

# NOAA Technical Memorandum NMFS



**MAY 2017**

## **DISTRIBUTION OF CALIFORNIA SEA LIONS, NORTHERN ELEPHANT SEALS, PACIFIC HARBOR SEALS, AND STELLER SEA LIONS AT THE CHANNEL ISLANDS DURING JULY 2011-2015**

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U.S. DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
National Marine Fisheries Service  
Southwest Fisheries Science Center

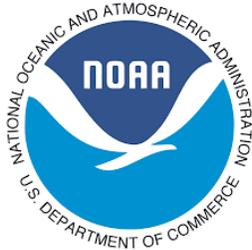
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ELEPHANT SEALS, PACIFIC HARBOR SEALS, AND  
STELLER SEA LIONS AT THE CHANNEL ISLANDS  
DURING JULY 2011-2015**

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## ABSTRACT

Aerial photographic surveys targeting California sea lions conducted during July 2011-2015 were used to describe inter-island and intra-island distributions of California sea lions, northern elephant seals, Pacific harbor seals, and Steller sea lions within the Channel Islands. Age/sex class counts were made for California sea lions, Steller sea lions, and northern elephant seals, but not for Pacific harbor seals. Each island was subdivided into areas to document intra-island distribution of each species. California sea lions were found at all of the Channel Islands. However, San Miguel Island, San Nicolas Island, Santa Barbara Island, and San Clemente Island accounted for 99.8% to 99.9% of California sea lion pups counted, with San Miguel Island and San Nicolas Island having the most pups and non-pups of those four islands. In July 2015, when all islands were surveyed for elephant seals, 2790 elephant seals (61.3% of Channel Islands total) were at San Miguel Island, 932 (20.5% of total) at San Nicolas Island, and 816 (17.9% of total) at Santa Rosa Island. There were 1367 Pacific harbor seals counted at the Channel Islands in July 2015, and a single Steller sea lion was counted at San Nicolas Island in 2013.

## INTRODUCTION

The Channel Islands, located in the Southern California Bight, (SCB; Figure 1), are inhabited by large populations of pinnipeds. California sea lions (*Zalophus californianus*), northern elephant seals (*Mirounga angustirostris*), and Pacific harbor seals (*Phoca vitulina richardsi*) are the most numerous pinniped species at the Channel Islands (Lowry et al., 2008; Lowry et al., 2014; Lowry et al., 2017). California sea lions and Pacific harbor seals are found at all of the Channel Islands (Lowry et al., 2008; Lowry et al., 2014; Lowry et al., 2017). Northern fur seals (*Callorhinus ursinus*) have only been observed at a single island, and Steller sea lions (*Eumetopias jubatus*) and Guadalupe fur seals (*Arctocephalus townsendi*) are rare visitors to the Channel Islands (Bonnell et al., 1980; Stewart and Yochem, 1984; Orr, et al., 2012).

Within the SCB, eight of the twelve Channel Islands are located in the U.S., and a group of four islands, known as Islas Coronados, are located in Mexico (Figure 1). Only the islands located in the U.S. will be discussed here. The eight islands in the U.S. are Anacapa Island (AI), Santa Cruz Island (SCruzI), Santa Rosa Island (SRI), San Miguel Island (SMI), Santa Barbara Island (SBI), San Nicolas Island (SNI), Santa Catalina Island (SCatI), and San Clemente Island

(SCI). Three islets that have pinnipeds are Castle Rock (located 1 km from the NW shoreline of SMI), Richardson Rock (located 10 km NW from Point Bennett, SMI), and Gull Island (located 1.4 km from Punta Arena, SCruzI). SMI and SNI have the largest number of pinnipeds of all the Channel Islands (Bonnell et al., 1980; Lowry, 2002; Lowry et al., 2014; Lowry et al., 2017).

Various government agencies and private organizations are responsible for managing resources and activities at each of the Channel Islands. The U.S. Navy manages the island and surrounding waters of SNI and SCI. Channel Islands National Park manages AI, SCruzI (the National Park Service owns 24% of the island), SRI, SMI, and SBI. The Nature Conservancy also manages SCruzI (it owns 76% of the island). Channel Islands National Marine Sanctuary manages the surrounding waters from the mean high tide mark to six nautical miles offshore of AI, SCruzI, SRI, SMI, and SBI. SCatI is managed by the Catalina Island Conservancy. These agencies and organizations require island pinniped distribution data to manage activities that could impact pinnipeds within their respective jurisdictions.

Since 1927, pinniped surveys conducted at the Channel Islands, most of which took place during summer, documented pinniped inter-island distribution (for a list refer to Lowry et al., 2017), but very few documented intra-island distribution (Bartholomew, 1951; Bartholomew et al., 1951; Odell, 1972; Bonnell et al., 1980; Stewart and Yochem, 1984; Carretta et al., 2000; and Lowry, 2002). The most thorough intra-island study of pinniped distribution at the Channel Islands included 24 surveys during 1975-1977 (Bonnell et al., 1980). Since then, smaller-scale intra-island pinniped distribution studies have been published for some or all of the Channel Islands: (1) California sea lion and northern elephant seal pups at SNI during 1980-1982 (Stewart and Yochem, 1984), (2) all pinnipeds at SCI during 1998-1999 (Carretta et al., 2000), and (3) northern elephant seals at the Channel Islands during 1981-2001 (Lowry et al., 2002). Unfortunately, descriptions of intra-island pinniped distribution from these studies are currently obsolete due to expanding populations of California sea lions, northern elephant seals, and Pacific harbor seals that took place after those studies were published (Lowry et al., 2008, 2014; and Lowry et al., 2017). Inter-island distribution of California sea lions, northern elephant seal pups, and Pacific harbor seals were described recently, but only for each annual peak abundance period (Lowry et al., 2008, 2014; and Lowry et al., 2017). Peak abundance for northern elephant seals is during January and February (breeding season), California sea lions is during June and

July (breeding season), and harbor seals is during late-May to early-June (molt season in southern California).

In 1987, the Southwest Fisheries Science Center (SWFSC) began using aerial photography at the Channel Islands to census pinnipeds. July aerial surveys began at SMI in 1987, then expanded to include additional islands, until 2003 when all the Channel Islands were included in aerial surveys (Lowry et al., 1996; Lowry, 2002; Lowry and Carretta, 2003; Lowry et al., 2005 and 2008; Lowry et al., 2017). July surveys were intended to census California sea lions after all pups had been born because pup counts were used to monitor population trends and abundance of the U.S. population (e.g., Lowry and Maravilla-Chavez, 2005; Carretta et al., 2015). Prior to 2011, only sea lions were counted during July surveys. However, starting in 2011, elephant seals and harbor seals were also counted at SNI to document intra-island distribution of those species during summer for the U.S. Navy at SNI. Beginning in 2012, northern elephant seals and Pacific harbor seals were counted from photographs at SMI, SBI, and SCI, and in 2015 all of the Channel Islands were included in the study. Population trends and abundance of elephant seals and harbor seals are determined using census data collected during winter (Lowry et al., 2002 and 2014) and at the end of May or early-June, respectively, (Lowry and Carretta, 2003; Lowry et al., 2005 and 2008); therefore the July surveys for these species only provide summer residence count-data.

Here we report the distribution of California sea lions, northern elephant seals, Pacific harbor seals, and Steller sea lions hauled out at the Channel Islands from aerial photographic surveys conducted by SWFSC during July 2011-2015. Total numbers of California sea lions, northern elephant seals, Pacific harbor seals, and Steller sea lions at the Channel Islands in July 2011-2015 are provided, along with data showing inter-island and intra-island distributions of various age/sex classes and category totals of California sea lions, northern elephant seals, and Steller sea lions, as well as non-age/sex class counts of Pacific harbor seals.

## METHODS

### **SWFSC Surveys**

Aerial photographic surveys at all Channel Islands were conducted during early to mid-July 2011-2015 (Table 1). California sea lions and Steller sea lions were photographed at all

islands during 2011-2015. Northern elephant seals and Pacific harbor seals were photographed at SNI during 2011-2014, at SMI and SBI during 2012-2014, and at all Channel Islands in 2015 (Table 2). Pinniped counts for Castle Rock were included in counts of SMI and counts for Gull Island were included in counts of SCruzI, but counts for Richardson Rock are reported separately.

### **SWFSC Survey methods**

Aerial photographic surveys were conducted with a twin-engine, high-winged Partenavia P-68 Observer model aircraft (Figure 2). The glass nose of the Partenavia P-68 Observer model aircraft provided the pilot with excellent forward and downward views for aligning the aircraft over beaches and rocks. The aircraft was flown at a ground speed of 185 km/h (100 knots) and 244 m (800 ft) altitude for most islands, except at SBI and the north side of West AI where the aircraft was flown at 396 m (1300 ft) altitude. The low altitude and lens configuration ensured that California sea lions could be detected on rocky substrates (especially when animals were wet and consequently darkly colored), aided in identification of different pinniped species and age/sex classes, and enabled accurate counts from aerial photographs. The aircraft was flown directly over the coastline with minor adjustments to locate and photograph pinnipeds onshore. Multiple overlapping photographic passes were made over large rocks and portions of island coastlines and beaches to ensure that all hauled-out pinnipeds were photographed. Surveys were conducted without regard to tidal conditions and at any time of day between approximately 2 hours after sunrise and 2 hours before sunset.

During 2011-2013, pinnipeds were photographed with a Canon EOS 1Ds Mark III, full-frame 21.1-megapixel digital single lens reflex (DSLR) camera. In 2014 and 2015, they were photographed with a Canon EOS 5D Mark III, full-frame 22.3-megapixel DSLR. A Zeiss 85-mm-focal-length lens was used at 244 m altitude during 2011-2014. A Canon 135-mm-focal-length lens was used during 2011-2013, and a Zeiss 135-mm-focal-length lens was used in 2014 and 2015 to photograph pinnipeds from 396 m altitude. Image motion compensation was achieved by using a custom-made rocking mechanism in the camera mount manufactured by Aerial Imaging Solutions<sup>1</sup>. The focus ring of the 85mm lens was immobilized with tape when

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focused at 244 m, and the 135 mm lens was taped when focused at 396 m. A laptop computer was connected to the camera, along with a GPS receiver and radar altimeter, and software in the computer (developed by Aerial Imaging Solutions) controlled the camera's forward motion compensation mechanism and fired the camera on command. A video camera and monitor provided a view through the camera's viewfinder, which allowed the operator to see what was being photographed. For each photograph, the computer recorded the geographical position, date, and time the photograph was taken in a comma separated values (csv) file.

The DSLR camera was attached to a gimbal camera-mount that faced the camera vertically downward over a camera port inside the aircraft, and the camera was manually leveled at the vertical position with a bubble level. The computer controlled all camera functions. Camera aperture was set at  $f/5.6$  in aperture priority shooting mode and shutter speed was set at or above  $1/800$  second by changing the ISO image sensor setting between 100 and 1000. Photographs were overexposed by  $+1/3$  f-stop (for sunny conditions) or  $+2/3$  f-stop (for overcast conditions). White balance in the camera was set on automatic, and all photographs were taken in JPEG image file format set at fine image quality and a 3:2 aspect ratio. The camera was operated at a cycle rate that achieved 40% overlap between adjacent photographs, and occasionally 60% overlap for short photographic passes.

Adobe Bridge CS5 was used to review and select digital photographs, and to initiate the photo-merging process. Adobe Photoshop CS5 Extended, version 12.1 x64 on Windows 7 64-bit operating system, received photographs from Adobe Bridge CS5 and was subsequently used to create photographic mosaics from multiple overlapping digital photographs of beach- and rock-sections within the Adobe Photoshop software screen on a 24-inch or 27-inch Dell ultra-sharp computer monitor. Photographs were merged manually using the move and transpose tools. Under-exposed or over-exposed images were brightened or darkened, respectively, with image tools in Adobe Photoshop. The brush tool was used to draw a line to separate and mark animals and to code areas on the mosaic that would be counted. Adjacent mosaic files of photographs were compared, and a brush-line was inserted onto the mosaic to separate counted animals from uncounted ones, and to demarcate areas where animals should or should not be counted. As age/sex class categories were manually counted using the count tool in Adobe Photoshop Extended, each animal was automatically marked with a unique colored dot and number. The software maintained a running total of each age/sex class category. The total counted for each

age/sex class category would then be recorded into a Microsoft Excel spreadsheet along with other data identifying the counts (e.g., island, date, area codes, and mosaic file name), then transferred into a Microsoft Access database.

### **Species identification**

Identification of pinniped species from aerial photographs begins with differentiating otariids and phocids by locating the position of the fore flipper. The fore flipper is approximately just forward of the midway point on the body in otariids, and near the head in phocids. California sea lions, Steller sea lions, northern fur seals, and Guadalupe fur seals are otariids. Northern elephant seals and Pacific harbor seals are phocids. Although not all species found at the Channel Islands were counted in this study, the counter must be capable of identifying all pinniped species in the aerial photographs to prevent miscounts. The following characteristics were used to identify each of the six pinniped species found in aerial photographs of the Channel Islands:

#### **California sea lion:**

- Adult females are blond, brown, or grey; males are brown or grey
- Long square-like muzzle on narrow head
- Hair on top of fore flipper
- Sub-adult and adult males have a distinct sagittal crest
- Pups are brown or tan (black when wet) with a noticeable neck, and larger than northern fur seal pups
- Short hind flipper
- Fore flipper not as wide as in Steller sea lions

#### **Steller sea lion:**

- Massive size
- Adults are blond; juveniles and pups are brown
- Very broad head, with short muzzle
- Fore flipper is very wide, especially in adults
- Sub-adult and adult males do not have a sagittal crest
- Short hind flipper

**Northern fur seal:**

- Very long hind flippers that can reach up to the fore flipper; one hind flipper is often raised vertical when resting
- No hair on top of fore flipper; distinct pelage line visible where fore flipper meets the body
- Pups are black with short neck
- Adults are dark brown or black; some have light-dark patterns from outer guard-hair loss
- Pointed head

**Guadalupe fur seal:**

- Very long pointed head and muzzle
- Hair on top of fore flipper
- Grey color
- Hind flipper longer than California sea lion, but shorter than northern fur seal

**Northern elephant seal:**

- Uniform grey or brown color
- Become very large
- Juvenile, young-male, and sub-adult male elephant seals have a pointed muzzle when viewed from above
- Sub-adult males and adult males have a proboscis
- Adult males have a chest-shield of thick skin, and rounded head when viewed from above
- Hind flippers are longer and wider than those of harbor seals

**Pacific harbor seal:**

- Spotted or mottled with white or cream pelage mixed with black or brown spots
- Head has a square-shaped muzzle when viewed from above
- Small compared to elephant seals, up to the size of an adult female California sea lion
- Hind flippers are shorter and narrower than hind flippers of elephant seals

## Counting categories

Although California sea lions were photographed and counted at all Channel Islands during July 2011-2015, northern elephant seals, Pacific harbor seals, and Steller sea lions were not photographed at all islands nor were they counted during the entire study period. Northern fur seals and Guadalupe fur seals were not counted because other researchers count them regularly at SMI where those species occur. Determination of age/sex class for Pacific harbor seals from aerial photographic imagery is unreliable and was not included. However, California sea lions, northern elephant seals, and Steller sea lions were counted by age/sex class. The following characteristics were used to identify age/sex classes of these three species from aerial photographs:

### California sea lion:

- Live-pup: Newborns, very small compared to other age/sex classes, dark to light brown in color when dry, black when wet, with a short neck and muzzle
- Dead pup: Pups that are decomposing, bloated, or partially covered with sand, scavenged upon by western gulls (*Larus occidentalis*) or ravens (*Corvus corax sinuatus*), or that are lying on their side with the head bent back toward the spine as a result of rigor mortis
- Juvenile: Larger than live-pups, about one-fourth to two-thirds the length of an adult female with brown or light-brown hair, elongated neck and muzzle; sometimes found suckling on adult female or lying next to one; looks like a miniature adult female
- Adult female: Most often pelage will be blond in color when dry, but sometimes are brown; they are dark grey when wet; cranial sagittal crest is not present
- Young male: Approximately the same size as an adult female California sea lion; cranial crest has not begun to develop, and pelage is dark brown or blackish in color; during the breeding season, rarely found within groups of breeding adult females but will be found at the periphery of adult female groups or will be within groups of “bachelor” males or juveniles; when in tide pools they will often wrestle with similar-sized sea lions
- Sub-adult male: Sagittal crest is present and may or may not be fully formed, tuft of white hair on sagittal crest may or may not be present; pelage is dark brown to grey in color; they do not have a wide chest and neck
- Adult male: Sagittal crest is fully formed and has tuft of white hair; pelage is dark brown to grey in color; has a wide chest and neck; will often be patrolling a territory

when in water or on land during the breeding season; when stationary or near vertical in the water, the tuft of white hair on the sagittal crest will be visible

### **Northern elephant seal:**

- Live-pup: Normally none are present at Channel Islands during July; during breeding season they are black or silver-grey after their first molt; in springtime they become cream colored with a dark grey or brown back
- Juvenile: Approximately same size as an adult female or sub-adult male California sea lion, and often is cream or yellowish in color
- Adult female: Normally none are present at Channel Islands during July; they have a dark brown or grey color and slightly pointed head; penile opening is not present when laying on their back
- Young male: Same size as an adult female elephant seal, but smaller than sub-adult male; dark grey or brown pelage; penile opening is visible when laying on their back
- Sub-adult male: Larger than a young male or adult female elephant seal; proboscis not fully developed and pointed; does not have a chest shield, and is dark grey or brown in color; penile opening is visible when laying on their back
- Adult male: Very large elephant seal that has a very wide chest with a shield, and has a well-developed proboscis; dark grey or brown pelage; head has a rounded appearance when viewed from above; penile opening is visible when laying on their back

### **Steller sea lion:**

- Pup: Two to three times longer than a California sea lion pup; dark brown pelage (black when wet)
- Juvenile: Broad head (not pointed like that of a California sea lion), and is same size as a sub-adult or adult male California sea lion, but without wide chest and sagittal crest; pelage is dark brown
- Adult female: Two to three times larger than an adult male California sea lion; pelage is blond or yellowish, or grey when wet
- Young male: Approximately the same size as an adult female Steller sea lion; pelage is blond color, during breeding season will be alone at the periphery of adult female groups or will be within groups of “bachelor” males or juveniles, or alone on a rock
- Sub-adult male: No development of wide chest and neck

- Adult male: Very wide chest and neck, and large broad head, they are blond in color, during the summer breeding season, adult males will defend a territory within or near groups of adult females, but sometimes will be found alone or with sub-adult males

### **Intra-island distribution**

The perimeter of each island was divided into small area-coded units to describe intra-island distribution of California sea lions, northern elephant seals, Pacific harbor seals, and Steller sea lions. These area-code units either followed the Bureau of Land Management (BLM) numerical system in Bonnell et al. (1980) or new alphabetical codes that were created to divide or group the BLM codes (Figures 3 and 4). Additionally, area H at SMI, which includes Point Bennett, was further divided into numerical haulout sites (Figure 5) because of its highly dense population of pinnipeds whose distribution varies within that area.

## **RESULTS**

### **California sea lions**

California sea lions were found at all Channel Islands (Tables 3 and 4). During July 2011-2015, between 99,279 (in 2015) and 149,838 (in 2012) California sea lions were counted from digital aerial photographs taken at the Channel Islands (Table 3). The highest count of California sea lion pups at the Channel Islands was recorded in 2012 (n=67,124; Table 3). After that year, there was a reduction in pup counts at the Channel Islands in 2013 (n=42,686; 63.6% of 2012 total), in 2014 (n=47,691; 71.0% of 2012 total), and in 2015 (n=28,348; 42.2% of 2012 total). During the 2011-2015 period, the highest number of adult female California sea lions was counted in 2013 (n=60,733), and the highest number of adult males was counted in 2014 (n=7,453). California sea lion pups and adult females made up the highest number of California sea lions present at each of the Channel Islands during July 2011-2015 (Table 3).

During July 2011-2015, SMI had the largest number of California sea lions at the Channel Islands, followed by SNI, SBI, SCI and other islands (Tables 3 and 4). California sea lions at SMI averaged 62,150.2 individuals per year (SD = 7,836.8) and at SNI they averaged 52,634.8 individuals per year (SD = 9,899.0), followed by SBI and SCI (Table 4). California sea lion adult females made up the greatest proportion by age/sex class at all Channel Islands (Tables

3 and 4). SMI, SNI, SBI, and SCI accounted for 99.8% to 99.9% of California sea lion pups counted at the Channel Islands, with SMI and SNI having the most pups of those four islands.

California sea lions were not uniformly distributed around the perimeter of each of the Channel Islands (Tables 5, 6, and 7; Figures 6, 7, and 8). Area H at SMI had more California sea lions on island (65.4% of pups, 41.6% of non-pups) than any other island-area at SMI (Table 7; Figures 6 and 8). Within area H at SMI, haulout site 54 had the most sea lions on island, with nearly twice as many as any other haulout site within Area H (Table 8). Area 406 at SCI had the most California sea lion pups and non-pups on island, 75.1% and 58.5% of the total counted, respectively (Table 7, Figures 6 and 8). Area A at SBI had the most sea lion pups and non-pups on island, 75.2% and 47.7%, respectively. Areas D, H, L and Q at SNI had the most total number of California sea lions on island.

### **Northern elephant seals**

Northern elephant seals were found on island mostly at SMI, SNI, and SRI, but a few ( $\leq 11$ ) were also found on island at SBI and SCI (Tables 3 and 4). In July 2015 (when all Channel Islands were surveyed for elephant seals), there were 4,554 northern elephant seals counted at the Channel Islands (Table 3). Northern elephant seal sub-adult males made up the highest number of elephant seals at the Channel Islands during July 2011-2015 (Table 3).

During July 2011-2015, SMI had the largest on island number of northern elephant seals at the Channel Islands (Tables 3 and 4). In 2015, when all islands were surveyed for elephant seals, 2790 were on island at SMI (61.3% of Channel Islands total), 932 at SNI (20.5% of total), and 816 at SRI (17.9% of total). Sub-adult male elephant seals made up the greatest proportion by age/sex class at each of the Channel Islands where they were observed (Tables 3 and 4).

Northern elephant seals were not uniformly distributed around the perimeter of each of the Channel Islands (Tables 5, 6, and 7; Figures 9 and 10). Area H at SMI had more northern elephant seals on island (32.5% of island total) than any other island-area at SMI (Table 7). Area K at SNI had the most elephant seals on island. Elephant seals at SRI were mostly found in areas 622D, 625A, and 626.

### **Pacific harbor seals**

In July 2015 (when all Channel Islands were surveyed for harbor seals), Pacific harbor seals were found at all of the Channel Islands except SCatI and AI (Table 3). There were 1367 Pacific harbor seals counted at the Channel Islands in July 2015 (Table 3). SMI had the largest number of Pacific harbor seals of all the Channel Islands (Tables 3 and 4). In 2015 there were 550 counted at SMI (40.2% of total), 259 counted at SNI (18.9%), 247 at SRI (18.1%), and the remaining (22.8%) were counted at other islands (Table 3).

Pacific harbor seals were not uniformly distributed around the perimeter of each of the Channel Islands (Tables 5, 6, and 7; Figures 11 and 12). Most Pacific harbor seals at SMI were found in areas J and N, and at SNI they were mostly found in areas L, N, and Q. Area 656 at SCI and areas 615A and 626 at SRI had the most harbor seals at each of those two islands (Table 3, Figure 13).

### **Steller sea lions**

A single juvenile Steller sea lion was counted within area H at SNI in 2013 (Table 3).

## **DISCUSSION**

California sea lions were the most abundant pinniped species hauled out at the Channel Islands during July 2011-2015 surveys. Although northern elephant seals were present also at the Channel Islands during those surveys, very few were hauled out compared to what is normally present during their winter breeding season. Pacific harbor seals were also less abundant than during their spring molt period (Lowry et al., 2008). Steller sea lions are rare visitors to the Channel Islands (M. Lowry, unpublished data) and only one was seen during this study at SNI in 2013.

The July 2011-2015 intra-island distribution was very different from pinniped intra-island distributions described in previous studies conducted since the late 1970s (Bonnell et al., 1980, and Stewart and Yochem 1984, M. Lowry, unpublished data). As populations of California sea lions and northern elephant seals grew, coastal occupation of the islands increased and spread around each of the main rookery-islands. At SNI, sea lions and elephant seals increased eastward along the southern shoreline, eventually rounding the east end and occupying the

northeastern side of the island. At SMI, sea lions increased along the northwestern shoreline from Point Bennett to Otter Harbor (Areas I and J), and on the southeastern and eastern end of the island (Areas A, B, and C).

The data collected during the July 2011-2015 surveys not only show inter-island and intra-island variability in the number of pinnipeds occupying the Channel Islands during summer months, but they also show annual variability in how pinnipeds occupy each island. Changing oceanographic conditions, as occurred during 2011-2015 (Peterson et al., 2015; Jacox et al., 2016), influenced pinniped use of the Channel Islands. The only way to capture the effects of changing oceanographic effects on pinniped distribution is by conducting surveys spanning multiple years and seasons. For example, the SCB and California coast were affected by abnormally warm-water in 2014 (e.g., the warm-water “blob”) and by the 2015 El Niño (Bond et al., 2015; Peterson et al., 2015; Jacox et al., 2016). These warm-water conditions had an adverse effect on California sea lions resulting in decreased pup production and decreased abundance of non-pups at the Channel Islands, as shown from our study. At this time, it is unknown how these conditions affected northern elephant seals and Pacific harbor seals.

There is a need for multi-year surveys for other seasons at the Channel Islands to document how pinnipeds utilize island coastal areas during other seasonal or monthly time periods. As pinniped species shift from breeding to non-breeding activities on the islands, their abundance and distributions change. Knowing how pinniped abundance and distribution differs seasonally, monthly, and yearly is therefore beneficial for managing island use.

California sea lions are the most abundant pinniped species found at the Channel Islands during the peak of their breeding season in July. California sea lion pupping and breeding season begins in mid-May, peaks at the end of June or beginning of July, and ends by mid-August when most or all sub-adult males and adult males leave the Channel Island rookeries (Allen et al., 2011). During the sea lion non-breeding season, the Channel Islands are mostly inhabited by adult females, pups, and juveniles, although there is a slight increase in the numbers of males in the winter, possibly due to the arrival of northward migrating males from the California sea lion population in Baja California, Mexico.

Northern elephant seals are very abundant at the Channel Islands from December to March when their pupping and breeding season occurs, with the peak occurring during the end of January (Le Boeuf and Bonnell, 1980; Stewart, 1989). The largest elephant seal rookeries in the

U. S. in 2010 were at SMI (16,208 pups), SNI (10,882 pups), and SRI (5,946 pups; Lowry et al. 2014). It is during this period that elephant seals are censused for estimating population trends and abundance (Lowry et al., 2014). Another peak in elephant seal abundance occurs during their molting periods (Le Boeuf and Bonnell, 1980; Stewart, 1989). Adult females mostly molt in May and consequently were not present in large numbers in July. Adult and sub-adult males molt in July and so these age/sex classes represented the largest group of elephant seals in the July 2011-2015 surveys.

At the Channel Islands, harbor seals are most abundant on land during their molting season, which peaks between mid-May and early-June (Stewart and Yochem, 1994). It is during this period that harbor seal surveys are conducted for estimating population trends and abundance. In summer, harbor seals do not haul out in great numbers at the Channel Islands. Lowry et al. (2003 and 2005) lists geographical positions (latitude and longitude) of haulout sites used by harbor seals at the Channel Islands during their molt period.

The data tables and figures in this report provide information that may be useful for managing human activities along the coastline of each of the Channel Islands during the summer season. Pinniped surveys conducted during additional seasons, including months during which northern elephant seals and Pacific harbor seals are most abundant on the islands, would provide necessary data for managing the islands during other times of the year.

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Table 1. Dates of aerial photographic surveys at the Channel Islands during 2011-2015.

Island/Rock	2011	2012	2013	2014	2015
Anacapa Island	July 11	July 13	July 8	July 8	July 10
Richardson Rock	July 13	July 14	Missed	July 10	July 7
San Clemente Island	July 11	July 13	July 13	July 07	July 12
San Miguel Island	July 13	July 14	July 11	July 10	July 7
San Nicolas Island	July 18	July 13	July 17	July 9	July 8
Santa Barbara Island	July 18	July 13	July 11	July 8	July 9
Santa Catalina Island	July 11	July 13	July 12	July 7	July 9
Santa Cruz Island	July 11	July 13	July 8	July 8	July 9 & 10
Santa Rosa Island	July 11	July 13	July 11	July 10	July 9 & 10

Table 2. Years in which California sea lions, northern elephant seals, and Pacific harbor seals were surveyed and counted at the Channel Islands during aerial photographic surveys conducted in July 2011-2015. NP = Not present when survey was conducted.

Island	Year	California sea lion		Northern elephant seal		Pacific harbor seal	
		Surveyed	Counted	Surveyed	Counted	Surveyed	Counted
Anacapa Island	2011	Yes	Yes	No		No	
	2012	Yes	Yes	No		No	
	2013	Yes	Yes	No		No	
	2014	Yes	Yes	No		No	
	2015	Yes	Yes	Yes	Yes	Yes	Yes
Richardson Rock	2011	Yes	Yes	Yes	NP	Yes	NP
	2012	Yes	Yes	Yes	NP	Yes	NP
	2013	No		No		No	
	2014	Yes	Yes	Yes	NP	Yes	NP
	2015	Yes	Yes	Yes	NP	Yes	Yes
San Clemente Island	2011	Yes	Yes	Yes	No	Yes	Yes
	2012	Yes	Yes	Yes	Yes	Yes	Yes
	2013	Yes	Yes	Yes	Yes	Yes	Yes
	2014	Yes	Yes	Yes	Yes	Yes	Yes
	2015	Yes	Yes	Yes	Yes	Yes	Yes
San Miguel Island	2011	Yes	Yes	No		No	
	2012	Yes	Yes	Yes	Yes	Yes	Yes
	2013	Yes	Yes	Yes	Yes	Yes	Yes
	2014	Yes	Yes	Yes	Yes	Yes	Yes
	2015	Yes	Yes	Yes	Yes	Yes	Yes
San Nicolas Island	2011	Yes	Yes	Yes	Yes	Yes	Yes
	2012	Yes	Yes	Yes	Yes	Yes	Yes
	2013	Yes	Yes	Yes	Yes	Yes	Yes
	2014	Yes	Yes	Yes	Yes	Yes	Yes
	2015	Yes	Yes	Yes	Yes	Yes	Yes
Santa Barbara Island	2011	Yes	Yes	Yes	Yes	Yes	Yes
	2012	Yes	Yes	Yes	Yes	Yes	Yes
	2013	Yes	Yes	Yes	Yes	Yes	Yes
	2014	Yes	Yes	Yes	Yes	Yes	Yes
	2015	Yes	Yes	Yes	Yes	Yes	Yes
Santa Catalina Island	2011	Yes	Yes	No		No	
	2012	Yes	Yes	No		No	
	2013	Yes	Yes	No		No	
	2014	Yes	Yes	No		No	
	2015	Yes	Yes	Yes	NP	Yes	NP
Santa Cruz Island	2011	Yes	Yes	No		No	
	2012	Yes	Yes	No		No	
	2013	Yes	Yes	No		No	
	2014	Yes	Yes	No		No	
	2015	Yes	Yes	Yes	NP	Yes	Yes

Table 2. (Continued)

Island	Year	California sea lion		Northern elephant seal		Pacific harbor seal	
		Surveyed	Counted	Surveyed	Counted	Surveyed	Counted
Santa Rosa Island	2011	Yes	Yes	No		No	
	2012	Yes	Yes	No		No	
	2013	Yes	Yes	No		No	
	2014	Yes	Yes	No		No	
	2015	Yes	Yes	Yes	Yes	Yes	Yes

Table 3. Counts of each age-sex class and category totals with the percentage represented by each island of the Channel Islands total for California sea lions, northern elephant seals, Pacific harbor seals, and Steller sea lions during aerial photographic surveys conducted in July 2011-2015.

Year	Island/Rock	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
		count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%
<b>California sea lion</b>																	
2011	Anacapa Island	32	0.1	323	2.1	579	1.2	127	3.8	12	0.2	24	0.4	1,065	1.3	1,097	0.8
	Richardson Rock	0	0.0	53	0.3	186	0.4	4	0.1	23	0.5	16	0.3	282	0.4	282	0.2
	San Clemente Island	2,883	4.7	343	2.2	3,243	6.6	104	3.1	57	1.2	225	3.6	3,972	5.0	6,855	4.9
	San Miguel Island	26,953	43.5	10,094	64.8	26,109	53.1	2,003	59.4	2,853	58.4	3,401	54.5	44,460	56.1	71,413	50.6
	San Nicolas Island	28,087	45.4	3,629	23.3	15,191	30.9	924	27.4	1,755	35.9	2,316	37.1	23,815	30.1	51,902	36.8
	Santa Barbara Island	3,941	6.4	359	2.3	2,414	4.9	165	4.9	134	2.7	244	3.9	3,316	4.2	7,257	5.1
	Santa Catalina Island	17	0.0	118	0.8	251	0.5	22	0.7	2	0.0	6	0.1	399	0.5	416	0.3
	Santa Cruz Island	1	0.0	285	1.8	683	1.4	16	0.5	38	0.8	3	0.0	1,025	1.3	1,026	0.7
	Santa Rosa Island	0	0.0	365	2.3	515	1.0	6	0.2	9	0.2	5	0.1	900	1.1	900	0.6
Channel Islands total	61,914	100.0	15,569	100.0	49,171	100.0	3,371	100.0	4,883	100.0	6,240	100.0	79,234	100.0	141,148	100.0	
2012	Anacapa Island	50	0.1	458	2.9	418	0.8	113	3.2	15	0.2	14	0.2	1,018	1.2	1,068	0.7
	Richardson Rock	1	0.0	51	0.3	135	0.3	2	0.1	20	0.3	7	0.1	215	0.3	216	0.1
	San Clemente Island	3,220	4.8	689	4.3	2,634	5.3	60	1.7	176	2.9	269	3.8	3,828	4.6	7,048	4.7
	San Miguel Island	28,289	42.1	7,972	49.8	21,664	43.4	1,508	42.1	3,064	49.8	3,163	45.1	37,371	45.2	65,660	43.8
	San Nicolas Island	31,972	47.6	5,317	33.2	20,171	40.4	1,527	42.7	2,612	42.4	3,251	46.4	32,878	39.7	64,850	43.3
	Santa Barbara Island	3,558	5.3	452	2.8	2,862	5.7	221	6.2	208	3.4	271	3.9	4,014	4.9	7,572	5.1
	Santa Catalina Island	31	0.0	74	0.5	147	0.3	6	0.2	4	0.1	7	0.1	238	0.3	269	0.2
	Santa Cruz Island	0	0.0	402	2.5	1,078	2.2	56	1.6	20	0.3	15	0.2	1,571	1.9	1,571	1.0
	Santa Rosa Island	3	0.0	609	3.8	835	1.7	87	2.4	38	0.6	12	0.2	1,581	1.9	1,584	1.1
Channel Islands total	67,124	100	16,024	100	49,944	100	3,580	100	6,157	100	7,009	100	82,714	100	149,838	100	
2013 <sup>1</sup>	Anacapa Island	48	0.1	261	1.4	642	1.1	179	5.8	38	0.6	26	0.4	1,146	1.2	1,194	0.9
	San Clemente Island	2,458	5.8	777	4.1	3,703	6.1	83	2.7	184	2.8	223	3.5	4,970	5.2	7,428	5.4
	San Miguel Island	21,014	49.2	8,563	45.1	26,826	44.2	1,708	55.7	3,402	51.2	2,878	45.0	43,377	45.3	64,391	46.5
	San Nicolas Island	16,225	38.0	8,037	42.4	24,277	40.0	956	31.2	2,688	40.4	2,881	45.0	38,839	40.5	55,063	39.8
	Santa Barbara Island	2,918	6.8	615	3.2	3,495	5.8	100	3.3	258	3.9	351	5.5	4,819	5.0	7,737	5.6
	Santa Catalina Island	20	0.0	109	0.6	294	0.5	5	0.2	10	0.2	8	0.1	426	0.4	446	0.3
	Santa Cruz Island	0	0.0	450	2.4	935	1.5	31	1.0	34	0.5	19	0.3	1,469	1.5	1,469	1.1
	Santa Rosa Island	3	0.0	155	0.8	561	0.9	5	0.2	32	0.5	15	0.2	768	0.8	771	0.6

Table 3. (Continued)

Year	Island/Rock	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
		count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%
<b>California sea lion (continued)</b>																	
2013	Channel Islands total	42,686	100	18,967	100	60,733	100	3,067	100	6,646	100	6,401	100	95,814	100	138,499	100
2014	Anacapa Island	52	0.1	189	1.9	400	0.7	230	7.8	49	0.9	20	0.3	888	1.1	940	0.7
	Richardson Rock	0	0.0	78	0.8	387	0.7	17	0.6	19	0.3	12	0.2	513	0.6	513	0.4
	San Clemente Island	1,927	4.0	696	7.1	4,064	7.1	83	2.8	121	2.2	265	3.6	5,229	6.3	7,156	5.5
	San Miguel Island	23,607	49.5	4,075	41.6	23,410	41.1	1,223	41.5	2,700	48.8	3,490	46.8	34,898	42.2	58,505	44.9
	San Nicolas Island	19,587	41.1	4,205	42.9	23,363	41.0	1,082	36.8	2,446	44.2	3,350	44.9	34,446	41.7	54,033	41.4
	Santa Barbara Island	2,498	5.2	296	3.0	3,785	6.6	111	3.8	153	2.8	284	3.8	4,629	5.6	7,127	5.5
	Santa Catalina Island	19	0.0	36	0.4	247	0.4	24	0.8	3	0.1	12	0.2	322	0.4	341	0.3
	Santa Cruz Island	0	0.0	119	1.2	650	1.1	56	1.9	32	0.6	13	0.2	870	1.1	870	0.7
	Santa Rosa Island	1	0.0	109	1.1	651	1.1	118	4.0	12	0.2	7	0.1	897	1.1	898	0.7
	Channel Islands total	47,691	100	9,803	100	56,957	100	2,944	100	5,535	100	7,453	100	82,692	100	130,383	100
2015	Anacapa Island	40	0.1	324	3.1	795	1.8	61	1.4	20	0.3	19	0.3	1219	1.7	1259	1.3
	Richardson Rock	0	0.0	59	0.6	93	0.2	8	0.2	15	0.2	12	0.2	187	0.3	187	0.2
	San Clemente Island	385	1.4	449	4.3	1,947	4.5	214	4.9	126	1.9	170	2.8	2,906	4.1	3291	3.3
	San Miguel Island	17,084	60.3	4,733	45.0	20,746	48.0	1,705	38.7	3,442	52.0	3,072	50.3	33,698	47.5	50,782	51.2
	San Nicolas Island	9,963	35.1	4,053	38.5	16,477	38.1	1,570	35.6	2,740	41.4	2,523	41.3	27,363	38.6	37,326	37.6
	Santa Barbara Island	864	3.0	348	3.3	1,552	3.6	203	4.6	215	3.2	271	4.4	2,589	3.7	3,453	3.5
	Santa Catalina Island	11	0.0	157	1.5	445	1.0	78	1.8	11	0.2	4	0.1	695	1.0	706	0.7
	Santa Cruz Island	1	0.0	200	1.9	1098	2.5	335	7.6	27	0.4	14	0.2	1,674	2.4	1,675	1.7
	Santa Rosa Island	0	0.0	197	1.9	92	0.2	237	5.4	25	0.4	17	0.3	568	0.8	568	0.6
	Channel Islands total	28,348	100	10,521	100	43,245	100	4,411	100	6,621	100	6,102	100	70,899	100	99,247	100
<b>Northern elephant seal</b>																	
2011 <sup>2</sup>	San Nicolas Island	0		4		0		3		332		273		612		615	
	Santa Barbara Island	0		0		0		0		1		3		4		4	
2012 <sup>2</sup>	San Clemente Island	0		0		0		1		4		2		7		7	
	San Miguel Island	0		20		0		129		1,388		395		1,932		1,932	
	San Nicolas Island	0		9		0		58		389		346		802		802	
	Santa Barbara Island	0		0		0		0		3		2		5		5	
2013 <sup>2</sup>	San Clemente Island	0		0		0		0		0		0		0		0	
	San Miguel Island	0		66		0		303		1,364		305		2,038		2,038	

Table 3. (Continued)

Year	Island/Rock	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total		
		count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%	
<b>Northern elephant seal (Continued)</b>																		
2013 <sup>2</sup>	San Nicolas Island	0		28		0		91		489		125		733		733		
	Santa Barbara Island	0		2		0		2		3		1		8		8		
2014 <sup>2</sup>	San Clemente Island	0		0		0		1		3		2		6		6		
	San Miguel Island	0		11		0		421		1,248		958		2,638		2,638		
	San Nicolas Island	0		3		0		122		395		295		815		815		
	Santa Barbara Island	0		0		0		2		6		0		8		8		
2015	San Clemente Island	0		0	0.0	0		2	0.3	2	0.1	1	0.2	5	0.1	5	0.1	
	San Miguel Island	0		21	72.4	0		434	58.3	1,976	62.6	359	57.4	2,790	61.3	2,790	61.3	
	San Nicolas Island	0		6	20.7	0		208	28.0	591	18.7	127	20.3	932	20.5	932	20.5	
	Santa Barbara Island	0		1	3.4	0		3	0.4	7	0.2	0	0.0	11	0.2	11	0.2	
	Santa Rosa Island	0		1	3.4	0		97	13.0	580	18.4	138	22.1	816	17.9	816	17.9	
	Channel Islands total	0		29	100	0		744	100	3,156	100	625	100	4,554	100	4,554	100	
<b>Pacific harbor seal</b>																		
2011 <sup>2</sup>	San Nicolas Island																229	
2012 <sup>2</sup>	San Miguel Island																	559
	San Nicolas Island																	326
	Santa Barbara Island																	18
2013 <sup>2</sup>	San Miguel Island																	565
	San Nicolas Island																	605
	Santa Barbara Island																	8
2014 <sup>2</sup>	San Clemente Island																	16
	San Miguel Island																	673
	San Nicolas Island																	610
2015	Anacapa Island																	2
	Richardson Rock																	3
	San Clemente Island																	116
	San Miguel Island																	550
	San Nicolas Island																	259
	Santa Barbara Island																	9
	Santa Cruz Island																	181

Table 3. (Continued)

Year	Island/Rock	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total		
		count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%	
<b>Pacific harbor seal (Continued)</b>																		
2015	Santa Rosa Island																247	18.1
	Channel Islands total																1,367	100
<b>Steller sea lion</b>																		
2013	San Nicolas Island	0		1	100.0	0		0		0		0		1	100.0		1	100
	Channel Islands total	0		1		0		0		0		0		1			1	

<sup>1</sup>Richardson Rock was not photographed.

<sup>2</sup>Not all Channel Islands were censused for northern elephant seals and Pacific harbor seals, therefore cannot compute percentage of all Channel Islands.

Table 4. Mean and standard deviation (SD) of counts represented by each age/sex class and category total for California sea lions, northern elephant seals, and Steller sea lions counted from aerial photographs taken during surveys conducted in July 2011-2015. Note:  $n$  = number of years of data; blank = no data collected.

Island/Rock	$n$	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
		Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std
<b>California sea lion</b>																	
Anacapa Island	5	44.4	8.3	311.0	99.1	566.8	164.2	142.0	64.7	26.8	16.0	20.6	4.7	1,067.2	126.3	1,111.6	122.6
Richardson Rock	4	0.3	0.5	60.3	12.3	200.3	130.2	7.8	6.7	19.3	3.3	11.8	3.7	299.3	148.0	299.5	147.8
San Clemente Island	5	2,174.6	1,111.2	590.8	185.0	3,118.2	845.3	108.8	60.8	132.8	51.0	230.4	40.1	4,181.0	937.4	6,355.6	1,725.6
San Miguel Island	5	23,389.4	4,531.9	7,087.4	2,579.6	23,751.0	2,670.1	1,629.4	287.8	3,092.2	327.9	3,200.8	248.0	38,760.8	4,906.0	62,150.2	7,836.8
San Nicolas Island	5	21,166.8	8,903.4	5,048.2	1,783.3	19,895.8	4,034.7	1,211.8	313.4	2,448.2	403.1	2,864.2	448.0	31,468.2	5,928.9	52,634.8	9,899.0
Santa Barbara Island	5	2,755.8	1,195.8	414.2	125.5	2,821.6	889.0	160.0	53.8	193.6	50.0	284.2	40.1	3,873.4	928.1	6,629.2	1,792.1
Santa Catalina Island	5	19.6	7.3	98.8	45.9	276.8	108.4	27.0	29.8	6.0	4.2	7.4	3.0	416.0	172.3	435.6	166.1
Santa Cruz Island	5	0.4	0.5	291.2	137.4	888.8	212.8	98.8	133.1	30.2	6.9	12.8	5.9	1,321.8	353.6	1,322.2	353.6
Santa Rosa Island	5	1.4	1.5	287.0	204.3	530.8	274.2	90.6	95.8	23.2	12.5	11.2	5.1	942.8	381.5	944.2	382.4
<b>Northern elephant seal</b>																	
San Clemente Island	4	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.8	2.3	1.7	1.3	1.0	4.5	3.1	4.5	3.1
San Miguel Island	4	0.0	0.0	29.5	24.7	0.0	0.0	321.8	141.4	1,494.0	327.1	504.3	304.8	2,349.5	427.6	2,349.5	427.6
San Nicolas Island	5	0.0	0.0	10.0	10.3	0.0	0.0	96.4	76.4	439.2	101.8	233.2	101.4	778.8	117.5	779.4	116.5
Santa Barbara Island	5	0.0	0.0	0.6	0.9	0.0	0.0	1.4	1.3	4.0	2.4	1.2	1.3	7.2	2.8	7.2	2.8
Santa Rosa Island	1	0.0		1.0		0.0		97.0		580.0		138.0		816.0		816.0	

Table 4. (Continued)

Island/Rock	<i>n</i>	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total		
		Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	Mean	Std	
<b>Pacific harbor seal</b>																		
Anacapa Island	1																2.0	
Richardson Rock	1																3.0	
San Clemente Island	2																66.0	70.7
San Miguel Island	4																586.8	57.8
San Nicolas Island	5																405.8	187.5
Santa Barbara Island	3																11.7	5.5
Santa Cruz Island	1																181.0	
Santa Rosa Island	1																247.0	
<b>Steller sea lion</b>																		
San Nicolas Island	1	0.0		1.0		0.0		0.0		0.0		0.0		1.0			1.0	

Table 5. Island-area counts by age-sex class and category total for California sea lions, northern elephant seals, and Pacific harbor seals from aerial photographs taken at the Channel Islands during July 2011-2015. Counts are provided only for island-areas having animals. Refer to Table 1 for survey date and to Figures 3 and 4 for location of island-areas.

Island	Year	Area	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total
<b>California sea lion</b>										
Anacapa Island	2011	680	32	323	579	127	12	24	1,065	1,097
	2012	680	50	458	418	113	15	14	1,018	1,068
	2013	680	48	261	642	179	38	26	1,146	1,194
	2014	680	52	189	400	230	49	20	888	940
	2015	680	40	324	795	61	20	19	1,219	1,259
Richardson Rock <sup>1</sup>	2011	103	0	53	186	4	23	16	282	282
	2012	103	1	51	135	2	20	7	215	216
	2014	103	0	78	387	17	19	12	513	513
	2015	103	0	59	93	8	15	12	187	187
San Clemente Island	2011	404	0	8	27	17	13	10	75	75
		406	2,300	174	1,804	19	21	131	2,149	4,449
		407	583	131	846	67	20	69	1,133	1,716
		411	0	31	566	1	3	15	616	616
	2012	406	2,521	288	1,644	12	48	157	2,149	4,670
		407	671	135	620	48	118	99	1,020	1,691
		410	0	25	6	0	0	0	31	31
		411	28	241	364	0	10	13	628	656
	2013	404	1	44	55	9	20	3	131	132
		406	1,844	247	1,842	14	63	132	2,298	4,142
		407	603	221	1,041	59	91	76	1,488	2,091
		411	10	265	765	1	10	12	1,053	1,063
	2014	404	1	43	30	15	13	7	108	109
		406	1,416	363	2,061	16	47	153	2,640	4,056
		407	493	156	1,224	45	54	92	1,571	2,064
		411	17	134	749	7	7	13	910	927
	2015	404	0	8	22	37	7	2	76	76
		406	266	168	999	34	39	109	1,349	1,615
		407	113	79	503	114	69	56	821	934
		410	0	21	30	7	2	0	60	60
411		6	173	393	22	9	3	600	606	
San Miguel Island	2011	A	24	4,341	1,896	154	228	77	6,696	6,720
		B	0	0	1	0	4	1	6	6
		C	376	1,652	2,521	28	58	50	4,309	4,685
		D	0	0	1	0	0	4	5	5
		E	0	0	0	2	23	23	48	48
		F	0	0	1	184	454	787	1,426	1,426
		G	3,133	164	2,072	68	17	145	2,466	5,599
		H	17,986	1,279	13,788	749	827	1,431	18,074	36,060
		I	0	1	0	160	316	418	895	895
		J	4,477	1,075	4,372	656	920	362	7,385	11,862
		K	0	0	0	0	0	0	0	0
		L	7	1,468	478	2	6	16	1,970	1,977
		M	0	0	0	0	0	0	0	0
N	0	0	0	0	0	0	0	0		

Table 5. (Continued)

Island	Year	Area	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total
<b>California sea lion (Continued)</b>										
San Miguel Island (Continued)	2011	O	950	114	979	0	0	87	1,180	2,130
	2012	A	9	1,853	1,108	53	204	72	3,290	3,299
		B	0	0	0	0	7	6	13	13
		C	429	740	2,003	72	70	45	2,930	3,359
		D	0	0	0	0	0	6	6	6
		E	0	0	0	7	25	26	58	58
		F	0	10	12	131	595	731	1,479	1,479
		G	3,216	358	2,083	75	34	141	2,691	5,907
		H	19,277	2,363	11,633	565	751	1,162	16,474	35,751
		I	0	7	17	97	382	435	938	938
		J	4,535	1,283	3,460	421	948	443	6,555	11,090
		L	4	1,287	623	87	47	32	2,076	2,080
		N	0	0	0	0	0	1	1	1
		O	819	71	725	0	1	63	860	1,679
		2013	A	8	1,155	1,830	125	153	42	3,305
	B		7	529	831	26	33	20	1,439	1,446
	C		624	1,165	2,614	17	19	47	3,862	4,486
	D		0	0	2	0	4	10	16	16
	E		0	0	4	4	17	20	45	45
	F		0	24	9	156	415	288	892	892
	G		2,325	700	2,141	137	294	311	3,583	5,908
	H		13,645	3,203	13,185	585	858	1,202	19,033	32,678
	I		6	36	45	264	840	472	1,657	1,663
	J		3,717	1,160	4,586	362	737	371	7,216	10,933
	K		0	0	1	0	5	5	11	11
	L		35	536	764	32	25	16	1,373	1,408
	N		0	0	1	0	0	2	3	3
	O		647	55	813	0	2	72	942	1,589
	2014	A	15	865	1,368	204	191	65	2,693	2,708
		B	22	390	1,518	30	43	25	2,006	2,028
		C	763	235	2,034	32	41	67	2,409	3,172
		D	0	0	1	1	14	26	42	42
		E	0	0	2	3	15	33	53	53
		F	3	8	23	50	304	424	809	812
		G	2,616	152	1,737	52	217	269	2,427	5,043
		H	14,922	1,108	10,127	387	655	1,351	13,628	28,550
		I	25	28	118	230	708	687	1,771	1,796
		J	4,622	719	4,317	224	482	406	6,148	10,770
		K	0	0	1	0	2	15	18	18
L		62	525	1,398	2	20	21	1,966	2,028	
M		0	0	0	3	3	8	14	14	
N		0	3	7	4	4	4	22	22	
O	557	42	759	1	1	89	892	1,449		
2015	A	8	793	793	219	216	62	2,083	2,091	
	B	22	962	1,637	76	27	25	2,727	2,749	
	C	546	352	1,672	40	42	70	2,176	2,722	
	D	0	0	0	1	13	13	27	27	
	E	0	1	0	4	22	31	58	58	

Table 5. (Continued)

Island	Year	Area	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total
<b>California sea lion (Continued)</b>										
San Miguel Island (Continued)	2015	F	6	21	23	45	299	376	764	770
		G	1,819	141	1,437	82	204	265	2,129	3,948
		H	10,972	842	10,070	484	950	1,220	13,566	24,538
		I	80	40	306	304	924	509	2,083	2,163
		J	3,090	1,009	3,687	361	704	406	6,167	9,257
		K	0	0	0	0	4	6	10	10
		L	60	526	556	85	29	18	1,214	1,274
		M	0	0	0	0	1	0	1	1
		N	0	3	2	2	3	3	13	13
O	481	43	563	2	4	68	680	1,161		
San Nicolas Island	2011	A	192	632	525	10	15	15	1,197	1,389
		B	552	66	472	0	2	23	563	1,115
		C	770	22	305	41	174	166	708	1,478
		D	4,927	241	2,064	15	9	153	2,482	7,409
		E	998	251	659	159	216	160	1,445	2,443
		F	2,989	219	1,371	15	11	136	1,752	4,741
		G	303	90	191	119	222	144	766	1,069
		H	5,085	259	2,284	76	67	295	2,981	8,066
		I	1,527	137	576	78	113	141	1,045	2,572
		J	3,344	248	1,946	63	132	242	2,631	5,975
		K	0	1	0	17	93	178	289	289
		L	5,388	337	2,728	56	67	267	3,455	8,843
		M	1,955	137	1,138	50	241	243	1,809	3,764
		N	0	0	0	0	0	6	6	6
	Q	57	989	932	225	393	147	2,686	2,743	
	2012	A	285	237	941	80	101	32	1,391	1,676
		B	686	96	547	7	6	40	696	1,382
		C	720	35	274	76	189	245	819	1,539
		D	5,894	250	2,304	2	9	201	2,766	8,660
		E	1,245	176	873	154	258	227	1,688	2,933
		F	3,613	220	1,589	47	29	203	2,088	5,701
G		385	84	255	175	328	242	1,084	1,469	
H		5,800	426	2,347	120	111	386	3,390	9,190	
I		1,788	205	730	137	200	193	1,465	3,253	
J		3,709	473	2,257	162	206	274	3,372	7,081	
K		0	2	4	31	209	223	469	469	
L		5,933	587	3,923	126	176	373	5,185	11,118	
M		1,854	268	1,726	150	236	326	2,706	4,560	
Q		60	2,258	2,401	260	554	286	5,759	5,819	
2013		A	114	537	1,129	12	64	20	1,762	1,876
		B	459	156	525	5	4	30	720	1,179
		C	609	235	591	92	322	235	1,475	2,084
	D	3,005	835	2,301	5	26	160	3,327	6,332	
	E	564	340	854	93	251	199	1,737	2,301	
	F	1,679	581	1,576	0	19	193	2,369	4,048	
	G	121	194	327	66	336	284	1,207	1,328	
	H	2,466	813	2,262	29	91	339	3,534	6,000	
	I	825	489	706	73	196	154	1,618	2,443	

Table 5. (Continued)

Island	Year	Area	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total
<b>California sea lion (Continued)</b>										
San Nicolas Island (Continued)	2013	J	1,853	809	2,481	48	130	237	3,705	5,557
		K	0	2	3	80	194	126	405	405
		L	3,333	879	3,713	39	135	330	5,096	8,429
		M	1,136	357	2,119	69	308	296	3,149	4,285
		N	0	0	0	0	0	1	1	1
	Q	61	1,810	5,690	345	612	277	8,734	8,795	
	2014	A	125	370	415	163	47	20	1,015	1,140
		B	490	138	743	9	2	36	928	1,418
		C	592	191	476	125	234	239	1,265	1,857
		D	3,177	310	2,442	21	9	191	2,973	6,150
		E	639	399	934	101	261	221	1,916	2,555
		F	2,025	364	1,857	18	25	206	2,470	4,495
		G	143	187	295	153	289	293	1,217	1,360
		H	3,189	406	2,551	56	98	342	3,453	6,642
		I	886	179	694	77	182	202	1,334	2,220
		J	2,359	407	2,578	35	125	261	3,406	5,765
		K	0	1	9	39	190	230	469	469
		L	4,262	386	3,839	18	139	399	4,781	9,043
		M	1,568	238	1,993	45	215	381	2,872	4,440
	N	0	0	1	0	4	17	22	22	
	O	0	0	0	0	0	1	1	1	
	Q	132	629	4,536	222	626	311	6,324	6,456	
	2015	A	63	331	421	110	44	16	922	985
		B	178	64	408	3	3	25	503	681
		C	277	102	301	170	357	194	1,124	1,401
		D	1,281	229	1,354	29	8	123	1,743	3,024
		E	266	153	479	115	255	144	1,146	1,412
F		982	140	836	173	42	150	1,341	2,323	
G		46	48	106	82	303	225	764	810	
H		1,787	213	1,523	56	103	266	2,161	3,948	
I		379	98	392	99	204	144	937	1,316	
J		1,447	184	1,802	60	120	190	2,356	3,803	
K		0	0	5	37	207	223	472	472	
L		2,430	243	2,921	59	142	296	3,661	6,091	
M	779	249	1,817	58	269	262	2,655	3,434		
N	0	0	0	0	5	3	8	8		
Q	48	1,999	4,112	519	678	262	7,570	7,618		
Santa Barbara Island	2011	A	2,922	124	1,371	9	11	92	1,607	4,529
		B	17	82	145	96	55	45	423	440
		C	282	57	298	9	8	29	401	683
		D	720	54	532	20	7	40	653	1,373
		E	0	42	68	31	53	38	232	232
	2012	A	2,686	108	1,393	8	7	91	1,607	4,293
		B	15	73	297	71	61	53	555	570
		C	225	86	395	23	11	22	537	762
		D	632	104	663	15	27	51	860	1,492
		E	0	81	114	104	102	54	455	455
	A	2,193	225	2,076	19	65	147	2,532	4,725	

Table 5. (Continued)

Island	Year	Area	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total	
<b>California sea lion (Continued)</b>											
Santa Barbara Island (Continued)	2013	B	3	91	214	13	73	62	453	456	
		C	147	136	356	1	12	23	528	675	
		D	575	137	801	34	44	65	1,081	1,656	
		E	0	26	48	33	64	54	225	225	
	2014	A	1,913	199	2,107	6	13	114	2,439	4,352	
		B	6	30	292	79	64	41	506	512	
		C	234	20	410	0	0	21	451	685	
		D	345	38	864	16	18	52	988	1,333	
		E	0	9	112	10	58	56	245	245	
	2015	A	644	101	904	26	29	108	1,168	1,812	
		B	1	66	85	46	63	28	288	289	
		C	37	59	165	12	12	19	267	304	
		D	182	89	398	54	44	65	650	832	
		E	0	33	0	65	67	51	216	216	
	Santa Catalina Island	2011	502	17	117	221	21	2	4	365	382
523			0	0	0	1	0	1	2	2	
528			0	1	30	0	0	1	32	32	
2012		502	0	31	11	0	0	1	43	43	
		523	31	32	94	6	4	5	141	172	
		524	0	5	30	0	0	0	35	35	
		528	0	6	12	0	0	1	19	19	
2013		502	20	102	281	5	10	8	406	426	
		522	0	1	3	0	0	0	4	4	
		528	0	6	10	0	0	0	16	16	
2014		502	17	26	194	22	3	11	256	273	
		522	2	10	53	2	0	1	66	68	
2015		502	11	139	442	29	11	4	625	636	
		522	0	10	0	30	0	0	40	40	
		528	0	8	3	19	0	0	30	30	
Santa Cruz Island	2011	641	0	203	198	5	0	0	406	406	
		648	0	13	10	0	0	0	23	23	
		655	1	69	475	11	38	3	596	597	
	2012	641	0	170	611	27	2	1	811	811	
		655	0	232	467	29	18	14	760	760	
	2013	641	0	8	30	0	0	1	39	39	
		643	0	30	64	0	0	0	94	94	
		655	0	412	841	31	34	18	1,336	1,336	
	2014	641	0	45	147	27	2	0	221	221	
		655	0	74	503	29	30	13	649	649	
	2015	641	0	17	0	22	0	0	39	39	
		648	0	94	324	3	8	3	432	432	
		655	1	89	774	310	19	11	1,203	1,204	
	Santa Rosa Island	2011	617	0	166	388	0	5	2	561	561
			621	0	181	82	0	1	1	265	265
624			0	18	45	6	3	2	74	74	
2012		617	0	458	731	0	10	1	1,200	1,200	
		621	0	7	1	24	8	3	43	43	
		624	3	144	103	63	20	8	338	341	

Table 5. (Continued)

Island	Year	Area	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total	
<b>California sea lion (Continued)</b>											
Santa Rosa Island (Continued)	2013	617	0	37	172	0	5	3	217	217	
		621	0	42	23	0	2	0	67	67	
		624	3	76	366	5	25	12	484	487	
	2014	617	0	47	259	88	4	2	400	400	
		621	0	39	84	22	6	1	152	152	
		624	1	23	308	8	2	4	345	346	
	2015	617	0	164	92	139	9	6	410	410	
		621	0	33	0	95	8	3	139	139	
		622	0	0	0	1	0	0	1	1	
		624	0	0	0	1	8	7	16	16	
		625A	0	0	0	1	1	1	2	2	
	<b>Northern elephant seal</b>										
	San Clemente Island	2012	406	0	0	0	1	4	2	7	7
2013		406	0	0	0	0	0	0	0	0	
2014		406	0	0	0	1	3	2	6	6	
2015		406	0	0	0	2	0	1	3	3	
		407	0	0	0	0	2	0	2	2	
San Miguel Island	2012	A	0	1	0	0	67	94	162	162	
		B	0	0	0	0	5	0	5	5	
		C	0	0	0	1	117	80	198	198	
		D	0	0	0	5	43	4	52	52	
		E	0	0	0	2	78	40	120	120	
		F	0	4	0	17	30	10	61	61	
		G	0	4	0	18	126	49	197	197	
		H	0	6	0	44	614	59	723	723	
		I	0	1	0	1	1	0	3	3	
		J	0	3	0	17	262	48	330	330	
		K	0	0	0	21	7	0	28	28	
		L	0	1	0	2	29	11	43	43	
		N	0	0	0	1	9	0	10	10	
	2013	D	0	1	0	3	0	0	4	4	
		E	0	1	0	6	48	6	61	61	
		F	0	7	0	11	54	8	80	80	
		G	0	3	0	20	136	32	191	191	
		H	0	17	0	140	404	109	670	670	
		I	0	4	0	19	89	8	120	120	
		J	0	5	0	24	235	51	315	315	
		K	0	4	0	16	38	5	63	63	
		L	0	1	0	4	40	11	56	56	
		N	0	2	0	8	12	2	24	24	
		A	0	9	0	4	67	23	103	103	
		B	0	3	0	3	50	8	64	64	
		C	0	9	0	40	167	41	257	257	
		D	0	0	0	5	24	1	30	30	
		2014	A	0	3	0	11	59	71	144	144
			B	0	0	0	10	15	23	48	48
C	0		0	0	51	117	81	249	249		
D	0		0	0	18	32	5	55	55		

Table 5. (Continued)

Island	Year	Area	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total
<b>Northern elephant seal (Continued)</b>										
San Miguel Island (Continued)	2014	E	0	0	0	24	49	37	110	110
		F	0	0	0	17	40	33	90	90
		G	0	2	0	46	120	54	222	222
		H	0	1	0	59	334	416	810	810
		I	0	4	0	97	205	40	346	346
		J	0	0	0	43	109	135	287	287
		K	0	0	0	17	67	12	96	96
		L	0	0	0	12	16	44	72	72
	M	0	1	0	14	83	6	104	104	
	N	0	0	0	2	2	1	5	5	
	2015	A	0	0	0	6	51	3	60	60
		B	0	1	0	7	59	32	99	99
		C	0	4	0	73	244	20	341	341
		D	0	0	0	15	10	0	25	25
		E	0	3	0	22	89	10	124	124
		F	0	0	0	20	64	3	87	87
		G	0	4	0	37	117	29	187	187
		H	0	2	0	95	553	160	810	810
		I	0	2	0	79	294	19	394	394
		J	0	0	0	38	246	35	319	319
K		0	4	0	31	109	17	161	161	
L		0	1	0	2	61	6	70	70	
M	0	0	0	7	71	25	103	103		
N	0	0	0	2	8	0	10	10		
San Nicolas Island	2011	C	0	0	0	0	13	10	23	23
		D	0	0	0	0	23	17	40	40
		E	0	2	0	0	55	51	108	108
		F	0	0	0	0	1	12	13	13
		G	0	0	0	0	0	2	2	2
		H	0	1	0	0	1	4	6	6
		J	0	0	0	0	2	7	9	9
		K	0	1	0	3	125	76	205	208
		M	0	0	0	0	49	31	80	80
	Q	0	0	0	0	63	63	126	126	
	2012	A	0	1	0	0	5	2	8	8
		B	0	0	0	0	7	45	52	52
		C	0	0	0	0	6	4	10	10
		D	0	1	0	0	20	20	41	41
		E	0	0	0	19	70	53	142	142
		F	0	1	0	0	7	1	9	9
		G	0	0	0	4	2	3	9	9
		H	0	1	0	1	1	1	4	4
		I	0	2	0	0	2	0	4	4
J		0	0	0	0	2	0	2	2	
K	0	0	0	28	159	95	282	282		
L	0	1	0	1	1	0	3	3		
M	0	0	0	1	36	60	97	97		
Q	0	2	0	4	71	62	139	139		

Table 5. (Continued)

Island	Year	Area	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total
<b>Northern elephant seal (Continued)</b>										
San Nicolas Island (Continued)	2013	A	0	3	0	1	30	8	42	42
		B	0	1	0	1	8	1	11	11
		C	0	0	0	4	23	3	30	30
		D	0	3	0	10	13	6	32	32
		E	0	3	0	12	53	24	92	92
		F	0	2	0	4	22	2	30	30
		G	0	1	0	1	0	1	3	3
		H	0	3	0	1	1	0	5	5
		I	0	2	0	1	7	2	12	12
	J	0	0	0	0	11	3	14	14	
	K	0	4	0	26	122	20	172	172	
	M	0	3	0	9	82	25	119	119	
	N	0	0	0	7	32	1	40	40	
	Q	0	3	0	14	85	29	131	131	
	2014	A	0	0	0	2	4	7	13	13
		B	0	0	0	0	8	7	15	15
		C	0	0	0	10	13	6	29	29
		D	0	1	0	6	7	10	24	24
		E	0	0	0	9	43	36	88	88
		F	0	0	0	5	4	2	11	11
		G	0	0	0	1	3	4	8	8
		H	0	0	0	0	13	2	15	15
		I	0	0	0	0	10	19	29	29
		J	0	0	0	0	9	17	26	26
		K	0	0	0	46	95	63	204	204
		L	0	0	0	2	3	0	5	5
		M	0	0	0	22	82	50	154	154
N	0	0	0	2	13	6	21	21		
O	0	0	0	5	35	22	62	62		
Q	0	2	0	12	53	44	111	111		
2015	A	0	0	0	2	5	4	11	11	
	B	0	0	0	1	3	0	4	4	
	C	0	1	0	7	31	2	41	41	
	D	0	0	0	18	18	3	39	39	
	E	0	1	0	53	43	11	108	108	
	F	0	0	0	11	21	0	32	32	
	G	0	0	0	3	7	0	10	10	
	H	0	0	0	2	7	0	9	9	
	I	0	0	0	6	19	5	30	30	
	J	0	1	0	2	15	6	24	24	
	K	0	2	0	37	172	57	268	268	
	L	0	0	0	5	0	0	5	5	
	M	0	0	0	33	140	11	184	184	
N	0	0	0	4	17	2	23	23		
Q	0	1	0	24	93	26	144	144		
Santa Barbara Island	2011	D	0	0	0	0	1	3	4	4
	2012	A	0	0	0	0	3	2	5	5
	2013	A	0	0	0	0	2	0	2	2

Table 5. (Continued)

Island	Year	Area	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total		
<b>Northern elephant seal (Continued)</b>												
Santa Barbara Island (Continued)	2013	D	0	2	0	2	1	1	6	6		
	2014	D	0	0	0	2	6	0	8	8		
	2015	B	0	1	0	0	0	0	1	1		
		D	0	0	0	3	7	0	10	10		
Santa Rosa Island	2015	611	0	0	0	2	0	0	2	2		
		621	0	1	0	5	40	4	50	50		
		622	0	0	0	12	148	33	193	193		
		624	0	0	0	33	140	19	192	192		
		626	0	0	0	14	103	40	157	157		
		625A	0	0	0	23	92	31	146	146		
		625B	0	0	0	7	6	0	13	13		
		625C	0	0	0	1	51	11	63	63		
<b>Pacific harbor seal</b>												
Anacapa Island	2015	680	0	0	0	0	0	0	0	2		
Richardson Rock	2015	103	0	0	0	0	0	0	0	3		
San Clemente Island	2014	406								8		
		411								8		
	2015	402									13	
		404									64	
		406									22	
		407									2	
411									15			
San Miguel Island	2012	A									7	
		B									45	
		C									17	
		D									34	
		E									77	
		F									29	
		G									37	
		H									27	
		J									108	
		L									68	
		N									110	
		2013	A									50
			B									10
			C									20
	D										64	
	E										56	
	F										29	
	2014	G									1	
		H									14	
		J									112	
L										87		
N										122		
A										45		
B									10			
C									50			
D									86			

Table 5. (Continued)

Island	Year	Area	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total	
<b>Pacific harbor seal (Continued)</b>											
San Miguel Island (Continued)	2014	E								70	
		F								28	
		G								1	
		H								21	
		J								133	
		L								38	
		M								9	
		N								182	
	2015	A									19
		B									7
		C									57
		D									100
		E									54
		F									29
		H									1
J										60	
M									17		
N									206		
San Nicolas Island	2011	D								8	
		E								2	
		F									6
		I									11
		J									6
		L									73
		M									22
		Q									101
	2012	D									27
		F									5
		J									10
		L									119
		M									47
	Q									118	
	2013	A									16
		C									25
		D									46
		E									12
		F									50
		I									7
J										12	
K										2	
L										86	
M										58	
N									111		
Q									180		
2014	A									15	
	C									47	
	D									20	
	E									31	

Table 5. (Continued)

Island	Year	Area	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total	
<b>Pacific harbor seal (Continued)</b>											
San Nicolas Island (Continued)	2014	F								43	
		I								4	
		J								12	
		L								139	
		M								19	
		N								71	
		O								38	
		Q								171	
	2015	A									1
		C									37
		D									3
		E									31
		F									14
		I									3
		J									6
		L									1
		M									5
N										60	
Q									98		
Santa Barbara Island	2012	B								5	
		C								4	
		D								9	
	2013	A								2	
		D								6	
	2015	B								5	
		C								1	
D									3		
Santa Cruz Island	2015	643								28	
		647								2	
		655								9	
		656								142	
Santa Rosa Island	2015	615								83	
		618								19	
		624								55	
		626								90	
<b>Steller sea lion</b>											
San Nicolas Island	2013	H	0	1	0	0	0	0	1	1	

<sup>1</sup>Richardson Rock not photographed in 2013.

Table 6. Island-area mean and standard deviation (SD) of age/sex class counts and category total counts of California sea lions, northern elephant seals, and Pacific harbor seals obtained from aerial photographs taken during surveys of the Channel Islands conducted during July 2011-2015. Refer to Figures 3 and 4 for location of island-areas. Only island-areas with animals and islands having multiple years of data are included. No counts made where blanks appear.

Area	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>California sea lion</b>																
Anacapa Island																
680	44.4	8.3	311.0	99.1	566.8	164.2	142.0	64.7	26.8	16.0	20.6	4.7	1,067.2	126.3	1,111.6	122.6
Richardson Rock																
103	0.3	0.5	60.3	12.3	200.3	130.2	7.8	6.7	19.3	3.3	11.8	3.7	299.3	148.0	299.5	147.8
San Clemente Island																
404	0.5	0.6	25.8	20.5	33.5	14.7	19.5	12.2	13.3	5.3	5.5	3.7	97.5	27.1	98.0	27.6
406	1,669.4	892.6	248.0	81.7	1,670.0	403.5	19.0	8.8	43.6	15.3	136.4	19.4	2,117.0	473.9	3,786.4	1,238.3
407	492.6	221.5	144.4	51.3	846.8	295.6	66.6	27.9	70.4	37.1	78.4	17.4	1,206.6	316.6	1,699.2	467.0
410	0.0	0.0	23.0	2.8	18.0	17.0	3.5	4.9	1.0	1.4	0.0	0.0	45.5	20.5	45.5	20.5
411	12.2	10.8	168.8	93.1	567.4	189.6	6.2	9.3	7.8	2.9	11.2	4.7	761.4	207.4	773.6	208.6
San Miguel Island																
A	12.8	6.9	1,801.4	1,480.2	1,399.0	470.5	151.0	66.6	198.4	28.9	63.6	13.4	3,613.4	1,795.2	3,626.2	1,801.2
B	10.2	11.1	376.2	403.0	797.4	789.8	26.4	31.1	22.8	16.8	15.4	11.2	1,238.2	1,211.0	1,248.4	1,221.5
C	547.6	154.7	828.8	587.0	2,168.8	392.0	37.8	20.8	46.0	19.3	55.8	11.8	3,137.2	921.4	3,684.8	857.1
D	0.0	0.0	0.0	0.0	0.8	0.8	0.4	0.5	6.2	6.9	11.8	8.7	19.2	15.5	19.2	15.5
E	0.0	0.0	0.2	0.4	1.2	1.8	4.0	1.9	20.4	4.2	26.6	5.4	52.4	5.9	52.4	5.9
F	1.8	2.7	12.6	9.8	13.6	9.5	113.2	62.9	413.4	122.2	521.2	223.4	1,074.0	349.1	1,075.8	347.2
G	2,621.8	580.3	303.0	239.3	1,894.0	300.8	82.8	32.3	153.2	121.7	226.2	78.1	2,659.2	553.8	5,281.0	824.6
H	15,360.4	3,340.1	1,759.0	993.1	11,760.6	554.0	134.1	808.2	111.4	1,273.2	113.2	1,709.0	16,155.0	2,507.8	31,515.4	4,935.2
I	22.2	33.9	22.4	17.5	97.2	125.1	211.0	82.8	634.0	272.3	504.2	108.0	1,468.8	528.0	1,491.0	555.7
J	4,088.2	665.2	1,049.2	211.1	4,084.4	483.8	404.8	158.0	758.2	188.3	397.6	32.3	6,694.2	579.9	10,782.4	950.0
K	0.0	0.0	0.0	0.0	0.5	0.6	0.0	0.0	2.8	2.2	6.5	6.2	9.8	7.4	9.8	7.4
L	33.6	27.8	868.4	469.1	763.8	369.8	41.6	42.3	25.4	14.9	20.6	6.7	1,719.8	395.7	1,753.4	381.2
M	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.7	1.3	1.5	2.7	4.6	5.0	7.8	5.0	7.8
N	0.0	0.0	1.2	1.6	2.0	2.9	1.2	1.8	1.4	1.9	2.0	1.6	7.8	9.5	7.8	9.5
O	690.8	192.0	65.0	29.8	767.8	150.4	0.6	0.9	1.6	1.5	75.8	11.6	910.8	180.0	1,601.6	354.5

Table 6. (Continued)

Area	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>California sea lion (Continued)</b>																
San Nicolas Island																
A	155.8	85.6	421.4	160.1	686.2	328.2	75.0	65.6	54.2	31.5	20.6	6.8	1,257.4	334.4	1,413.2	368.0
B	473.0	186.5	104.0	41.7	539.0	126.0	4.8	3.5	3.4	1.7	30.8	7.2	682.0	164.6	1,155.0	294.8
C	593.6	192.1	117.0	94.0	389.4	138.2	100.8	49.1	255.2	81.0	215.8	34.3	1,078.2	315.7	1,671.8	288.4
D	3,656.8	1,797.1	373.0	260.1	2,093.0	434.9	14.4	11.2	12.2	7.7	165.6	31.2	2,658.2	597.2	6,315.0	2,094.9
E	742.4	383.2	263.8	105.2	759.8	187.8	124.4	30.4	248.2	18.4	190.2	36.8	1,586.4	298.2	2,328.8	563.6
F	2,257.6	1,047.4	304.8	174.3	1,445.8	382.1	50.6	70.5	25.2	11.6	177.6	32.3	2,004.0	463.8	4,261.6	1,241.0
G	199.6	139.7	120.6	65.8	234.8	88.1	119.0	46.0	295.6	45.3	237.6	59.5	1,007.6	227.6	1,207.2	266.2
H	3,665.4	1,715.1	423.4	236.3	2,193.4	391.7	67.4	33.8	94.0	16.8	325.6	46.3	3,103.8	568.5	6,769.2	2,006.8
I	1,081.0	569.0	221.6	154.9	619.6	140.4	92.8	26.7	179.0	37.8	166.8	28.6	1,279.8	284.7	2,360.8	699.8
J	2,542.4	963.4	424.2	244.7	2,212.8	334.4	73.6	50.6	142.6	35.7	240.8	32.0	3,094.0	571.6	5,636.2	1,181.7
K	0.0	0.0	1.2	0.8	4.2	3.3	40.8	23.5	178.6	48.5	196.0	44.3	420.8	78.9	420.8	78.9
L	4,269.2	1,438.7	486.4	252.9	3,424.8	557.3	59.6	40.5	131.8	39.7	333.0	54.1	4,435.6	818.3	8,704.8	1,793.4
M	1,458.4	495.1	249.8	78.6	1,758.6	379.0	74.4	43.2	253.8	35.9	301.6	54.6	2,638.2	502.0	4,096.6	479.0
N	0.0	0.0	0.0	0.0	0.3	0.5	0.0	0.0	2.3	2.6	6.8	7.1	9.3	9.0	9.3	9.0
O	0.0		0.0		0.0		0.0		0.0		1.0		1.0		1.0	
Q	71.6	34.2	1,537.0	695.1	3,534.2	1,873.5	314.2	124.8	572.6	109.7	256.6	63.8	6,214.6	2,283.4	6,286.2	2,284.1
Santa Barbara Island																
A	2,071.6	891.4	151.4	56.7	1,570.2	514.5	13.6	8.6	25.0	23.9	110.4	22.8	1,870.6	590.2	3,942.2	1,202.7
B	8.4	7.2	68.4	23.4	206.6	92.3	61.0	32.3	63.2	6.5	45.8	12.8	445.0	101.3	453.4	105.2
C	185.0	95.9	71.6	43.0	324.8	99.3	9.0	9.4	8.6	5.1	22.8	3.8	436.8	110.3	621.8	181.1
D	490.8	221.5	84.4	39.5	651.6	191.2	27.8	16.5	28.0	16.2	54.6	10.6	846.4	194.5	1,337.2	309.1
E	0.0	0.0	38.2	26.8	68.4	47.6	48.6	36.7	68.8	19.3	50.6	7.3	274.6	101.4	274.6	101.4
Santa Catalina Island																
502	13.0	8.0	83.0	51.5	229.8	155.6	15.4	12.3	5.2	5.0	5.6	3.9	339.0	213.0	352.0	217.2
522	0.7	1.2	7.0	5.2	18.7	29.8	10.7	16.8	0.0	0.0	0.3	0.6	36.7	31.1	37.3	32.1
523	15.5	21.9	16.0	22.6	47.0	66.5	3.5	3.5	2.0	2.8	3.0	2.8	71.5	98.3	87.0	120.2
524	0.0		5.0		30.0		0.0		0.0		0.0		35.0		35.0	
528	0.0	0.0	5.3	3.0	13.8	11.5	4.8	9.5	0.0	0.0	0.5	0.6	24.3	7.9	24.3	7.9

Table 6. (Continued)

Area	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>California sea lion (Continued)</b>																
Santa Cruz Island																
641	0.0	0.0	88.6	91.2	197.2	245.3	16.2	12.8	0.8	1.1	0.4	0.5	303.2	322.0	303.2	322.0
643	0.0		30.0		64.0		0.0		0.0		0.0		94.0		94.0	
648	0.0	0.0	53.5	57.3	167.0	222.0	1.5	2.1	4.0	5.7	1.5	2.1	227.5	289.2	227.5	289.2
655	0.4	0.5	175.2	148.5	612.0	180.5	82.0	127.7	27.8	9.0	11.8	5.5	908.8	337.8	909.2	337.8
Santa Rosa Island																
617	0.0	0.0	174.4	170.1	328.4	250.4	45.4	64.7	6.6	2.7	2.8	1.9	557.6	379.2	557.6	379.2
621	0.0	0.0	60.4	68.8	38.0	42.1	28.2	39.1	5.0	3.3	1.6	1.3	133.2	87.0	133.2	87.0
622	0.0		0.0		0.0		1.0		0.0		0.0		1.0		1.0	
624	1.4	1.5	52.2	58.6	164.4	163.0	16.6	26.1	11.6	10.4	6.6	3.8	251.4	198.3	252.8	199.6
625A	0.0		0.0		0.0		1.0		0.0		1.0		2.0		2.0	
<b>Northern elephant seal</b>																
San Clemente Island																
406	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.8	1.8	2.1	1.3	1.0	4.0	3.2	4.0	3.2
407	0.0		0.0		0.0		0.0		2.0		0.0		2.0		2.0	
San Miguel Island																
A	0.0	0.0	3.3	4.0	0.0	0.0	5.3	4.6	61.0	7.7	47.8	42.0	117.3	45.5	117.3	45.5
B	0.0	0.0	1.0	1.4	0.0	0.0	5.0	4.4	32.3	26.3	15.8	14.4	54.0	39.0	54.0	39.0
C	0.0	0.0	3.3	4.3	0.0	0.0	41.3	30.1	161.3	60.0	55.5	30.1	261.3	59.2	261.3	59.2
D	0.0	0.0	0.3	0.5	0.0	0.0	11.5	6.0	27.3	13.9	2.5	2.4	41.5	14.4	41.5	14.4
E	0.0	0.0	1.0	1.4	0.0	0.0	13.5	11.1	66.0	20.7	23.3	17.7	103.8	29.1	103.8	29.1
F	0.0	0.0	2.8	3.4	0.0	0.0	16.3	3.8	47.0	15.0	13.5	13.3	79.5	13.0	79.5	13.0
G	0.0	0.0	3.3	1.0	0.0	0.0	30.3	13.5	124.8	8.4	41.0	12.4	199.3	15.7	199.3	15.7
H	0.0	0.0	6.5	7.3	0.0	84.5	42.7	476.3	129.5	186.0	158.8	0.0	753.3	69.0	753.3	69.0
I	0.0	0.0	2.8	1.5	0.0	0.0	49.0	46.2	147.3	128.7	16.8	17.3	215.8	185.4	215.8	185.4
J	0.0	0.0	2.0	2.4	0.0	0.0	30.5	12.1	213.0	70.2	67.3	45.7	312.8	18.3	312.8	18.3
K	0.0	0.0	2.0	2.3	0.0	0.0	21.3	6.8	55.3	43.4	8.5	7.5	87.0	56.6	87.0	56.6
L	0.0	0.0	0.8	0.5	0.0	0.0	5.0	4.8	36.5	19.1	18.0	17.5	60.3	13.5	60.3	13.5
M	0.0	0.0	0.5	0.7	0.0	0.0	10.5	4.9	77.0	8.5	15.5	13.4	103.5	0.7	103.5	0.7
N	0.0	0.0	0.5	1.0	0.0	0.0	3.3	3.2	7.8	4.2	0.8	1.0	12.3	8.2	12.3	8.2

Table 6. (Continued)

Area	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
<b>Northern elephant seal (Continued)</b>																	
San Nicolas Island																	
A	0.0	0.0	1.0	1.4	0.0	0.0	1.3	1.0	11.0	12.7	5.3	2.8	18.5	15.8	18.5	15.8	
B	0.0	0.0	0.3	0.5	0.0	0.0	0.5	0.6	6.5	2.4	13.3	21.4	20.5	21.5	20.5	21.5	
C	0.0	0.0	0.2	0.4	0.0	0.0	4.2	4.4	17.2	9.8	5.0	3.2	26.6	11.3	26.6	11.3	
D	0.0	0.0	1.0	1.2	0.0	0.0	6.8	7.6	16.2	6.3	11.2	7.2	35.2	7.2	35.2	7.2	
E	0.0	0.0	1.2	1.3	0.0	0.0	18.6	20.4	52.8	11.1	35.0	17.9	107.6	21.3	107.6	21.3	
F	0.0	0.0	0.6	0.9	0.0	0.0	4.0	4.5	11.0	9.8	3.4	4.9	19.0	11.1	19.0	11.1	
G	0.0	0.0	0.2	0.4	0.0	0.0	1.8	1.6	2.4	2.9	2.0	1.6	6.4	3.6	6.4	3.6	
H	0.0	0.0	1.0	1.2	0.0	0.0	0.8	0.8	4.6	5.4	1.4	1.7	7.8	4.4	7.8	4.4	
I	0.0	0.0	1.0	1.2	0.0	0.0	1.8	2.9	9.5	7.1	6.5	8.6	18.8	12.8	18.8	12.8	
J	0.0	0.0	0.2	0.4	0.0	0.0	0.4	0.9	7.8	5.7	6.6	6.4	15.0	10.1	15.0	10.1	
K	0.0	0.0	1.4	1.7	0.0	0.0	28.0	16.1	134.6	30.9	62.2	27.7	226.2	46.7	226.8	46.4	
L	0.0	0.0	0.3	0.6	0.0	0.0	2.7	2.1	1.3	1.5	0.0	0.0	4.3	1.2	4.3	1.2	
M	0.0	0.0	0.6	1.3	0.0	0.0	13.0	14.2	77.8	40.3	35.4	19.6	126.8	42.3	126.8	42.3	
N	0.0	0.0	0.0	0.0	0.0	0.0	4.3	2.5	20.7	10.0	3.0	2.6	28.0	10.4	28.0	10.4	
O	0.0	0.0	0.0	0.0	0.0	0.0	5.0	0.0	35.0	0.0	22.0	0.0	62.0	0.0	62.0	0.0	
Q	0.0	0.0	1.6	1.1	0.0	0.0	10.8	9.3	73.0	16.2	44.8	17.5	130.2	12.8	130.2	12.8	
Santa Barbara Island																	
A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	0.7	1.0	1.4	3.5	2.1	3.5	2.1	
B	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	
D	0.0	0.0	0.5	1.0	0.0	0.0	1.8	1.3	3.8	3.2	1.0	1.4	7.0	2.6	7.0	2.6	
<b>Pacific harbor seal</b>																	
San Clemente Island																	
402																13.0	
404																64.0	
406																15.0	9.9
407																2.0	
411																11.5	4.9
San Miguel Island																	
A																30.3	20.6

Table 6. (Continued)

Area	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
<b>Pacific harbor seal (Continued)</b>																	
San Miguel Island																	
B																18.0	18.1
C																36.0	20.4
D																71.0	28.8
E																64.3	11.1
F																28.8	0.5
G																13.0	20.8
H																15.8	11.2
J																103.3	30.8
L																64.3	24.7
M																13.0	5.7
N																155.0	46.3
San Nicolas Island																	
A																10.7	8.4
C																36.3	11.0
D																20.8	17.0
E																19.0	14.4
F																23.6	21.3
I																6.3	3.6
J																9.2	3.0
K																2.0	
L																83.6	53.1
M																30.2	21.7
N																80.7	26.8
O																38.0	
Q																133.6	39.1
Santa Barbara Island																	
A																2.0	
B																5.0	0.0
C																2.5	2.1

Table 6. (Continued)

Area	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
<b>Pacific harbor seal (Continued)</b>																	
Santa Barbara Island (Continued)																	
D																6.0	3.0

Table 7. Percentage mean (Mean %) and standard deviation (SD) of island-area counts for each age/sex class and category total for California sea lions, northern elephant seals, and Pacific harbor seals found in aerial photographs taken at the Channel Islands during July 2011-2015. Refer to Figures 3 and 4 for location of area codes. Pacific harbor seals were not counted by age/sex class. Areas with no animals are excluded.

Island /Area	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD
<b>California sea lion</b>																
Anacapa Island																
680	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
Richardson Rock																
103	100.0		100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
San Clemente Island																
404	0.0	0.0	4.0	2.3	1.0	0.3	15.6	3.3	12.5	7.3	2.4	1.5	2.3	0.4	1.7	0.5
406	75.1	4.2	42.8	8.6	54.0	5.2	18.1	1.7	33.6	4.6	59.5	2.6	50.7	4.5	58.5	7.1
407	24.1	3.7	25.2	8.3	26.7	2.5	64.6	11.4	50.2	11.9	33.8	2.3	28.7	1.4	26.9	2.2
410	0.0	0.0	4.2	0.7	0.9	0.9	1.6	2.3	0.8	1.1	0.0	0.0	1.4	0.9	1.1	1.0
411	0.7	0.6	27.2	12.6	18.1	2.7	4.2	4.8	5.9	0.7	4.7	1.8	18.2	2.6	12.8	3.9
San Miguel Island																
A	0.1	0.0	23.5	11.5	5.8	1.4	9.6	5.2	6.5	1.3	2.0	0.3	9.1	3.5	5.7	2.1
B	0.1	0.1	7.2	8.4	3.5	3.6	1.7	1.9	0.7	0.6	0.5	0.4	3.4	3.5	2.2	2.3
C	2.5	0.9	10.5	4.4	9.1	0.7	2.4	1.5	1.5	0.7	1.7	0.4	8.0	1.3	5.9	0.8
D	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.4	0.2	0.1	0.0	0.0	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.7	0.1	0.8	0.1	0.1	0.0	0.1	0.0
F	0.0	0.0	0.2	0.2	0.1	0.0	6.7	3.1	13.5	4.2	16.1	6.4	2.8	0.8	1.7	0.4
G	11.2	0.4	4.2	2.5	8.0	1.0	5.1	1.8	4.9	3.8	7.2	2.8	6.9	1.0	8.5	0.7
H	65.4	2.0	24.9	9.8	49.5	4.1	33.8	3.9	26.1	2.1	39.8	2.2	41.6	2.3	50.6	2.4
I	0.1	0.2	0.4	0.4	0.4	0.6	13.3	5.7	20.3	7.8	15.7	2.9	3.9	1.7	2.5	1.2
J	17.6	1.4	15.9	4.0	17.2	0.9	24.3	5.9	24.6	6.5	12.5	1.3	17.3	0.7	17.4	0.8
K	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.1	0.0	0.0	0.0	0.0
L	0.2	0.1	12.2	3.8	3.2	1.6	2.6	2.7	0.8	0.5	0.6	0.2	4.5	1.1	2.8	0.5
M	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.0
N	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
O	2.9	0.4	0.9	0.2	3.2	0.4	0.0	0.1	0.1	0.0	2.4	0.3	2.3	0.3	2.6	0.3
San Nicolas Island																
A	0.7	0.1	9.1	4.9	3.4	1.3	5.9	5.7	2.1	1.1	0.7	0.2	4.0	0.9	2.7	0.5
B	2.2	0.4	2.1	0.7	2.7	0.4	0.4	0.3	0.1	0.1	1.1	0.1	2.2	0.4	2.2	0.3
C	2.9	0.5	2.3	1.7	1.9	0.4	8.3	3.3	10.3	2.3	7.5	0.4	3.4	0.7	3.2	0.6
D	16.7	2.3	7.0	2.2	10.6	2.0	1.2	0.8	0.5	0.3	5.8	0.7	8.5	1.4	11.7	2.4
E	3.4	0.5	5.5	2.6	3.8	0.6	10.7	3.8	10.3	1.3	6.6	0.5	5.1	0.8	4.4	0.4
F	10.5	0.5	5.9	2.2	7.3	1.5	3.5	4.4	1.0	0.4	6.2	0.3	6.4	1.0	8.0	1.2
G	0.8	0.3	2.4	1.3	1.2	0.3	10.1	3.9	12.1	0.7	8.2	1.4	3.2	0.3	2.3	0.2
H	17.1	1.3	8.0	2.0	11.2	2.4	5.6	2.4	3.8	0.3	11.4	1.0	10.0	1.7	12.7	2.1
I	4.9	0.7	4.1	1.3	3.1	0.6	7.7	1.1	7.3	0.5	5.8	0.3	4.1	0.4	4.4	0.6
J	12.3	1.3	8.0	2.3	11.2	1.0	5.9	3.0	5.9	1.6	8.5	1.2	9.9	0.9	10.7	0.6
K	0.0	0.0	0.0	0.0	0.0	0.0	3.6	2.7	7.2	1.1	6.9	1.6	1.4	0.3	0.8	0.3
L	20.9	2.3	9.3	2.0	17.4	1.6	4.8	2.5	5.3	1.1	11.6	0.2	14.1	1.1	16.5	0.7
M	7.1	0.9	5.0	0.9	8.9	1.3	6.1	2.5	10.6	2.1	10.5	0.5	8.4	0.8	7.9	0.9
N	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.0	0.0	0.0	0.0
O	0.0		0.0		0.0		0.0		0.0		0.0		0.0		0.0	

Table 7. (Continued)

Island /Area	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD
<b>California sea lion (Continued)</b>																
San Nicolas Island (Continued)																
Q	0.4	0.2	31.3	14.2	17.2	8.0	26.2	8.1	23.3	1.8	8.9	1.5	19.5	6.1	12.5	5.9
Santa Barbara Island																
A	75.2	0.9	38.3	16.9	55.8	4.2	9.3	6.5	11.8	8.3	38.6	3.2	47.8	5.3	58.7	4.1
B	0.3	0.2	16.6	4.7	7.1	2.0	39.4	24.5	34.0	6.8	16.1	3.7	11.6	1.7	7.0	1.0
C	6.4	2.0	16.1	5.8	11.6	1.5	4.6	4.2	4.3	2.5	8.2	2.1	11.3	1.5	9.3	0.6
D	18.1	2.7	19.7	5.5	23.3	1.4	18.8	11.2	13.5	5.8	19.2	2.8	22.0	2.0	20.6	2.2
E	0.0	0.0	9.3	6.0	2.2	1.6	28.0	14.6	36.5	9.1	17.9	2.2	7.3	2.7	4.4	1.6
Santa Catalina Island																
502	97.9	4.7	79.3	22.5	85.1	14.2	84.9	26.9	100.0	0.0	86.0	15.9	83.1	14.6	84.3	12.7
522	3.5	6.1	11.7	14.2	7.5	12.1	15.6	20.2	0.0	0.0	2.8	4.8	9.1	10.2	8.8	9.9
523	0.0	0.0	20.9	29.6	3.7	5.3	2.3	3.2	0.0	0.0	15.5	1.7	9.3	12.4	8.2	11.0
524	0.0		6.8		20.4		0.0		0.0		0.0		14.7		13.0	
528	0.0	0.0	4.9	3.0	6.0	5.0	6.1	12.2	0.0	0.0	7.7	9.0	6.0	2.3	5.6	2.0
Santa Cruz Island																
641	0.0	0.0	32.3	28.0	22.3	22.9	26.8	22.7	3.3	4.6	2.4	3.3	24.3	22.0	24.3	22.0
643			6.7		6.8		0.0		0.0		0.0		6.4		6.4	
648	0.0	0.0	25.8	30.0	15.5	19.8	0.5	0.6	14.8	21.0	10.7	15.2	14.0	16.7	14.0	16.7
655	100.0	0.0	56.0	24.7	70.1	17.1	73.0	22.5	90.8	12.2	93.3	8.8	68.8	16.3	68.8	16.3
Santa Rosa Island																
617	0.0	0.0	54.2	24.5	66.7	30.2	26.6	36.9	33.4	14.7	26.4	12.6	56.7	20.0	56.6	20.0
621	0.0	0.0	26.1	18.4	6.6	7.4	17.3	17.5	24.1	17.5	15.4	9.4	16.5	11.0	16.4	11.0
622			0.0		0.0		0.4		0.0		0.0		0.2		0.2	
624	100.0	0.0	19.7	19.3	26.7	28.1	55.9	49.1	42.6	23.6	57.0	17.0	26.8	24.5	26.9	24.5
625A			0.0		0.0		0.4		0.0		5.9		0.4		0.4	
<b>Northern elephant seal</b>																
San Clemente Island																
406							100.0	0.0	66.7	57.7	100.0	0.0	86.7	23.1	86.7	23.1
407							0.0		100.0		0.0		40.0		40.0	
San Miguel Island																
A			11.5	11.9			1.3	1.1	4.3	1.1	9.9	9.8	5.3	2.6	5.3	2.6
B			2.3	2.7			1.2	1.0	2.1	1.5	3.5	3.8	2.2	1.5	2.2	1.5
C			8.2	9.7			10.7	6.9	10.6	2.0	11.9	6.4	11.1	1.5	11.1	1.5
D			0.3	0.7			2.9	1.4	1.6	1.3	0.4	0.4	1.5	1.0	1.5	1.0
E			4.0	6.9			3.6	2.1	4.4	0.9	4.7	3.7	4.5	1.3	4.5	1.3
F			7.7	9.6			6.4	4.6	3.1	0.7	2.4	1.1	3.4	0.4	3.4	0.4
G			15.4	7.3			10.0	3.2	8.6	1.9	9.2	2.9	8.7	1.5	8.7	1.5
H			18.6	10.9			29.1	14.1	32.2	8.1	34.7	13.7	32.5	3.6	32.5	3.6
I			14.2	14.9			12.1	10.3	9.5	7.6	3.0	2.3	8.3	6.6	8.3	6.6
J			5.6	7.2			10.0	2.3	14.3	4.6	13.2	3.0	13.7	3.0	13.7	3.0
K			6.3	9.0			8.2	5.5	3.5	2.4	1.9	2.0	3.5	1.8	3.5	1.8
L			2.8	2.5			1.5	1.0	2.3	0.8	3.2	1.2	2.6	0.2	2.6	0.2
M			4.5	6.4			2.5	1.2	5.1	2.2	3.8	4.5	3.8	0.2	3.8	0.2
N			0.8	1.5			1.1	1.0	0.5	0.3	0.2	0.3	0.6	0.4	0.6	0.4
San Nicolas Island																
A			5.5	6.3			0.9	0.7	2.3	2.5	3.1	2.4	2.4	2.2	2.4	2.2

Table 7. (Continued)

Island /Area	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD
<b>Northern elephant seal (Continued)</b>																
San Nicolas Island (Continued)																
B			0.9	1.8			0.4	0.5	1.5	0.7	4.0	6.1	2.6	2.7	2.6	2.7
C			3.3	7.5			3.2	3.4	3.7	1.4	2.2	1.0	3.4	1.3	3.4	1.2
D			11.0	13.6			4.9	5.0	3.9	2.1	4.5	1.6	4.6	1.3	4.6	1.3
E			15.5	20.6			15.8	13.3	12.7	4.4	14.8	4.4	14.1	3.4	14.0	3.3
F			3.7	5.2			2.8	2.6	2.2	1.8	1.4	1.8	2.4	1.3	2.4	1.3
G			0.7	1.6			2.1	2.8	0.5	0.5	0.8	0.5	0.8	0.4	0.8	0.4
H			9.4	10.3			0.8	0.7	1.0	1.3	0.5	0.6	1.0	0.5	1.0	0.5
I			7.3	10.5			1.0	1.4	1.9	1.2	3.0	2.8	2.2	1.4	2.2	1.4
J			3.3	7.5			0.2	0.4	1.6	1.0	3.1	2.2	1.9	1.1	1.9	1.1
K			14.5	14.9			46.5	32.0	31.3	7.6	27.5	10.9	29.2	5.1	29.2	5.2
L			3.7	6.4			1.9	0.4	0.3	0.4	0.0	0.0	0.5	0.1	0.5	0.1
M			2.1	4.8			9.1	8.1	17.0	5.6	14.9	4.7	16.0	3.4	16.0	3.4
N			0.0	0.0			3.8	3.4	4.2	2.0	1.5	0.6	3.5	1.7	3.5	1.7
O			0.0				4.1		8.9		7.5		7.6		7.6	
Q			23.3	25.6			8.7	5.8	16.8	2.2	19.9	3.5	17.0	2.6	17.0	2.6
Santa Barbara Island																
A			0.0				0.0		83.3	23.6	50.0	70.7	62.5	53.0	62.5	53.0
B			100.0				0.0		0.0				9.1		9.1	
D			50.0	70.7			100.0	0.0	83.3	33.3	100.0	0.0	91.5	11.8	91.5	11.8
Santa Rosa Island																
611			0.0				2.1		0.0		0.0		0.3		0.3	
621			100.0				5.2		6.9		2.9		6.1		6.1	
622			0.0				12.4		25.5		23.9		23.7		23.7	
624			0.0				34.0		24.1		13.8		23.5		23.5	
626			0.0				14.4		17.8		29.0		19.2		19.2	
625A			0.0				23.7		15.9		22.5		17.9		17.9	
625B			0.0				7.2		1.0		0.0		1.6		1.6	
625C			0.0				1.0		8.8		8.0		7.7		7.7	
<b>Pacific harbor seal</b>																
Anacapa Island																
680																100.0
Richardson Rock																
103																100.0
San Clemente Island																
402																11.2
404																55.2
406																34.5 21.9
407																1.7
411																31.5 26.2
San Miguel Island																
A																5.1 3.4
B																3.1 3.3
C																6.1 3.5
D																12.1 5.0
E																11.0 1.9

Table 7. (Continued)

Island /Area	Pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD	Mean %	SD
<b>Pacific harbor seal (Continued)</b>																
San Miguel Island (Continued)																
F															4.9	0.5
G															2.3	3.7
H															2.7	1.9
J															17.5	4.4
L															11.1	5.0
M															2.2	1.2
N															26.4	8.0
San Nicolas Island																
A															1.8	1.3
C															8.7	5.2
D															4.8	3.1
E															5.0	5.0
F															5.0	2.9
I															1.9	1.9
J															2.4	0.5
K															0.3	
L															21.2	14.4
M															7.7	5.2
N															17.7	5.8
O															6.2	
Q															35.2	6.5
Santa Barbara Island																
A															25.0	
B															41.7	19.6
C															16.7	7.9
D															52.8	21.0
Santa Cruz Island																
643															15.5	
647															1.1	
655															5.0	
656															78.5	
Santa Rosa Island																
615															33.6	
618															7.7	
624															22.3	
626															36.4	
<b>Steller sea lion</b>																
San Nicolas Island																
H			100.0												100.0	100.0

<sup>1</sup>Only one northern elephant seal census conducted at Santa Rosa Island, in 2015.

Table 8. Number of California sea lions, northern elephant seals, and Pacific harbor seals counted by age/sex class and category total from photographs of haulout sites within Area H at San Miguel Island taken during aerial photographic surveys conducted in July 2011-2015. No counts obtained for blank cells and only sites with animals are included. Refer to Figure 5 for location of haulout sites.

Haulout site	Year	Pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-Pup total	Total
<b>California sea lion</b>									
40	2011	1,988	77	1,329	11	9	99	1,525	3,513
	2012	2,055	164	1,286	7	5	127	1,589	3,644
	2013	1,366	290	1,287	6	8	120	1,711	3,077
	2014	1,600	57	1,148	1	7	141	1,354	2,954
	2015	999	66	1,049	0	12	89	1,216	2,215
41	2011	731	33	559	1	1	41	635	1,366
	2012	879	67	524	0	1	42	634	1,513
	2013	635	82	532	0	2	43	659	1,294
	2014	772	10	482	0	0	50	542	1,314
	2015	425	16	373	0	7	43	439	864
52	2011	527	52	634	0	1	45	732	1,259
	2012	498	76	461	1	0	35	573	1,071
	2013	377	62	606	1	3	35	707	1,084
	2014	396	47	494	0	0	48	589	985
	2015	285	28	434	4	2	40	508	793
53	2011	1,339	131	1,347	7	10	111	1,606	2,945
	2012	1,649	207	1,140	10	10	95	1,462	3,111
	2013	1,071	199	1,359	7	10	99	1,674	2,745
	2014	1,335	79	1,024	1	4	108	1,216	2,551
	2015	944	83	1,048	25	16	98	1,270	2,214
54	2011	6,359	203	4,145	67	112	307	4,834	11,193
	2012	6,971	436	3,626	142	83	281	4,568	11,539
	2013	4,882	829	3,878	93	86	275	5,161	10,043
	2014	5,403	162	2,809	30	85	281	3,367	8,770
	2015	4,344	127	3,330	87	168	312	4,024	8,368
55	2011	166	63	320	0	0	35	418	584
	2012	152	119	241	0	0	24	384	536
	2013	116	162	423	1	8	28	622	738
	2014	123	148	513	0	0	39	700	823
	2015	61	15	218	8	1	24	266	327
56	2011	2,432	288	2,370	4	14	203	2,879	5,311
	2012	3,031	338	2,021	1	11	179	2,550	5,581
	2013	2,244	409	2,451	1	12	182	3,055	5,299
	2014	2,178	204	1,810	0	1	199	2,214	4,392
	2015	1,736	116	1,848	13	12	186	2,175	3,911
57	2011	99	17	156	0	0	19	192	291
	2012	102	33	124	0	1	16	174	276
	2013	67	42	183	0	4	14	243	310
	2014	82	35	142	0	0	29	206	288
	2015	56	11	85	1	0	16	113	169

Table 8. (Continued)

Haulout site	Year	Pups	Juveniles	Adult females	Young males	Sub-adult	Adult males	Non-Pup total	Total
<b>California sea lion (Continued)</b>									
58	2011	2,676	321	1,898	275	126	183	2,803	5,479
	2012	2,213	626	1,196	195	271	145	2,433	4,646
	2013	1,777	859	1,522	9	27	90	2,507	4,284
	2014	1,834	221	993	39	69	134	1,456	3,290
	2015	1,260	264	1,035	25	23	86	1,433	2,693
59	2011	421	5	310	0	0	29	344	765
	2012	414	29	256	0	0	29	314	728
	2013	372	23	301	0	2	28	354	726
	2014	415	5	265	1	2	32	305	720
	2015	308	4	222	0	0	22	248	556
60	2011	1,248	89	720	384	554	359	2,106	3,354
	2012	1,313	268	758	209	369	189	1,793	3,106
	2013	738	246	643	467	696	288	2,340	3,078
	2014	784	140	447	315	487	290	1,679	2,463
	2015	554	112	428	321	709	304	1,874	2,428
<b>Northern elephant seal</b>									
41	2012	0	2	0	0	0	0	2	2
52	2012	0	1	0	0	0	0	1	1
	2013	0	1	0	0	0	0	1	1
	2015	0	0	0	6	0	0	6	6
53	2012	0	1	0	0	0	0	1	1
	2014	0	0	0	1	0	0	1	1
	2015	0	0	0	6	0	0	6	6
54	2012	0	1	0	22	366	20	409	409
	2013	0	6	0	97	308	85	496	496
	2014	0	0	0	31	263	314	608	608
	2015	0	1	0	39	450	148	638	638
56	2012	0	0	0	2	2	0	4	4
	2013	0	1	0	1	8	0	10	10
	2014	0	0	0	0	2	2	4	4
	2015	0	0	0	10	5	0	15	15
58	2012	0	0	0	20	231	29	280	280
	2013	0	3	0	40	77	19	139	139
	2014	0	0	0	26	64	97	187	187
	2015	0	1	0	24	93	12	130	130
60	2012	0	1	0	0	15	10	26	26
	2013	0	6	0	2	11	5	24	24
	2014	0	1	0	1	5	3	10	10
	2015	0	0	0	10	5	0	15	15
<b>Pacific harbor seal</b>									
40	2013								1
54	2015								1
56	2012								21
	2013								13
	2014								17

Table 8. (Continued)

Haulout site	Year	Pups	Juveniles	Adult females	Young males	Sub-adult	Adult males	Non-Pup total	Total
<b>Pacific harbor seal (Continued)</b>									
57	2012								6
	2014								4

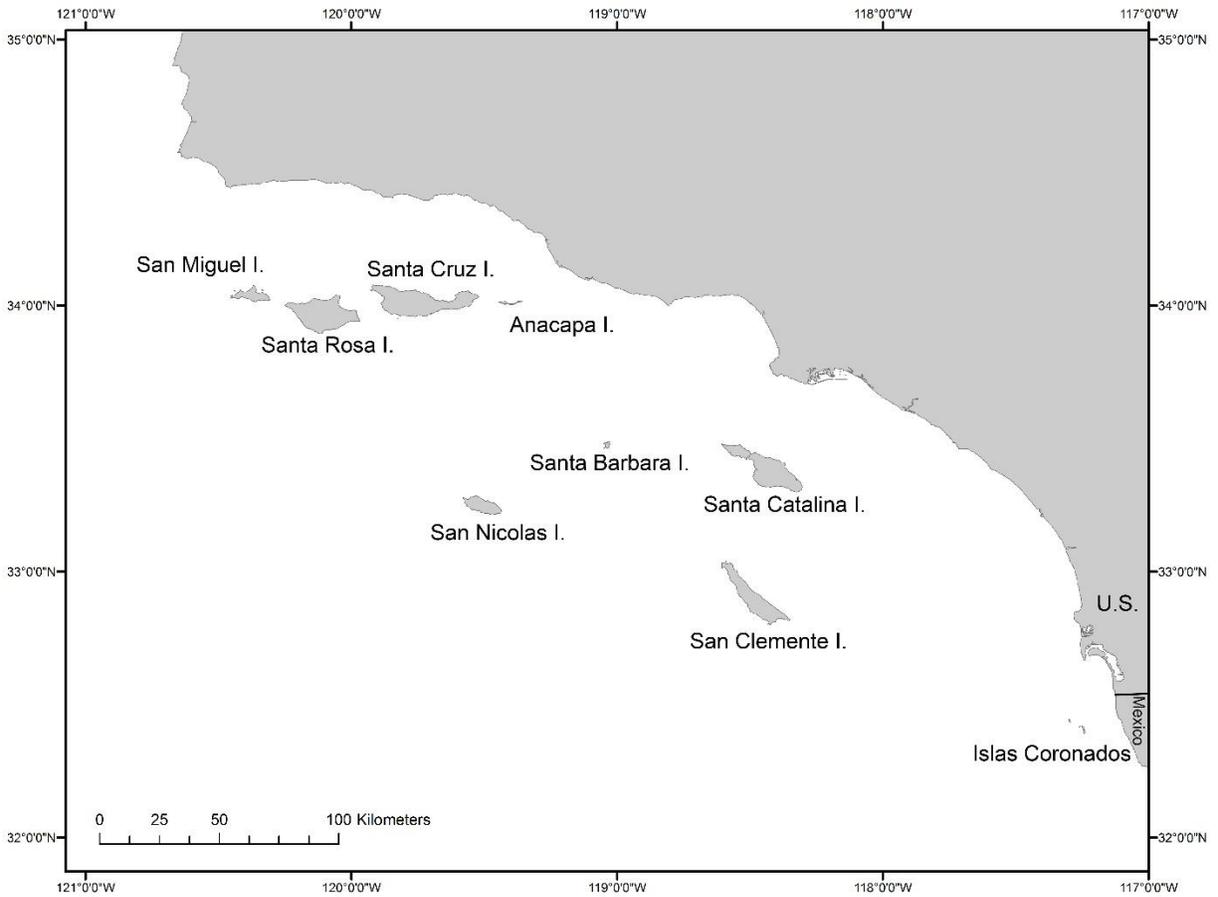


Figure 1. The Channel Islands within the Southern California Bight (SCB). Not shown are Castle Rock (located 1 km from the NW shoreline of SMI), Richardson Rock (located 10 km NW from Point Bennett, SMI), and Gull Island (located 1.4 km from Punta Arena, SCruzI).



Figure 2. Partenavia P-68 Observer used by SWFSC to conduct aerial photographic surveys of pinnipeds at the Channel Islands.

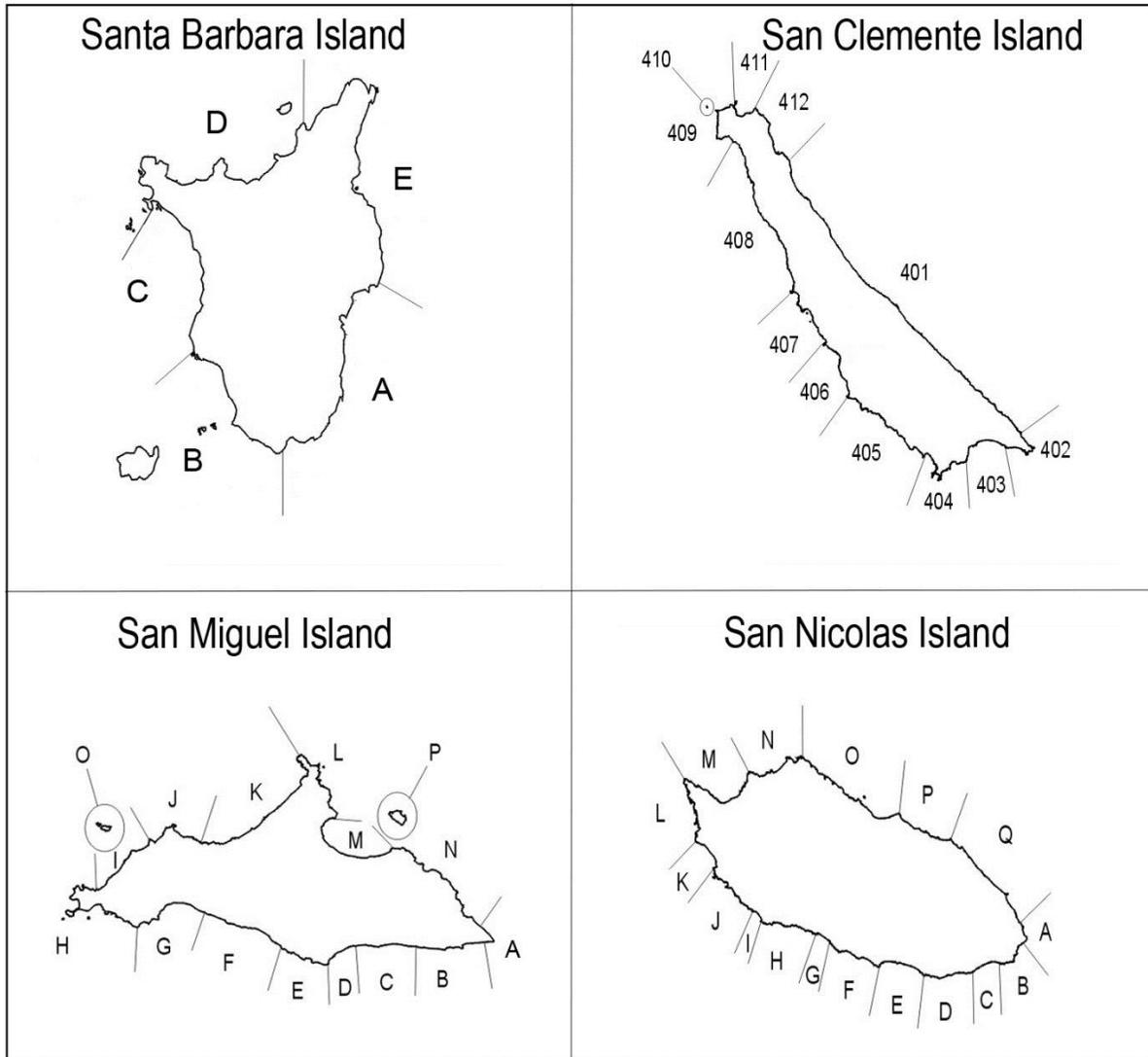


Figure 3. Area codes for Santa Barbara Island, San Clemente Island, San Miguel Island, and San Nicolas Island. Area codes for San Clemente Island are from Bonnell et al. (1980). Refer to Appendix 1 for geographical positions (i.e., latitude and longitude) of area boundaries.

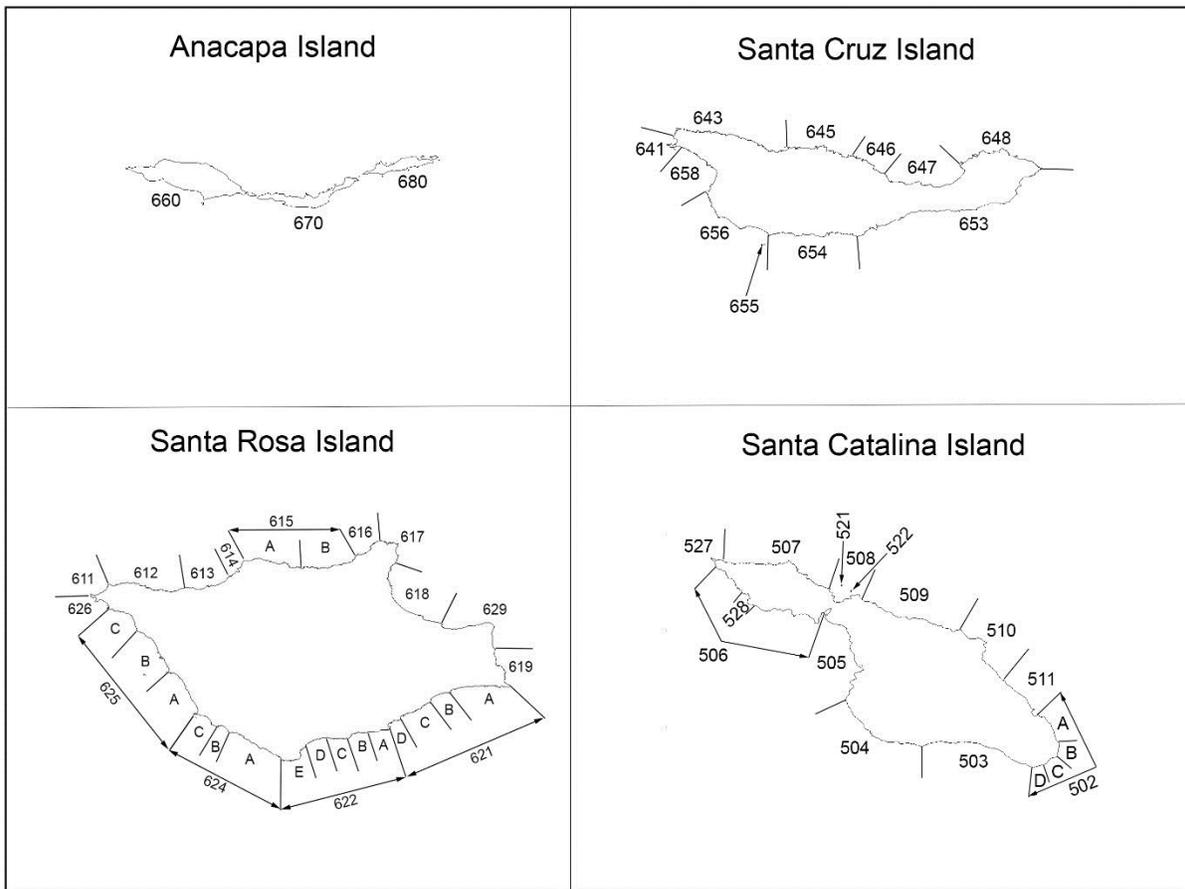


Figure 4. Area codes for Santa Catalina Island, Santa Cruz Island, Anacapa Island, and Santa Rosa Island from Bonnell et al. (1980). Areas 615, 621, 622, 624, and 625 at Santa Rosa Island and area 502 at Santa Catalina Island (Bonnell et al., 1980) were divided into subareas. Area 502C at Santa Catalina Island includes area 523 from Bonnell et al. (1980). Refer to Appendix 1 for geographical positions (i.e., latitude and longitude) of area boundaries.

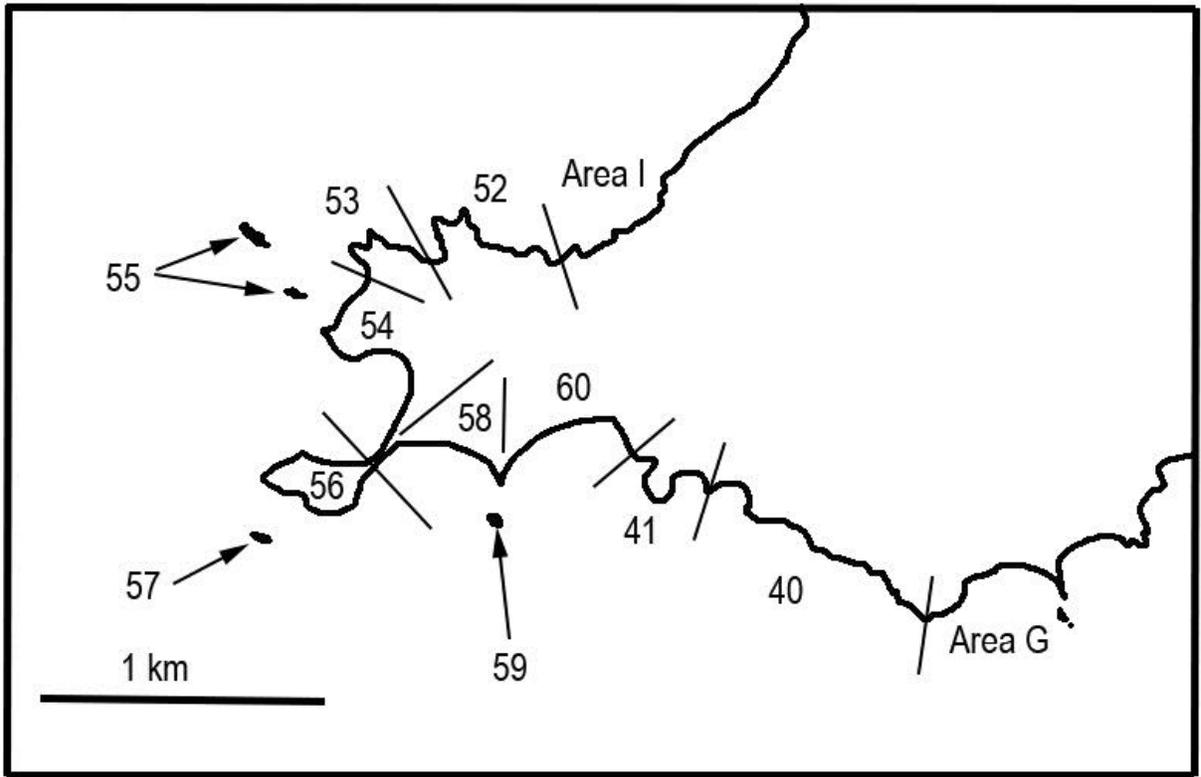
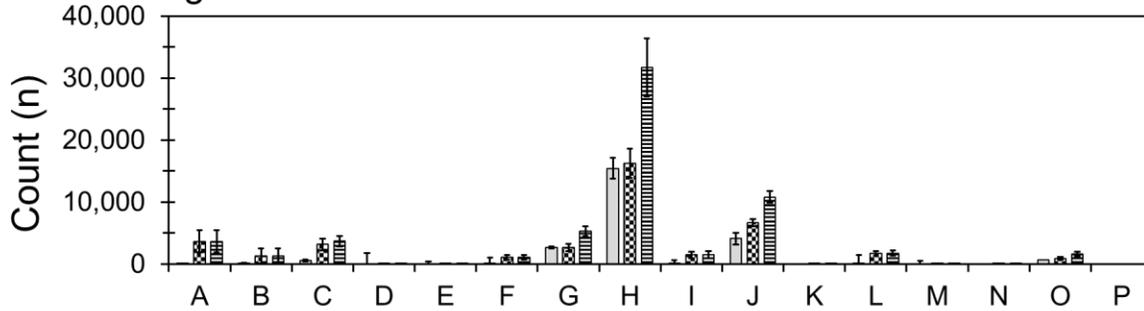
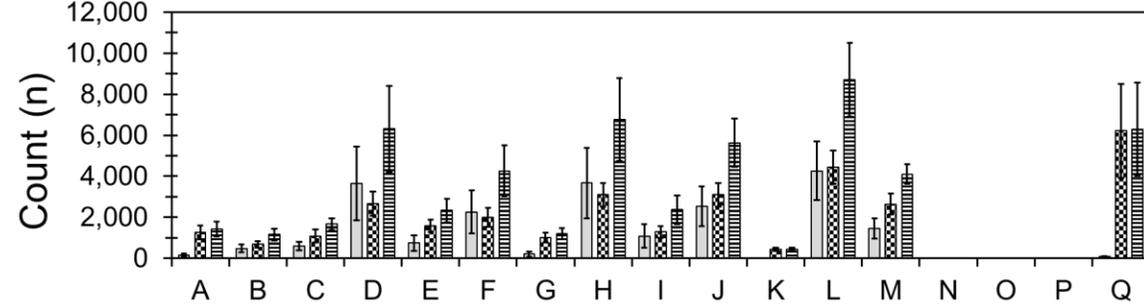


Figure 5. Haulout site codes within Area H (Point Bennett and southwest shoreline) at San Miguel Island, California.

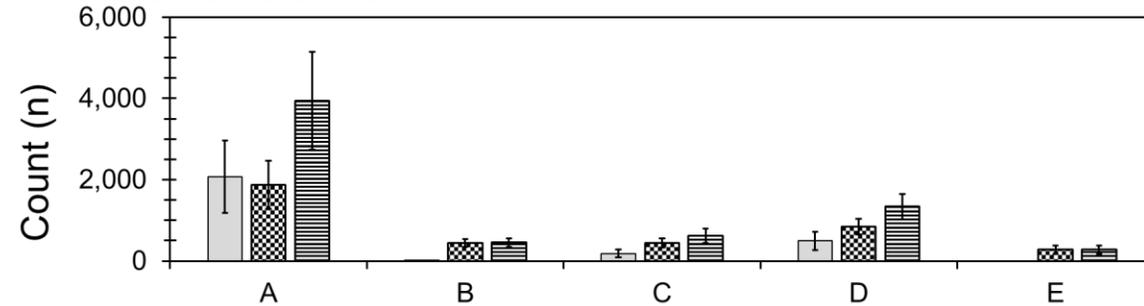
A. San Miguel Island



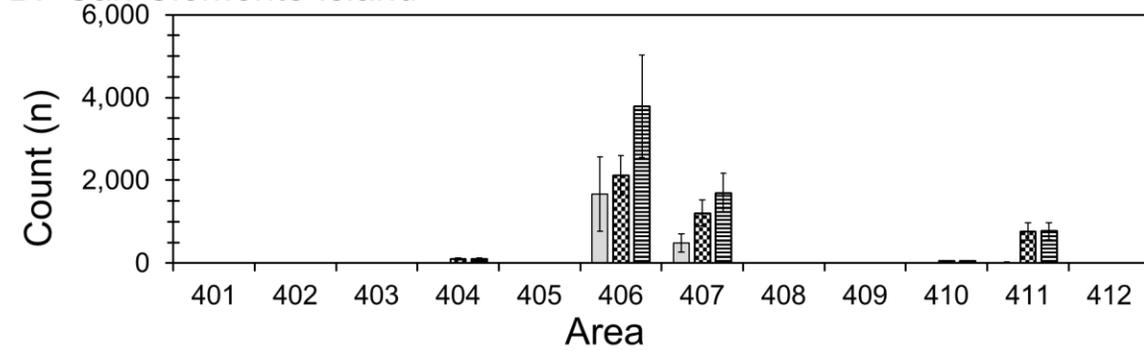
B. San Nicolas Island



C. Santa Barbara Island



B. San Clemente Island



□ Pups    ▣ Non-pups    ▤ Total

Figure 6. Mean number of California sea lion pups, non-pups, and total (pups + non-pups) counted ( $\pm 1$  SD) at areas of (A) San Miguel Island, (B) San Nicolas Island, (C) Santa Barbara Island, and (D) San Clemente Island, California during July 2011-2015. Refer to Figure 3 for location of areas.

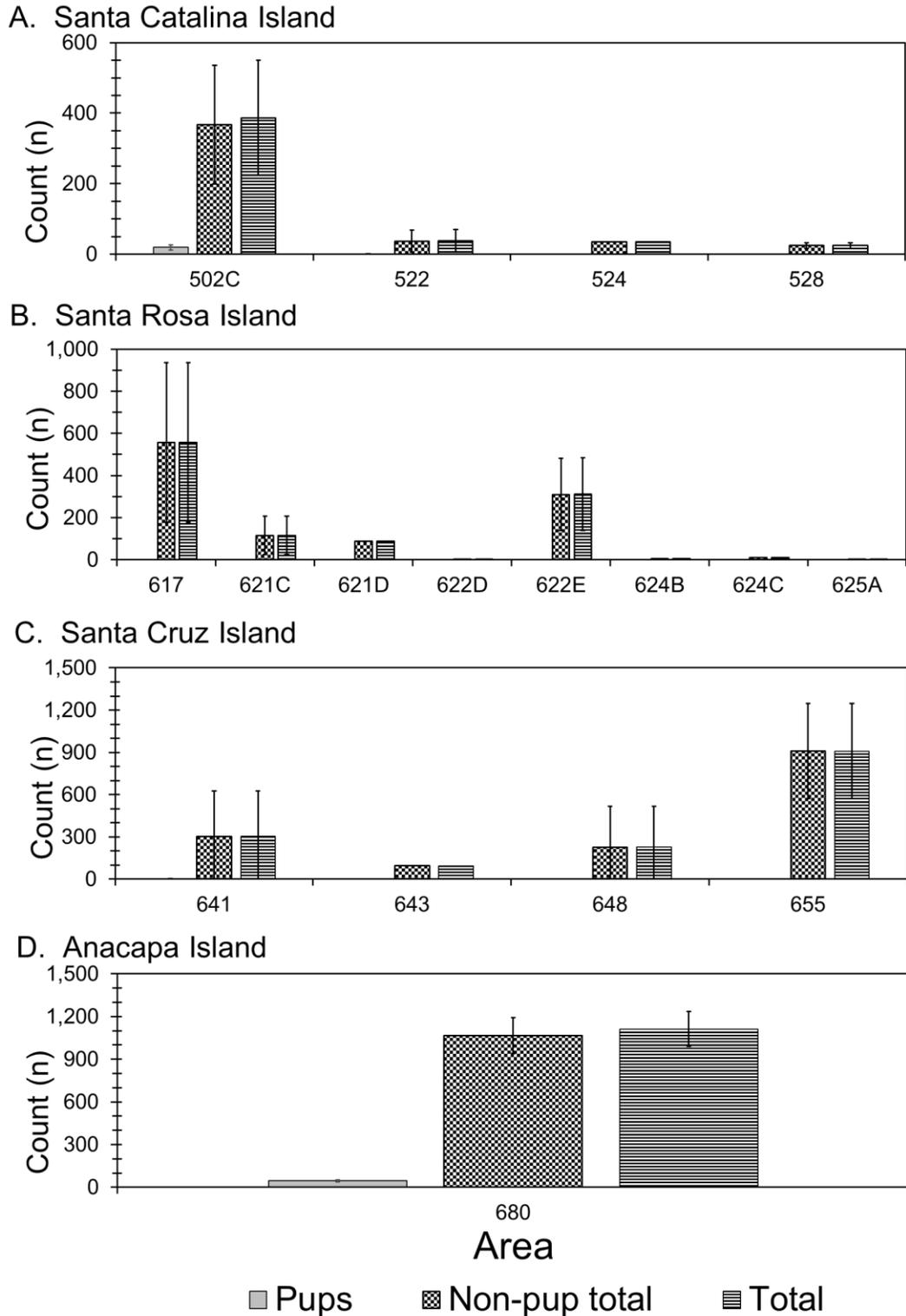
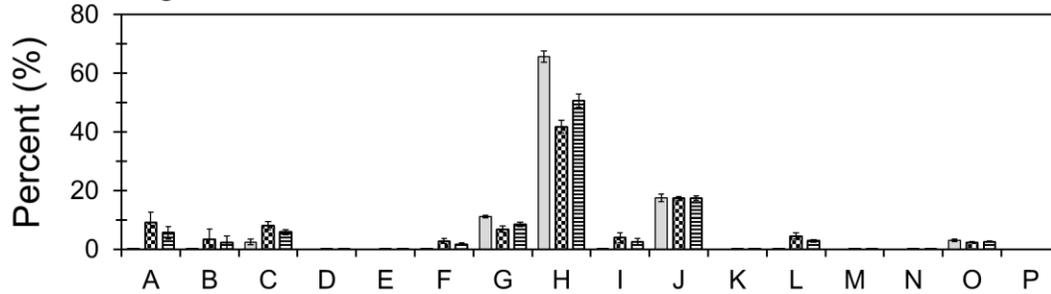


Figure 7. Mean number of California sea lion pups, non-pups, and total counted ( $\pm 1$  SD) at areas of (A) Santa Catalina Island, (B) Santa Rosa Island, (C) Santa Cruz Island, and (D) Anacapa Island, California during July 2011-2015. Only areas with sea lions are shown. Refer to Figure 4 for location of areas.

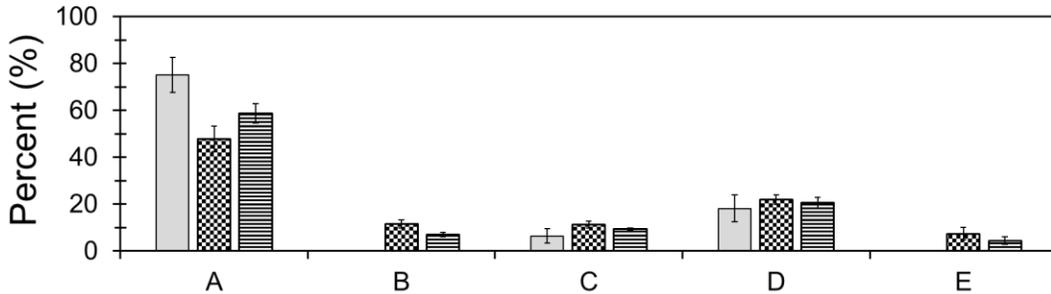
A. San Miguel Island



B. San Nicolas Island



C. Santa Barbara Island



D. San Clemente Island

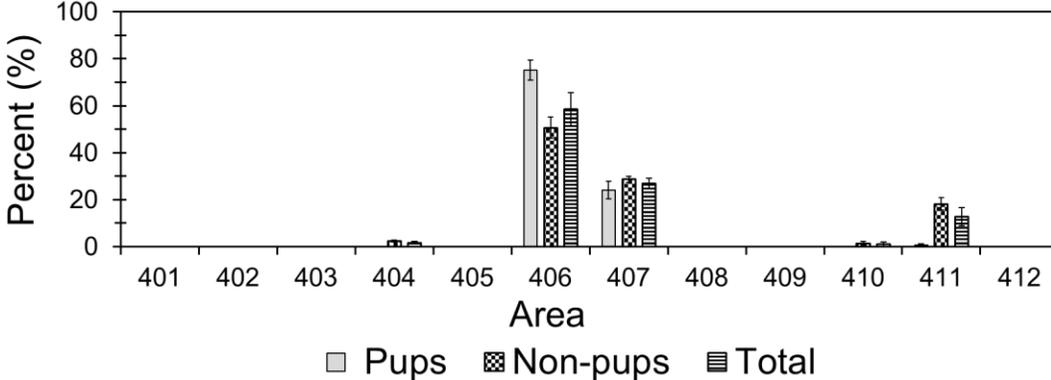
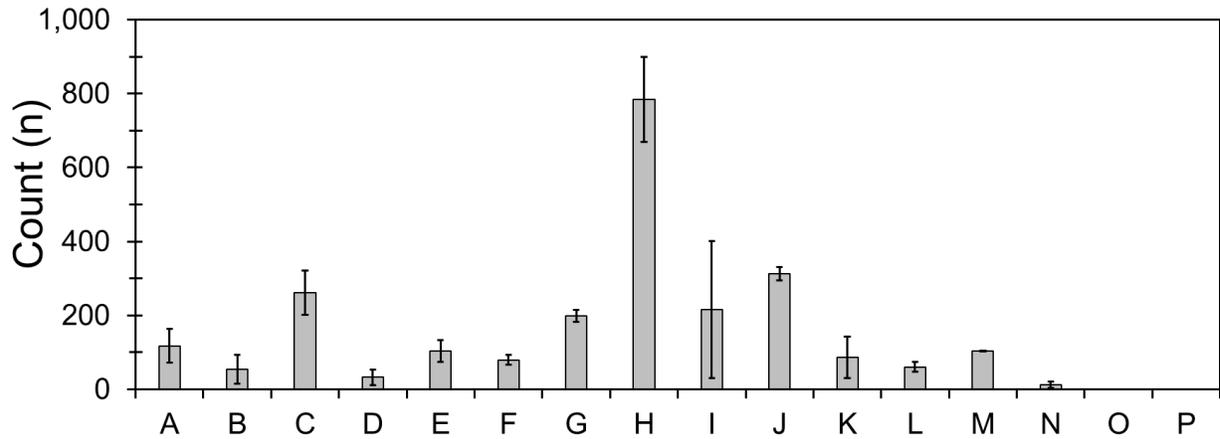
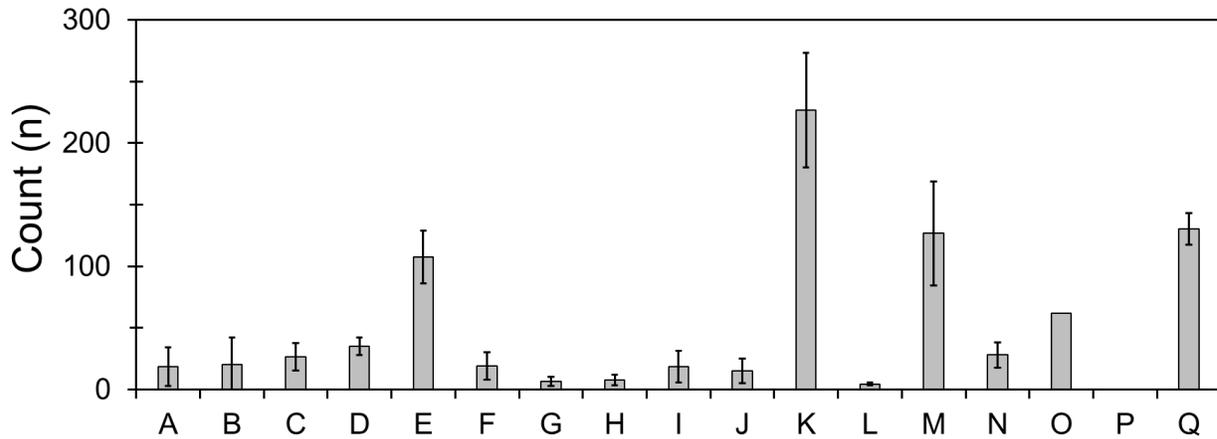


Figure 8. Mean percentage distribution ( $\pm 1$  SD) of California sea lion pups, non-pups, and total (pups + non-pups) counted at areas of (A) San Miguel Island, (B) San Nicolas Island, (C) Santa Barbara Island, and (D) San Clemente Island, California during July 2011-2015. Refer to Figure 3 for location of areas.

**A. San Miguel Island**



**B. San Nicolas Island**



**C. Santa Rosa Island**

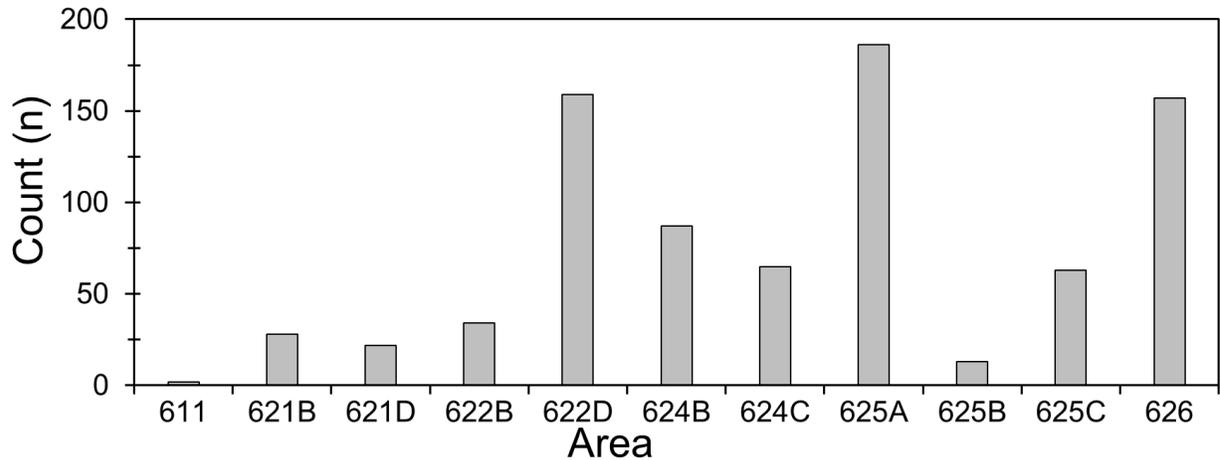
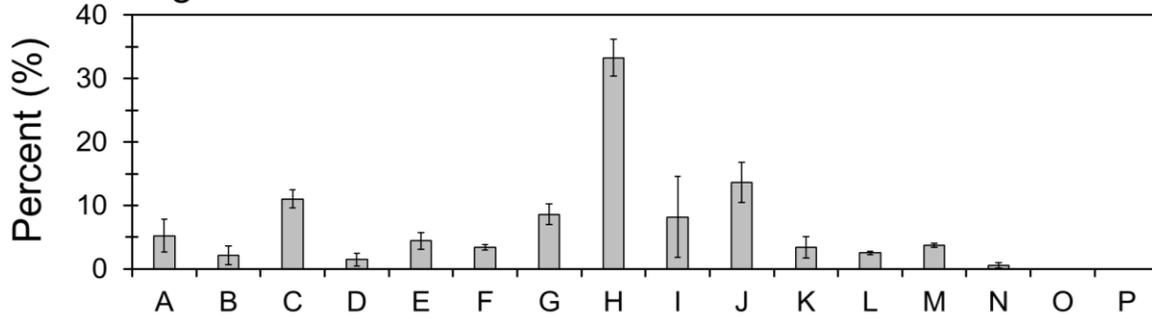
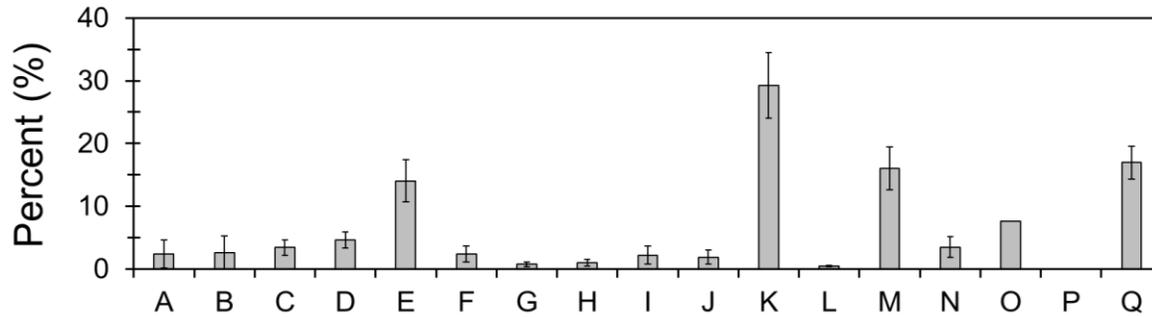


Figure 9. Mean number of northern elephant seals counted ( $\pm 1$  SD) at areas of (A) San Miguel Island and (B) San Nicolas Island, California during July 2011-2015; and (C) number of northern elephant seals counted at areas of Santa Rosa Island, California in July 2015 (only areas with seals are shown for Santa Rosa Island). Refer to Figures 3 and 4 for location of areas.

A. San Miguel Island



B. San Nicolas Island



C. Santa Rosa Island

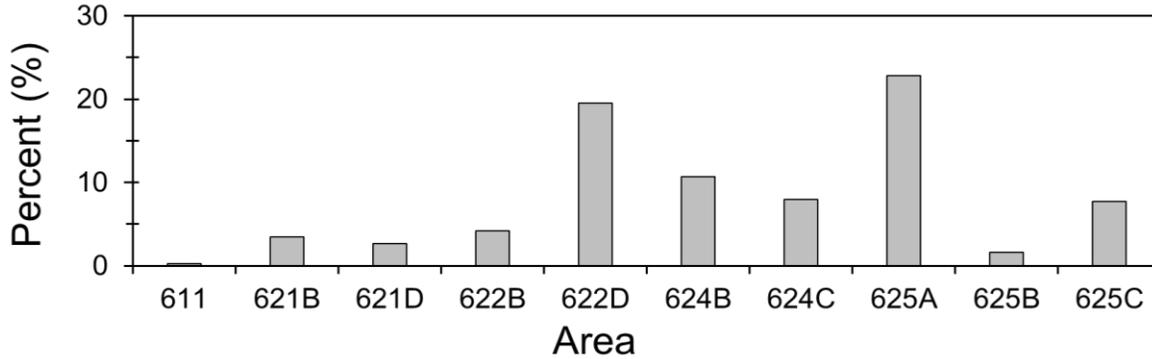
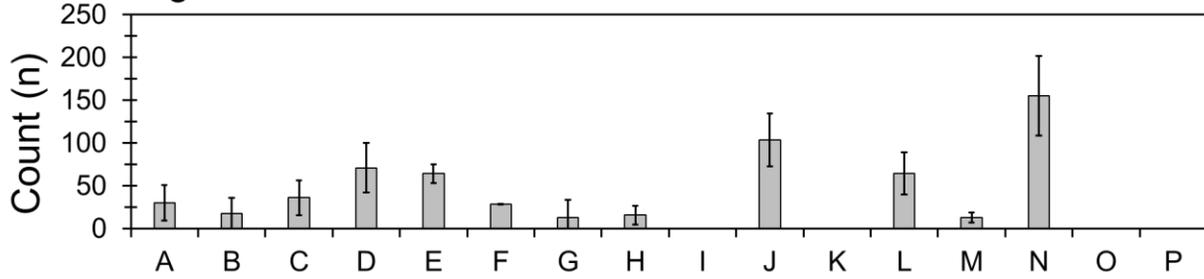
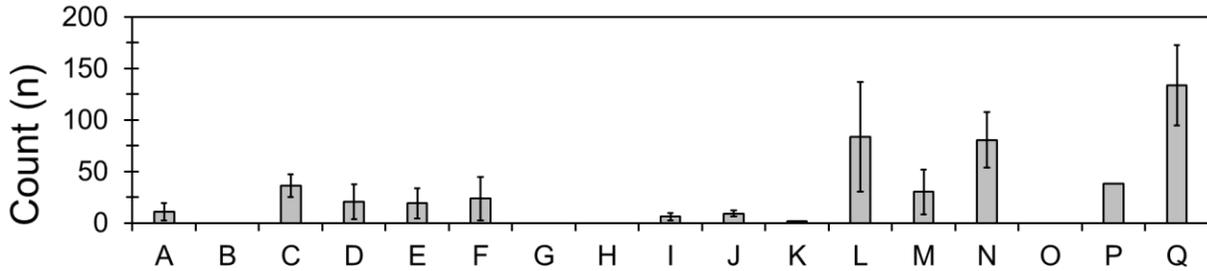


Figure 10. Mean percentage ( $\pm 1$  SD) of northern elephant seals counted at areas of (A) San Miguel Island and (B) San Nicolas Island, California during July 2011-2015; and (C) percentage of northern elephant seals counted at areas of Santa Rosa Island, California in July 2015 (only areas with seals are shown for Santa Rosa Island). Refer to Figures 3 and 4 for location of areas.

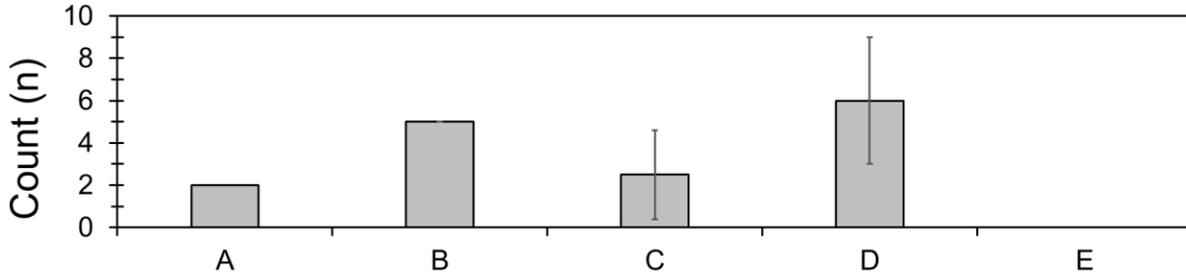
A. San Miguel Island



B. San Nicolas Island



C. Santa Barbara Island



D. San Clemente Island

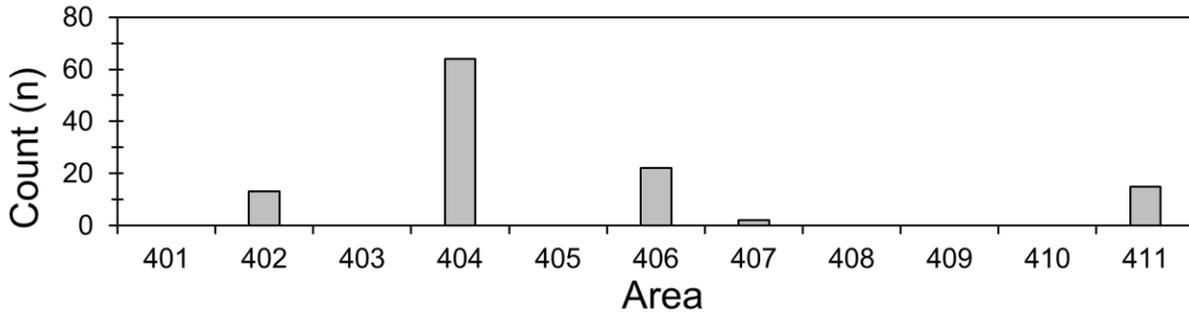
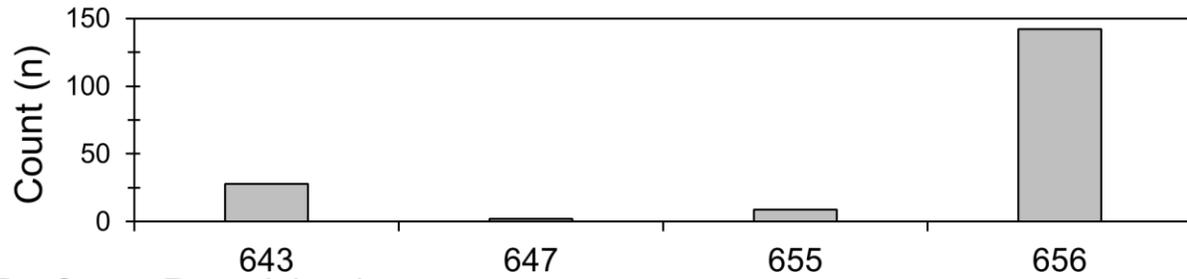


Figure 11. Mean number of Pacific harbor seals counted ( $\pm 1$  SD) at areas of (A) San Miguel Island, (B) San Nicolas Island, and (C) Santa Barbara Island, California during July 2011-2015, and counts of Pacific harbor seals at areas of (D) San Clemente Island, California in July 2015. Refer to Figure 3 for location of areas.

A. Santa Cruz Island



B. Santa Rosa Island

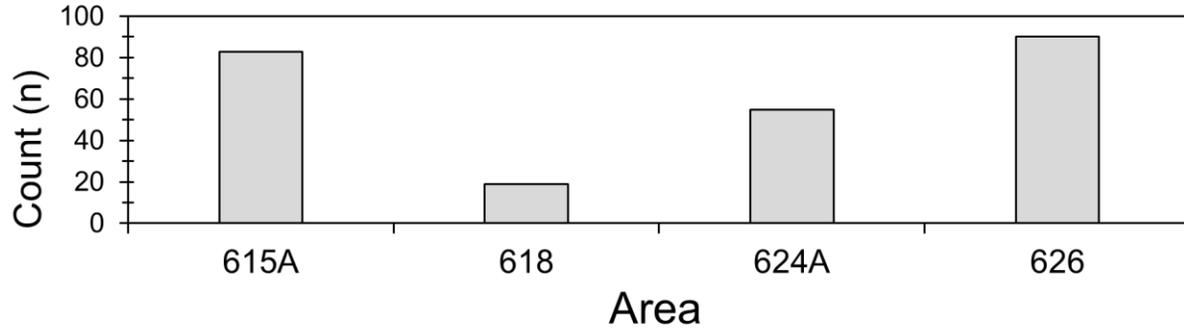


Figure 12. Number of Pacific harbor seals counted at areas of (A) Santa Cruz Island and (B) Santa Rosa Island, California during July 2015. Only areas with seals are shown. Refer to Figure 4 for location of areas.