UNITED STATES DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL MARINE FISHERIES SERVICE

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 to:
Office of Protected Resources,
National Marine Fisheries Service,
National Oceanographic and Atmospheric Administration

Submitted by:
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Point Mugu, CA 93042

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ACRONYMS AND ABBREVIATIONS

3-D	3-dimensional
ABL	Airborne Laser
AGS	Advanced Gun System
~	approximately
ATAR	Autonomous Terrestrial Acoustic Recorder
avg.	average
CFR	Code of Federal Regulations
cm	centimeters
CPA	closest point of approach
dB re 20 µPa	decibels reference 20 micropascals
dBA	decibel, A-weighted, to emphasize mid-frequencies and to de-emphasize low and high frequencies to which human (and pinniped) ears are less sensitive
DR	Ducted Rocket (pertains to GQM-163A "Coyote" SSST)
EIS/OEIS	Environmental Impact Statement/Overseas Environmental Impact Statement
ESA	Endangered Species Act
hr	hours
Hz	hertz
IHA	Incidental Harassment Authorization
JATO	jet-assisted take-off
kg	kilograms
kHz	kilohertz
km	kilometers
LOA	Letter of Authorization
m	meters
min	minute
mm	millimeter
MMPA	Marine Mammal Protection Act
M_{pa}	Frequency weighting appropriate for pinnipeds in air (Southall et al. 2007)
NAWCWD	Naval Air Warfare Center Weapons Division
NMFS	National Marine Fisheries Service
PTS	Permanent Threshold Shift
RAM	Rolling Airframe Missile
s	seconds
SCB	Southern California Bight
SEL	sound exposure level, a measure of the energy content of a transient sound
SEL-A	A-weighted sound exposure level
SEL-f	flat-weighted sound exposure level
SEL-M	M_{pa}-weighted sound exposure level
SNI	San Nicolas Island
SPL	sound pressure level
SPL-A	A-weighted sound pressure level
SPL-f	flat-weighted sound pressure level
SPL-M	M_{pa}-weighted sound pressure level
SSST	Supersonic Sea-Skimming Target
SWFSC	Southwest Fisheries Science Center
TTS	Temporary Threshold Shift
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
VAFB	Vandenberg Air Force Base

Petition for Regulations – Taking of Marine Mammals Incidental to Target and Missile Launch Activities at San Nicolas Island, California

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I. NATURE OF THE REQUEST

The Naval Air Warfare Center Weapons Division (NAWCWD), pursuant to Section 101(a)5 of the Marine Mammal Protection Act (MMPA), 16 United States Code (USC) §1371(a)(5); 50 Code of Federal Regulations (CFR) §216, Subpart I, petitions the National Marine Fisheries Service (NMFS) to implement new regulations for takes of marine mammals incidental to missile launches from San Nicolas Island (SNI), California, for the period 2014–2019. The regulations sought would allow the incidental, but not intentional, "taking" of pinnipeds, including Pacific harbor seals (*Phoca vitulina*), northern elephant seals (*Mirounga angustirostris*), and California sea lions (*Zalophus californianus*), in the event that such a result occurs in the course of launch operations on SNI.

NAWCWD is the Navy's full-spectrum research, development, acquisition, test, and evaluation (RDAT&E) center of excellence for weapons systems associated with air warfare, aircraft weapons integration, missiles and missile subsystems, and assigned airborne electronic warfare systems. NAWCWD is a multi-site organization that includes the Point Mugu Sea Range and is responsible for environmental compliance for this Range. Therefore, NAWCWD petitions NMFS to implement the new regulations for incidental takes of marine mammals by harassment during the launch program for missiles and targets from several launch sites on SNI. These activities are considered Military Readiness Activities (as defined in section 315(f) of Public Law 107–314; 16 U.S.C. 703) and are afforded the provisions of Section 319 of the National Defense Authorization Act for fiscal year 2004 (Public Law 108–136, 117 Stat. 1433).

Based on the results of a standard, ongoing marine mammal monitoring program conducted during missile launches during 2001–2012 (Holst et al. 2005a, b; 2008, Holst and Greene 2010, and Ugoretz and Greene 2012), the Navy does not anticipate that such launch operations, described in detail in the Point Mugu Sea Range Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) (NAWCWD 2002), will result in the "taking" of significant numbers of marine mammals. Moreover, these takes of marine mammals are not likely to be lethal, and any impact on these species would be negligible. Accordingly, this Petition has been filed for the purpose of ensuring that the activities described herein are conducted in compliance with the MMPA when marine mammals are taken incidentally and unintentionally during the course of launch operations.

Specifically, NAWCWD requests authorization to incidentally take Pacific harbor seals, northern elephant seals, and California sea lions by level B harassment subsequent to missile launches on SNI. The period requested is between June 2014 and June 2019 with no more than 40 missile launches per year during that timeframe. NAWCWD requests that, consistent with small take regulations for other Navy Ranges, the regulations allowing these takes specify that a Letter of Authorization covering the entire period of the regulations be allowed.

II. INFORMATION SUBMITTED IN ACCORDANCE WITH 50 CFR §216.104

NMFS regulations governing the issuance of regulations and Letters of Authorization (LOAs) permitting incidental takes under certain circumstances are codified at 50 CFR Part 216, Subpart I (216.101 – 216.106). Section 216.104 sets out 14 specific items that must be addressed in requests for rulemaking pursuant to Section 101(a) (5) of the MMPA. Each of these items is addressed in detail below.

1. OPERATIONS TO BE CONDUCTED

A detailed description of the specific activity or class of activities that can be expected to result in incidental taking of marine mammals.

1.1 Overview of the Activity

NAWCWD plans to continue a launch program for missiles and targets from several launch sites on SNI, California. The purpose of these launches is to support test and training activities associated with operations on the NAWCWD Point Mugu Sea Range. Figure 1 provides a regional site map of the Range and SNI. A more detailed description of the island and proposed launch activities are provided later in this section, in the Point Mugu Sea Range Final EIS/OEIS (NAWCWD 2002), and in reports on previous missile launch monitoring periods (Holst et al. 2005a, b; 2008, Holst and Greene 2010, and Ugoretz and Greene 2012). 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 SNI launches are used for practicing defensive drills against the types of weapons simulated by these missiles. Some launches may be conducted for the related purpose of testing new types of targets, to verify that they are suitable for use as operational targets.

The missiles are launched from one of several fixed locations on the western end of SNI and fly generally westward through the Point Mugu Sea Range. Launches are expected to involve supersonic and subsonic missiles. The primary launch locations are the Alpha Launch Complex located 190 meters (m) above sea level on the west-central part of SNI and the Building 807 Launch Complex, at the western end of SNI at approximately (~) 11 m above sea level as well as other launch pads nearby these locations (Figure 2).

NAWCWD plans to launch up to 40 missiles from SNI 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, also dependent upon operational requirements. Nighttime launches will only take place when required by the test objectives.

The Navy will continue the existing mitigation and monitoring efforts (described in Sections 11 and 13 of this Petition and in the existing monitoring plan- FR 75, No. 226) during every launch when pinnipeds are present on beaches in the area of potential take. These efforts may be scaled back at a future date, at least for launches of the smaller or less noisy launch missiles, when NMFS and the Navy concur that previous monitoring results are sufficient to show that the effects of these launches on marine mammals at SNI are minimal or to only include seasons when pinnipeds are expected to be most susceptible to disturbance (e.g., breeding and pupping periods).

This Petition seeks regulations that would allow NMFS to issue an LOA for the "taking" by Level B harassment of three pinniped species incidental to missile launch activities. Consistent with NMFS actions for other Navy installations allowing LOAs extending past one year (FR 77 No. 21), this Petition also serves as a request for an LOA for the entire period of the requested regulations (2014-2019). Currently, LOAs for missile launch activities on the Point Mugu Sea Range must be renewed annually. To date, the Navy has complied

with this requirement, and NMFS has issued annual LOAs. However, in order to alleviate some of the administrative burden associated with processing annual LOAs, the Navy requests that NMFS allow for LOAs with a period of validity matching the period of the requested regulations.

The Navy may launch as many as 200 missiles from SNI over a 5-year operations program, with up to 40 launches per year though the 5-year launch total may be significantly lower. Some launch events involve a single missile, while others involve the launch of multiple missiles either in quick succession or at intervals of a few hours. The number of launches per month varies depending on operational needs.

The following is a description of the types of missiles that may be launched. Missiles vary from tactical and developmental weapons to target missiles used to test defensive strategies and other weapons systems. Missiles covered by this request range from relatively small and quieter missiles like the Rolling Airframe Missile (RAM) to larger and louder missiles like the Terrier Black-Brant. The GQM 163A (Coyote) Supersonic Sea-Skimming Target (SSST) is anticipated to be the most commonly launched missile. However, it may become necessary to substitute similar missiles or different equipment in some cases. While other missiles may be launched in the future, the largest contemplated under this Petition is 23,000 kilograms (kg) (NAWCWD 2002).

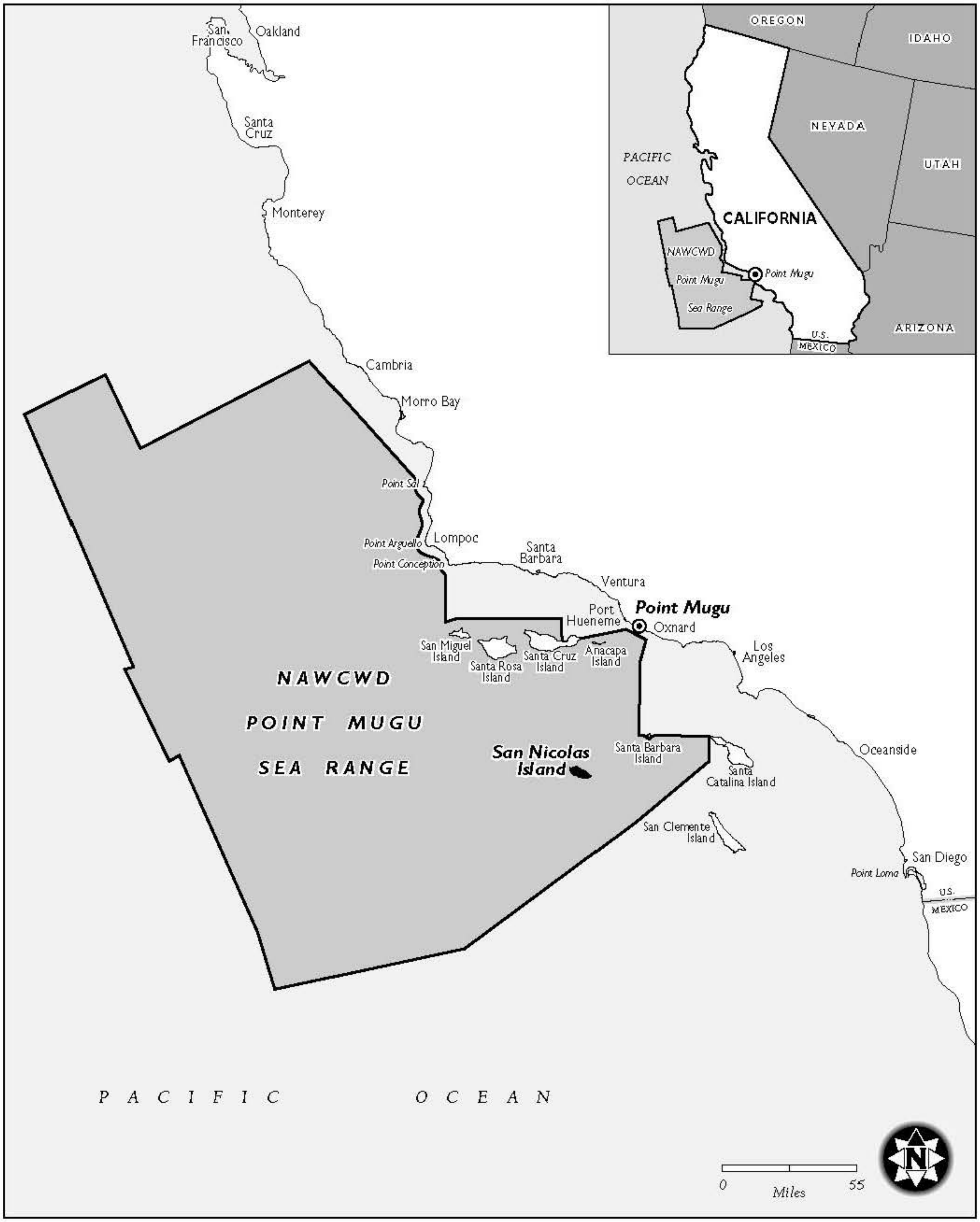

Figure 1. Regional Site Map of the Point Mugu Sea Range and SNI.

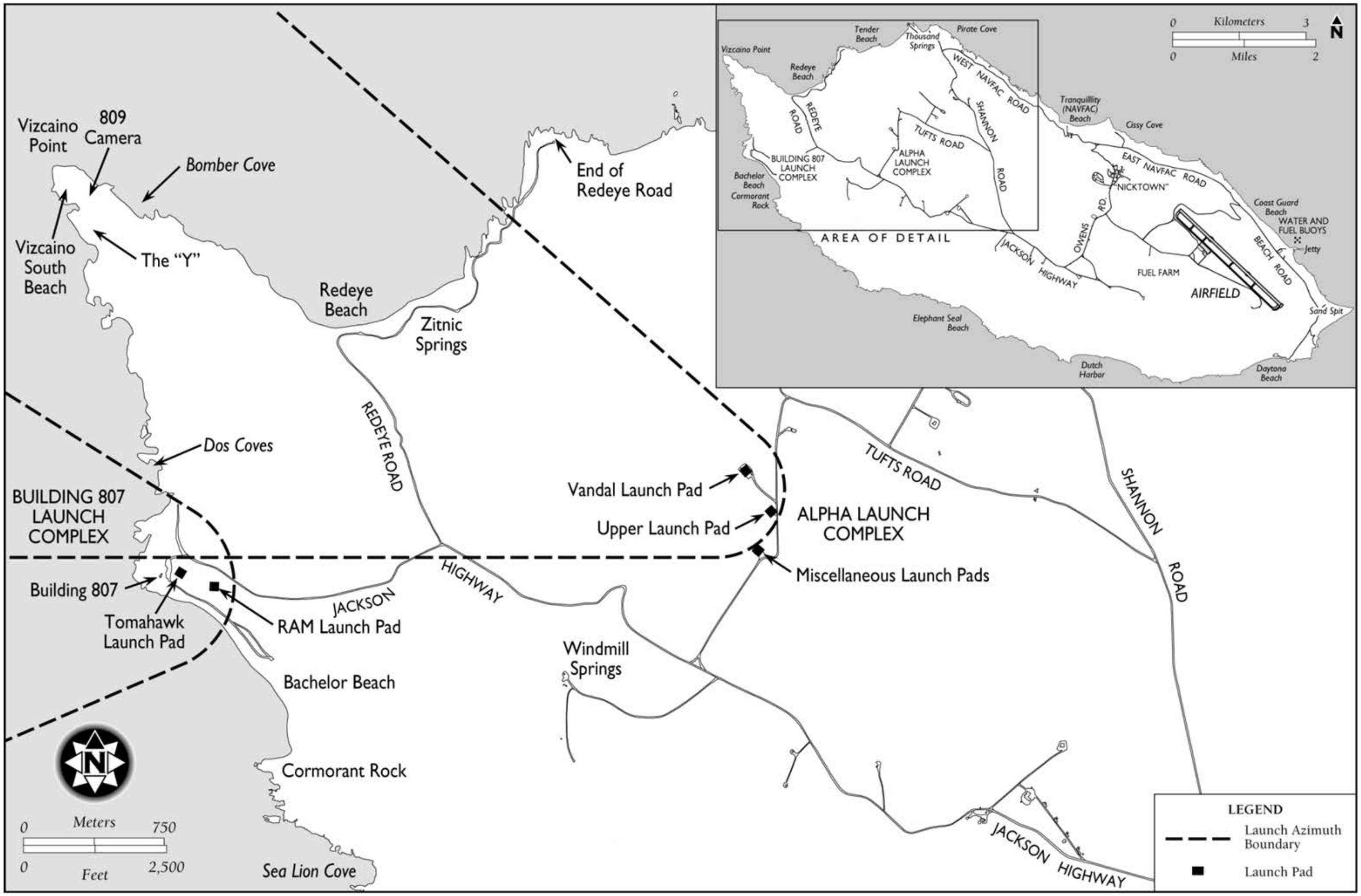

Figure 2. Map of SNI showing the Alpha Launch Complex, Building 807 Launch Complex, and the names of adjacent beaches on which pinnipeds are known to haul out. Also shown are the anticipated launch azimuths (dashed lines) for each launch complex. These launch azimuths are typical, although occasionally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

1.1.1 Rolling Airframe Missile (RAM)

The Navy/Raytheon RAM is a supersonic, lightweight, quick-reaction missile (Figure 3). 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 in diameter and 2.8 m long. Its launch weight is 73.5 kg, and operational versions have warheads that weigh 11.4 kg.

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 (M_{pa}) were 76 to 96 dB re 20 $\mu Pa^2 \cdot s$. 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 3. RAM launcher at the Building 807 Launch Complex on SNI (photograph by U.S. Navy).

1.1.2 GQM-163A "Coyote"

The Coyote, designated GQM-163A, is an expendable SSST powered by a ducted-rocket ramjet (Figure 4). It has replaced the Vandal, which was used as the primary missile during launches from 2001–2005. The Coyote is similar in size and performance to the Vandal.

The Coyote is capable of flying at low altitudes (4 m cruise altitude) and supersonic speeds (Mach

2.5) over a flight range of 83 kilometers (km). This missile 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 missile. The solid-rocket booster is ~46 centimeters (cm) in diameter and is of the type used to launch the Navy's "Standard" surface-to-air missile. The GQM-163A target missile is 5.5 m long and 36 cm 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 (Figure 4). A modified AQM-37C Aerial Target Test Set is utilized for target checkout, mission programming, verification of the missile's ability to perform the entire mission, and homing updates while the missile is in flight. Previous Coyote launches produced SPL-f of 125–134 dB re 20 μPa^2·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 μPa^2·s. M-weighted SELs ranged from 60 to 114 dB re 20 μPa^2·s, and peak pressures ranged from 100 to 144 dB re 20 μPa.

Figure 4. Coyote missile with booster and launcher at the Alpha Launch Complex on SNI (photograph by U.S. Navy).

1.1.3 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 µPa^2•s at sites 1.3-2.7 km from the CPA (Holst et al., 2011, Ugoretz and Greene, 2012).

1.1.4 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 µPa^2·s, and an M_{pa}-weighted SEL of 92 dB re 20 µPa^2·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 µPa^2·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. Terrier-Black Brant target missile.

1.1.5 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 anti-ballistic 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.

1.1.6 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 23 August 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 µPa^2·s, and an m_{pa}-weighted SEL of 105 dB re 20 µPa^2·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 6 April 2006; it produced an SPL-f of 84 dB re 20 µPa, an SEL-f of 88 dB re 20 µPa, and an m_{pa}-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 m_{pa}-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.

1.2 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 missiles 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 (see Section 12).

2. Dates, Duration, and Region of Activity

The date(s) and duration of such activity and the specific geographical region where it will occur.

NAWCWD seeks incidental take authorization for specific launch activities at SNI, with implementation of regulations effective for a period of 5 years commencing in 2014. Launch operations during 2001–2002, 2002–2003, 2004-2009, and 2009-2014 were conducted under separate Incidental Harassment Authorizations (IHAs). Launch operations from 2003 to the present have been conducted under previously requested and issued LOAs. As part of this request, the petitioner seeks an LOA applicable to the conduct of further such launch operations. An LOA for the entire period of the requested regulations, commencing in June 2014, is requested as part of this Petition. The specific location where the "taking" under discussion here may occur is on and around the western portion of SNI (Figure 2).

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.

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 14 launches from January 2011 to December 2012 (Holst et al. 2005a, b; 2008, Holst and Greene 2010, and

Ugoretz and Greene 2012). 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 above, 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.

3. SPECIES AND NUMBERS OF MARINE MAMMALS IN AREA

The species and numbers of marine mammals likely to be found within the activity area.

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. Southern sea otters (*Enhydra lutris nereis*), managed by the United States Fish and Wildlife Service (USFWS), are found in the kelp beds around SNI, but all previous monitoring has shown no impact from missile launches on this species. Given this fact and their relative distance from the missile launch locations they are not expected to be impacted.

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 27 April 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 haulout 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.

Incidental take authorization is only being sought for California sea lions, northern elephant seals, and harbor seals. Due to the rare occurrence of northern fur seals, Guadalupe fur seals, and Steller sea lions in the Sea Range, they are highly unlikely to be affected by launch activities. Given the distance offshore and lack of evidence of impacts to southern sea otters they are also unlikely to be affected by launch activities. Thus, incidental take authorization is not being sought for these species. For

completeness and to avoid redundancy, the required information about all six pinniped species and (insofar as it is known) numbers of species near the launch areas, are included in Section 4, below.

4. Status, Distribution and Seasonal Distribution of Affected Species or Stocks of Marine Mammals

A description of the status, distribution, and seasonal distribution (when applicable) of the affected species or stocks of marine mammals likely to be affected by such activities.

4.1 Species Likely to be Affected by Launch Activities

The following species are likely to be affected by launch activities on SNI and occur in the area of proposed activity: harbor seals, northern elephant seals, and California sea lions.

4.1.1 Harbor Seal

The harbor seal is not listed under the Endangered Species Act (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 where launches occur. They are also found on the south side and east end of the island in large numbers, as well as other sites. Peak counts on SNI are several hundred seals, representing ~2% 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. The following discussion and figures provide additional details.

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 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. 2012); 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. 2012). 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).

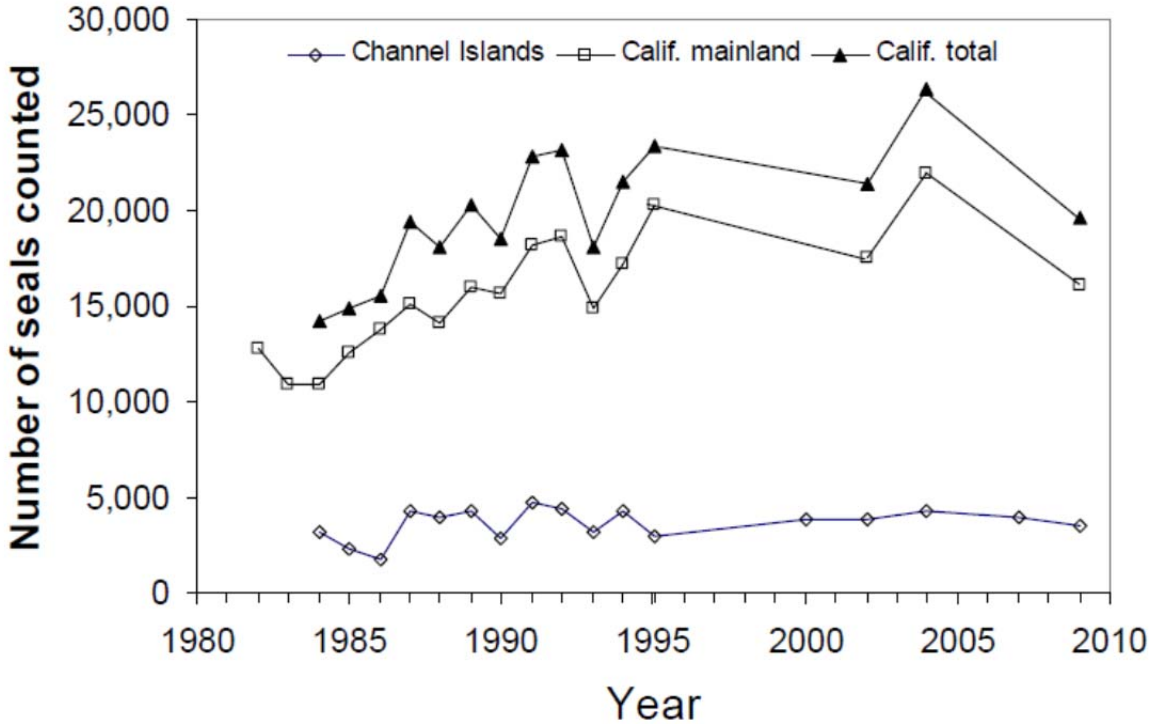

Figure 6. Harbor seal haulout counts in California during May/June (Hanan 1996; R. Read, CDFG unpubl. data; Lowry et al. 2008, NMFS unpubl. data from 2009 surveys). From Carretta et al. (2012).

The California population of harbor seals increased between 1981 and 2004, but this increase has slowed since 1995 (Figure 6, Carretta et al. 2012). The net productivity rate may be decreasing; from 1983–1994, the rate averaged 9.2% (Carretta et al. 2012). 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% (not taking into account fisheries mortality), and for southern California, it was 1.9%. 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. 2012), 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% per year at San Miguel Island, 0.02% at SNI, and -1.0% 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% per year at Santa Catalina Island and +5.7% 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% (±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% 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.

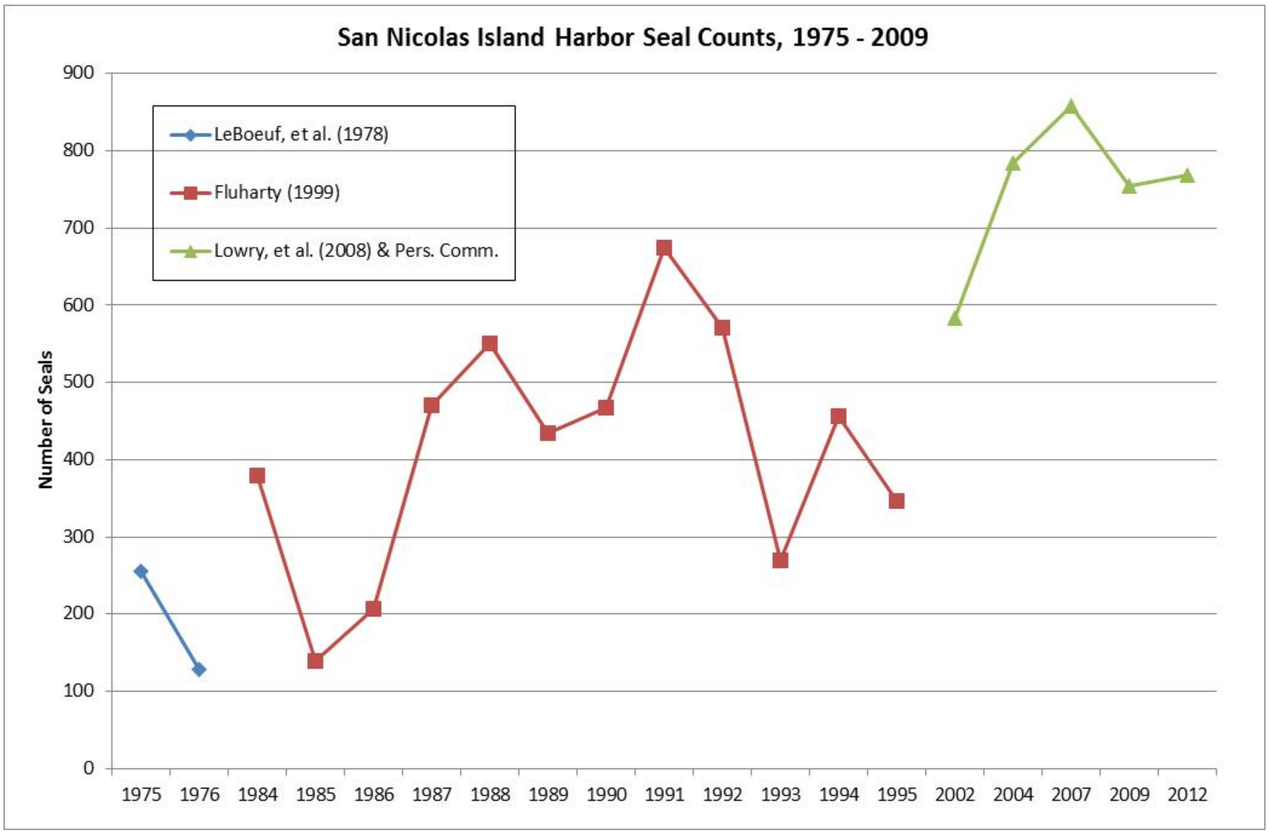

Figure 7. Counts of harbor seals at SNI, 1975–94. Data from 2009 and 2012 aerial counts are from Lowry, pers. comm.

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).

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 M*arine Mammal Technical Report* (Koski et al. 1998) accompanying the Point Mugu Sea Range Final EIS/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% 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 ~15% of the maximum count during the peak of haul out (i.e., 10–12% of those using the site). The typical seasonal pattern is reflected in harbor seal counts on SNI (Figure 11).

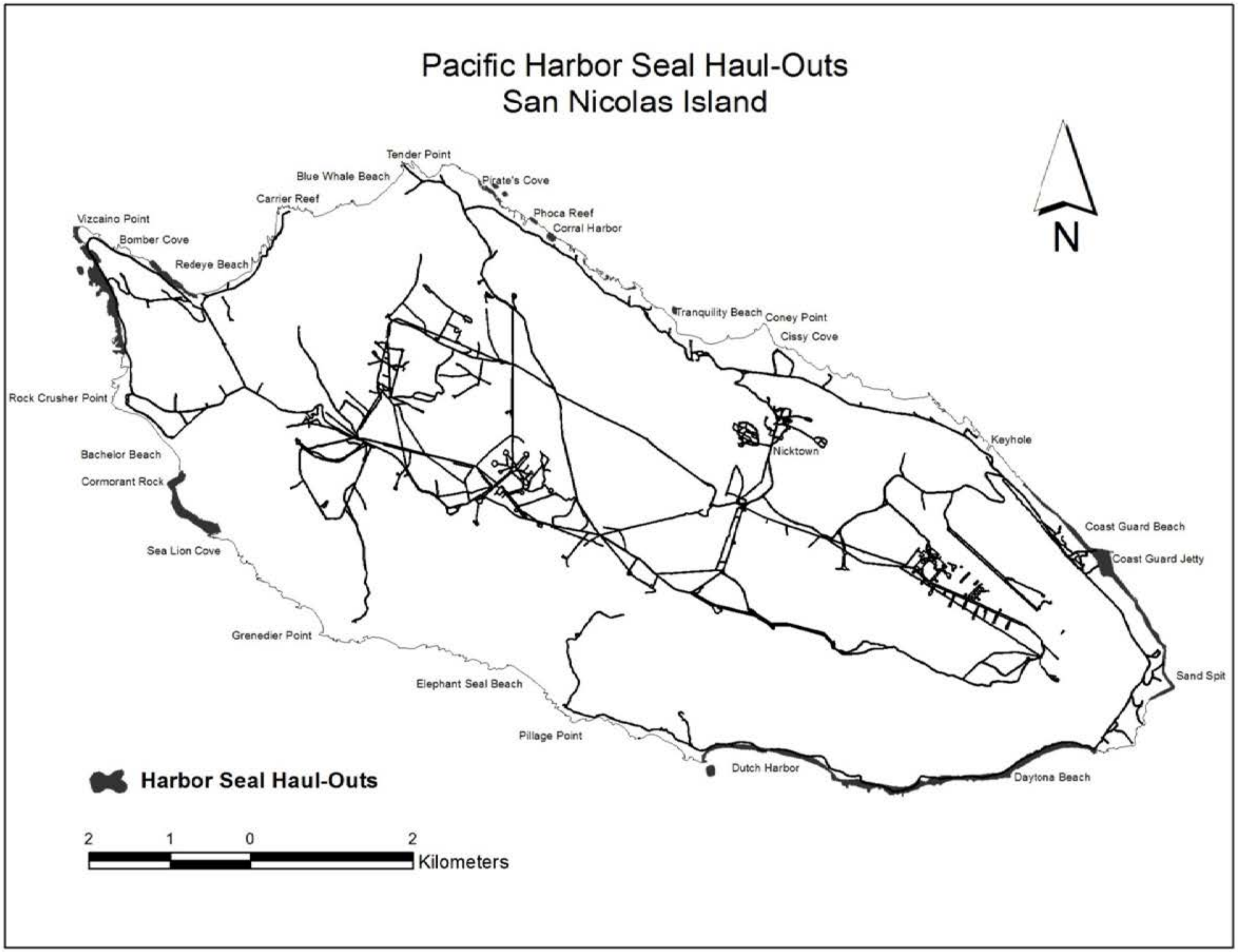

Figure 8. Map of SNI showing beaches on which harbor seals are known to haul out. Updated in 2013 by J. Ugoretz (NAWCWD, pers. comm.).

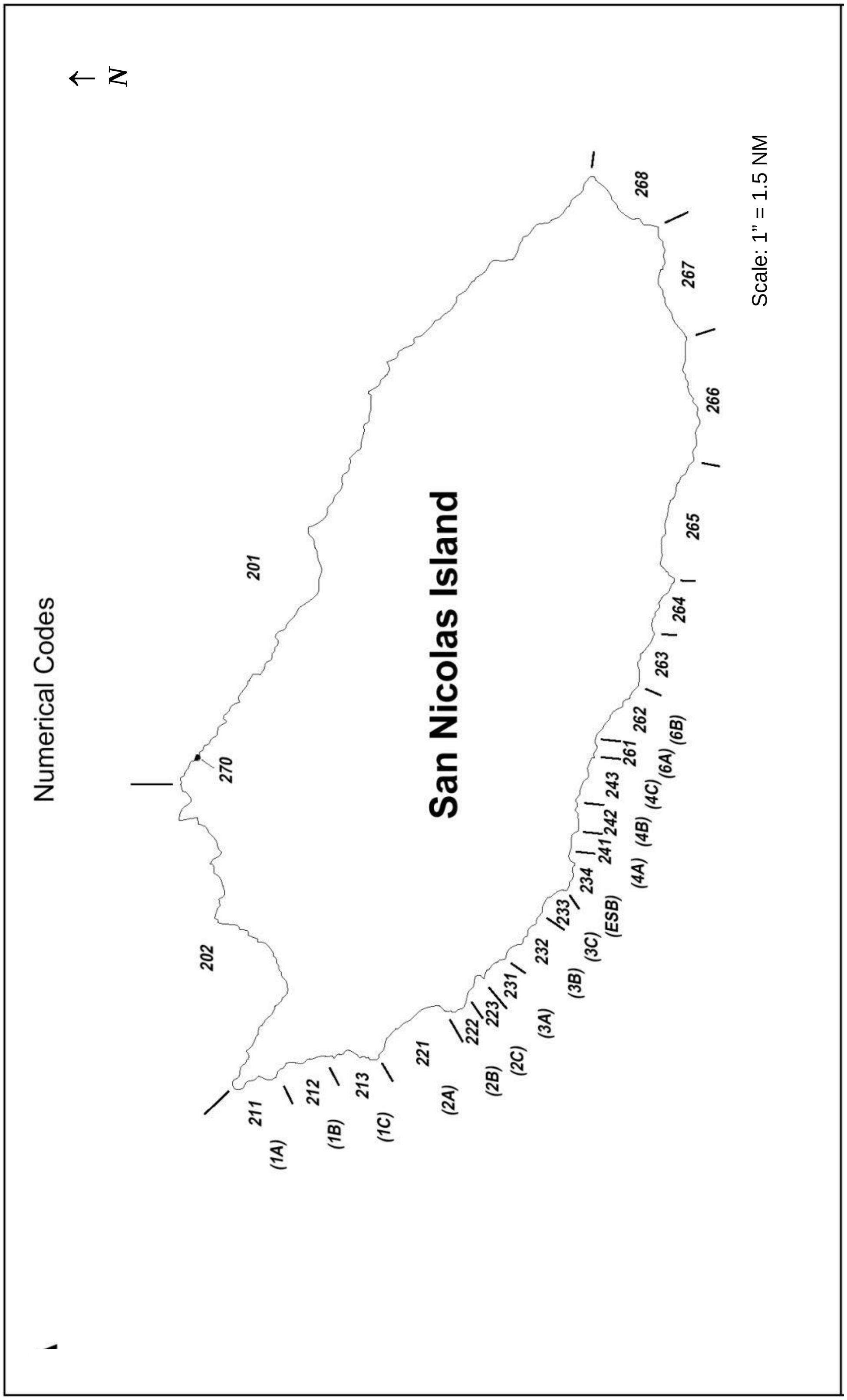

Figure 9. SNI census areas and associated numerical codes used by Stewart and Yochem (1984) to identify census areas.

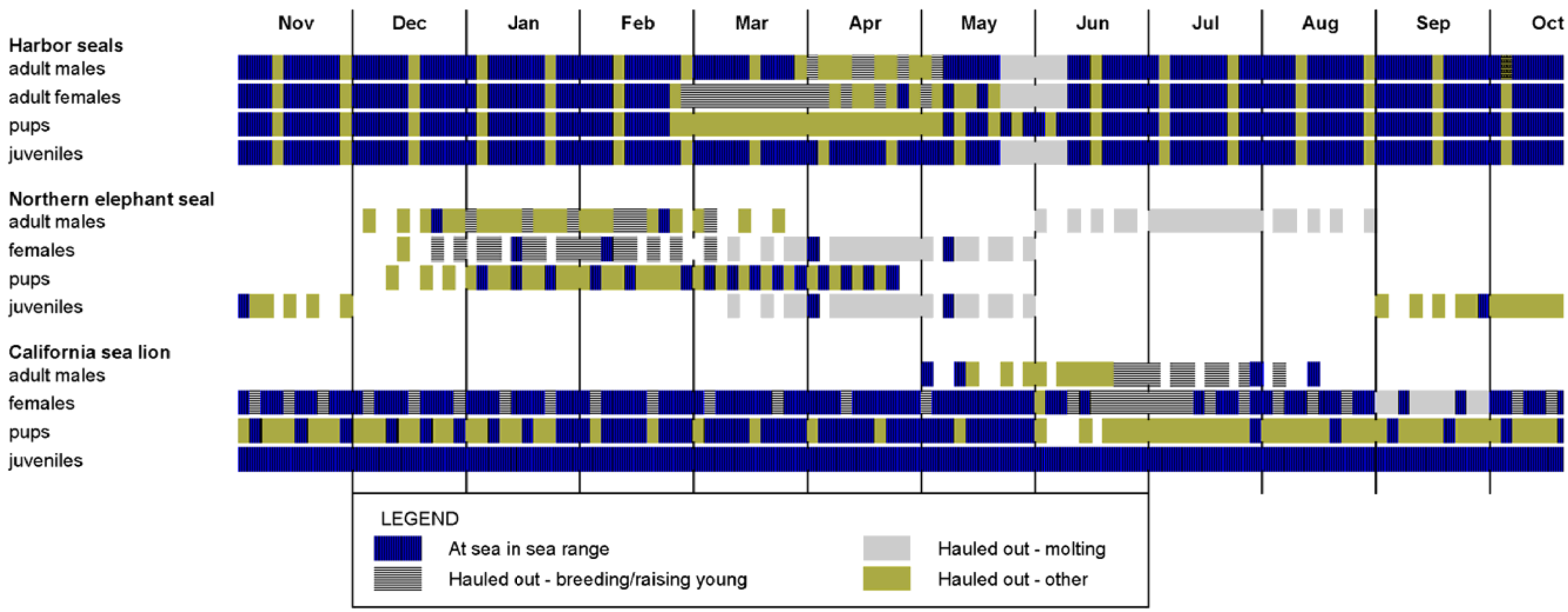

Figure 10. Annual activities of three pinniped species common to SNI. Activities include hauling out on land for breeding, pupping, or molting, and feeding at sea. Gaps in the bars indicate that not all animals are engaged in that activity. The size of the gap indicates approximate proportions of animals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

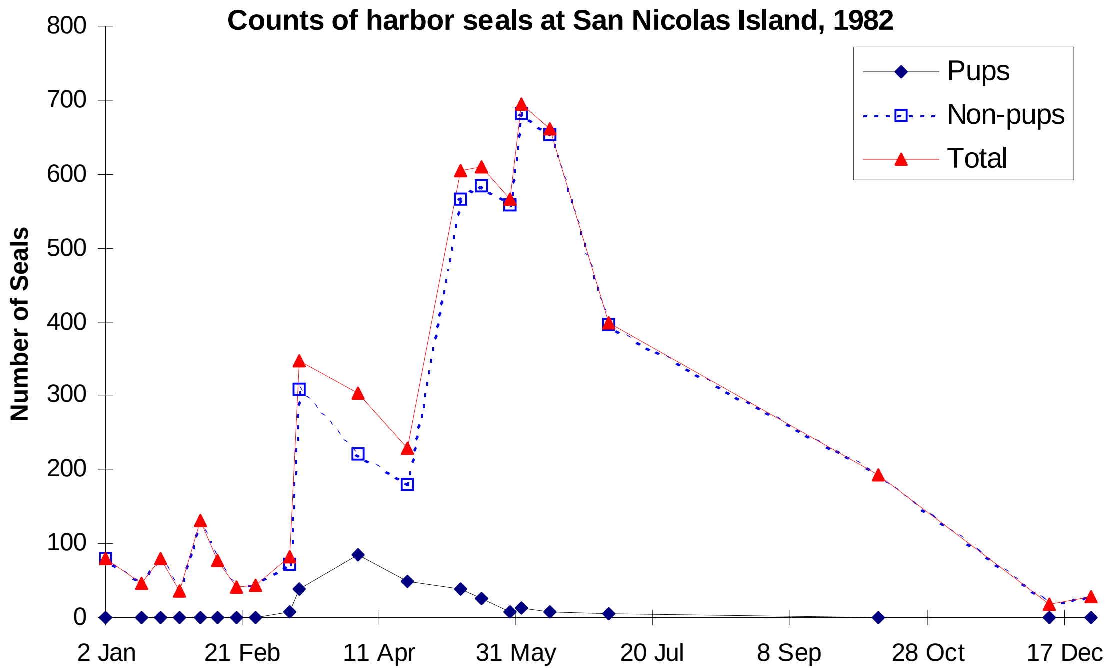

Figure 11. Counts of harbor seals throughout the year on SNI, 1982. From Stewart and Yochem (1984).

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).

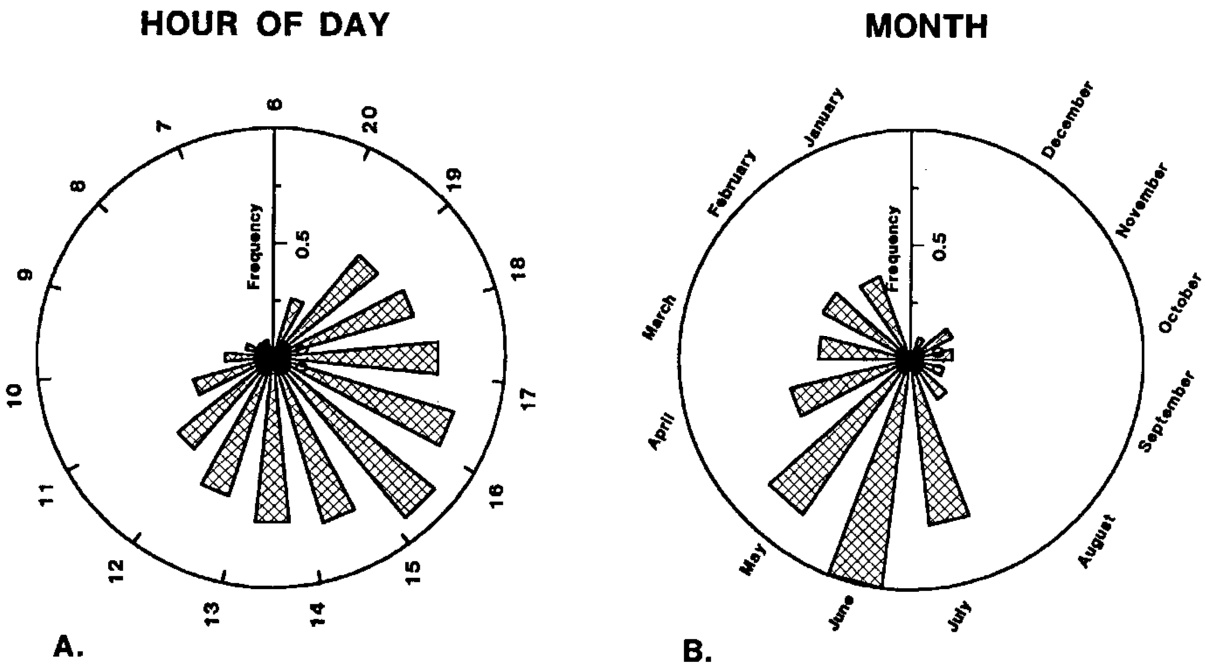

Figure 12. Abundance of harbor seals at terrestrial haul-out sites on the Channel Islands on (A) an hourly basis during the day and (B) a monthly basis during the year. From Stewart and Yochem (1994).

4.1.2 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 the western part of the island. Over the course of the year, ~32,186 elephant seals may use SNI (Lowry 2002; Barlow et al. 1993), representing ~32% 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. The following discussion and figures provide additional details.

Historically, northern elephant seals are believed to have hauled out by the thousands along the coast of California and Baja California (Scammon 1874 *in* Bonnell and Dailey 1993), but there is little or no documentation of their actual distribution and breeding range before exploitation (Stewart et al. 1993c). They were heavily hunted during the 19th century and were subsequently reduced to a single breeding colony numbering perhaps as few as a hundred 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. 2007).

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. 2007). 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, ~28,000 pups were born or ~79% of the total number (35,549) of pups in California (Figure 14; Carretta et al. 2007). Applying the multiplier of 3.5 times to this pup count (Barlow et al. 1993; Carretta et al. 2007), the northern elephant seal population in the Sea Range was ~98,000 individuals in 2005. Koski et al. (1998) estimated that ~26,623, 6,495, 7,409, and 11,356 northern elephant seals are present in coastal and off-shore 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 ~90% 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.

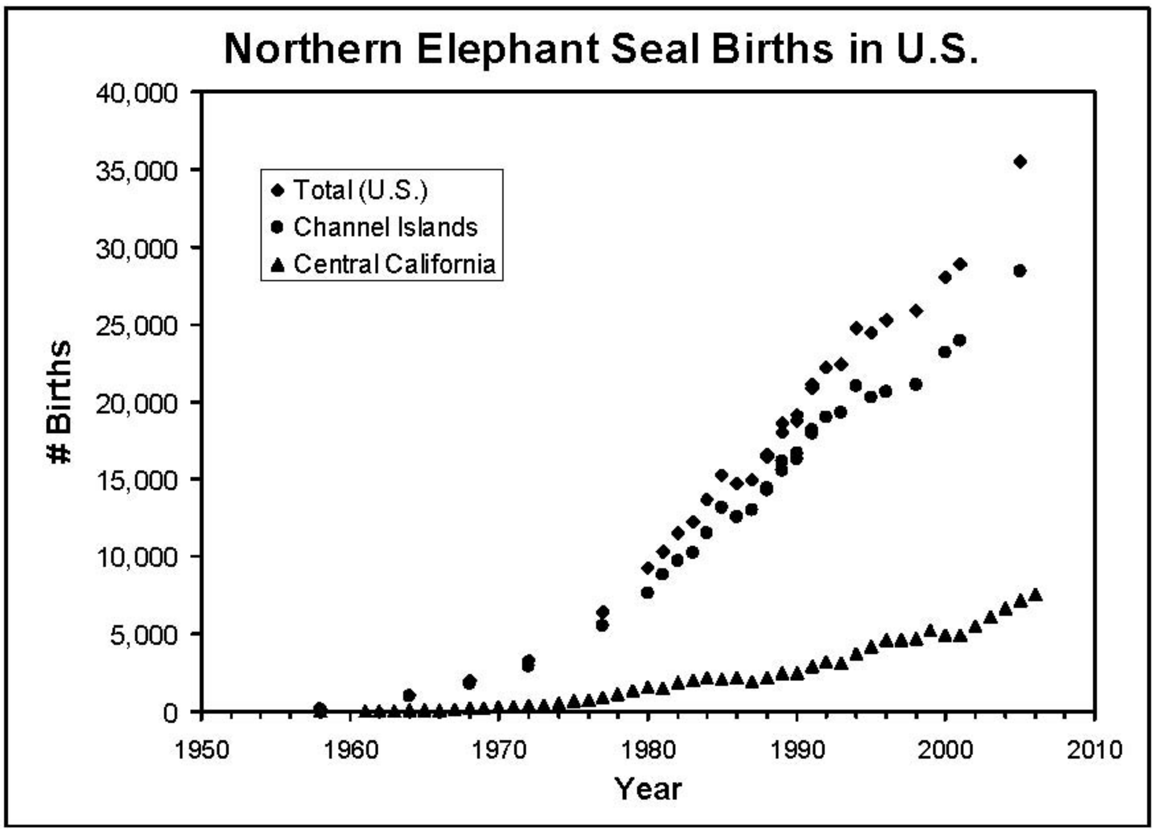

Figure 13. Estimated number of northern elephant seal births in California 1958–2005. Multiple independent estimates are presented for the Channel Islands 1988–1991. Estimates are from Stewart et al. (1994a), Lowry et al. (1996), Lowry (2002) and unpublished data from S. Allen, D. Crocker, B. Hatfield,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

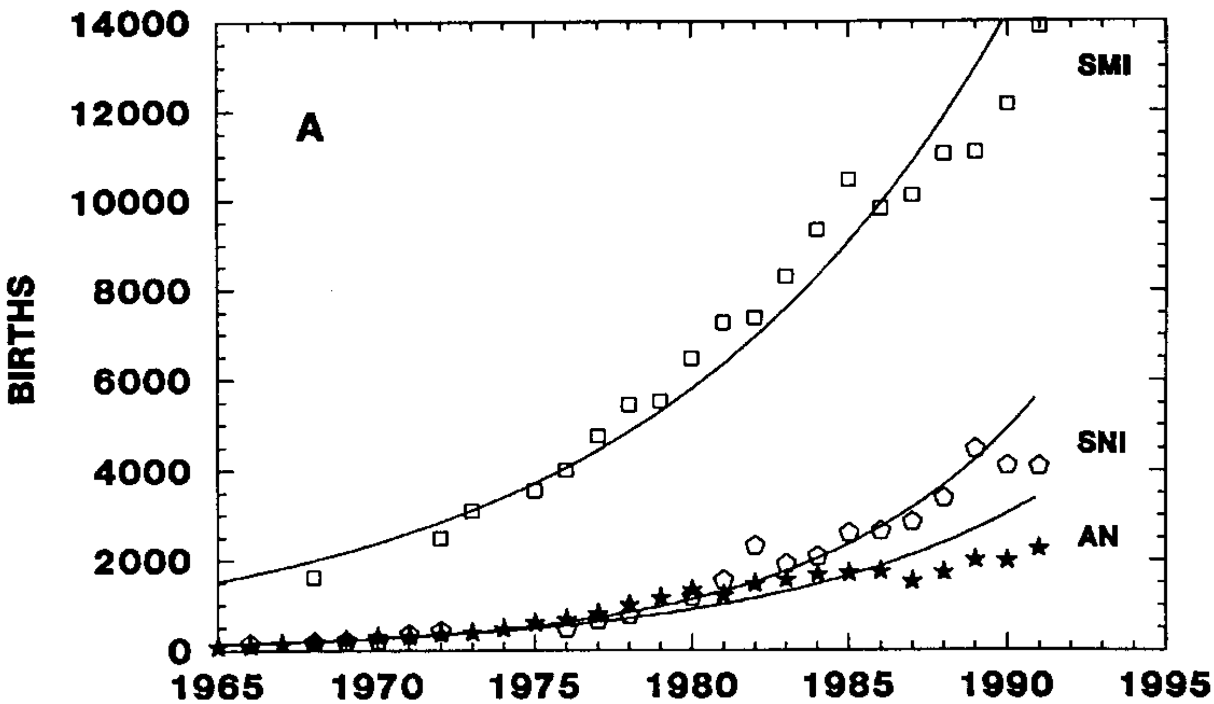

Figure 14. Growth of the northern elephant seal population as indicated by births at San Miguel Island (SMI), SNI, and Año Nuevo Island (AN). From Stewart et al. (1994a).

SNI is currently the second largest elephant seal rookery and haulout in Southern California. Within the Point Mugu Sea Range, ~67% of elephant seals haul out on San Miguel Island, ~32% on SNI, and small numbers on Santa Rosa (1%), 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 1. Table 2 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 (Figure 10).

TABLE 1. 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 2. 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

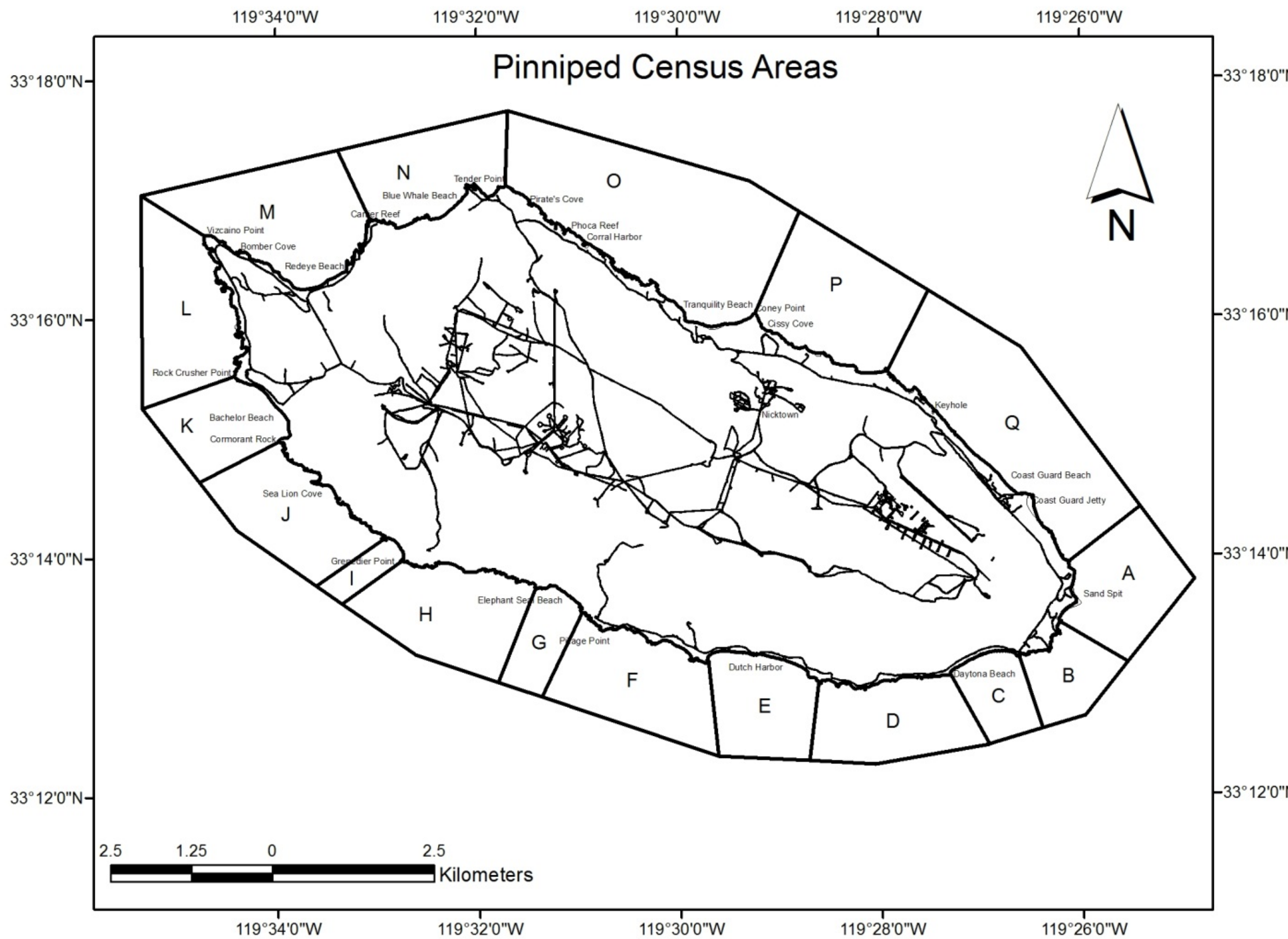

Figure 15. Census areas on SNI and associated alphabetic codes used by Lowry (NMFS) to identify census areas.

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% of the California stock.

From 1988 to 1995, the pup counts on SNI increased at an average rate of 15.4% per year (Figure 14). From 1988 to 2001, the number of births increased at an average annual rate of 7.3% (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% for 1964 to 1979, 10.2% for 1980 to 1985, and 8.41% 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 (5 May 2004) and during the breeding/pupping season (27 January 2005) (Holst et al., 2005).

Northern elephant seals haul out at sandy beaches twice annually along almost the entire shoreline of SNI (Figure 16): once to breed and give birth, and a second time to molt (Figure 10). Adult males haul out separately from females and juveniles to molt (males in July-August and females and juveniles in April-June). They prefer gradually sloping, sandy beaches, or sand spits. If sandy beaches are not available, they will haul out on cobble beaches, 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 (post breeding 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 M*arine Mammal Technical Report* (Koski et al. 1998) accompanying the Point Mugu Sea Range Final EIS/OEIS (NAWCWD 2002). Their brief periods of movement through the seas near SNI occur during the times of year with vertical interruptions in the bar graphs shown in Figure 10.

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 1 month old (Odell 1974; Le Boeuf and Laws 1994); they go to sea at 1 to 3 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).

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 (Figure 10). Most females that weaned their pups 6–8 weeks earlier return from northern feeding areas to molt. However, some females and juveniles from SNI 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 ~1 month to complete, after which time the animals return to northern feeding areas until the next pupping/breeding season. Juveniles (1–4 years old) also molt at this time. By the end of April, 80% of pups have left the rookery, and the remainder leave in May.

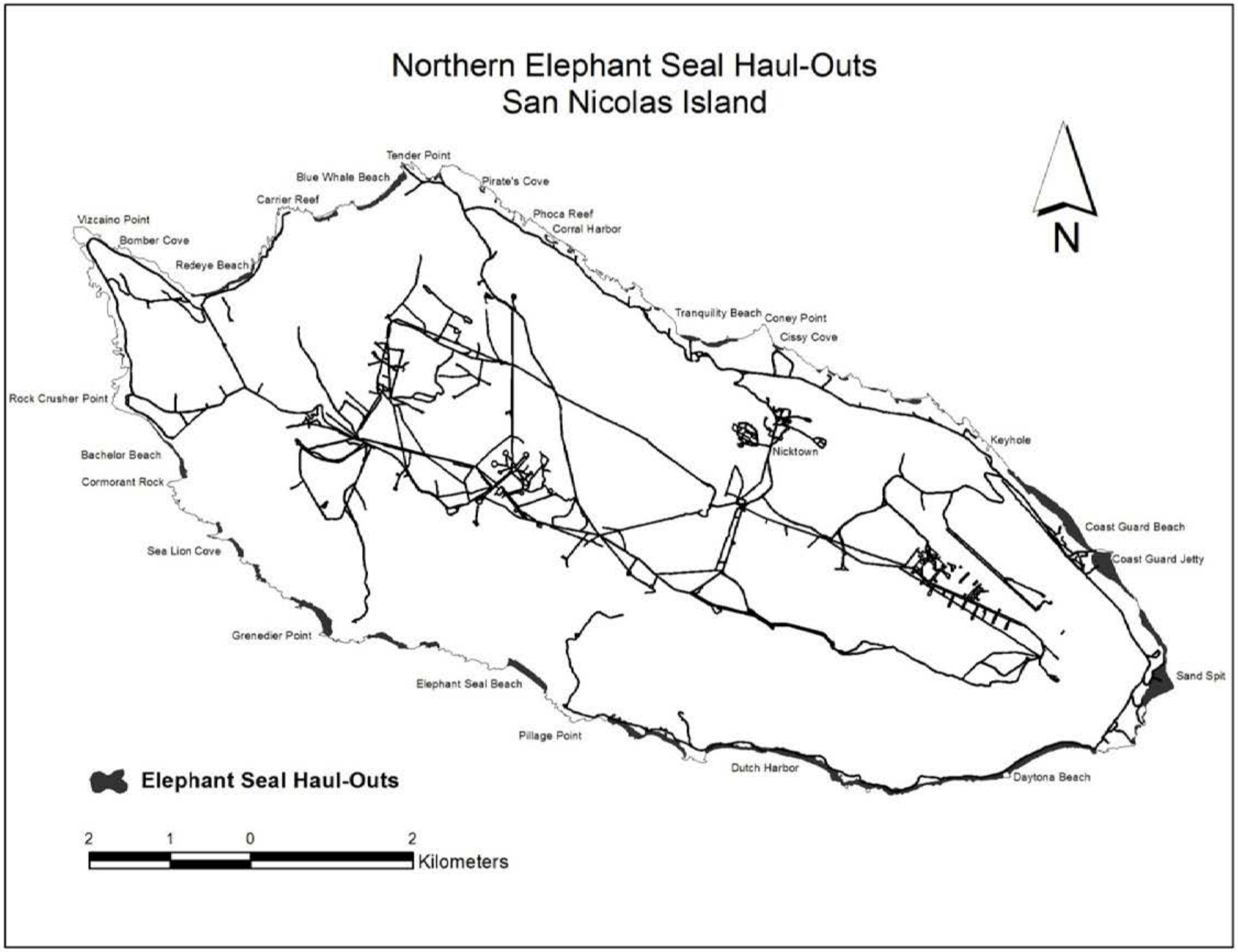

Figure 16. Map of SNI showing beaches on which northern elephant seals are known to haul out. Updated in 2013 by J. Ugoretz (NAWCWD, pers. comm.).

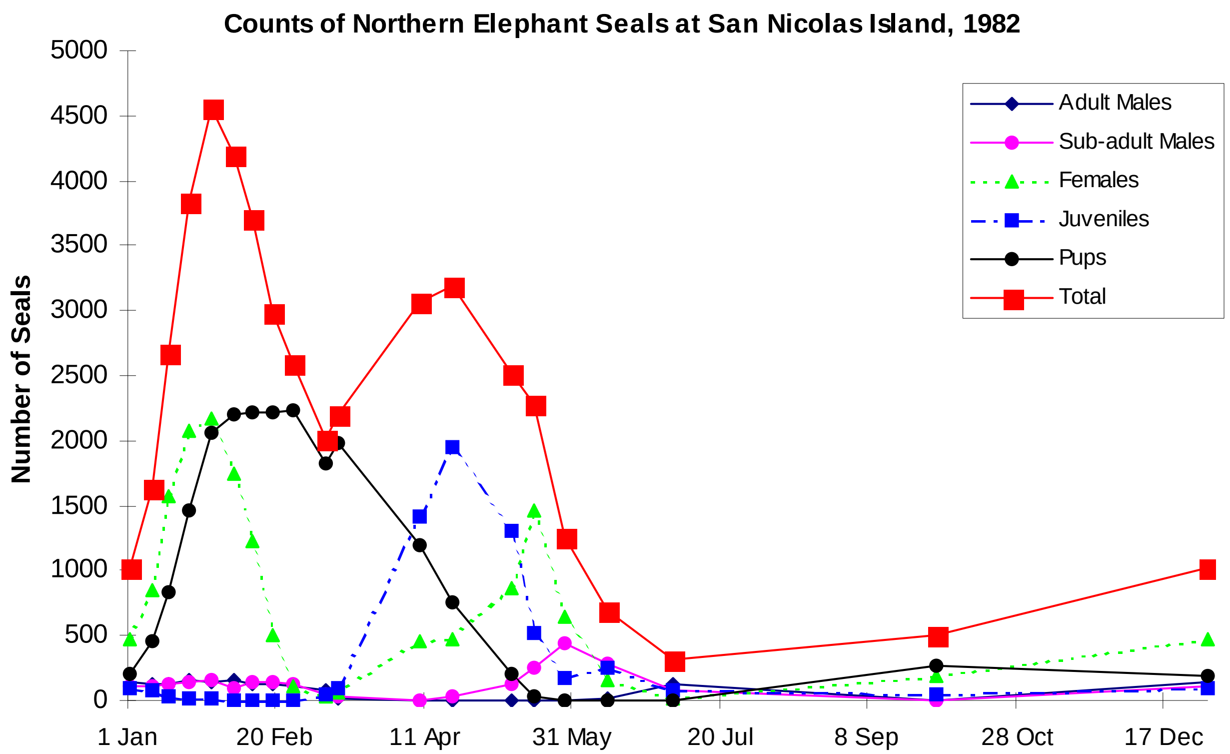

Figure 17. Counts of northern elephant seals throughout the year at SNI, 1982. Plotted from Table 1 in Stewart and Yochem (1984).

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 3 to 4 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 males[1] 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).

4.1.3 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 8 days before beginning an alternating pattern of foraging at sea and 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

[1] Pubertal subadult males: capable of copulating, but not old enough to hold a breeding territory.

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%) 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% (2,137 of 2,538) of identified pinniped sightings at sea during previous studies (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 8 days before going to sea to feed for 2 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 4–8 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 7 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 in July after all pups have been born,
- multiplying pup counts by 1.15 to account for 15% 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 (Carretta et al. 2012).

In 2008, 59,774 pups were counted in California; this number was adjusted for a 15% mortality rate and the percentage of pups in the population to come up with an estimate of 296,750 (Carretta et al. 2012). California sea lion populations have increased steadily since 1950 (Carretta et al. 2007 and 2012). For the U.S. stock of California sea lions, the number of pups showed an annual increase of 5.4% 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. 2012). In contrast, the population on SNI increased at nearly 6.8% 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, 2005).

Barlow et al. (1997) reported that 47% of the U.S. stock or 49% 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 3) 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 3). 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 3). 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.

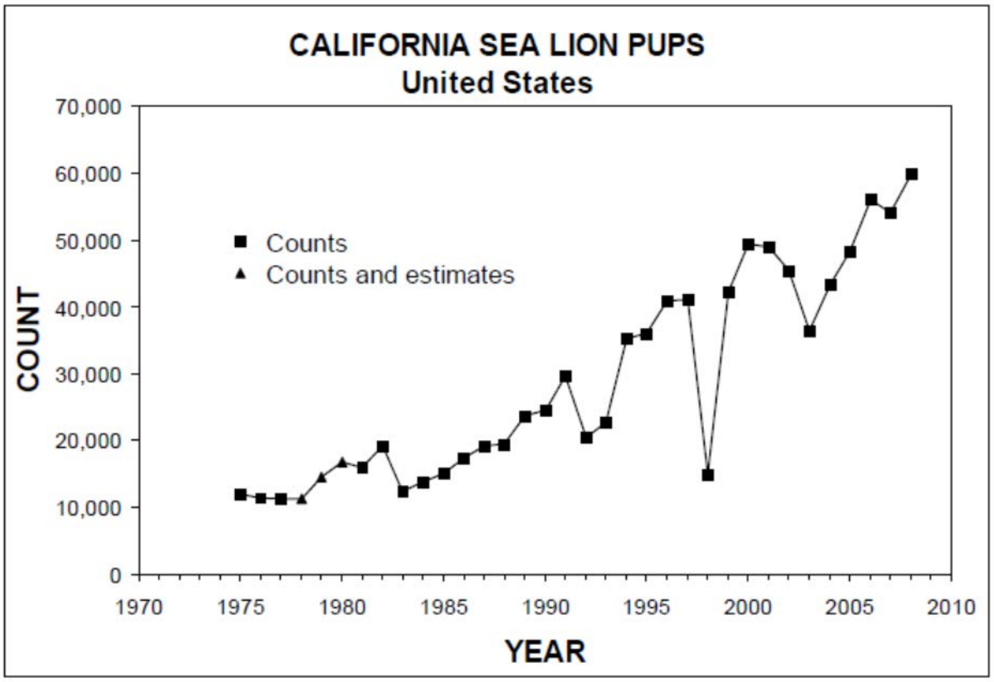

Figure 18. U.S. pup count index for California sea lions (1975–2008). From Carretta et al. (2012).

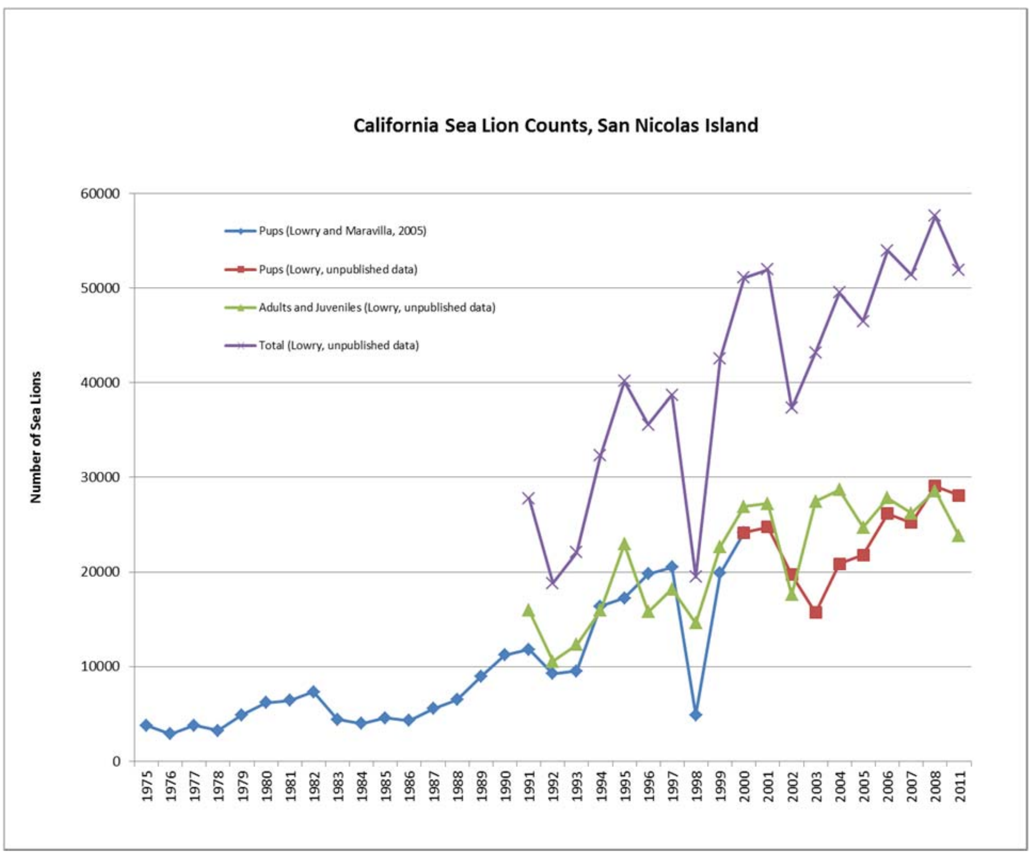

Figure 19. Counts of California sea lions at SNI, 1975–2011. No data from 2009, 2010. Plotted from Table 3 in Lowry and Maravilla (2005) and Lowry unpublished data.

TABLE 3. 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).

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**

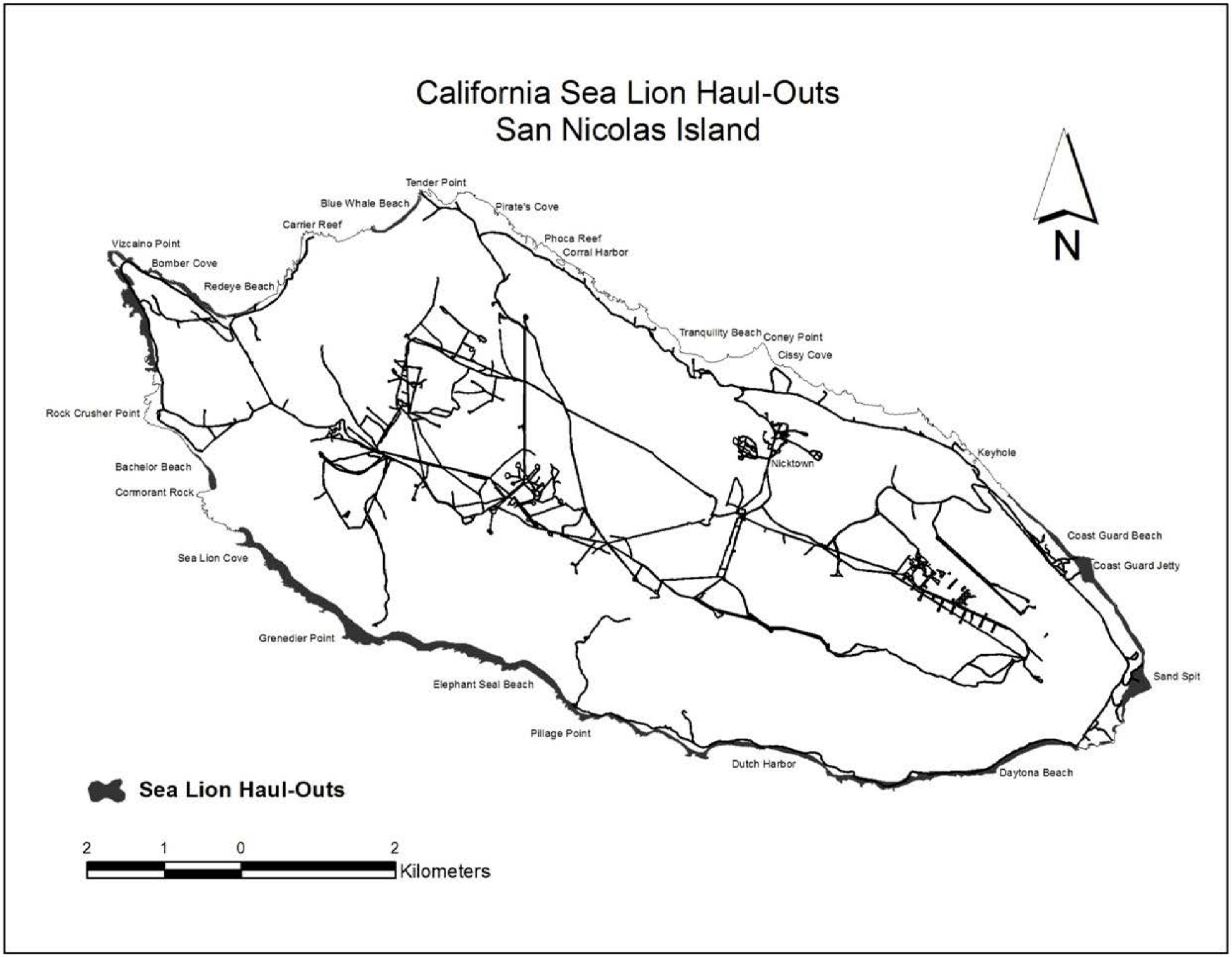

Figure 20. Map of SNI showing beaches on which California sea lions are known to haul out in large numbers. From Lowry et al. (1992), and updated in 2000 by G. Smith (NAWCWD, pers. comm.)

4.2 Other Marine Mammal Species that May Occur in the Area

4.2.1 Southern Sea Otter

Two sea otter subspecies occur within the continental U.S. The southern sea otter occurs off the mainland coast of central California ranging from Half Moon Bay in the north to Santa Barbara in the south as well as a translocated colony at SNI (Tinker et al. 2006). The northern sea otter, subspecies *Enhydra lutris kenyoni*, is found in Washington and Alaska. Unlike all other marine mammals which are under the jurisdiction of NMFS, the southern sea otter is a species under the federal jurisdiction of the USFWS. Southern sea otters are listed as threatened under the ESA. Sea otters rarely come ashore, spending most of their life in the ocean where they regularly swim, feed, and rest and may occasionally be present in deeper waters when moving between areas or in attempts to establish new habitat (Burn and Doroff 2005). Tinker et al. (2006) indicate that sea otters spend between 36-52 percent of time at the surface between dives, depending on the size and type of prey being consumed.

The current minimum population estimate of southern sea otters along the mainland coastline (2006–2010) is 2,719 (U. S. Department of Interior 2012). The translocated colony of southern sea otters at SNI exists as a result of a program conducted by the USFWS under the governance of Public Law 99-625. There are presently approximately 54 independent southern sea otters (plus eight pups) currently at SNI (B. Hatfield, USGS Pers. Comm.). On average, the growth rate of the SNI otter translocated colony has slowed from a high of approximately 9 percent in 1993 (Tinker et al. 2008). Even so, the present growth rate for the SNI translocated colony (2.5 percent between 2006 and 2010) is significantly higher than the declining mainland population (appx. -0.3 percent in the same period, U.S. Department of Interior 2012).

SNI otters are subject to different habitat conditions and stressors than those inhabiting the central California coastline (Carretta et al. 2009; Tinker et al. 2008). Navy management and restricted access to the area has had a beneficial effect. As has been reported, the abundance of sea otter prey at SNI exceeds that at the central California coastline by as much as three orders of magnitude (Tinker et al. 2008). As a result of greater prey availability for sea otter in the SNI translocated colony, the average food intake rate was more than double, only half as much time was spent foraging, and they were in better body condition in comparison to southern sea otter present along the central California coastline (Tinker et al. 2008).

As described above, monitoring of SNI sea otter populations has shown no negative impact of missile launches on the population. The USFWS Biological Opinion (BO) for activities, including missile launches, on SNI concluded that Navy activities are not likely to jeopardize the species (U.S. Department of the Interior, 2001). Given the distances between the missile launch sites and CPA to the nearest sea otters offshore, missile launches will not result in any disturbance and peak sound levels will be well below those that could potentially cause a temporary threshold shift to hearing. Therefore, incidental take authorization is not being sought for southern sea otters.

4.2.2 Northern fur seal

There are two stocks of northern fur seals recognized in the U.S.: the San Miguel Island stock and the Eastern Pacific stock, which primarily breeds on the Pribilof Islands in the Bering Sea. The San Miguel Island stock is not listed as threatened or endangered under the ESA, and it is not considered depleted under the MMPA. The Eastern Pacific stock is not listed as threatened or endangered under the ESA, but has been declining; it is considered depleted and designated a strategic stock (Angliss and Outlaw 2008). Adult females and pups migrate from the Bering Sea to California (e.g., Ream et al. 2005). Thus, both stocks occur in the Sea Range during autumn and winter, but only the San Miguel stock is found there during the May to November period. In winter, there may be as many as 44,641 northern fur seals in the waters of the Point Mugu Sea Range, with most seen in offshore locations (Koski et al. 1998).

Although the northern fur seal is not a regular breeding species on SNI, a few individuals hauled out at SNI in summer during the 1990s (Stewart and Yochem 2000), and a single female with a pup was sighted on the island in July of 2007 (G. Smith, NAWCWD, pers. comm.).

San Miguel Island and the adjacent Castle Rock have the only rookery of northern fur seals in California. Declines of the San Miguel Island population over the last 25 years have been associated with severe El Niño events in 1982-83 and 1997-98 (DeLong and Antonelis 1991, Melin et al. 2005 *in* Carretta et al. 2011). Although the number of pups decreased by 80% from 1997 to 1998 (Melin et al. 2005), the population began to recover in 1999. Based on 2007 pup counts, the current population estimate for San Miguel Island is 5,395 (Carretta et al. 2011).

The colonies at San Miguel Island are occupied from early May to late November with different age and sex classes being present at different times. Adult males are the first animals to arrive; upon arrival, they establish territories that they defend from other males. Females arrive several weeks later and give birth within one to two days of their arrival. After nursing their pups for an average of 8.3 days, the females alternate between periods of 6.9 (±1.4 SD) days at sea feeding and 2.1 (±0.3 SD) days nursing. Pups are weaned at four to five months of age and go to sea immediately (Antonelis et al. 1990). Adult males leave the haul-out sites in early August and go to sea to feed until the following May (Carretta et al. 2011). Juveniles and other non-breeding animals haul out from mid-August to early October to molt. Given the limited sightings on SNI, it is unlikely that northern fur seals would be impacted by missile launches. Therefore, incidental take authorization is not being sought for northern fur seals.

4.2.3 Guadalupe fur seal

The Guadalupe fur seal is listed as threatened under the ESA. It is considered depleted and designated as a strategic stock under the MMPA. Sealing during the 19th century nearly reduced the once abundant Guadalupe fur seal to extinction (Townsend 1931). However, from 1954 to 1993, the Guadalupe fur seal population increased at an average annual rate of 13.7%, and it may be expanding its range (Le Boeuf and Bonnell 1980; Gallo-Reynoso 1994; Carretta et al. 2007). The best available population estimate is 7,408 for 1993 (Gallo-Reynoso 1994; Carretta et al. 2007). However, very few of these animals are expected to occur within the Sea Range.

Guadalupe fur seals mainly breed and pup on Isla de Guadalupe in Mexico (Le Boeuf and Bonnell 1980). In 1997, a second rookery was discovered at Isla Benito del Este, Baja California (Maravilla-Chavez and Lowry 1999), and a pup was born and reared successfully to weaning at San Miguel Island (Melin and DeLong 1999).

Archaeological evidence suggests that the Guadalupe fur seal was typically found in the Channel Islands before commercial exploitation (Walker and Craig 1979). Since the drastic decline, only occasional sightings have been made in offshore waters of the Channel Islands, including in or near the Sea Range. From 1969 to 1986, 43 sightings of Guadalupe fur seals were made at San Miguel and San Nicolas islands. Two sightings have also been recorded at Santa Barbara Island, and one sighting was made at San Clemente Island (Stewart et al. 1987). Prior to 1985, there were only two sightings of Guadalupe fur seals from central and northern California, in Monterey Bay in 1977 and Princeton Harbor in 1984 (Webber and Roletto 1987). However, nine strandings and five sightings were reported along the central and northern coast of California from 1988 to 1995, suggesting that the Guadalupe fur seal may be expanding its range (Hanni et al. 1997).

Twenty-one sightings of Guadalupe fur seals were made on SNI from 1949 to 1986 (Bartholomew 1950; Stewart 1981a; Stewart et al. 1987; G. Smith, NAWCWD, pers. comm..). Most sightings were either juveniles of undetermined sex or adult males. One male was observed in six consecutive years from

1981 to 1986; it was defending a territory amongst breeding California sea lions along the south shore ~6.9 km from the western tip of the island. A lone female was observed on the south side of SNI in the summer of 1997 (G. Smith, NAWCWD, pers. comm.). A lone male Guadalupe fur seal was again seen defending a territory on the south shore of SNI between 2006 and 2009 and again in 2012 (J. Laake, NOAA, pers. comm.). Observations suggest that Guadalupe fur seals are capable of obtaining space for breeding amongst California sea lions, and that they may successfully recolonize the Channel Islands once they are abundant enough to establish a breeding population (Stewart et al. 1987). However, since only single individuals of this species have been seen on SNI since 1981 and most recent observations were on the south shore far from launch operations, it is unlikely any would occur ashore during the proposed activities during the period of the regulations. Therefore, incidental take authorization is not being sought for Guadalupe fur seals.

4.2.4 Steller sea lion

The Eastern stock of Steller sea lions, which occur farther north in California, is listed as threatened under the ESA as a result of steep declines in southwest Alaska from 1956–1960 to 1985 (Merrick et al. 1987). This stock is a strategic stock under the MMPA and is considered depleted. Although the size of the Eastern stock has been increasing over the several years and is currently estimated at 48,519–54,989 (Angliss and Outlaw 2008), the numbers in California declined from 6,000–7,000 in the late 1960s to ~2,000 in 1989 (Loughlin et al. 1992). The population size in northern and central California appears to be stable at 1,500–2,000 non-pup individuals (NMFS 2008; Angliss and Outlaw 2008). The size of the colony closest to SNI, on Año Nuevo Island, has been declining since 1970, resulting in an 85% reduction in the breeding population by 1987 (Le Boeuf et al. 1991). From 1990 to 1993, the number of pups declined by 9.9%, and non-pups declined by 31.5% (Westlake et al. 1997). More recently, non-pup counts appear to have stabilized at Año Nuevo and Farallon Islands (Hastings and Sydeman 2002); pup counts at Año Nuevo have also stabilized (NMFS 2008). Pup counts at Año Nuevo Island and the Farallon Islands in 2000 and 2002 were 349 and 380, respectively (Angliss and Outlaw 2008). In 2004, the pup count for Año Nuevo was 221 individuals (NMFS 2008), but only 22 pups were counted on the Farallones (Hastings and Sydeman 2002; NMFS 2008). At San Miguel Island, formerly the southern extent of the species' breeding range, Steller sea lions are no longer known to breed; the last mature Steller sea lion was seen there in 1983 (DeLong and melin 1999).

Historically, Steller sea lions were sighted occasionally at SNI (Bartholomew and Boolootian 1960). A sub-adult male Steller sea lion was sighted at San Clemente Island on 27 April 2013 and individuals have been sighted at San Miguel Island and one adult male at SNI in 2010 (M. Lowry, NOAA, pers. comm.). However, while these few Steller sea lions adults have been sighted at the Channel Islands recently, they are very rare and it is highly unlikely any would be ashore on SNI during the period of the regulations. Therefore, incidental take authorization is not being sought for Steller sea lions.

5. TYPE OF INCIDENTAL TAKE AUTHORIZATION REQUESTED

The type of incidental taking authorization that is being requested (i.e., takes by harassment only, takes by harassment, injury and/or death), and the method of incidental taking.

NAWCWD requests issuance of regulations and an associated LOA to authorize non-lethal incidental take by harassment (Level B) during planned missile launch operations at SNI, California. Injury or mortality is unlikely during routine launch activities.

Some of the operational activities outlined in Sections 1 and 2 for the SNI launch program have the potential to disturb or displace pinnipeds. These activities may result in "Level B" harassment as defined in the 1994 amendments to the MMPA. No take by serious injury or death is likely, given the nature of the planned activities, the standard, ongoing monitoring and mitigation measures, and the previous monitoring results (Sections 11 and 13). NAWCWD will adopt mitigation measures to reduce disturbance to marine mammals that might occur on the western end of the island. These measures will also be designed to minimize the possibility of injury, e.g., to pups (see Section 11).

6. NUMBERS OF MARINE MAMMALS THAT MAY BE TAKEN

By age, sex, and reproductive condition (if possible), the number of marine mammals (by species) that may be taken by each type of taking identified in [Section 5], and the number of times such takings by each type of taking are likely to occur.

The material for Sections 6 and 7 has been combined and presented in reverse order in section 7 below to minimize duplication between sections. First the potential impacts on marine mammals from launch operations are estimated, as called for in Section 7. Then, the numbers of marine mammals that could be affected by the proposed launch activities on SNI are estimated. Section 7 includes the required description of the rationale for the estimates of the potential numbers of harassment takes during the planned operations.

7. ANTICIPATED IMPACT ON SPECIES OR STOCKS

The anticipated impact of the activity upon the species or stock of marine mammal.

The likely or possible impacts of the planned missile launch operations at SNI on marine mammals involve both acoustic and non-acoustic effects. Acoustic effects relate to sound produced by the missile engines and, in some cases, their booster rockets. The acoustic sense of marine mammals probably constitutes their most important distance receptor system, and launch sounds have several types of potential effects on marine mammals.

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 expected to minimize the potential for disturbance to pinnipeds hauled out nearby. Visual disturbance caused by the missile flying overhead is likely to be minor and brief as the missiles are relatively small, move at high 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 missile launch, but this has not been documented in videotaped records of pinniped groups during launches at SNI in 2001–2012 (Holst et al. 2005a, b; 2008, Ugoretz and Greene, 2012).

7.1 Noise Characteristics and Effects

The effects of noise on marine mammals are highly variable. 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 missile launches; sound exposure 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. The following noise effect categories are based on Richardson, et al. (1995):

(1) The noise may be too weak to be heard at the location of the pinniped, 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 pinniped; these can range from temporary alert responses to active avoidance reactions such as stampedes into the sea from terrestrial haul-out sites. It is possible, although unlikely, that stampedes could result in injuries or deaths of some individuals, especially pups.

(4) Upon repeated exposure, pinnipeds 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 missile launches), and associated with situations that the pinniped perceives as a threat.

(5) Any man-made noise that is strong enough to be heard has the potential to reduce (mask) the ability of pinnipeds to hear natural sounds at similar frequencies, including calls from conspecifics, and environmental sounds such as surf noise. Masking is of most concern when exposure to sound is continuous, or nearly so, and of less or no concern when exposure is brief and/or infrequent (as in the present situation).

(6) If mammals choose to 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. Such chronic physiological effects are highly unlikely due to the relatively infrequent and brief nature of the sounds from the planned launches (up to 40 launches per year, on varying azimuths; only a fraction of the animals hauled out during any one launch).

(7) Very strong sounds have the potential to cause temporary or permanent reduction in hearing sensitivity (see Section 7.5, below). Effects of non-explosive sounds on hearing thresholds of marine mammals are poorly known. Received sound levels must far exceed the animal's hearing threshold for there to be any temporary threshold shift (TTS). Received levels must be even higher for there to be risk of permanent threshold shift (PTS).

7.1.1 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% of the cumulative energy (interval between receipt of 5% and 95%) 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 4; Figures 21 and 22). 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 μPa^2·s (123 dB m_{pa}-weighted) near the launcher, to 96–107 dBA (105–114 dB m_{pa}-weighted) at beaches 0.8–1.7 km from the CPA, and 46–87 dBA (60–91 dB m_{pa}-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 21 and 22). 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 4. The range of sound levels (maximum in bold) recorded near the launcher and at nearshore locations for all missile types launched at SNI from 2001 through 2008. Units for Peak and SPL are in dB re 20 µPa; SEL is shown in dB re $(20\ \mu Pa)^2 \cdot s$.

	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 missiles, 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.

7.1.2 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.

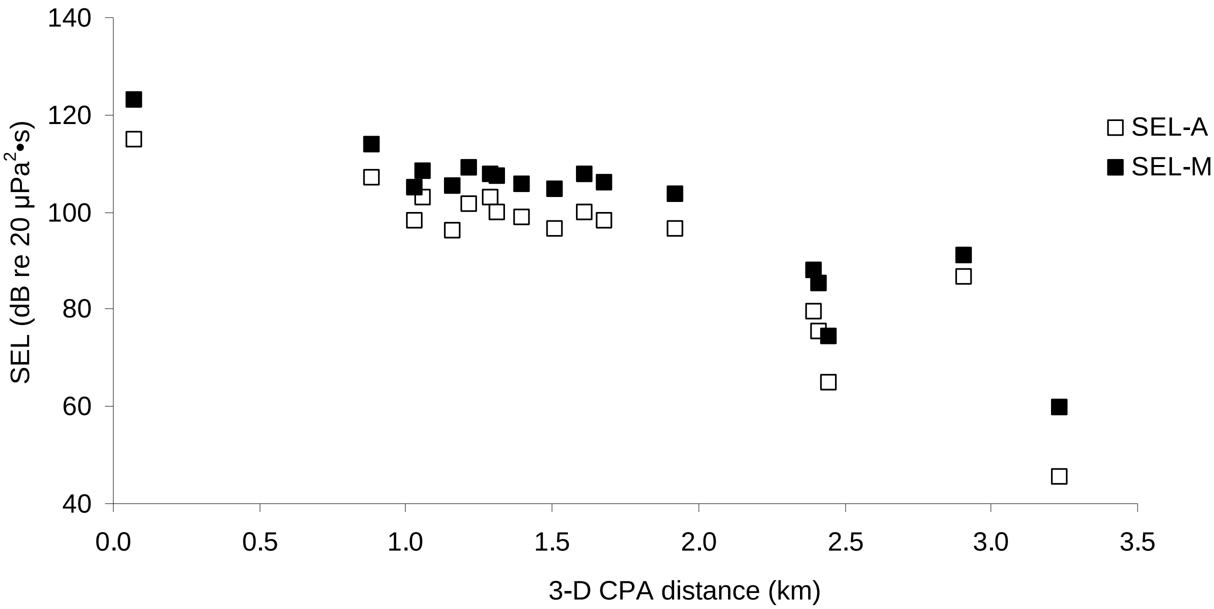

Figure 21. SELs (A- and mpa-weighted) for Coyote launches at SNI relative to the 3-D CPA distance, 2003–2007.

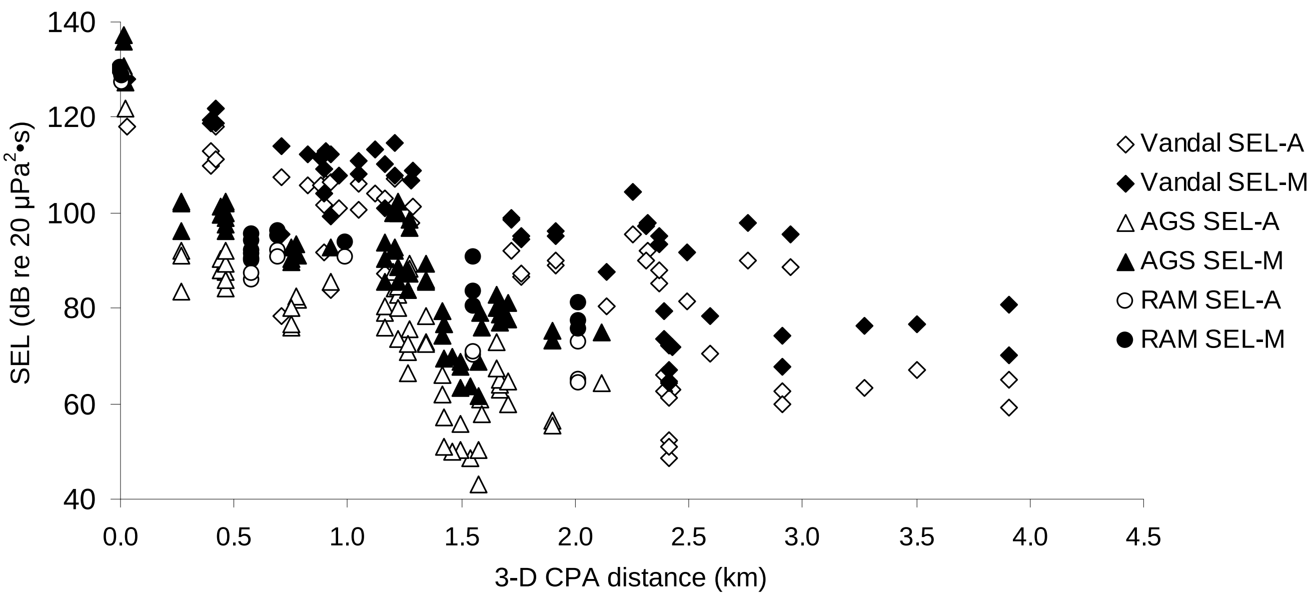

Figure 22. SELs (A- and mpa-weighted) for Vandal, AGS, and RAM launches relative to the 3-D CPA distance, 2003–2007.

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 missile launches on SNI.

Background sounds have been (and will be) recorded on a second audio channel of the ATAR (see Section 13) using a higher sensitivity microphone and higher gain setting. This channel will overload during the brief periods when it receives the missile 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[2], 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.

7.1.3 Sound Propagation

In-air sound propagation from missile launch sources at SNI had not been well studied prior to the monitoring work during 2001–2007. Measured sound levels of several missile types as related to CPA distance are shown in Figures 21 and 22. Additional data are needed for a full characterization of the sounds produced by the launches; the monitoring program described in Section 13 will provide additional information. However, some relevant general principles can be described (Section 4.6 *in* Richardson et al. 1995).

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.

7.2 Pinniped Sound Production

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 140 m away and detectable by the mother up to 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.

[2] These average ambient sounds are comparable to sound levels expected in quiet residential areas.

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 extremely 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.

7.3 Pinniped Hearing Abilities

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 23; 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 missile launches (see below).

7.4 Behavioral Reactions of Pinnipeds to Missile 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. Published papers and available technical reports describing behavioral responses of pinnipeds to the types of sound recorded near haul-out sites on SNI indicate that there is much variability in the responses (Figure 24). Responses can range from momentary startle reactions to animals fleeing into the water or otherwise away from their resting sites in what has been termed a stampede. Studies of pinnipeds during missile launch events have demonstrated that different pinniped species, and even different individuals in the same haul-out group, can exhibit a range of responses from alert to stampede. It is this variation that makes setting reaction criteria difficult. 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). Missile 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).

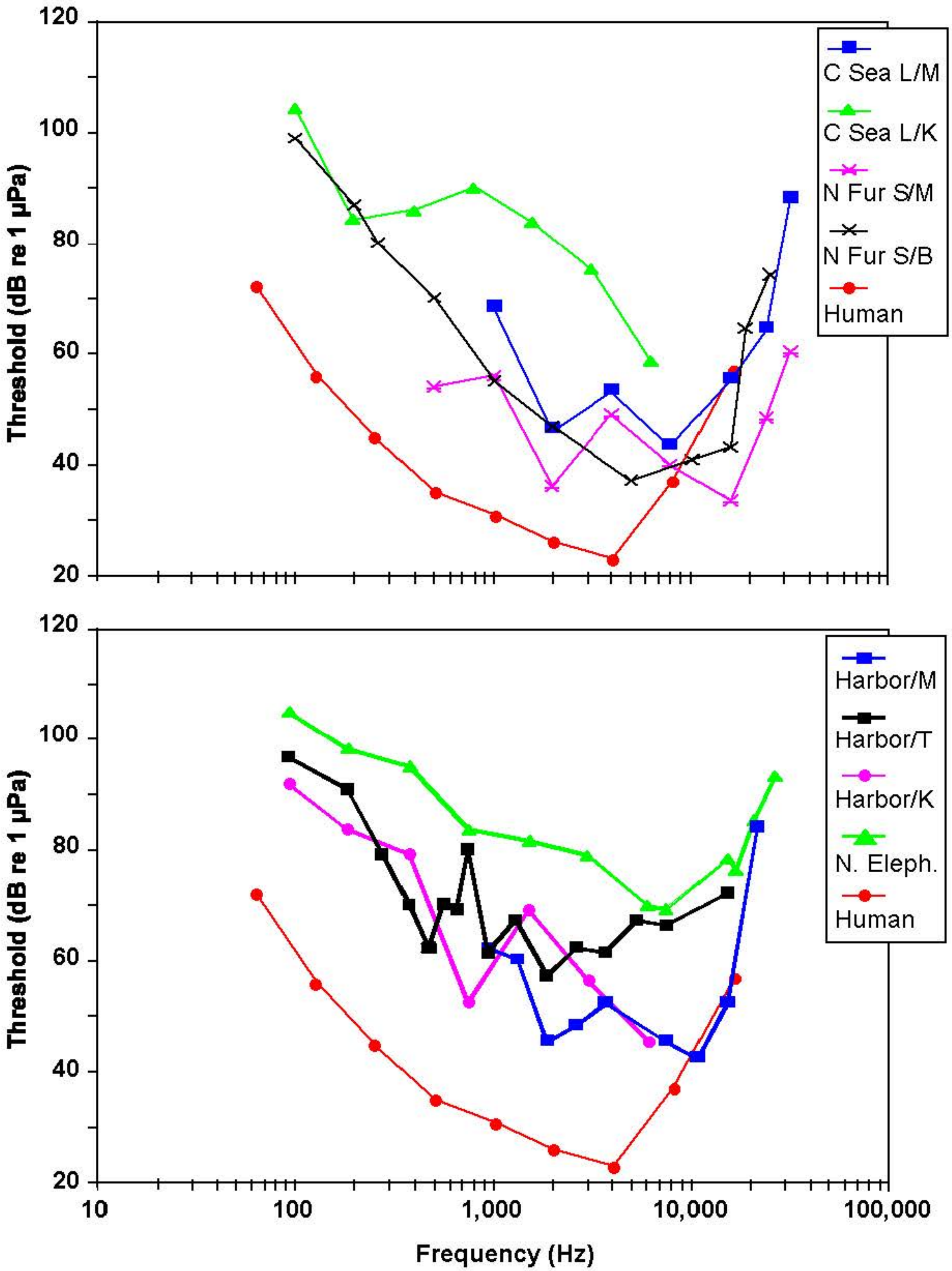

Figure 23. In-air hearing thresholds for selected otariid and phocid pinnipeds and the sensitivity thresholds for humans for comparison. (Subtract 26 dB from these values to obtain the equivalent levels in dB re 20 µPa, the usual units for in-air hearing thresholds.) Adapted from Richardson et al. (1995) with the addition of data from Kastak and Schusterman (1998, 1999).

Previous to the start of the monitoring work at SNI under an IHA issued in 2001, most existing data on reactions of hauled-out pinnipeds to sonic booms or launch noise involved far larger launch missiles (e.g., Titan IV) than the Coyotes and other missiles that will be launched from SNI (Figure 25). In most cases, where the species of pinnipeds occurring in the Sea Range have been exposed to the sounds of large missile launches (such as the Titan IV from Vandenberg Air Force Base [VAFB]), animals did not flush into the sea unless the sound level to which they were exposed was relatively high (Figure 25). The reactions of harbor seals to even these large missile launches have been limited to short-term (5–30 min) abandonment of haul-out sites (NMFS 2003). NMFS (1999) has stated, in the context of launches of large missiles from VAFB, that brief alert or startle reactions by pinnipeds on a beach are not considered to constitute disturbance sufficient to require an incidental take authorization.

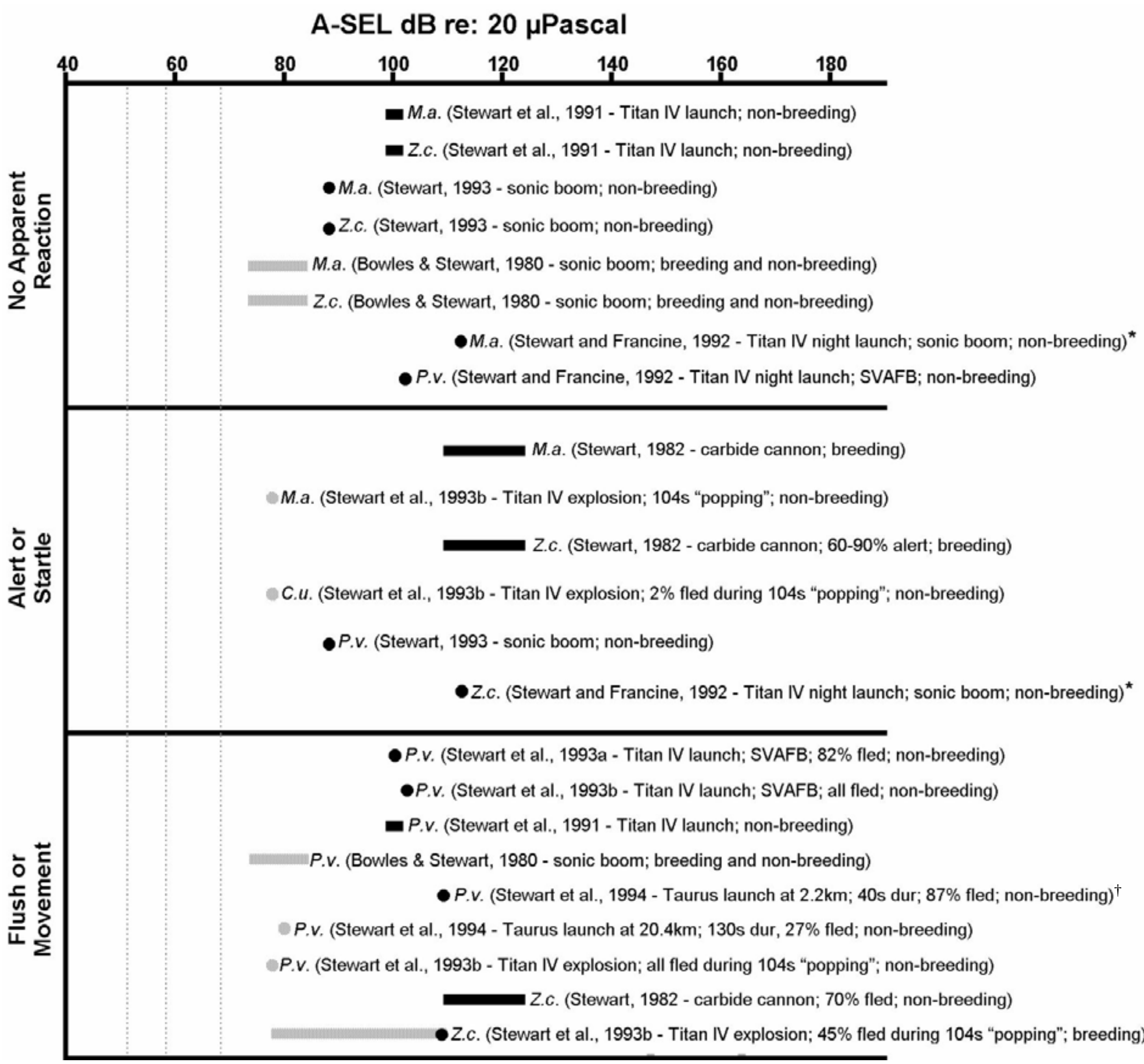

Figure 24. Behavioral responses by pinnipeds hauled out within the Point Mugu Sea Range to transient anthropogenic acoustic stimuli of varying source and intensity. C.u.= Callorhinus ursinus, M.a. = Mirounga angustirostris, P.v. = Phoca vitulina, Z.c. = Zalophus californianus.

* Sound intensity values measured as dBA peak. † Stewart et al. 1994b.

Holst et al. (2005a, 2008, 2010, and 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, and 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.

As expected, responses of California sea lions to the launches varied by individual and age group (Holst et al. 2005a, 2008, 2010, 2011). Some sea lions exhibited brief startle responses and increased vigilance for a short period after each launch. Other sea lions, particularly pups that were previously playing in groups along the margin of the haul-out beaches, 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, 2008, 2010, 2011, Ugoretz and Greene 2012). 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 within the audible range of the launch 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) (Holst et al. 2005a, 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 missile 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 missile launches; AGS launches caused the fewest reactions. Elephant seals showed significantly less reaction during launches involving missiles other than Vandals (Holst et al. 2008).

The BQM-34 and especially the BQM-74 subsonic drone missiles that may be launched from SNI are smaller and less noisy than Coyotes. Launches of BQM-34 drones from NAS Point Mugu have not normally resulted in harbor seals leaving their haul-out area at the mouth of Mugu Lagoon ~3.2 km to the side of the launch track (Lawson et al. 1998).

In addition to noise, night launches will also emit light. Haul-out beaches near Building 807 Launch Complex in particular may be affected by light during nighttime launches. However, additional responses to the light, above and beyond those that are elicited by the launch sounds are not anticipated.

The proposed continuation of the launch monitoring program will enable further documentation of pinniped responses to various launch missiles with different acoustic characteristics, and to nighttime launches.

7.4.1 Habituation

Since the launches are relatively infrequent, and of such brief duration, it is unlikely that the pinnipeds near the launch sites will become habituated to these sounds. Pinnipeds that haul out on the island for extended periods, or that return to haul-out sites regularly over the course of the year, may be exposed to sounds of more than one launch, and may be "taken" by harassment more than once each year. However, given the infrequency and brevity of these events, it is questionable whether much (if any) habituation has occurred.

7.4.2 Masking

Any man-made noise that is strong enough to be heard has the potential to reduce (mask) the ability of marine mammals to hear natural sounds at similar frequencies, including calls from conspecifics and environmental sounds such as surf noise. However, the infrequent launches (up to 40 per year, of which some will be of small missiles) will cause masking for no more than a very small fraction of the time during any single day (e.g., usually less than 2 s and rarely more than 5 s during a single launch). It can be assumed that these occasional brief episodes of masking will have no significant effects on the abilities of pinnipeds to hear one another or to detect natural environmental sounds that may be relevant to the animals.

7.4.3 Stampede-Related Injury or mortality

Bowles and Stewart (1980) reported that harbor seals on San Miguel Island reacted to low-altitude jet overflights with alert postures and often with rapid movement across the haul-out sites, especially when aircraft were visible. These harbor seals flushed into the water in response to some sonic booms and to a few of the overflights by light aircraft, jets above 244 m, and helicopters below 305 m. Sometimes the harbor seals did not return to land until the next day, although they more commonly returned the same day. These authors postulated that such disturbance-induced stampedes or mother-pup separations could be a source of increased mortality. However, observations during actual sonic booms (Figure 22) and tests with a carbide cannon simulating sonic booms at San Miguel and SNI provided no evidence of such pinniped injury or mortality (Stewart 1982) and no mortality has been observed during missile launches (Holst et al., 2005a, 2008, 2010, 2011, Ugoretz and Greene 2012).

It is possible, although unlikely, that launch-induced stampedes could have adverse impacts on individual pinnipeds on the west end of SNI. However, during missile launches in 2001–2012, there was no evidence of launch-related injuries or deaths (Holst et al. 2005a, 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% for northern fur seals at nearby San Miguel Island, 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 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 also increased and new harbor seal haul-out sites have been established at locations directly under and near the launch tracks of missiles (Figure 9).

7.4.4 Behavioral "Take" Criteria

In general, if the received level of the noise stimulus exceeds both the background (ambient) noise level and the auditory threshold of the receiving animals, and especially if the stimulus is novel to them, then there may be a behavioral response. However, there can also be cases where the sound is audible but no overt response occurs. The probability and type of behavioral response will also depend on the season, the group composition of the pinnipeds, and the type of activity in which they are engaged. For example, in some cases harbor seals at SNI appear to be more responsive during the pupping/breeding season (Holst et al. 2005a, 2008) while in others mothers and pups seem to react less to launches than lone individuals (Ugoretz and Greene 2012) and California sea lions seem to be consistently less responsive during the pupping season (Holst et al. 2005a, 2008, 2010, 2011, Ugoretz and Greene 2012).

It is difficult to derive unequivocal criteria to identify situations in which launch sounds are expected to cause biologically significant disturbance responses to pinnipeds hauled out on SNI. Consistent with NMFS (2002), one or more pinnipeds blinking its eyes, lifting or turning its head, or moving a few feet along the beach as a result of a human activity are not considered a "take" under the MMPA definition of harassment.

Before the start of the monitoring work at SNI in 2001, the available data were quite limited in detail and highly variable (e.g., Figure 25). Even with the monitoring results from 2001–2012, the available data are insufficient to establish the relationships between sound levels and the responses of each pinniped species. However, Holst et al. (2008, 2010, and 2011) did find that a greater proportion of California sea lions and elephant seals responded with increasing SELs; the relationship between harbor seal responses and SELs was less clear. Even though pinnipeds are disturbed at SNI during launches, no deaths due to stampeding have been witnessed at SNI during the 2001–2012 monitoring period (Holst et al. 2005a, 2008, 2010, 2011, Ugoretz and Greene 2012).

Table 5 shows the received levels of transient and prolonged sounds at which "taking" may begin to occur for pinnipeds. Lawson et al. (1998) noted disturbance criteria for prolonged sounds of 100 dBA re 20 $\mu Pa^2 \cdot s$ SEL for all pinnipeds. Based on the results of launch monitoring at SNI that showed that harbor seals responded to launches with SELs <100 dBA, Holst et al. (2005a) suggested a disturbance criterion of 90 dBA SEL for harbor seals. Southall et al. (2007), based on the same data but with different frequency-weighting, noted that m_{pa}-weighted SELs of 100 dB re 20 $\mu Pa^2 \cdot s$ could result in significant behavioral changes by pinnipeds (M_{pa}-weighted values are greater than A-weighted SELs for launch

sounds [Figures 22 and 23]).

TABLE 5. Assumed in-air sound pressure criteria for significant disturbance and for TTS and PTS in pinnipeds

	Criterion Level		
Criterion Type	**A-weighted (re 20 µPa²·s SEL)**	**M_{pa}-weighted (re 20 µPa²·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), with relevant sections included in Section 8 of this Petition. Monitoring work at SNI has found that typically only a small fraction (approx. 10%) 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).

Previous monitoring at SNI has shown that sea lions and harbor seals move along the beach and/or enter the water at m_{pa}-weighted SELs >100 dB re 20 µPa²·s. In fact, sea lions and harbor seals can be disturbed at lower levels. Some harbor seals have been shown to leave the haul out site and/or enter the water at m_{pa}-weighted SELs as low as 60 dB re 20 µPa²·s, although the proportion of animals reacting is smaller when levels are lower (e.g., Holst et al. 2005a, b; 2008, 2011). Stampedes of California sea lions into the water occur infrequently during launches at SNI, especially when received sound levels are <100 dB re 20 µPa²·s (e.g., Holst et al. 2005a, b; 2008, 2011). Northern elephant seals tolerate much higher sound levels without reacting strongly. In general, there is much variability, with some pinnipeds tolerating high levels of sound and others reacting to lower levels (e.g., Figure 24).

Continued testing and improvement of the provisional disturbance criteria will occur, using additional quantitative field observations coupled with accurate sound measurements. This is desirable in order to establish more firmly the relationship between behavioral responses and the acoustic stimuli that elicit them. The previous launch monitoring program has shown that the proportions of responding California sea lions and northern elephant seals were significantly greater with increasing SEL values (Holst et al. 2005a, 2008, 2011). The monitoring work described in Section 13 of this Petition will seek to verify or refine the provisional disturbance criterion used here as it applies to exposure of the three most common species of pinnipeds on SNI to launches of supersonic and subsonic missiles.

7.5 Hearing Impairment

As noted earlier, very strong sounds have the potential to cause temporary or permanent reduction in hearing sensitivity. Received sound levels must far exceed the animal's hearing threshold for there to be any TTS. For transient sounds, the sound level necessary to cause TTS is inversely related to the duration of the transient. Received levels must be even higher for there to be risk of permanent hearing impairment. Although it is possible that some pinnipeds (particularly harbor seals) may incur TTS (and possibly, although unlikely, even slight 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 missiles at VAFB. No launch at SNI since 2001 has exposed pinnipeds to noise levels at or exceeding those where PTS could be incurred.

7.5.1 Auditory "Take" Criteria

There are few published data on TTS thresholds for pinnipeds in air exposed to impulsive or brief non-impulsive sounds. J. Francine, quoted in NMFS (2001:41837), 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). Unpublished 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 (Table 5, Kastak et al. 2005). 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 ~143 dB re 20 μPa (peak) or if received m_{pa}-weighted SEL is ~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 stronger, on an SEL basis (Southall et al. 2007; Table 5).

7.5.2 Possibility of Hearing Impairment during Launches at SNI

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 $\mu Pa^2 \cdot s$ (M_{pa}-weighted), with higher values applying to other species (Table 5). The measured SEL values near pinniped beaches during missile launches at SNI during 2001–2007 were <129 dB re 20 $\mu Pa^2 \cdot s$ (A- or m_{pa}-weighted). In fact, few if any pinnipeds were exposed to SELs >122 dB re 20 $\mu Pa^2 \cdot s$ on an m_{pa}-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 peak-pressure levels at haul-out sites sometimes reached ≥143 dB re 20 μPa 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.

7.6 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*). They 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.

7.7 Estimating "Takes" by Harassment

The petitioner seeks authorization to "take" marine mammals under the jurisdiction of NMFS in the proposed area of activity. Species for which authorization is sought are California sea lions, harbor seals, and northern elephant seals. No takes are expected for Guadalupe fur seals, northern fur seals, or Steller sea lions as these species occur only rarely on SNI at present. No takes of southern sea otters are expected due to their distance from missile launch sites and CPAs. For purposes of this Petition, pinnipeds are assumed to be "taken by harassment" if, as a result of a launch, TTS occurs, or biologically significant behavioral patterns of pinnipeds are significantly altered. Any takes are most likely to result from operational noise as launch missiles pass near haul-out sights, and/or associated visual cues. This section estimates maximum potential take and the likely take, per year, during the planned missile launch program at SNI, and describes the rationale for these take estimates.

The launch sounds could be received for several seconds and, to be conservative, are considered to be prolonged rather than transient sounds. Given the variety of responses documented previously for the sounds of man-made activities lasting several seconds, an SEL of 100 dB re 20 μPa^2·s (M_{pa}-weighted) is considered appropriate as a disturbance criterion for pinnipeds hauled out at the west end of SNI, particularly for California sea lions and northern elephant seals. Some pinnipeds that haul-out on the western end of SNI are expected to be within the area where m_{pa}-weighted SELs from launches reach >100 dB re 20 μPa^2·s. It is likely that far fewer pinnipeds occur within the area where sounds from smaller launch missiles, such as the BQMs or AGS missiles and slugs, reach >100 dB re 20 μPa^2·s. However, none of the recorded SELs appear to be sufficiently strong to induce TTS. This assumes that an m_{pa}-weighted SEL of 129 dB re 20 μPa^2·s from a single launch might cause TTS, at least in harbor seals, and that no pinnipeds (especially harbor seals) will occur close to the launchers at the Building 807 Launch Complex.

Based on the reaction criterion, the distance to which it is assumed to extend, and the estimated numbers of pinnipeds exposed to m_{pa}-weighted SELs ≥100 dB re 20 μPa^2·s, estimates of the numbers of pinnipeds on the west end of SNI that might react strongly to the launch sounds are shown below. Based on data collected during 2001–2012, an additional adjustment was made for harbor seals, as they are known to react strongly at times to m_{pa}-weighted SELs <100 dB re 20 μPa^2·s.

To estimate the maximum number of hauled-out pinnipeds within the area where sound levels are expected to be >100 dB re 20 μPa^2·s m_{pa}-weighted, locations where m_{pa}-weighted SELs >100 dB have been recorded during past launches were determined and the maximum total number of pinnipeds of each species expected to occur within that area for the first year (2014) under the sought regulations was calculated (see details below). The percentage of animals that actually responded in previous monitoring years was then applied to estimate the number of animals potentially harassed.

Previous monitoring during 2001–2012 showed that m_{pa}-weighted SELs ≥100 dB re 20 μPa^2·s were measured in areas K, L, and M. Aerial and ground based census data provided by Mark Lowry, NOAA SWFSC, and in Carretta (2012), provide the most recent counts available of northern elephant seals, harbor seals, and California sea lions at SNI. For each species, censuses were typically conducted seasonally when maximum numbers are known to occur on land. All three species are seasonal breeders: elephant seals are most abundant on land during their winter breeding period; harbor seals and California sea lions are most abundant on land during their spring and summer breeding periods, respectively. In addition, other life history traits such as feeding patterns reduce the proportion of time that individuals might be hauled out on SNI; these are discussed in the sub-sections for the individual species, below.

Past monitoring shows that the actual number of pinnipeds harassed is likely to be far lower than these maximum estimates. Between 2001 and 2012, a maximum of 1,990 California sea lions, 395 harbor seals, and 130 northern elephant seals were estimated to have been potentially harassed in any single monitoring year incidental to missile launches at SNI (Holst et al. 2008, 2010, 2011, Ugoretz and Greene 2012). These numbers may represent multiple exposures of single animals, as beaches were monitored repeatedly over the course of the year during numerous launches. However, some animals that displayed behavioral reactions may have been missed, as not all areas can be monitored during the launches. Pinnipeds that were potentially affected left the haul-out site in response to the launch, left the water at a vigorous pace, or exhibited prolonged movement or behavioral changes relative to their behavior immediately prior to the launch. Of the California sea lions, many were young animals such as pups or juveniles. It is unlikely that any of the pinnipeds on SNI were adversely impacted by such behavioral reactions and none were killed (Holst et al. 2005a, 2008, 2010, 2011, Ugoretz and Greene 2012).

Although the effects of sounds from missiles proposed for launching from SNI on in-air hearing sensitivity of pinnipeds have not been measured, there is a possibility that some launch sounds (particularly those associated with sonic booms) as received on beaches where pinnipeds haul out on SNI may cause TTS. However, given the levels of sound received, any cases of TTS are expected to be mild and reversible, and would not constitute injury (Southall et al. 2007).

7.7.1 Northern Elephant Seal

All northern elephant seal sex and age classes can be found on SNI beaches at certain times of year. However, adult northern elephant seals are at sea for 8 to 10 months per year, and juveniles are offshore for an even greater proportion of the time. Based on what is known about the proportion of the year that various age and sex classes spend ashore, it is likely that elephant seals might be ashore only 17 to 34% of the year. Northern elephant seals are most abundant on land during their winter breeding period (late January to early February).

To estimate the potential maximum numbers of northern elephant seals that might be exposed to sound levels ≥100 dB re 20 μPa^2·s m_{pa}-weighted in 2014, the highest pup counts within map areas K, L, and M in any year between 2000 and 2010 were used (yielding a total of 1,854), and a continuing growth rate of 7.3% since 2010 was applied. This results in a maximum potential pup count of 2,458 for those map areas in 2014 (Table 2). Based on data collected from 1988 to 2010, the total count of all age classes expected to be hauled is approximately twice the number of pups hauled out. Therefore, the maximum number hauled out in areas of potential impact for 2014 was approximated by doubling the maximum potential calculated pup count. Thus, the maximum expected number of elephant seals that may be exposed to sound levels ≥100 dB m_{pa}-weighted during 2014 is estimated to be 4,916.

In the absence of any contrary data, it is assumed that elephant seals exhibit high site fidelity when they return to shore, and that the 4,916 elephant seals calculated above represent the maximum total number that might be exposed to "strong" (≥100 dB re 20 μPa^2·s m_{pa}-weighted) sounds during the year, assuming missiles are launched when all animals are hauled out and all beaches within the area receive strong sounds. If some seals haul out on different beaches at various times during the year, sometimes within and sometimes outside the area exposed to levels ≥100 dB, then the number of times an individual elephant seal might be exposed to strong launch sounds would be reduced. However, the total number of individuals that would be exposed at least once over the course of the year would probably be increased. Movements from one beach to another may be more likely for juveniles than for older seals, given that this has been observed in other pinniped species (such as for harbor seal pups; Thompson et al. 1994).

Published studies and results from the 2001–2012 monitoring at SNI indicate that elephant seals are more tolerant of transient noise and other forms of disturbance than are California sea lions or harbor seals. Hence, the 100 dB re 20 μPa^2·s m_{pa}-weighted SEL criterion for disturbance, as used here, is probably too low (conservative) for this species. If so, the actual impact zone is smaller than assumed here, and the number of elephant seals that might be "taken by harassment" will be *substantially* lower than the number of seals present within the area where sound levels are ≥100 dB. For example, during the 2001–2012 launch program, the majority of northern elephant seals did not exhibit more than brief startle reactions in response to launches (Holst et al. 2005a, 2008, 2010, 2011, Ugoretz and Greene 2012). 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 (typically much less than 10%) of northern elephant seals moved a short distance (<10 m) away from their resting site, but settled within minutes. Elephant seals rarely moved or reacted more than this.

Therefore the Navy estimates that up to 10% of 4,916 elephant seals (or 492 seals) might be "taken by harassment" during each year of planned launch operations. The effects of this harassment on individuals and the population are expected to be negligible. The Navy's standard, ongoing monitoring activities (Section 13) will further investigate if northern elephant seals react in ways that would be considered harassment under certain launch conditions and (if so) the approximate numbers involved. Any "take" is expected to be limited to Level B harassment.

7.7.2 Harbor Seal

All sex and age classes of harbor seals (including pregnant females) could be found on the beaches seasonally throughout the year, although in reduced numbers at certain times due to foraging patterns and adverse weather. Harbor seals are seasonal breeders and thus are slightly more abundant during their late winter and spring breeding and molting periods.

To determine the potential numbers of harbor seals that might be "taken by harassment", the maximum total harbor seal count for SNI (Figure 8, 858 seals in 2008) was used and it was assumed that

the population has remained relatively stable subsequently. Previous monitoring during 2001–2012 showed that generally most if not all monitored harbor seals entered the water in response to those launches, though on occasion smaller numbers or even no seals reacted. However, a small proportion of harbor seals in area O reacted to levels below 100 dB m_{pa}-weighted (as low as 60 dB) by entering the water. It was previously estimated that ~70% of harbor seals that haul out on SNI use the beaches within areas K, L, and M. If harbor seals are expected to respond to launches with lower sound levels, then it can be assumed that a small proportion of animals hauled out in areas I, J, N, and O would also be affected. Therefore, a conservative approximation of the percentage of harbor seals on SNI that may be impacted is likely around 80%.

The 2008 count of 858 seals may be an underestimate as it is based on a single survey, with no consideration of the natural variability in the number of these seals observed at other haul-out sites. However, assuming this survey estimate is correct, the number of harbor seals that might be affected within areas I through O is 686.

The proportion of harbor seals hauled out at any given time varies with time of day, date, and other factors. During the night, the number potentially affected would be greatly reduced as harbor seals usually go to sea to forage between 1900 and 1100 local time (Figure 12). Thus, the average proportion of harbor seals ashore over the course of a 24-hour (hr) period might be less than one third of the peak numbers. Also, during August to February, it has been reported that the numbers hauled out might be only 65 to 83% of the maximum numbers ashore during the breeding season. During winter, the proportion hauled out relative to the peak season might be only 15%. If we assume that, for all months except the breeding season, each seal might haul out for an average of only 8 hours between foraging bouts, then a given harbor seal would probably be present for only a few of the ~40 launches per year.

During the majority of launches, most individuals 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 time (Holst et al. 2005a, 2008, 2010, 2011, Ugoretz and Greene 2012). During follow-up monitoring the next day, harbor seals were usually hauled out again at these sites (Holst and Lawson 2002). There was no evidence of mortality or injury to these seals. Additional monitoring is needed to establish the relationship between received sound levels, distance from the sound source, and the nature and consistency of responses.

Therefore, the Navy estimates that a maximum of 686 harbor seals on SNI might be taken by harassment during a 1-year period of launches. The Navy's standard, ongoing monitoring activities will provide further information useful in determining whether harbor seals do react in any significant way to these launches. Any "take" is expected to be limited to Level B harassment.

7.7.3 California Sea Lion

All sexes and ages of California sea lions are found on SNI seasonally. Adult female California sea lions and juvenile sea lions are found on the beaches throughout the year, although in reduced numbers at certain times due to foraging patterns and adverse weather. Males generally come ashore only briefly during the spring breeding period but can be found at other times as well.

To estimate the maximum potential numbers of sea lions that might be hauled out within areas exposed to sound levels ≥100 dB re 20 $\mu Pa^2 \cdot s$ m_{pa}-weighted, the maximum number of sea lions occurring within map areas K, L, and M (Figure 16) in any year between 2001 and 2011 was calculated. During this period, a maximum of 14,963 sea lions were within areas K, L, and M (Table 3). After adjusting for a population growth of 5.6% per year, a maximum of 20,749 sea lions of all ages and sexes might be hauled out within the area exposed to levels ≥100 dB in 2014. For most of the year, only females and pups (and

then perhaps less than half of these) are expected to be ashore, so the number of animals exposed to these levels from any one launch will be significantly less than the estimated total number. Further, based on observations from video recordings of sea lions closest to the missile path during launches, only a portion of the sea lions ashore flee into the water; many startle or move only a short distance on the beach (Holst et al. 2005a, 2008, 2010, 2011, Ugoretz and Greene 2012). An even smaller proportion of sea lions hauled out further away from the missile path react to the launches (Holst et al. 2005a, 2008, 2010, 2011, Ugoretz and Greene 2012).

During 2001–2012, responses of California sea lions to the launches varied by individual, age group, season and missile type. Some sea lions exhibited brief startle responses and increased vigilance for a short period after each launch. Other sea lions, particularly pups that were previously playing in groups along the margin of the haul-out beaches, appeared to react more vigorously. Some pups rushed into the water, while other pups in the water rushed onto shore. Most adult sea lions already hauled out milled about on the beach for a short period before settling. Most sea lions in all age classes settled back to pre-launch behavior patterns within minutes of the launch time.

Based on past monitoring, approximately 10% of the California sea lions exposed to launch sounds during each year of launch activity might exhibit disturbance of behavioral patterns. Therefore, the Navy estimates that a maximum of 2,740 California sea lions on SNI might be taken by harassment during a 1-year period. The Navy's standard, ongoing monitoring activities will provide information valuable in determining how many California sea lions do react in any significant way to these launches. Any take is expected to be limited to Level B harassment.

7.8 Summary

Missile launches are characterized by sudden sound onsets, moderate to high peak sound levels (depending on the type of missile and distance), and short sound duration. Effects of missile launches on some pinnipeds in the Channel Islands have been studied. In most cases, where pinnipeds have been exposed to the sounds of large missile launches (such as the Titan IV from 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 missile 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 (harbor seals) are more reactive when hauled out than are other species (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. Given this variability in response, the Navy assumes that biologically significant disturbance will sometimes occur upon exposure to launch sounds with SELs of 100 dB re 20 $\mu Pa^2 \cdot s$ or higher; for harbor seals, this level may be lower. 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.

The numbers of individuals that might stampede or make large-scale movements are difficult to estimate. However, monitoring results to date indicate that the reactions of many pinnipeds (especially elephant seals) are no more than minor. The Navy estimates that no more than the following numbers of pinnipeds are likely to be "taken" annually in this manner: 492 northern elephant seals, 686 harbor seals, and 2,740 California sea lions.

If the regulations and an associated LOA are issued by NMFS for the planned five-year period of launch operations, the Navy provisionally estimates that no more than 2,300 northern elephant seals, 3,430 harbor seals, and 13,700 California sea lions might be "taken" in this manner in 2014–2019. These values are five times the annual estimates listed above, and include repeated counts of the same individuals in as many as 5 successive years. However, based on the results of the marine mammal monitoring conducted by the Navy during the 2001–2012 launch program, all of these estimates (annual and 5-year) are likely substantial overestimates of the actual numbers of pinnipeds that will show strong reactions. This is particularly the case for northern elephant seals and for California sea lions. Also, with this procedure, many of the same animals would be counted during more than one of the five years; the total numbers reacting over the 5-year period would be lower than the 5-year values quoted above. The monitoring program described in Section 13 will provide data on the actual numbers of "takes", on the specific nature of the "taking", and on the relationship between sound exposure and the nature and frequency of responses.

Based on measurements of received sound levels during previous launches at SNI (Holst et al. 2005a, 2008, 2010, 2011, Ugoretz and Greene 2012), the Navy expects that there is a very limited potential of 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 not expected that any pinnipeds would be close enough to the launchers to be exposed to sounds strong enough to cause PTS.

Given that the observations of pinnipeds during missile launches at SNI have not shown injury, mortality or extended disturbance, and that their populations and/or distributions on the island are expanding, the effects of missile launches are expected to be limited to short-term and localized behavioral changes falling within the MMPA definition of Level B harassment.

8. ANTICIPATED IMPACT ON SUBSISTENCE

The anticipated impact of the activity on the availability of the species or stocks of marine mammals for subsistence uses.

There are no subsistence uses for these pinniped species in California waters, and thus no anticipated impacts on subsistence.

9. ANTICIPATED IMPACT ON HABITAT

The anticipated impact of the activity upon the habitat of the marine mammal populations, and the likelihood of restoration of the affected habitat.

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 (e.g., Red Eye Beach), rock ledges (e.g., Phoca Reef), and rocky cobble (e.g., Bachelor Beach). Pinnipeds continue to use beaches around the western end of SNI, and indeed are expanding their use of some beaches despite ongoing launch activities for many years. Similarly, it appears that sounds from prior launches have not affected pinniped use of coastal areas at VAFB (NMFS 2003). Thus, periodic launches do not prevent pinnipeds from using beaches.

The pinnipeds do not feed when hauled out on these beaches, and the airborne launch sounds will not persist in the water near the island for more than a few seconds. Therefore, it is not expected that the launch activities will have any impact on the food or feeding success of these pinnipeds.

Boosters from missiles (e.g., JATO bottles for BQM drone missiles) may be jettisoned shortly after launch and fall on the island, but are not expected to impact 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.

Overall, the proposed missile launch activity is not expected to cause significant impacts on habitats used by pinnipeds on SNI, or on the food sources that these pinnipeds utilize.

10. ANTICIPATED IMPACT OF LOSS OR MODIFICATION OF HABITAT

The anticipated impact of the loss or modification of the habitat on the marine mammal populations involved.

As described in Section 9, "ANTICIPATED IMPACT ON HABITAT", the effects of the planned launch activities on pinniped habitats and food resources at SNI are expected to be negligible. Thus, "loss or modification of habitat" will not have any impacts on the pinnipeds of SNI.

11. MITIGATION MEASURES

The availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks, their habitat, and on their availability for subsistence uses, paying particular attention to rookeries, mating grounds, and areas of similar significance.

To minimize the likelihood that impacts will occur to the species and stocks of marine mammals, all operational activities will be conducted in accordance with all Federal, state, and local regulations. NAWCWD will coordinate all activities with the relevant Federal and state agencies. These will include NMFS, USFWS, and the California Coastal Commission.

This activity will happen infrequently, with a variety of launch azimuths, and will produce only brief but rapid-onset sounds. Any given animal is expected to haul out during only a small number of the launches and will be close to the launch azimuth for only a few launches. Thus, it is unlikely that pinnipeds hauled out on beaches at the western end of SNI will exhibit much, if any, habituation to missile launch activities.

The number of individual animals expected to be disturbed during the proposed activity will be small in relation to regional population sizes. With the standard, ongoing monitoring and mitigation provisions described below, effects on those individuals are expected to be well documented, and limited to harassment. This is expected to have negligible impacts on the species and stocks.

As during launches conducted under the previous Regulations, where practicable, the Navy will adopt the following mitigation measures, provided that doing so will not compromise operational safety, human safety, national security or other requirements or mission goals:

(1) To avoid additional harassment to the pinnipeds on beach haul-out sites, and to avoid any possible sensitizing and/or predisposing pinnipeds to greater responsiveness to the sights and sounds of a launch, the Navy will limit activities near the beaches in advance of launches,

(2) The Navy will attempt to avoid launch activities during harbor seal pupping season (February through April),

(3) The Navy will attempt to limit launch activities during other pinniped pupping seasons,

(4) The Navy will attempt to not launch missiles from the Alpha Complex at low elevation (less than 1,000 feet (305 m)) on launch azimuths that pass close to pinniped haul-out sites when occupied,

(5) The Navy will attempt to avoid launching multiple missiles in quick succession over haul-out sites, especially when young pups are present,

(6) Aircraft and helicopter flight paths during missile launch operations will maintain a minimum altitude of 1,000 feet (305 m) from pinniped haul-outs and rookeries, 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 1,000 feet (305 m),

(7) 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 will be reviewed, in cooperation with NMFS, and, if necessary, appropriate changes must be made through modification to the Letter of Authorization, prior to conducting the next launch of the same vehicle under that Letter of Authorization.

12. PLAN OF COOPERATION

Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses…

As the proposed activity will take place in California, Section 12 does not apply to this Petition.

13. MONITORING AND REPORTING PLAN

The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity. Monitoring plans should include a description of the survey techniques that would be used to determine the movement and activity of marine mammals near the activity site(s) including migration and other habitat uses, such as feeding.

The Navy expects that the planned launches will cause disturbance reactions by some of the pinnipeds on the beaches, but no pinniped mortality or serious injuries, and no significant long-term effect on the stocks of pinnipeds hauled out on SNI. During the period of the requested regulations and associated LOA, the Navy will monitor the haul-out areas before, during, and after launch operations to document and characterize any observed responses, and (to the extent feasible) to detect any instances of pinniped injuries or deaths should they occur. The monitoring will be designed to determine how common the disturbance reactions are, the area over which they occur, and their relationship to launch sounds. Any changes to the monitoring plan would be proposed separately, and subject to further NMFS approval. The Navy anticipates that, if monitoring of certain types of launches shows that they cause no or minimal disturbance to pinnipeds, monitoring during subsequent launches of those types would either be terminated or scaled back.

The planned monitoring tasks are introduced briefly here, and then described in more detail in subsequent subsections and are equal to those adopted by NMFS for NAWCWD missile launch activities in 2010. In November 2010, the Navy's monitoring plan was revised in two ways: (1) northern elephant seals were removed from the plan for targeted monitoring due to their lack of response to launches, and (2) the use of FLIR thermal imaging cameras for nighttime launches was added (FR 75, No. 226). The proposed monitoring Plan is described below. It is very similar to the launch monitoring that has been conducted since 2010. This will assure that the results from the ongoing and previous work are consistent and can be combined for overall analyses. The Navy understands that this monitoring Plan will be subject to further review by NMFS, and that refinements may be required:

(1) The Navy will continue a standard, ongoing, land-based monitoring program to assess effects on harbor seals, northern elephant seals, and California sea lions on SNI. This monitoring will occur at up to three sites at different distances from the launch site before, during, and after each launch, depending upon presence of pinnipeds during each launch. The monitoring will be via autonomous video or Forward Looking Infrared (FLIR) cameras. Pinniped behavior on the beach will be documented prior to the planned launch operations, during the launch, and following the launch. Northern elephant seals will not be specifically targeted for monitoring, though may be present in the field of view when monitoring other species.

(2) During each launch, the Navy will obtain calibrated recordings of the sounds of the launches as received at different distances from the missile's flightline. It is anticipated that acoustic data will be acquired at each video monitoring location, to estimate sounds received by pinnipeds, and at the launch site to estimate maximum potential sound received. These recordings will

provide for a thorough description of launch sounds as received at different locations on western SNI, and of the factors that affect received sound levels. By analysis of the paired data on behavioral observations and received sound levels, the Navy will further characterize the relationship between the two. If there is a clear correlation, we will determine the "dose-response" relationship.

The monitoring effort may be changed in the future, if and when NMFS and the Navy concur that previous monitoring results are sufficient to show that the effects of some or all types of launches on some or all species of pinnipeds at SNI are minimal. The following paragraphs describe anticipated changes in the monitoring effort over the 5-year period of applicability of the requested regulations:

(1) Monitoring may be reduced during launches of small or less noisy missiles, depending on results from ongoing and future monitoring efforts.
(2) Monitoring may be scaled back to include only the launches during sensitive seasons for pinnipeds (e.g., breeding/pupping period for harbor seals), as launches are expected to have the greatest impact on populations during these times.

The monitoring work described here has been planned as a self-contained project independent of any other related monitoring projects that may be occurring in the same region. The Navy is prepared to discuss coordination of its monitoring program with any related work that might be done by other groups insofar as this is practical and desirable (see Section 14, Coordinating Research).

13.1 Visual Monitoring of Pinnipeds during Each Launch

The Navy proposes to conduct marine mammal and acoustic monitoring during launches from SNI, using simultaneous autonomous audio recording of launch sounds and video recording of pinniped behavior. The land-based monitoring will provide data required to characterize the extent and nature of "taking". In particular, it will provide the information needed to document the nature, frequency, occurrence, and duration of any changes in pinniped behavior that might result from the missile launches, including the occurrence of stampedes.

These video and audio records will be used to document pinniped responses to the launches. This will include the following components:

(1) Identify and document any change in behavior or movements that may occur at the time of the launch;
(2) Compare received levels of launch sound with pinniped responses, based on acoustic and behavioral data from up to three monitoring sites at different distances from the launch site and missile path during each launch; from the data accumulated across a series of launches, to attempt to establish the "dose-response" relationship[3] for launch sounds under different launch conditions if possible;
(3) Ascertain periods or launch conditions when pinnipeds are most and least responsive to launch activities, and
(4) Document take by harassment and, although unlikely, any mortality or injury.

13.1.1 Field methods

[3] This is equivalent to estimating behavioral zones of influence by comparing pinnipeds' reactions to varying received levels of launch sounds.

The launch monitoring program will include remote video recordings before, during and after launches when pinnipeds are present in the area of potential impact and visual assessment by trained observers before and after the launch. Remote cameras are essential during launches because safety rules prevent personnel from being present in most of the areas of interest. In addition, video techniques will allow simultaneous "observations" at up to three different locations, and will provide a permanent record that can be reviewed in detail. During some launches, use of video methods may allow observations of up to three pinniped species during the same launch, though in general one or two species will be recorded.

The Navy will seek to obtain video and audio records from up to three locations at different distances from the flight path of each missile launched from SNI. This will be important to ascertain the lateral extent of the disturbance effects and the "dose-response" relationship between sound levels and pinniped behavioral reactions. No specific effort will be made to monitor elephant seals, though they may be present in mixed groups when monitoring other species. It is very likely that paired video and audio data will be obtained from less than three sites during some launches, given the various potential problems with video and acoustic recorders, timing of remote recordings when launches are delayed, absence of pinnipeds from some locations at some times, etc. Corresponding data is available from the previous monitoring periods (2001–2013).

Two different types of cameras will be available for use in obtaining video data simultaneously from three sites:

(1) Small handheld high-definition video cameras on photographic tripods are available to be set up by Navy personnel at various locations on the day of a launch, with the video data being accessible following the launch. Recording duration varies between 300 and 600 minutes following initiation of record mode on these cameras, depending upon battery life, external memory card available and other factors. The digital data is later copied to DVD-ROMs for subsequent viewing and analysis.

(3) Portable FLIR video cameras will be set up by the Navy for nighttime launches. These cameras have a recording duration of approximately 300 minutes from initiation of the record mode. The FLIR video data will be accessible following the launch. The digital data will later be copied to DVD-ROMs for subsequent viewing and analysis.

Before each launch, Navy personnel will set up or activate up to three of the available video cameras such that they overlook chosen haul-out sites. Placement will be such that disturbance to the pinnipeds is minimized, and each camera will be set to record a focal subgroup of sea lions or harbor seals within the haul-out aggregation for the maximum recording time permitted by the videotape capacity. The entire haul-out aggregation on a given beach will not be recorded during some launches, as the wide-angle view necessary to encompass an entire beach would not allow detailed behavioral analyses (Holst et al. 2005a, 2008). It will be more effective to obtain a higher-magnification view of a sample of the animals on the beach. Prior to selecting a focal animal group, a pan of the entire haul out beach and surrounding area will be made in order to document the total number of animals in the area. Trained staff will make observations of the haul-out and note them on field data sheets prior to and after the launch.

Following each launch, video recordings will continue for at least 15 minutes and up to several hours. Personnel will return to the observing sites as soon as it is safe, to record the numbers and types of pinnipeds that remain on the haul-out site(s) and any notable changes. Greater post-launch time intervals are not advisable as storms and other events may alter the composition of pinniped haul-out groups independent of launch events.

13.1.2 Video and Data Analysis

Video data will be transferred to DVD-ROMs. A trained biologist will review and code the data from the video data as they are played back to a color monitor. Procedures will follow those of Holst et al. (2005a, 2008).

The variables transcribed from the videos, or recorded directly at the beach sites, will include:

(1) Composition of the focal subgroup of pinnipeds (approximate numbers and sexes of each age class),
(2) Description and timing of disruptive event (launch); this will include documenting the occurrence of launch, whether launch noise is evident on audio channel, and duration of audibility, and
(3) Movements of pinnipeds, including number and proportion moving, direction and distance moved, pace of movement (slow or vigorous).

In addition, the following variables concerning the circumstances of the observations will also be recorded from the videotape or from direct observations at the site:

(4) Study location,
(5) Local time,
(6) Weather (including an estimate of wind strength and direction, and presence of precipitation), and
(7) Tide state (Exact times for local high and low tides will be determined by consulting relevant tide tables for the day of the launch).

13.2 Acoustical measurements

Acoustical recordings will be obtained during each monitored launch. These recordings will be suitable for quantitative analysis of the levels and characteristics of the received launch sounds. In addition to providing information on the magnitude, characteristics, and duration of sounds to which pinnipeds are exposed during each launch, these acoustic data will be combined with the pinniped behavioral data to determine if there is a “dose-response” relationship between received sound levels and pinniped behavioral reactions.

The Navy will use up to four autonomous audio recorders to make acoustical measurements. During each launch, these will be located as close as practical to monitored pinniped haul-out sites and near the launch pad itself. The monitored haul-out sites will typically include one site as close as possible to the missile’s planned flight path and one or two locations farther from the flight path within the area of potential impact with pinnipeds present. ATARs will be deployed at the recording locations on the launch day well before the launch time, and will be retrieved later the same day.

During each launch, data on the type and trajectory of the missile will be documented. From these records the CPA of the missile to the microphone will be determined, along with its altitude above the shoreline. These data will be important in comparing acoustic data with those from other launches. Other factors to be considered will include wind speed and direction and launch characteristics (e.g. low- vs. high-angle launch). These analyses will include data from previous and ongoing monitoring work (Holst et al. 2005a, 2008, 2010, 2011, Ugoretz and Greene 2012), as well as measurements to be obtained during launches under the provisions of the Regulations and LOA.

13.2.1 Analysis Procedures and Terminology

Currently, the ATARs record digital data directly onto a removable memory drive within the ATAR. The digital data on the removable drives are copied to a recordable CD-ROM after the recording period and returned to an acoustical contractor for sound analysis.

Both time-series and frequency-domain analyses are performed on the acoustic data. Time-series results include signal waveform and duration, peak pressure level (peak), root mean square (rms) SPL, and SEL. SPL and SEL are determined with three alternative frequency weightings: flat-, A-, and m_{pa}-weighted. Frequency-domain results included estimation of SPLs in one-third octave bands for center frequencies from 4 to 16,000 kilohertz (kHz). The following subsections describe how these values are defined and calculated (see also Holst et al. 2008 for additional details).

Time-Series Analysis—All analyses require identification of a signal's beginning and end. This identification can be complicated by background noise (whether instrumental or ambient), poorly defined signal onsets, and gradually diminishing signal "tails". To obtain a consistent measure of signal duration for each flight, we first defined a "net energy" E. This measure of energy in excess of background is calculated as the cumulative signal energy above mean background energy:

$$E = \frac{1}{fs}\sum_{i=1}^{N} (x_i^2 - \langle n^2 \rangle)\ \mathrm{Pa}^2\ \mathrm{s}$$

where *x* represents all data points in an event file, *n* represents only background noise data points before the flight sound, N is the total number of samples in the event file, and f_s is the sampling rate.

Based on this consistent definition of net energy E, the beginning and end of a flight sound is defined as the times associated with the accumulation of 5% and 95% of E.

Duration is defined as the difference between these start and end times.

Sound exposure is defined as 90% of E, representing total sound exposure in units of $Pa^2 \cdot s$. **SEL** is determined from 10·log (sound exposure).

Sound pressure is defined as the square root of the sound exposure divided by the duration. Sound pressure is equivalent to the rms value of the signal, less background noise, over the duration. **SPL** is determined from 20·log (sound pressure).

The **peak instantaneous pressure** is defined as the largest sound pressure magnitude (positive or negative) exhibited by the signal, even if the signal reaches that level only momentarily.

Peak instantaneous pressure level is determined from 20·log (peak instantaneous pressure).

Frequency-Domain Analysis—Frequency weighting is a form of filtering that serves to measure sounds over a broad frequency band with various schemes for de-emphasizing sounds at frequencies not heard well and retaining sounds at frequencies that animals hear well. The concept is that sound at frequencies not heard by animals is less likely to injure or disturb them, and therefore such sounds should not be included in measurements relevant to those animals.

Welch's (1967) Weighted Overlapped Segment Averaging (WOSA) method is used to generate representative power spectral densities in each case. Power spectral densities are calculated for the signal and pre-signal background noise on the low-sensitivity channel, and for background noise on the high-sensitivity channel. These spectral density values are then summed into one-third octave bands.

For these analyses, the "signal" consists of the recorded data (missile signal plus background noise). This time series is segmented according to duration (determined from the broad-band time series analysis) as follows:

- for duration >1 s, use 32,768-sample blocks of total length 0.74 s with Blackman-Harris (Harris 1978) minimum three-term window, overlapped by 50%. This results in frequency cells spaced by 1.35 hertz (Hz) and an effective cell width (resolution) of 2.3 Hz.

- for 0.0929 s< duration <1 s, use 4,096-sample blocks of total length 0.0929 s with Blackman-Harris minimum three-term window, overlapped by 50%. This results in frequency cells spaced by 10.77 Hz and an effective cell width (resolution) of 18.3 Hz.
- for duration <0.0929 s, use the samples spanning the signal duration and apply a uniform window. This results in cell spacing in hertz given by the reciprocal of the record length in seconds. The cell width (resolution) is the same as the cell spacing.

Background noise data recorded on the high sensitivity channel, consisting of 4 s of data selected from before the missile signal, are segmented into 44,100-sample blocks overlapped by 50% and weighted by the Blackman-Harris minimum three-term window. This results in 1-Hz cell spacing and 1.7-Hz cell width, or resolution.

The spectral density values are integrated across standard one-third octave band frequencies to obtain summed SPLs for each band. This analysis is performed for the signal, the noise on the signal channel (low sensitivity channel), and the background noise (high sensitivity channel). Note that when the cell spacing is broad, the lowest frequency one-third octave bands cannot be computed. However, the cases of broad cell spacing correspond to cases of very short duration signals. Low frequencies are not important for short duration sounds.

Time-series results for the full 3 to 20,000 Hz bandwidth are calculated for flat-, A-, and m_{pa}-weightings. ***Flat-weighting*** leaves the signal spectrum unchanged. For instantaneous peak pressure, where the highest instantaneous pressure is of interest, it is not useful to diminish the level with filtering, so only the flat-weighted instantaneous peak pressure is relevant. Also, non-uniform weighting is not useful when reporting results for specific frequencies or narrow frequency bands. Therefore, only flat-weighting is used for frequency-domain analyses.

A-weighting shapes the signal's spectrum based on the standard A-weighting curve (Kinsler et al. 1982:280; Richardson et al. 1995:99). This slightly amplifies signal energy at frequencies between 1 and 5 kHz and attenuates signal energy at frequencies outside this band. This process is designed to mimic the frequency response of the human ear to sounds at moderate levels. It is a standard method of presenting data on airborne sounds. The relative sensitivity of pinnipeds listening in air to different frequencies is more-or-less similar to that of humans (Richardson et al. 1995), so A-weighting may be relevant to pinnipeds.

M_{pa}-weighting is a recent development that arose from an effort to develop science-based guidelines for regulating sound exposures (Southall et al. 2007). During this process, separate weighting functions have been developed for five categories of marine mammals, with these functions being appropriate in relation to the hearing abilities of those groups of mammals (Southall et al. 2007). Two of these categories are pinnipeds listening in water and in air, for which the weighting functions have been designated m_{pw} and m_{pa}, respectively. The five "M-weighting" functions are almost flat between the known or inferred limits of functional hearing for the species in each group, but down-weight ("attenuate") sounds at higher and lower frequencies. As such, they are analogous to the C-weighting function that is often applied in human noise exposure analyses where the concern is about potential effects of high-level sounds. With m_{pa}-weighting, the lower and upper "inflection points" are 75 Hz and 30 kHz.[4] m_{pa}-weighted sound levels are useful for purposes of assessing impacts on pinnipeds of sounds with high-received levels, such as those during some missile overflights.

[4] The data will only be recorded at frequencies up to 20 kHz, so the (probably negligible) energy at 20–30 kHz is not included in calculating the m_{pa} (or other) measures.

13.3 Reports

Annual interim technical reports will be submitted to NMFS no later than December 31 for the duration of the Regulation period. These interim technical reports will provide full documentation of methods, results, and interpretation pertaining to all monitoring tasks for launches during each calendar year. However, only preliminary information would be included for any launches during the 60-day period immediately preceding submission of each report to NMFS.

A draft comprehensive technical report will be submitted to the Office of Protected Resources, NMFS, and the Southwest Regional Office, NMFS, 180 days prior to the expiration of the Regulations providing full documentation of the methods, results, and interpretation of all monitoring tasks for launches to date. A revised final comprehensive technical 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.

In the unanticipated event that any cases of pinniped mortality are judged to result from launch activities at any time during the period covered by the regulations, this will be reported to NMFS immediately.

14. COORDINATING RESEARCH TO REDUCE AND EVALUATE INCIDENTAL TAKE

Suggested means of learning of, encouraging, and coordinating research opportunities, plans, and activities relating to reducing such incidental taking and evaluating its effects.

The Navy plans to discuss and where possible, coordinate its terrestrial pinniped monitoring program (as summarized in Section 13) 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.

As noted in Section 13, 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., U.S. Air Force research on the effects of large booster launches from VAFB; Thorson et al. 1999; Southall et al. 2007:519-20).

III. CONCLUSION

Up to six species of marine mammals under the jurisdiction of NMFS and one under the jurisdiction of USFWS occur on SNI. The California sea lion is abundant within the potentially affected area on western SNI, and northern elephant seals and harbor seals are found in lesser numbers on SNI and in nearshore waters. Northern fur seals may also be present in very small numbers on occasion, and there is a slight chance that Guadalupe fur seals might be present. Steller sea lions have been sighted occasionally in the past. Southern sea otters are present in small numbers in the waters offshore SNI, but rarely haul out on beaches. Given the sporadic occurrence of these last three pinniped species and distance from the launch sites and CPAs of sea otters, it is unlikely that any of them would be exposed to the effects of missile launches and take authorization for these species is not being requested.

The Navy is requesting regulations to authorize taking by harassment of pinnipeds incidental to the launch of missiles from the west end of SNI, California. Because previous monitoring of similar launches has shown that most of the disturbance to nearby pinnipeds (when it occurs) will be transitory and of small amplitude, NAWCWD is requesting authorization for a take of pinnipeds by Level B harassment. NAWCWD has proposed mitigation and monitoring measures to reduce the likelihood and severity of impacts to marine mammals, to characterize the nature of incidental “takes”, and to estimate the actual numbers of marine mammals “taken” incidentally during planned launch operations at SNI.

The potential impacts of the planned launch operations at SNI on pinnipeds involve both acoustic and non-acoustic effects. Acoustic effects could result from sounds produced by missile launches and overflights. In addition to the launches themselves, the presence of personnel and the placement of monitoring equipment are potential sources of non-acoustic effects. During average ambient conditions, some activities are expected to be audible to marine mammals at distances up to several kilometers. However, the relatively low received sound levels at such long distances are not expected to disturb most seals or sea lions at these maximum distances.

Although sounds from some of the larger missile launches may be strong enough to cause TTS in certain individual pinnipeds close to the launch trajectory, any cases of TTS are expected to be mild and reversible. It is also possible that launch sounds might on rare occasions exceed (by a narrow margin) the current best estimate of the PTS-onset criterion, particularly for launches of large missiles that produce sonic booms. However, sounds exceeding the PTS criteria have only been recorded at pinniped haul-out sites during Vandal launches (Holst et al. 2008, 2011), which have been discontinued at SNI. Thus, it seems unlikely that any pinnipeds would be exposed to launch sounds strong enough to cause PTS during the 2014–2019 monitoring period.

Previous monitoring has shown that pinniped reactions to launches from SNI are highly variable, and could involve occasional stampedes or other abrupt movements by some individuals on the beaches around the western end of the island. These disturbance reactions are not expected to result in long-term negative consequences for the individuals or their populations.

The numbers of individuals that might stampede or otherwise move more than a few feet on the beach are difficult to estimate. The Navy estimates that no more than 492 northern elephant seals, 686 harbor seals, and 2,740 California sea lions are likely to be “taken” in this manner during all the launches within any one-year period of applicability of the requested Regulations. However, based on monitoring to date, these estimates may be substantial overestimates of the actual numbers of pinnipeds that will show strong reactions (especially northern elephant seals).

Larger numbers of pinnipeds are expected to show momentary alert or startle reactions that do not involve sudden large-scale movements on the beaches. These momentary reactions would involve

blinking of the eyes, lifting or turning the head, or moving a few feet along the beach. Consistent with previous guidance from NMFS, these pinnipeds are not considered to be “taken”.

For reasons set forth above, it is expected that the Navy’s missile launch operations on SNI will have no greater than a Level B harassment impact on California sea lions, harbor seals, and northern elephant seals. NAWCWD requests that NMFS promulgate regulations allowing takes of pinnipeds incidental to missile launch operations at SNI, California.

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