taurus, and Delta IV launches indicates that no PTS resulted from these launches. Therefore, only Level B harassment of Pacific harbor seals, California sea lions, northern elephant seals, and northern fur seals is expected as a result of these activities.

NMFS has been issuing ITAs to the USAF to conduct these activities for more than 20 years. The first MMPA authorization pursuant to Section 101(a)(5) became effective in 1986. NMFS issued regulations to the USAF to conduct these activities from February 7, 2009, through February 6, 2014 (74 FR 6236, February 6, 2009). During that period a total of 9 missiles and 13 rockets were launched. On February 24, 2014 NMFS reissued regulations to the USAF to conduct launch activities from March 26, 2014 through March 26, 2019 (79 FR 10016). The 5-year launch activity shall not exceed 75 missile and 175 rocket launches without additional coordination with NMFS.

SOCAL Range Complex

The SOCAL Range Complex is situated off the coast of southern California generally between Dana Point and San Diego and encompasses three primary components: ocean operating areas (OPAREAs), special-use airspace (SUA), and San Clemente Island (SCI). Extending more than 600 nm (1,111 km) southwest into the Pacific Ocean, the SOCAL Range Complex encompasses over 120,000 nm^2 (411,600 km^2) of sea space, 113,000 nm^2 (387,500 km^2) of SUA, and over 42 nm^2 (144 km^2) of land area (i.e., SCI). The Navy's mission is to organize, train, equip, and maintain combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. The Navy executes this responsibility by establishing and executing training programs, including at-sea training and exercises, and ensuring naval forces have access to the ranges, OPAREAs, and airspace needed to develop and maintain skills for the conduct of naval operations. Activities involving research, development, test, and evaluation for naval systems are an integral part of this readiness mandate.

Within the SOCAL Range Complex, the Navy plans to conduct training activities that will utilize active tactical sonar sources that fall primarily into the category of Anti-submarine Warfare exercises. These activities will include the use of mid- and high-frequency active sonar within the vicinity of the proposed action area for the Navy, NAWCWD, target and missile launch activities at SNI. The proposed SOCAL Range Complex Activities may cause various impacts, including primarily Level B harassments, to marine mammal species in the study area. Impacts from the active sonar will occur while the animals are in the water, whereas impacts from the NAWCWD's activities will occur while the animals are hauled out. However, where effects may occur to the same populations, those are considered in this assessment of cumulative

impacts regardless of whether the effects occur in air or in water. NMFS issued 5-year regulations to the Navy for the activities in the SOCAL Range Complex on January 14, 2009 (74 FR 3882). NMFS anticipates the reissuance of 5-year regulations for SOCAL Range Complex activities for 2014 through 2019; however, the Navy has yet to submit an application requesting these new regulations.

SNI Roads and Airfield Repairs project at Naval Base Ventura County
On October 23, 2013, NMFS received an application from the Navy, Naval Base Ventura County (NBVC), at SNI, California, for an IHA to take small numbers of three species of marine mammals, by Level B harassment only, incidental to a roads and airfield repairs project. NMFS published the *Federal Register* notice for the proposed IHA on February 26, 2014 (79 FR 10777).

The Navy proposes to repair roads and the airfield on SNI, California. The proposed activity would occur from August 1 through November 30, 2014, with two separate deliveries of materials to the island during this time period. Site preparation and barge deliveries would occur at either Daytona or Coast Guard beaches on the eastern side of the island. Pinnipeds haul out year round at both beaches. However, numbers tend to be lower during the proposed activity months. Each delivery requires approximately 5 days to complete. The following specific aspects of the proposed activities are likely to result in the take of marine mammals: barge beach landings, offloading, and removal and construction activities to prepare for barge landings.

Based on the survey data collected in 2011 and the number of days of activities, NMFS proposes to authorize the take, by Level B harassment only, of 750 California sea lions, 500 harbor seals, and 250 northern elephant seals. NMFS has preliminarily determined that the take levels are small relative to the regional stock sizes. There is no danger of injury or death from the proposed activity

4.7.9 Conclusion

The commercial, scientific, military, and recreational activities, as described above, which occur in the Pacific, would not occur on SNI during the proposed activities due to safety concerns. Furthermore, given the small scale and infrequent occurrence of the proposed activity, and its anticipated minimal environmental effects, the proposed missile launch activities, as described in the application, would not contribute significantly or measurably to the overall environmental effects of other human activities along the California coast. While certain activities could occur that may result in behavioral disturbance of pinniped species in the vicinity and general time frame during which a launch activity may occur at SNI, it is not expected that the animals would experience more than short-term disturbance or displacement as a result of any of the activities described above. Other commercial, scientific, military, and recreational activities in the vicinity are not expected to have an additive effect on the condition of the pinniped species. Additionally, none of the activities are anticipated to result in injury or mortality of marine mammals. Therefore, NMFS has determined that the proposed activities would not produce any significant cumulative impacts to the human environment.

Chapter 5 MITIGATION MEASURES

As required under the MMPA, NMFS considered mitigation to effect the least practicable adverse impact on marine mammals and has developed a series of mitigation measures, as well as monitoring and reporting procedures (Chapter 6), that would be required under annual (or less frequent, if warranted and requested) LOAs.

The following measures are designed to eliminate the potential for serious injury or mortality and to minimize harassment to marine mammals found at SNI, as well as to avoid any possible sensitizing or predisposing of pinnipeds to greater responsiveness towards the sights and sounds of a launch. These measures would be required under Alternatives 1 (Preferred Alternative), 3 and 4. Should other mitigation measures be deemed necessary for future launch and test flight activities, these would be analyzed by NMFS and implemented after consultation and agreement with the Navy. These additional mitigation measures would be contained in the LOA.

The Navy will limit activities near the beaches in advance of launches. Existing safety rules for vehicle launches provide a built-in mitigation measure of this type: personnel are not normally allowed near any of the pinniped haul-out beaches that are located close to the flight track on the western end of SNI within several hours prior to launch. Also, because of the presence of colonies of sensitive seabirds (as well as pinniped haul-out sites) on western SNI, there are already special restrictions on personnel movements near beaches on which pinnipeds haul out. Furthermore, most of these beaches are closed to personnel year-round.

Other mitigation measures that have been incorporated into the proposed regulations include: (1) The Navy must avoid, whenever possible, launch activities during harbor seal pupping season (February through April), unless constrained by factors including, but not limited to, human safety, national security, or for launch trajectory necessary to meet mission objectives; (2) the Navy must limit, whenever possible, launch activities during other pinniped pupping seasons, unless constrained by factors including, but not limited to, human safety, national security, or for launch trajectory necessary to meet mission objectives; (3) the Navy must not launch missiles from the Alpha Complex at low elevation (less than 305 m [1,000 ft]) on launch azimuths that pass close to pinniped haul-out site(s) when occupied; (4) the Navy must avoid multiple vehicle launches in quick succession over haul-out sites when occupied, especially when young pups are present, except when required by mission objectives; and (5) the Navy must limit launch activities during nighttime hours, except when required by mission objectives (e.g., up to 10 nighttime launches for ABL testing per year).

Additionally, for two hours prior to, during, and approximately 30 minutes following each launch, personnel are not allowed near any of the pinniped haul-out beaches that are close to the flight track on the western end of SNI. Lastly, associated fixed-wing and rotary aircraft will maintain an altitude of at least 305 m (1,000 ft) when traveling near beaches on which pinnipeds are hauled out, except in emergencies or for real-time security incidents (e.g., search-and-rescue, fire-fighting, adverse weather conditions), which may require approaching pinniped haul-outs and rookeries closer than 305 m (1,000 ft).

If post-launch surveys determine that an injurious or lethal take of a marine mammal has occurred or there is an indication that the distribution, size, or productivity of the potentially affected pinniped populations has been affected, the launch procedure and the monitoring methods must be reviewed, in cooperation with NMFS, and, if necessary, appropriate changes must be made through modification to the LOA, prior to conducting the next launch of the same vehicle under that LOA.

Chapter 6 MONITORING AND REPORTING REQUIREMENTS

Under the Preferred Alternative (Alternative 2), Alternative 3, and Alternative 4, NMFS would require the Navy to undertake the following monitoring activities at SNI. The reporting requirements described in Section 6.2 would also be implemented under the three action alternatives.

6.1 Monitoring

As part of its application, the Navy provided a proposed monitoring plan, similar to that adopted for previous LOAs and regulations (see 74 FR 26580, June 3, 2009), for assessing impacts to marine mammals from missile launch activities from SNI. This monitoring plan is described in detail in the Navy's 2013 application (NAWCWD, 2013). The Navy proposes to conduct the following monitoring during the first year under the LOA and regulations.

6.1.1 Land-based Monitoring

In conjunction with a biological contractor, the Navy will continue its land-based monitoring program to assess effects on the three common pinniped species on SNI: northern elephant seals, harbor seals, and California sea lions. This monitoring will occur at three different sites of varying distance from the launch site before, during, and after each launch. The monitoring would be via autonomous video cameras. Pinniped behavior on the beach will be documented prior to, during, and following the launch. Additionally, new video equipment capable of obtaining video during night launches will be acquired for the ABL program.

During the day of each missile launch, the observer would place three digital video cameras overlooking chosen haul-out sites. Each camera would be set to record a focal subgroup within the haul-out aggregation for a maximum of four hours or as permitted by the videotape capacity. Following a launch, video records will be made for up to one hour. Observers will return to the observing sites as soon as it is safe to record the numbers and types of pinnipeds that are on the haul-out(s).

Following each launch, all digital recordings will be transferred to DVDs for analysis. A DVD player/computer with high-resolution freeze-frame and jog shuttle will be used to facilitate distance estimation, event timing, and characterization of behavior. Additional details of the field methods and video and data analysis can be found in the Navy's 2013 application (NAWCWD, 2013). Please refer to that document for additional detail.

6.1.2 Acoustical Monitoring

During each launch, the Navy would obtain calibrated recordings of the levels and characteristics of the received launch sounds. Acoustic data would be acquired using three ATARs at three different sites of varying distances from the target's flight path. ATARs can record sounds for extended periods (dependent on sampling rate) without intervention by a technician, giving them the advantage over traditional digital audio tape recorders should there be prolonged launch

delays. To the extent possible, acoustic recording locations would correspond with the sites where video monitoring is taking place. The collection of acoustic data would provide information on the magnitude, characteristics, and duration of sounds that pinnipeds may be exposed to during a launch. In addition, the acoustic data can be combined with the behavioral data collected via the land-based monitoring program to determine if there is a dose-response relationship between received sound levels and pinniped behavioral reactions. Once collected, sound files will be sent to the acoustical contractor for sound analysis. Additional details regarding the installation and calibration of the acoustic instruments and analysis methods are provided in the 2013 Navy's application (NAWCWD, 2013). Please refer to that document for more detail.

6.2 Reporting Requirements

The Navy's application indicates that they propose to submit annual interim technical reports to NMFS no later than December 31 for the duration of the regulation period. This interim technical report will provide full documentation of methods, results, and interpretation pertaining to all monitoring tasks for launches during each calendar year. This report must contain the following information: (1) The timing and nature of launch operations; (2) a summary of pinniped behavioral observations; and (3) an estimate of the amount and nature of all takes by harassment or other means. However, only preliminary information would be available to be included for any launches during the 60-day period immediately preceding submission of the interim report to NMFS.

If a freshly dead or seriously injured pinniped is found during post-launch monitoring, the incident must be reported within 48 hours to the NMFS Office of Protected Resources and the NMFS Southwest Regional Office.

In addition to annual technical reports, NMFS proposes to require the Navy to submit a draft comprehensive final technical report (i.e., draft comprehensive monitoring report) to NMFS 180 days prior to the expiration of the regulations. This technical report will provide full documentation of methods, results, and interpretation of all monitoring tasks for launches to date. A revised final comprehensive technical report (i.e., final comprehensive monitoring report), including all monitoring results during the entire period of the regulations will be due 90 days after the end of the period of effectiveness of the regulations. Both the 60-day and final reports will be subject to review and comment by NMFS. Any recommendations made by NMFS must be addressed in the final comprehensive report prior to acceptance by NMFS.

The Navy plans to discuss, and where possible, coordinate its terrestrial pinniped monitoring program (as summarized above and in Section 13 of their application) with the SNI pinniped census program conducted by NMFS scientists. In particular, where the Navy's monitoring efforts might contribute to improvements of haul-out correction factors for aerial surveys, the Navy will make such information available to NMFS. The Navy will coordinate with NMFS and facilitate any on-island monitoring of pinnipeds by NMFS scientists.

The Navy will sponsor pinniped and acoustical monitoring methods that will facilitate comparing and combining monitoring data where appropriate with other missile launch monitoring programs in California (e.g., USAF research on the effects of large booster launches from VAFB; Thorson et al., 1999; Southall et al., 2007:519-20).

6.3 Review of the Comprehensive Monitoring Report

In accordance with its previous MMPA regulations (see 74 FR 26580, June 3, 2009), which expire on June 2, 2014, the Navy submitted a draft comprehensive monitoring report, covering the period June 2009 - November 2013 (Ugoretz 2013). This report includes information from the annual reports submitted to NMFS during this time period, which were reviewed and summarized by NMFS in several *Federal Register* notices announcing issuance of annual LOAs for the activities at SNI. During this reporting period, 33 missiles were launched on 28 days: three single launches in 2009 (June 6 and 13, and August 10); four single launches in 2010 (May 3, June 9, July 8, and December 8); eight single launches in 2011 (February 21 and 24, May 12 and 16, July 17, August 25, and two separate launches on December 7); three dual launches in 2011 (September 29, November 3, and December 16); four single launches in 2012 (March, 11 and 28, June 12, and September 18); and eight single launches in 2013 (February 27, March 3, May 10, two separate launches on May 12, June 12, August 7, and August 8). Dual launches consisted of missile launched in rapid succession (e.g., less than 1 minute apart) (Ugoretz, 2013).

No evidence of pinniped injuries or fatalities related to missile launches was evident, nor was it expected, during the monitoring period. Approximately 3,252 California sea lions, 202 Pacific harbor seals, and no northern elephant seals were estimated to have been affected during the monitoring period. These figures are approximate and likely over- or underestimate pinnipeds affected because they; (a) include extrapolations for pinnipeds on beaches that were not monitored on any given launch day, (b) very likely count some of the same individuals more than once, and (c) also exclude pinnipeds on some beaches that were not monitored. The pinnipeds included in these estimates either left the haul-out site in response to the launch, or exhibited prolonged movement or behavioral changes relative to their behavior immediately prior to the launch.

The results from the 2009–2013 monitoring period (and those from previous monitoring periods) suggest that any effects of the launch operations were minor, short-term, and localized, at least for northern elephant seals and California sea lions. Some Pacific harbor seals may have left their haul-out site until the following low tide, but numbers occupying haul-out sites shortly after a launch or the next day, were generally similar to pre-launch levels. It is not likely that any of the pinnipeds on SNI were adversely impacted by such behavioral reactions. While sound levels for four launches were slightly over that which might cause temporary threshold shift (TTS), these measurements were taken adjacent to the launch pad and launch sounds near the pinniped haul-outs were below the range that would be likely to cause TTS or permanent hearing damage. In the unlikely event that any pinnipeds did incur TTS during launches at SNI, this would have presumably been mild and recoverable and thus not have caused permanent damage.

Based on the results presented in the draft comprehensive monitoring report, NMFS concludes that the previous monitoring and mitigation measures prescribed in the regulations were

effective. In addition, actual takes of marine mammals were generally lower than expected due to the implementation of monitoring and mitigation measures.

As stated in Section 6.2 above, the revised final comprehensive technical report, including all monitoring results during the entire 2009-2014 period of the current regulations will be due, and subject to review by NMFS, 90 days after the end of the period of effectiveness of the current regulations.

6.4 Conclusion

The inclusion of the mitigation and monitoring measure requirements in ITAs, as described in this EA, will ensure that the Navy's activities will have the least practicable adverse impact on affected marine mammal species and stocks, will have a negligible impact on the affected species or stocks, and will not have an unmitigable adverse impact on the affected species or stocks for subsistence uses. For military readiness activities (as described in the MMPA), a determination of least practicable adverse impacts on a species or stock includes consideration, in consultation with the Department of Defense, of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity. The proposed mitigation and monitoring measures presented in this document were developed in accordance with this MMPA process and are compliant with these considerations.

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Chapter 8 REFERENCES

Barlow, J., P. Boveng, M.S. Lowry, B.S. Stewart, B.J. Le Boeuf, W.J. Sydeman, R.J. Jameson, S.G. Allen, and C.W. Oliver. 1993. Status of the northern elephant seal population along the U.S. west coast in 1992. Administration Report LJ-93-01. U.S. National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA.

Barlow, J., K.A. Forney, P.S. Hill, R.L. Brownell Jr., J.V. Carretta, D.P. DeMaster, F. Julian, M.S. Lowry, T. Ragen, and R.R. Reeves. 1997. U.S. Pacific marine mammal stock assessments: 1996. NOAA-TM-NMFS-SWFSC-248. U.S. National Marine Fisheries Service, Southwest Fisheries Science Center, La Jolla, CA. 223 p.

Beeson, M.B., and D.A. Hanan. 1994. Harbor seal, *Phoca vitulina richardsi*, census in California, May-June, 1994. Report from California Department Fish and Game for U.S. National Marine Fisheries Service, Southwest Region, Long Beach, CA.

Berrens, R.P., J.S. DeWitt, D.D. Baumann, and M.E. Nelson. 1988. Examination of noise management approaches in the United States. U.S. Army Corps of Engineers, Institute for Water Resources, Fort Belvoir, VA.

Bonnell, M.L., and M.D. Dailey. 1993. Marine mammals. p. 604-681 In: M.D. Dailey, D.J. Reish, and J.W. Anderson, (eds.). Ecology of the Southern California Bight. University of California Press, Berkeley, CA.

Bonnell, M.L., and R.G. Ford. 1987. California sea lion distribution: a statistical analysis of aerial transect data. J. Wildl. Manage. 51:13-20.

Bonnell, M.L., B.J. Le Boeuf, M.O. Pierson, D.H. Dettman, G.D. Farrens, and C.B. Heath. 1981. Summary of marine mammal and seabird surveys of the Southern California Bight area, 1975-1978. Vol. III, Part I—Pinnipeds of the Southern California Bight. Report from Center for Coastal Marine Studies, University of California, Santa Cruz, CA, for U.S. Bureau of Land Management, Washington, DC.

Boveng, P. 1988. Status of the California sea lion population on the U.S. west coast. Admin. Rep. LJ-88-07. SWFSC, NMFS, La Jolla, CA.

Bowles, A.E., L. Wolski, E. Berg, and P.K. Yochem. 1999. Measurements of impulse noise-induced temporary threshold shift in endangered and protected animals. p. 932 In: Abstracts of the 137th Meeting of the Acoustical Society of America, Berlin, Germany.

Brunner, S. 2003. Fur seals and sea lions (Otariidae): Identification of species and species review. Systematics and Biodiversity 1:339-439.

Burgess, W.C. and C.R. Greene, Jr. 1998. BQM-34S and Vandal missile target launch sound measurements recorded at San Nicolas Island and NAWS Point Mugu. Rep. from Greeneridge Sciences Inc., Santa Barbara, CA, and Ogden Environmental and Energy Services, Inc., Santa Barbara, CA, for Naval Air Warfare Center, Weapons Division, Point Mugu, CA.

California Department of Fish and Game (CDFG). 2013. Final California Commercial Landings for 2012. State of California, The Resources Agency, Department of Fish and Game. https://www.dfg.ca.gov/marine/landings/landings

Carretta, J.V., K.A. Forney, M.S. Lowry, J. Barlow, J. Baker, D. Johnston, B. Hanson, M.M. Muto, D. Lynch, and L. Carswell. 2007. U.S. Pacific marine mammal stock assessments: 2007. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SWFSC-414. 320 pp.

Carretta, J.V., K.A. Forney, M.S. Lowry, J. Barlow, J. Baker, D. Johnston, B. Hanson, M.M. Muto, D. Lynch, and L. Carswell. 2009. U.S. Pacific marine mammal stock assessments: 2008. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SWFSC-434. 340 pp.

Carretta, J.V., K.A. Forney, M.S. Lowry, J. Barlow, J. Baker, B. Hanson, and M.M. Muto. 2013. U.S. Pacific marine mammal stock assessments: 2012. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SWFSC-504. 378 pp.

Clark, C. W., Ellison, W. T., Southall, B. L., Hatch, L., Van Parijs, S. M., Frankel, A., & Ponirakis, D. (2009). Acoustic masking in marine ecosystems: intuitions, analysis, and implication. *Marine Ecology Progress Series, 395*, 201-222.

Clinton, W.L. 1994. Sexual selection and growth in male northern elephant seals. p. 154-168 In: B.J. Le Boeuf and R.M. Laws (eds.) Elephant Seals: Population Ecology, Behavior, and Physiology. University of California Press, Berkeley, CA.

Cummings, W.C. 1993. Sonic booms and marine mammals: informational status and recommendations. Rep. from Oceanographic Consultants for NASA Langley Research Center, Hampton, VA, San Diego, CA.

Engle, J.M. 1994. Perspectives on the structure and dynamics of nearshore marine assemblages of the California Channel Islands. p. 13-26 In: W.L. Halvorson and G.J. Maender (eds.), The Fourth California Islands Symposium: Update on the Status of Resources. Santa Barbara Museum of Natural History. Santa Barbara, CA.

Fay, R.R. 1988. Hearing in vertebrates: a psychophysics databook. Hill-Fay Associates, Winnetka, IL. 621 pp.

Fluharty, M.J. 1999. Summary of Pacific harbor seal, *Phoca vitulina richardsi*, surveys in California, 1982 to 1995. Marine Region Administrative Report 99-1. California Department of Fish and Game. 49 pp.

Gisiner, R.C., and R.J. Schusterman. 1991. California sea lion pups play an active role in reunions with their mothers. Anim. Behav. 41:364-366.

Hanan, D.A. 1996. Dynamics of abundance and distribution for Pacific harbor seal, *Phoca vitulina richardsi*, on the Coast of California. Ph.D. Thesis, University of California at Los Angeles. 158 pp.

Harvey, J.T and D. Goley 2011. Determining a correction factor for aerial surveys of harbor seals in California. Marine Mammal Science. 27: 719-735.

Hayes, W.N., and E.I. Saif. 1967. Visual alarm reactions in turtles. Anim. Behav. 15:102-106.

Holst, M. and J.W. Lawson. 2002. Behavior of pinnipeds during target missile launches. p. 3-1 to 3-27 In: J.W. Lawson, E.A. Becker, and W.J. Richardson (eds.) Marine mammal and acoustical monitoring of target and missile launches on San Nicolas Island, August 2001 – July 2002. LGL Rep. TA2630-3. Report from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Naval Air Warfare Center Weapons Division, Point Mugu, CA, and National Marine Fisheries Service, Silver Spring, MD.

Holst, M. and C.R. Greene, Jr., with W.J. Richardson, T.L. McDonald, K. Bay, R.E. Elliott, and V.D. Moulton. 2005a. Marine mammal and acoustical monitoring of missile launches on San Nicolas Island, California, August 2001 – May 2005. LGL Rep. TA2665-5. Rep. from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Naval Air Warfare Center Weapons Division, Point Mugu, CA, and National Marine Fisheries Service, Silver Spring, MD, and Long Beach, CA.

Holst, M., J.W. Lawson, W.J. Richardson, S.J. Schwartz and G. Smith. 2005b. Pinniped responses during Navy missile launches at San Nicolas Island, California. p. 477-484 In: D.K. Garcelon and C.A. Schwemm (eds.), Proc. 6th Calif. Isl. Sympos., Ventura, CA, Dec. 2003. Nat. Park Serv. Tech. Publ. CHIS-05-01. Inst. Wildl. Stud., Arcata, CA.

Holst, M. and C.R. Greene, Jr., with W.J. Richardson, T.L. McDonald, K. Bay, R.E. Elliott, and R. Norman. 2008. Marine mammal and acoustical monitoring of missile launches on San Nicolas Island, California, August 2001 – March 2008. LGL Rep. TA4617-1. Rep. from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Naval Air Warfare Center Weapons Division, Point Mugu, CA, and Nat. Mar. Fish. Serv., Silver Spring, MD, and Long Beach, CA.

Holst, M. and C.R. Greene, Jr. 2010. Marine mammal and acoustical monitoring during vehicle launches on San Nicolas Island, California, June 2009 – June 2010. LGL Rep. TA4896-2. Rep. from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Naval Air Warfare Center Weapons Division, Point Mugu, CA, and Nat. Mar. Fish. Serv., Silver Spring, MD, and Long Beach, CA. 59 p.

Holst M., C.R. Greene Jr., W.J. Richardson, T.L. McDonald, K. Bay, S.J. Schwartz, and G. Smith. 2011. Responses of Pinnipeds to Navy Missile Launches at San Nicolas Island, California. Aquatic Mammals, 37(2), 139-150.

Huber, H.R. 1991. Changes in the distribution of California sea lions north of the breeding rookeries during the 1982-83 El Niño. p.129-137 In: F. Trillmich and K.A. Ono (eds.), Pinnipeds and El Niño/Responses to environmental Stress. Springer-Verlag, Berlin.

Huber, H. 1995. The abundance of harbor seals (*Phoca vitulina richardsi*) in Washington, 1991-1993. M.Sc.Thesis, University of Washington, Seattle, WA.

Huber, H.R., A.C. Rovetta, L.A. Fry, and S. Johnston. 1991. Age-specific natality of northern elephant seals at the South Farallon Islands, California. J. Mammal. 72:525-534.

Kastak, D., and Schusterman, R.J. 1998. Low-frequency amphibious hearing in pinnipeds: methods, measurements, noise, and ecology. J. Acoust. Soc. Am. 103:2216-2228.

Kastak, D., and R.J. Schusterman. 1999. In-air and underwater hearing sensitivity of a northern elephant seal (Mirounga angustirostris). Can. J. Zool. 77:1751-1758.

Kastak, D., B. Southall, M. Holt, C.R. Kastak, and R. Schusterman. 2004. Noise-induced temporary threshold shifts in pinnipeds: effects of noise energy. J. Acoust. Soc. Am. 116(4)Pt2:2531-2532.

Kastak, D., B.L. Southall, R.J. Schusterman, and C. Reichmuth. 2005. Underwater temporary threshold shift in pinnipeds: effects of noise level and duration. J. Acoust. Soc. Am. 118(5):3154-3163.

Kinsler, L.E., A.R. Frey, A.B. Coppens, and J.V. Sanders. 1982. Fundamentals of Acoustics. John Wiley & Sons, New York.

Koski, W.R., J.W. Lawson, D.H. Thomson, and W.J. Richardson. 1998. Point Mugu Sea Range marine mammal technical report. Report from LGL Limited, environmental research associates, King City, ON and Ogden Environmental and Energy Services, Santa Barbara, CA for Naval Air Warfare Center, Weapons Division, Point Mugu, CA and Southwest Division, Naval Facilities Engineering Command, San Diego, CA.

Lawson, J.W., W.R. Koski, W.J. Richardson, D.H. Thomson, and C.I. Malme. 1998. Biological consequences for marine mammals. p. 183-279 (plus Appendices) In: Point Mugu Sea Range marine mammal technical report. Report from LGL Ltd., King City, Ont., for Naval Air Warfare Center, Weapons Division, Point Mugu, CA.

Le Boeuf, B.J., and R.M. Laws, editors. 1994. Elephant seals: population ecology, behavior, and physiology. University of California Press, Berkeley, CA.

Le Boeuf, B.J., M.L. Bonnell, M.O. Pierson, D.H. Dettman, and G.D. Farrens. 1978. Final Report, 1975 - 1976, Marine Mammal and Seabird Survey of the Southern California Bight Area. Volume III - Principal Investigators' Reports. The Regents of the University of California, University of California, Santa Cruz, CA. 472 pp.

Le Boeuf, B.J., D.P. Costa, A.C. Huntley, and S.D. Feldcamp. 1988. Continuous, deep diving in female northern elephant seals, *Mirounga angustirostris*. Can. J. Zool. 66:446-458.

Le Boeuf, B.J., P.A. Morris, S.B. Blackwell, D.E. Crocker, and D.P. Costa. 1996. Diving behavior of juvenile northern elephant seals. Can. J. Zool. 74:1632-1644.

Lowry, M.S. 2002. Counts of northern elephant seals at rookeries in the southern California Bight: 1981-2001. NOAA-TM-NMFS-SWFSC-345, U.S. Dept. Comm., NOAA, NMFS, SWFSC.

Lowry, M.S. and J.V. Carretta. 2002. Pacific harbor seal, Phoca vitulina richardii, census in California during May-July 2002. NOAA-TM-NMFS-SWFSC-353. U.S. Dept. Comm., NOAA, NMFS, SWFSC.

Lowry, M. S. and O. Maravilla-Chavez. 2005. Recent abundance of California sea lions in western Baja California, Mexico and the United States. In D. K. Garcelon and C. A. Schwemm (editors), Proceedings of the Sixth California Islands Symposium, Ventura, California, December 1-3, 2003. p. 485-497. National Park Service Technical Publication CHIS-05-01, Institute for Wildlife Studies, Arcata, California.

Lowry, M.S., P. Boveng, R.L. DeLong, C.W. Oliver, B.S. Stewart, H. DeAnda, and J. Barlow. 1992. Status of the California sea lion (*Zalophus californianus*) population in 1992. NMFS, SWFSC La Jolla, CA.

Lowry, M.S., W.L. Perryman, M.S. Lynn, R.L. Westlake, and F. Julian. 1996. Counts of northern elephant seals, *Mirounga angustirostris*, from large-format aerial photographs taken at rookeries in Southern California during the breeding season. Fish. Bull. 94:176-185.

Lowry, M.S., J.V. Carretta and K.A. Forney. 2005. Pacific harbor seal, *Phoca vitulina richardsi*, census in California during May – July 2004. Administrative Report LJ-05-06. SWFSC, La Jolla, CA.

Lubard, S.C. and P.M. Hurdle. 1976. Experimental investigation of acoustic transmission from air into a rough ocean. Journal of the Acoustical Society of America. 60(5): 1048-1052.

Melin, S.R., R.L. DeLong and A.J. Orr. 2005. The status of the northern fur seal population at San Miguel Island, California. p. 87-102 In: J.W. Testa (ed.), Fur seal investigations, 2002-2003. U.S. Dep. Comer., NOAA Tech. Memo. NMFS-AFSC-151.

Mortenson, J. and M. Follis. 1997. Northern elephant seal (*Mirounga angustirostris*) aggression on harbor seal (*Phoca vitulina*) pups. Mar. Mam. Sci. 13: 526-530.

Naval Air Warfare Center Weapons Division (NAWCWD). 1996. Draft Point Mugu Range Management Plan. Point Mugu, CA. May.

NAWCWD. 2002. Final Environmental Impact Statement/Overseas Environmental Impact Statement Point Mugu Sea Range. Point Mugu, CA. March.

NAWCWD. 2008. Petition for Regulations Pursuant to Section 101(a)(5) of the Marine Mammal Protection Act Covering Taking of Marine Mammals Incidental to Target and Missile Launch Activities for the Period 2009-2014 at San Nicolas Island, California (50 CFR Part 216, Subpart I). Submitted by Naval Air Warfare Center Weapons Division, Point Mugu, CA, Prepared by TEC Inc., Santa Barbara, CA, and LGL Limited, Sidney, BC, Canada.

NAWCWD. 2013. Petition for Regulations Pursuant to Section 101(a)(5) of the Marine Mammal Protection Act Covering Taking of Marine Mammals Incidental to Target and Missile Launch Activities for the Period 2014-2019 at San Nicolas Island, California (50 CFR Part 216, Subpart I). Submitted by Naval Air Warfare Center Weapons Division, Point Mugu, CA, Prepared by TEC Inc., Santa Barbara, CA, and LGL Limited, Sidney, BC, Canada.

National Marine Fisheries Service (NMFS). 2003. Environmental Assessment Request by Naval Air Warfare Center Weapons Division Point Mugu for a Letter of Authorization to Allow the Incidental Take of Pinnipeds on San Nicolas Island, California During Missile and Target Launch Operations. 85 pp.

National Marine Fisheries Service (NMFS). 2009. Environmental Assessment on the Issuance of Regulations to Take Marine Mammals by Harassment Incidental to U.S. Navy Missile Launch Activities at San Nicolas Island, California. 79 pp.

NMFS. 2008. Recovery Plan for the Steller Sea Lion: Eastern and Western Distinct Population Segments (*Eumetopias jubatus*), Revision. Silver Spring, MD.

Odell, D. K. 1974. Seasonal occurrence of the northern elephant seal, Mirounga angustirostris, on San Nicolas Island, California. J. Mammal. 55:81-95.

Ono, K.A. 1991. Introductory remarks and the natural history of the California sea lion. p. 109-111 In: F. Trillmich and K.A. Ono (eds.), Pinnipeds and El Niño/Responses to Environmental Stress. Springer-Verlag, NY.

Perry, E.A., D.J. Boness and S.J. Insley. 2002. Effects of sonic booms on breeding gray seals and harbor seals on Sable Island, Canada. J. Acoust. Soc. Am. 111:599-609.

Peterson, R.S. and G.A. Bartholomew. 1967. The natural history and behavior of the California sea lion. Special Publication No. 1, American Society of Mammalogists.

Petrinovich, L. 1974. Individual recognition of pup vocalization by northern elephant seal mothers. Zeitchrift fuer Tierpsychologie 34:308-312.

Reiman, A.J., and J.M. Terhune. 1993. The maximum range of vocal communication in air between a harbor seal (*Phoca vitulina*) pup and its mother. Mar. Mamm. Sci. 9:182-189.

Renouf, D. 1984. The vocalization of the harbour seal pup (*Phoca vitulina*) and its role in the maintenance of contact with the mother. J. Zool. (Lond.) 202:583-590.

Renouf, D. 1985. A demonstration of the ability of the harbour seal *Phoca vitulina* (L) to discriminate among pup vocalizations. J. Exp. Mar. Biol. Ecol. 87:41-46.

Richardson, W.J., C.R. Greene, C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, Inc. San Diego, CA.

Riedman, M. 1990. The pinnipeds: Seals, sea lions and walruses. University of California Press, Berkeley.

Schramm, Y., S.L. Mesnick, J. de la Rosa, D.M. Palacios, M.S. Lowry, D. Aurioles-Gamboa, H.M. Snell, and S. Escorza-Treviño. 2009. Phylogeography of California and Galapagos sea lions and population structure within the California sea lion. Marine Biology 156:1375-1387.

Schwarz, A.L., and G.L. Greer. 1984. Responses of Pacific herring, *Chupea harengus pallasi*, to some underwater sounds. Can. J. of Fish. and Aq. Sci. 41:1183-1192.

Shipley, C., and G. Strecker. 1986. Day and night patterns of vocal activity of northern elephant seal bulls. J. Mammal. 67:775-778.

Shipley, C., M. Hines, and J.S. Buchwald. 1981. Individual differences in threat calls of northern elephant seal bulls. Animal Behavior 29:12-19.

Shipley, C., M. Hines, and J.S. Buchwald. 1986. Vocalizations of northern elephant seal bulls: development of adult call characteristics during puberty. J. Mammal. 67:526-536.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas and P.L. Tyack. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. Aquat. Mamm. 33(4):i-iv, 411-522.

Stewart, B.S. 1981. Behavioral response of northern elephant seals and California sea lions on San Nicolas Island, California, to loud impulse noise. J. Acoust. Soc. Am. 70 (Suppl. 1):S84.

Stewart, B.S. 1989. The ecology and population biology of the northern elephant seal, *Mirounga angustirostris* Gill 1866, on the southern California Channel Islands. Ph.D. Thesis, University of California, Los Angeles.

Stewart, B.S., and R.L. Delong. 1993. Seasonal dispersion and habitat use of foraging northern elephant seals. p. 179-194 In: I.L. Boyd (ed.) Marine mammals: advances in behavioral and population biology. Symp. Zool. Soc. Lond. 66. Clarendon Press, Oxford, U.K.

Stewart, B.S., and R.L. DeLong. 1995. Double migrations of the northern elephant seal, *Mirounga angustirostris*. J. Mammal. 76:196-205.

Stewart, B.S., and P.K. Yochem. 1984. Seasonal abundance of pinnipeds at San Nicolas Island, California, 1980-1982. Bull. South. Calif. Acad. Sci. 83:121-132.

Stewart, B.S., and P.K. Yochem. 1985. Aerial surveys of pinniped populations at the Channel Islands National Park and National Marine Sanctuary: 1984-1985. Technical Report 85-179. Hubbs-Sea World Research Institute, San Diego, CA.

Stewart, B.S., and P.K. Yochem. 1994. Ecology of harbor seals in the Southern California Bight. p. 123-134 In: W.L. Halvorson and G.J. Maender (eds.), The Fourth California Islands Symposium: Update on the Status of Resources. Santa Barbara Museum of Natural History, Santa Barbara, CA.

Stewart, B.S., and P.K. Yochem. 2000. Community ecology of California Channel Islands pinnipeds. p. 413-420 In: D.R. Browne, K.L. Mitchell and H.W. Chaney (eds.), Proc. 5th Calif. Islands Sympos., Santa Barbara, CA, March 1999, Compact disk ed. OCS Study MMS 99-0038. U.S. Minerals Manage. Serv., Pacific OCS Region, Camarillo, CA.

Stewart, B.S., P.K. Yokum, R.L. DeLong, and G.A. Antonelis. 1993. Trends in abundance and status of pinnipeds on the southern California Channel Islands. p. 501-516 In: E. Hochberg (ed.), Third California Islands Symposium: Recent advances in research on the California islands. Santa Barbara Museum of Natural History, Santa Barbara, CA.

Stewart, B.S., B.J. Le Boeuf, P.K. Yochem, H.R. Huber, R.L. DeLong, R.J. Jameson, W. Sydeman, and S.G. Allen. 1994a. History and present status of the northern elephant seal population. In: B.J. Le Boeuf and R.M. Laws (eds.), Elephant Seals. Univ. Calif. Press, Los Angeles.

Stewart, B.S., J.K. Francine, and P.H. Thorson. 1994b. Taurus launch at Vandenberg Air Force Base, 13 March 1994; sound levels and behavioral responses of harbor seals (*Phoca vitulina richardsi*) at Purisma Point and Rocky Point. HSWRI Technical Report 94-252. Rep. from Hubbs-Sea World Research Institute, San Diego, CA for U.S. Air Force, SMC/CEW, Vandenberg AFB, CA.

Thorson, P.H., J.K. Francine, and D.A. Eidson. 1998. Acoustic measurement of the Titan IV A-18 launch and quantitative analysis of harbor seal (*Phoca vitulina richardsi*) behavioral and auditory responses. Report from SRS Technologies, Manhattan Beach, CA, for Space and Missile Systems Center, Air Force Materiel Command, Los Angeles, CA.

Thorson, P.H., J.K. Francine, E.A. Berg, L.E. Meyers, and D.A. Eidson. 1999. Acoustic measurement of the 22 May 1999 Titan IV B-12 launch and quantitative analysis of auditory and behavioral responses for selected pinnipeds on Vandenberg Air Force Base and San Miguel Island, California. Report from SRS Technologies, Manhattan Beach, CA, for U.S. Air Force, Vandenberg AFB, CA.

Ugoretz, J. and C.R. Greene, Jr. 2012. Pinniped Monitoring During Missile Launches on San Nicolas Island, California, September 2011 - September 2012. Naval Air Warfare Center Weapons Division, Point Mugu, CA. 65 p.

Ugoretz, J. 2013. Draft Comprehensive Report - Pinniped Monitoring During Missile Launches on San Nicolas Island, California, June 2009 - November 2013. Naval Air Warfare Center Weapons Division, Point Mugu, CA. 115 pp.

Wolf, J. B.W., D. Tautz, and F. Trillmich. 2007. Galapagos and California sea lions are separate species: Genetic analysis of the genus Zalophus and its implications for conservation management. Frontiers in Zoology: 4:20.

Wolski, L.F. 1999. Physiological responses of harbor seals, California sea lions, and northern elephant seals to simulated sonic booms, air-puffs, and white-noise bursts. J. Acoust. Soc. Am. 106:2220.