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ABUNDANCE AND DISTRIBUTION OF PINNIPEDS AT THE CHANNEL ISLANDS IN SOUTHERN CALIFORNIA, CENTRAL AND NORTHERN CALIFORNIA, AND SOUTHERN OREGON DURING SUMMER 2016–2019

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Abundance and distribution of pinnipeds at the Channel Islands in southern California, central and northern California, and southern Oregon during summer 2016–2019

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ABSTRACT

Aerial photographic surveys of the coastline and offshore islands of southern California to southern Oregon were conducted during the summers of 2016–2019 to document breeding season abundance and distribution of California sea lions (*Zalophus californianus*), Steller sea lions (*Eumetopias jubatus*), northern fur seals (*Callorhinus ursinus*), and Guadalupe fur seals (*Arctocephalus townsendi*). Surveys also documented summer island-residence at the Channel Islands for northern elephant seals (*Mirounga angustirostris*) and Pacific harbor seals (*Phoca vitulina richardsi*). Age and sex counts were made for California sea lions, Steller sea lions, northern elephant seals, northern fur seals, and Guadalupe fur seals. The entirety of the survey area was *a-priori* subdivided into distinct regions to document intra-island and coastal distribution. The number of California sea lion pups observed increased from 36,039 in 2016 to 53,646 in 2019. Approximately 3,000 adult Steller sea lions were found in California and southern Oregon, but pup counts were about 2.3 times higher in Oregon. Northern fur seals were found at San Miguel Island (minimum 2,605 pups and 2,925 non-pups) and at the Farallon Islands (minimum 1,138 pups and 1,338 non-pups). Northern elephant seal counts at the Channel Islands ranged from 2,983 to 5,612 individuals. Pacific harbor seal counts at the Channel Islands, which are impacted by tide level, ranged from 1,980 in 2016 to 750 in 2019. One Guadalupe fur seal was found at San Nicolas Island in 2019.

INTRODUCTION

All pinniped species inhabiting U.S. waters are protected under the Marine Mammal Protection Act (MMPA) with some species provided additional protections under the Endangered Species Act (ESA). The National Marine Fisheries Service (NOAA Fisheries), under the MMPA, manages pinniped populations in U.S. waters. NOAA Fisheries censuses pinniped population “stocks”, conducts life history, genetic, and behavioral studies to provide assessment data for these species.

The U.S. Pacific coast is inhabited by six pinniped species, which are found at the Channel Islands in southern California, and on offshore islands and pinnacles, and along the mainland coast. At the Channel Islands in southern California, the rookeries and colonies found at San Miguel and San Nicolas islands contain the largest number of pinnipeds along the west coast of the U.S. and Mexico (Bonnell et al., 1980; Lowry and Maravilla-Chavez, 2005; Lowry et al., 2014; Lowry et al., 2017). In central California, Año Nuevo Island and associated Point, Point Reyes, and the Farallon Islands have the largest pinniped colonies. In southern Oregon, Rogue River Reef and Orford Reef have large colonies of Steller sea lions (Pitcher et al. 2007).

The most abundant pinnipeds of the U.S. west coast are California sea lions (*Zalophus californianus*), northern elephant seals (*Mirounga angustirostris*), and Pacific harbor seals (*Phoca vitulina richardsi*) (Lowry et al., 2008; Lowry et al., 2014; Lowry et al., 2017). All three are found year-round at the Channel Islands and are common elsewhere along the coast. Populations of these species are not listed as depleted under the MMPA or as threatened or endangered under the ESA.

The largest northern fur seal (*Callorhinus ursinus*) colonies are found in the Pribilof

Islands and other islands in the Bering Sea (Gentry 1998; Gelatt et al., 2015). In the U.S., breeding rookeries are found at San Miguel Island in the Channel Islands and at the Farallon Islands in central California, making up the "California stock" of northern fur seal (Muto 2019). This population is not currently depleted under the MMPA or listed under the ESA.

Steller sea lions (*Eumetopias jubatus*) are rarely found at the Channel Islands but have large colonies from central California to Alaska, with the highest densities occurring along the Alaskan coastline (Pitcher et al. 2007). Steller sea lions along the U.S. west coast are part of "Eastern U.S. stock" under the MMPA and the eastern Distinct Population Segment (DPS) under the ESA. They are not depleted (MMPA) or listed (ESA).

Guadalupe fur seals (*Arctocephalus townsendi*) are rare visitors to the Channel Islands and are primarily found south of the USA-Mexico border (Bonnell et al. 1980; Garcia-Aguilar, 2018), however increased numbers of stranded animals in U.S. waters in recent years have resulted in NOAA declaring an Unusual Mortality Event (UME) for this stock (NOAA 2021)[1]. Guadalupe fur seals are listed as threatened under the ESA and depleted under the MMPA.

NOAA Fisheries' Southwest Fisheries Science Center (SWFSC) conducts aerial photographic surveys to census pinniped populations in California and southern Oregon to monitor population distribution, trends, and abundance of U.S. populations (Orr et al. 2012; NMFS 2013; Lowry et al. 2017a; Laake et al. 2018). Survey effort for California sea lions, Steller sea lions, and northern fur seals is generally concentrated in mid-summer months, just after most species have finished annual pupping and pup numbers are at their maxima, providing a nearly complete pup census (population index). Northern elephant seals and harbor seals are also observed during these summer surveys, but these species have different reproductive cycles and so the survey data do not provide population indices. Rather, northern elephant seals are also censused during their winter breeding season (Lowry et al. 2002, 2014, 2019), and Pacific harbor seals in California are surveyed during their molt season in late-spring and early summer months (Lowry and Carretta 2003; Lowry et al. 2005 and 2008). However, due to funding limitations, the last population survey for elephant seals and harbor seals occurred in 2013 and 2012, respectively.

We report on aerial photographic surveys conducted between summer 2016 and 2019. The Channel Islands were surveyed every year during this period. Additional areas throughout California and southern Oregon were surveyed in some years. Surveys are used to document the distribution and abundance of pinnipeds hauled out at breeding rookeries, offshore islets, and reefs at the Channel Islands in southern California, and mainland coast from Point Conception, California, to Cape Arago, Oregon. Post survey imagery analysis provides estimates of both the total number of hauled out individuals of each species and general population demographic information.

[1]National Oceanic and Atmospheric Administration (NOAA). 2021. 2015–2021 Guadalupe Fur Seal Unusual Mortality Event in California, Oregon and Washington. https://www.fisheries.noaa.gov/national/marine-life-distress/2015-2021-guadalupe-fur-seal-unusual-mortality-event-california

METHODS

Study area

Aerial photographic surveys were conducted from the Channel Islands in southern California to Cape Arago, Oregon (Figure 1). All islands, rocks, pinnacles, islets, and mainland coastal zones commonly used by pinnipeds were surveyed and photographed. The survey effort includes all of the main Channel Islands (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)) and small islets utilized by pinnipeds including 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). Pinniped counts for Castle Rock are included in counts of SMI and counts for Gull Island are included in counts of SCruzI.

Surveys at the Channel Islands were optimized for monitoring CSLs and were conducted annually from July 2016 through July 2019, with additional surveys flown in August 2018. Surveys between Point Conception and Cape Arago, which were optimized for counting California sea lions and Steller sea lions, were conducted in July of 2016 and 2017, and at Año Nuevo Island and the Farallon islands in late-June 2018. The continental coast within the southern California section was not surveyed due to extremely low abundance of CSLs in that area and safety concerns of flying at low level in a large metropolitan coastal area.

Survey methods

Aerial photographic surveys were conducted with a twin-engine, high-winged Partenavia P-68 Observer model aircraft (Figure 2), but a Partenavia P-68 standard model aircraft was also used in June and July 2018. The aircraft was flown at a ground speed of 185 km/h (100 knots) and at 244 m (800 ft.) altitude. However, at SBI and at the Farallon Islands, the aircraft was flown at approximately 427 m (1400 ft.) due to seabird colony restrictions. The low altitude and lens configuration ensured that pinnipeds could be detected on rocky substrates (especially when animals were wet and darkly colored), aided in identification of species and age/sex classes, and enabled accurate counts of all species from aerial photographs. Multiple overlapping photographic passes were made 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. Harbor seal counts are not optimized, unless the survey occurs at low tide.

Pinnipeds were counted from vertical aerial photographs taken with a Canon EOS 1Ds Mark III, full-frame 21.1 megapixel digital single lens reflex (DSLR) camera mounted with either a Zeiss 85mm or a Zeiss 135mm lens. Image motion compensation was achieved by using a custom-made rocking mechanism in the camera mount manufactured by Aerial Imaging Solutions[2]. The focus ring of the Zeiss 85mm and 135mm lenses were immobilized with tape when focused at 244 m and 427 m, respectively. The camera was connected to a laptop computer

[2] Aerial Imaging Solutions, LLC, 5 Myrica Way, Old Lyme, CT 06371. info@aerialimagingsolutions.com

which was connected to a GPS receiver. Software developed by Aerial Imaging Solutions controlled the camera's forward motion compensation mechanism and fired the camera when triggered. A video camera and monitor provided a live feed through the camera's viewfinder. For each photograph, the computer recorded to csv (comma separated value) files the focal length of the lens, latitude, longitude, date, and time the photograph was taken.

The DSLR camera was attached to a gimbal camera-mount facing 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 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, which were then sent to Adobe Photoshop Creative Cloud 2015 for creating photographic mosaics from multiple overlapping digital photographs of beach- and rock-sections. Digital photos were viewed on a 27-inch Dell ultra-sharp computer monitor while processing. While creating the mosaics, 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. Age/sex class categories were manually counted using the count tool in Adobe Photoshop with each animal marked with a unique colored dot and number. Adobe Photoshop software maintained a running total of each age/sex class category for each pinniped species. The total counts for each species age/sex class category were manually 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 and counting categories

Identification of pinnipeds from aerial photographs and age-sex class descriptions are described in Lowry et al. (2017a and 2017b). Age/sex class counts were made for elephant seals, California sea lions, Steller sea lions, and northern fur seals, but not for Pacific harbor seals. The following age/sex classes were delineated to the best extent possible: (1) live pups, (2) dead pups, (3) juveniles, (4) adult females, (5) young males, (6) sub-adult males, and (7) adult males

Intra-island and mainland coastal distribution

The perimeter of each of the Channel Islands was divided into small area-coded units to describe intra-island distribution of elephant seals, California sea lions, Pacific harbor seals, northern fur seals, Steller sea lions, and Guadalupe fur seals. These area-code units followed

either 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 it is densely populated by various pinniped species whose distribution varies within that area.

The California coast was divided into three sections: (1) southern California, which includes all Channel Islands (the mainland coast and Coronado Islands immediately south of the border were excluded); (2) central California, which includes the mainland coastline, offshore rocks, and islands between Point Conception (34° 26.8' N, 120° 28.0' W) and Point Reyes (38°00.0' N, 123°00.0' W) and San Francisco Bay estuary; (3) northern California, which includes the continental coastline, offshore rocks, and islands between Point Reyes and the California-Oregon border (42° 0' N, 124° 12.7' W), and (4) southern Oregon from the California-Oregon border to Cape Arago (43° 18.5' N, 124° 24.5' W; Figure 1). Secondary, smaller strata within central and northern California were stratified into seven zones (zones A, B, and C in northern California; zones D, E, F, and G in central California; see Lowry and Forney (2005). Counts were summarized separately for each of the Channel Islands. The Farallon Islands were divided into South Farallon Islands and North Farallon Islands. Within San Francisco Bay Estuary, only CSLs at Pier 39 in San Francisco (37° 48.6' N, 122° 25.2' W) were surveyed during central California surveys.

Estimates

July and August 2018 adjustment

Issues with aircraft availability resulted in the 2018 survey of the Channel Islands being delayed (conducted in July and early August). Santa Barbara Island was surveyed in July and August. Other islands were surveyed either in July or in August. An effort was made to correct for the delayed timing (for comparability with other years), since sea lion abundance on the islands varies seasonally. The ratio of July:August counts for non-pups was calculated for SBI and applied to the other islands to estimate July counts from the August count data. This was found to severely over-estimate non-pup counts for July at SNI and SMI, and was therefore not used. Non-pup counts from August surveys are lower than other years because most sub-adult males and adult males had departed the rookery and are thus not comparable to counts in other years. For pups, the August counts were used, but they probably under-estimate pup production due to pre-August survey pup mortality and difficulty of detecting swimming pups.

Santa Barbara Island 2019

California sea lion, northern elephant seal, and Pacific harbor seal counts for Santa Barbara Island were not obtained in July 2019 due to technical difficulties. Estimates for those species were derived to make it possible to compare Channel Islands' annual totals and for estimating population trends and abundance of California sea lions. Harbor seal and elephant seal counts at SBI in 2019 were estimated from the average of July counts of each age-sex class obtained in July 2016–2018. California sea lions were estimated from ratios of counts for each age-sex class from Channel Islands obtained from July 2011–2017 surveys (Lowry et al. 2017a

and 2017b, Table 1 and 2). California sea lion age-sex classes in 2019 were estimated for SBI from the following equation:

$$n_{SBI,j,2019} = \overline{\left(\frac{n_{SBI,J,t}}{n_{other,J,t}}\right)} \times n_{other,j,2019}$$

where $n_{i,j,t}$ is the number of animals at location *i* that belong to age-sex *j* in year *t*. The locations (*i*) are SBI or other (non-SBI). The term $\overline{\left(\frac{n_{SBI,J,t}}{n_{other,J,t}}\right)}$ represents the average of yearly count ratios across years 2011 – 2017. This equation states that, for a given age-sex class, the ratio of n_{SBI}/n_{other} is constant across years and uses this assumption to find the unknown n_{SBI} in 2019 given the measured n_{other} in this year. Then, for each *j*, the total number of sea lions across all Channel Islands is $n_{SBI,j,2019} + n_{other,j,2019}$.

Correction to counts of live-pups from Año Nuevo Island and the Farallon Islands

California sea lions at Año Nuevo Island and the Farallon Islands were surveyed on June 26, 2018, six days prior to the peak pup count date of July 2. A logistic regression equation from Lowry et al. (2017a) was used to estimate the proportion of pups represented by the June 26 survey that would have been present on the July 2, 2018 peak. Error in the estimate was ignored because of the precision of the estimated proportion ($R^2 = 0.972$). Multiplying the number of live-pups counted prior to July 2 by the inverse of the predicted proportion (1/0.921) for June 26, 2018 yields an estimate at Año Nuevo Island of 908 pups from 836 counted and at the Farallon Islands of 1,281 pups from 1,180 counted.

Central and northern California pup estimates

Logistic power regression analysis (using CurveExpert Professional version 2.6.5) was used to estimate the number of pups in the U.S. population represented by Año Nuevo Island and the Farallon Islands (ANI+FI) in central California rookeries when no surveys were conducted in 2014, 2015, and 2019 (Figure 6). The logistic power regression model was fit to the ratio derived from the number of California sea lion pups counted at ANI+FI in central California rookeries to those counted at Channel Islands rookeries in southern California during 1992–2018 (Lowry et al. 2017a, 2017b, and data from this report). The equation, which incorporates the logistic power regression equation (Figure 6) from the model, estimates the number of pups in central and northern California within the U.S. population when central and northern California was not surveyed:

$$n_{CentNorthCA,t} = \left[\left(\frac{a}{1+\left(\frac{t}{b}\right)^{c}}\right) \times n_{ChannelIs,t}\right]_{ANI+FI,t} + \overline{n_{OtherCentCA,t}} + \overline{n_{NorthCA,t}}$$

where $n_{i,t}$ is the number of California sea lion pups at location *i* in year *t*. The locations (*i*) are Channel Islands (ChannelIs) and central and northern California (CentNorthCA), the latter of which includes: Año Nuevo Island plus the Farallon Islands (ANI+FI); other central California

haulouts (OtherCentCA); and northern California (NorthCA). The term $\left(\frac{a}{1+\left(\frac{t}{b}\right)^{c}}\right)$ is the logistic power regression where a = 0.054 with 95%CL = 0.01, b = 2015.596 with 95%CL = 0.96, c = -1528.756 with 95%CL = 575.03. The regression model describes the ratio of pups at ANI+FI to those at ChannelIs and how this ratio changed through time. Thus, the product of the regression model and $n_{\text{ChannelIs}}$ provides an annual estimate of $n_{\text{ANI+FI}}$. The $n_{\text{ANI+FI}}$ estimate is then added the mean of pups counted at other central California haulouts and at northern California to estimate the number of pups in central and northern California for year t. The term $\overline{\left(n_{OtherCentCA,t}\right)}$ represents the average of yearly pup counts at other central California haulouts (i.e., excluding ANI and FI) and the term $\overline{\left(n_{NorthCA,t}\right)}$ represents the average of yearly pup counts in northern California for surveys conducted in years 1992 – 2017. We used the equation to estimate number of pups in central and northern California from counts made at the Channel Islands in southern California during 2014, 2015, and 2019. However, it is recommended that the equation not be used beyond 2019 because the trajectory may change in the future and a new equation will need to be made from data collected after 2019.

RESULTS

California sea lions

Channel Islands

California sea lions were found at all Channel Islands during summer 2016 – 2019 (Table 1). The Channel Islands accounted for 95.2% to 97.0% of California sea lion pups and 72.4% to 78.3% of non-pups counted or estimated from surveys conducted over the entire survey area (Table 2). Estimated total numbers increased each year of the July surveys (Table 2). However, only 93,456 individuals were counted during the 2018 July/August surveys (Table 2), likely the result of decreased male presence at this later date.

SMI had the largest number of California sea lion pups and non-pups at the Channel Islands, followed by SNI, SBI, SCI, and other islands (Table 1, Figure 7 and 8). Together, SMI and SNI accounted for 86.8% to 90.1% of all pups counted within the study region (Table 3).

California sea lions were not uniformly distributed around the perimeter of each of the Channel Islands (Table 4; Figure 9). Area H at SMI had had the highest density of animals anywhere within the islands, although even within this area distribution was not even (Table 5). AI, SRI, SCruzI, and SCatI were sparsely populated by California sea lions (Table 4).

The largest number of pups (n = 51,094) and adult males (n= 7,267) were observed in 2019 (Table 2). The largest number of adult females were observed in 2016 (n = 46,809).

Central California

California sea lion pup counts at Año Nuevo Island and the Farallon Islands increased in 2016 – 2018 compared to previous counts obtained during surveys conducted in 1992 – 2013 (Lowry et al. 2017a). In 2016 and 2017, central California accounted for 3.0% and 4.4% of pups and 20.8% and 27.0% of non-pups counted within the study area, respectively. In 2018 and 2019,

this increased to 4.4% and 4.8% of pups in California. Zone E and D (Fig. 1) had the most individuals within central California (Table 6). The central California haulouts with the most California sea lions were located at Lion Rock, Pup Rock, and Pecho Rock within Zone G, Piedras Blancas lighthouse rocks within Zone F, Año Nuevo Island within Zone E, and at the Farallon Islands within Zone D (Appendix 2).

Northern California

Between 464 (2017) and 746 (2016) California sea lions were counted during northern California surveys (Table 2). The highest density haulouts were located at Bodega Rock and Fish Rocks within Zone C and Reading Rock and Castle Rock Shoals within Zone A (Appendix 2).

Southern Oregon

Between 65 (2017) and 218 (2016) California sea lions were counted during southern Oregon surveys (Table 6). The highest densities observed were at Cape Arago (Appendix 2).

Northern elephant seals

Channel Islands

The maximum count of northern elephant seals at the Channel Islands was 5,612 in July 2016, and they were found on all the northern islands (Table 7, Figure 10) with highest densities on SMI, SNI, and SRI (Table 7). Distribution was patchy around the islands, with Area H at SMI again harboring the highest density of animals (Table 4, Figure 11). Sub-adult males made up the highest proportion of the population during these summer surveys (Table 7).

Pacific harbor seals

Channel Islands

Pacific harbor seals were found at all the Channel Islands (Table 7) with a maximum count of 1,980 animals in July 2016. The highest densities were found at SMI, SNI, and SRI with patchy spatial distribution around the perimeter of each island (Table 4).

Steller sea lions

Channel Islands

Three juvenile Steller sea lions were observed in area 680 at Anacapa Island on July 5, 2019 (Table 4).

Central California

Counts increased steadily during the study period, reaching a maximum of 251 pups and 749 non-pups in late-June 2018 (Table 2). Central California estimates accounted for up to 28.0% of pups and 20.1% of non-pups in California. Most pups were counted in Zone E while more non-pups were counted in Zone D (Table 6). Pups were observed at both Año Nuevo Island within zone E and at the Farallon Islands in zone D (Appendix 2).

Northern California

Maximum counts of 640 pups and 2,522 non-pups were made in July 2016 (Table 2). Northern California estimates accounted for up to 76.8% of pups and 82.4% of non-pups in California (Table 2). Pups were observed in Zone A at the Saint George Reef rookery and in zone B at the Cape Mendocino rookery area (Table 6). No Steller sea lion rookeries were found within zone C (Table 6, Appendix 2). Non-pup counts were highest in Zone A (Table 6).

Southern Oregon

Over 2,000 pups and 3,000 non-pups were counted in July 2016 (Table 2 and 6). Rogue River Reef and Orford Reef, each having multiple large rocks, were the two largest rookeries in southern Oregon, and Cape Arago has a large Steller sea lion haulout (Appendix 2).

Northern fur seals

Channel Islands

Northern fur seals were found only at SMI (Table 7). Between 1,951 and 2,605 pups and 1,789 and 2,925 non-pups were counted at SMI over the study period. Highest densities were found in Area H (Point Bennett) and Area O (Castle Rock) (Table 4).

Central California

Northern fur seals were found only within Zone D at the Southeast Farallon Islands, located within Zone D (Table 6). Maximum counts of 1,138 pups and 1,338 non-pups were made in 2017. Fewer animals were observed during the June 26, 2018 survey as this occurred before the breeding season peak.

Guadalupe fur seals

Channel Islands

One Guadalupe fur seal adult female or young male was observed at Area H of San Nicolas Island on July 8, 2019.

DISCUSSION

We documented abundance and distribution of all pinnipeds found at the Channel Islands in southern California and for California sea lions, Steller sea lions, and northern fur seals found from Point Conception in central California to Cape Arago in southern Oregon during the summer months from 2016 through 2019. Because life-history parameters differ between each of the species, the exact timing of these surveys can have significant impact on the observed abundance and demographics during aerial reconnaissance surveys. Due to weather, aircraft, and equipment unpredictability, some surveys were conducted outside of the optimal early/mid-July window to capture maximum pup abundances and before adult and sub-adult male dispersal and cannot be compared to those conducted during the prime abundance period without a correction factor. Still, these surveys provide a snapshot of the relative abundance and spatial distribution of the six pinniped species within the study range.

California sea lions are the most abundant pinniped species at the Channel Islands during the peak of their breeding season in July. In central California they also colonize many offshore rocks and have growing rookeries at Año Nuevo Island and the Farallon Islands. Numbers of Steller sea lions increase significantly from south to north within the study region. Northern fur seal rookeries are found at SMI and the Farallon Islands, both of which appear to be increasing over time.

Although northern elephant seals were present at the Channel Islands during these surveys, very few were hauled out in comparison to the winter breeding season (Lowry et al. 2014; Lowry et al. 2020), spring juvenile and adult female molt period, and the autumn juvenile haulout period (Le Boeuf and Laws 1994). Pacific harbor seals were also less abundant at the Channel Islands during these surveys than during their late-spring molt period (Lowry et al. 2008) and the counts obtained during summer are affected also by tide level which were not optimized for censusing this species.

Beginning in late 2012 the California Current Ecosystem (CCE) was affected by a marine heatwave, which lasted into 2016 (Harvey et al. 2017). During this time the CCE experienced an anomalous warm-water period that later became associated with an El Niño event (Bond et al. 2015; Jacox et al. 2016; Harvey et al. 2017). Changes in oceanic conditions impacted California sea lion prey species abundance and distribution (McClatchie et al. 2016), resulting in lowered births and increased mortality of pups, juveniles, and adult females (Lowry et al. 2017a, 2017b, Laake et al. 2018; J. Laake pers. comm.). The arrival of large numbers of emaciated California sea lion pups on the southern California mainland resulted in NOAA Fisheries declaring an unusual California sea lion mortality event in 2013[3]. During the 2013 to 2015 period, California sea lion pup counts at the Channel Islands were 42.2% to 71.0% of what were produced in 2012 (Lowry et al. 2017b), and survival of pups and juveniles decreased (DeLong et al. 2017; Laake et al. 2018).

The decline in the number of California sea lions counted here in comparison to those in 2012 (Figure 12 and 13) likely reflects the impact of the 2013–2016 marine heatwave. This is due to fewer adult females in the population as a result of adult female mortality and low survival of pups born during this period. While there is indication here that the population of California sea lions is once again increasing (Table 4), it is also expected that warm-water events will become more prevalent in the future. These oceanographic changes include everything from increased surface and near-surface temperatures, possibly decreased upwelling, cooler temperatures below 70-m depth, and an increase in the frequency of central Pacific El Niño events (Auad et al. 2006; Yeh et al. 2009; Cai et al. 2014), all of which can greatly impact the population status and demographics of the pinnipeds that act as sentinels for oceanic conditions. Systematic aerial abundance and distribution surveys of West Coast U.S. pinniped populations should continue to serve as a monitoring tool for the California Current ecosystem.

This report demonstrates the importance of precise planning and timing of these surveys to capture the same life-history period and maximum terrestrial abundance counts annually. Difficulties persist in conducting aerial abundance estimate surveys, including obtaining financing, permits, an aircraft, weather delays, and equipment failure. Work will continue to

[3]https://www.fisheries.noaa.gov/national/marine-life-distress/active-and-closed-unusual-mortality-events

account for and minimize these variables and to ensure surveys are repeated at the same period each year, as they remain the most efficient means by which to cover large sections of the coastline over the shortest period of time, allowing for vital understanding and management of these protected species.

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Table 1. California sea lion age/sex class and category totals counted from aerial photographs taken during surveys conducted at each of the Channel Islands in southern California in July and August 2016 – 2019.

Year	Island or Rock	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
2016	Anacapa Island	2016-Jul-05	78	0	67	639	11	9	17	743	821
	Richardson Rock	2016-Jul-06	0	0	33	66	14	12	8	133	133
	San Clemente Island	2016-Jul-08	914	1	124	1,740	94	131	182	2,271	3,185
	San Miguel Island	2016-Jul-06	17,508	212	1,637	22,638	1,705	3,626	4,142	33,748	51,256
	San Nicolas Island	2016-Jul-05	14,944	64	939	18,330	1,268	2,360	2,445	25,342	40,286
	Santa Barbara Island	2016-Jul-05	1,481	3	121	1,669	210	158	253	2,411	3,892
	Santa Catalina Island	2016-Jul-08	31	0	25	279	2	8	11	325	356
	Santa Cruz Island	2016-Jul-05	0	0	114	567	2	7	12	702	702
	Santa Rosa Island	2016-Jul-06	10	0	78	881	6	33	35	1,033	1,043
2017	Anacapa Island	2017-Jul-09	114	0	132	339	111	16	15	613	727
	Richardson Rock	2017-Jul-25	1	0	26	105	10	14	3	158	159
	San Clemente Island	2017-Jul-08	1,583	1	292	1,928	143	148	211	2,722	4,305
	San Miguel Island	2017-Jul-25	23,103	285	3,406	17,266	2,349	1,423	1,705	26,149	49,252
	San Nicolas Island	2017-Jul-08	21,367	120	1,825	13,117	1,592	2,249	2,766	21,549	42,916
	Santa Barbara Island	2017-Jul-08	2,975	13	143	1,604	176	186	271	2,380	5,355
	Santa Catalina Island	2017-Jul-08	54	0	35	173	10	0	9	227	281
	Santa Cruz Island	2017-Jul-09	0	0	164	517	94	26	7	808	808
	Santa Rosa Island	2017-Jul-09	22	0	947	1,009	604	81	29	2,670	2,692
2018	Anacapa Island	2018-Jul-07	44	0	200	450	5	19	17	691	735
	Richardson Rock	2018-Aug-07	1	0	38	16	3	3	0	60	61
	San Clemente Island	2018-Jul-06	1,468	0	244	1,415	106	109	189	2,063	3,531
	San Miguel Island	2018-Aug-07	23,323	258	8,537	17,038	1,057	102	167	26,901	50,224
	San Nicolas Island	2018-Aug-07	21,061	93	1,455	10,732	499	109	163	12,958	34,019
	Santa Barbara Island	2018-Jul-07	1,795	7	97	1,624	94	94	259	2,168	3,963
	Santa Barbara Island[1]	2018-Aug-07	1,599	1	64	780	22	8	30	904	2,503
	Santa Catalina Island	2018-Jul-06	58	0	84	132	12	3	8	239	297
	Santa Cruz Island	2018-Aug-08	1	0	23	97	6	6	2	134	135
	Santa Rosa Island	2018-Aug-08	18	0	117	304	22	29	1	473	491

Table 1. (Continued)

Year	Island or Rock	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
2019	Anacapa Island	2019-Jul-05	128	0	114	284	35	25	30	488	616
	Richardson Rock	2019-Jul-07	0	0	28	156	2	16	4	206	206
	San Clemente Island	2019-Jul-06	1,408	2	138	1,063	53	129	188	1,571	2,979
	San Miguel Island	2019-Jul-07	25,154	224	6,443	20,771	1,645	2,613	3,651	35,123	60,277
	San Nicolas Island	2019-Jul-08	21,593	76	2,811	12,460	939	2,120	3,019	21,349	42,942
	Santa Barbara Island[2]	Estimate[2]	2,710	0	307	1,871	137	170	320	2,805	5,515
			±629		±61	±432	±36	±35	±56	±620	±1,249
	Santa Catalina Island	2019-Jul-06	66	0	60	199	4	11	19	293	359
	Santa Cruz Island	2019-Jul-05	1	0	89	254	4	7	6	360	361
	Santa Rosa Island	2019-Jul-09	34	0	563	790	113	88	30	1,584	1,618

[1]Santa Barbara Island: August 07, 2018 data was not included in Channel Islands total.

[2]Santa Barbara Island: 2019 Estimates for each California sea lion age/sex class derived from mean proportion of 2011-2017 data; Non-pup total and Total live are the sum of age/sex class estimates.

Table 2. Counts and estimates of California sea lions by age-sex class at Channel Islands in southern California, central California, and northern California, for July and August surveys conducted in 2016 – 2019. Only a partial survey was conducted in Central California in 2018, northern California was not surveyed in 2018, and no survey was conducted within central California and northern California in 2019. *Estimates are in italics.* ? = Unknown value

		Live pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
Year	Section	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
							California sea lion										
2016	Channel Islands	34,966	97.0	3,138	65.4	46,809	82.8	3,312	52.8	6,344	71.4	7,105	84.5	66,708	78.3	101,674	83.9
	Central California	1,073	3.0	1,644	34.3	9,727	17.2	2,747	43.8	2,450	27.6	1,182	14.0	17,750	20.8	18,823	15.5
	Northern California	0	0.0	13	0.3	10	0.0	215	3.4	86	1.0	126	1.5	746	0.9	746	0.6
	California[1]	36,039	100.0	4,795	100.0	56,546	100.0	6,274	100.0	8,880	100.0	8,413	100.0	85,204	100.0	121,243	100.0
2017	Channel Islands	49,219	96.0	6,970	61.8	36,058	80.5	5,089	58.5	4,143	51.3	5,016	79.7	57,276	72.4	106,495	81.7
	Central California	2,025	4.0	4,251	37.7	8,719	19.5	3,302	38.0	3,885	48.1	1,226	19.5	21,367	27.0	23,392	17.9
	Northern California	1	0.0	51	0.5	2	0.0	301	3.5	54	0.7	55	0.9	463	0.6	464	0.4
	California[1]	51,245	100.0	11,272	100.0	44,779	100.0	8,692	100.0	8,082	100.0	6,297	100.0	79,106	100.0	130,351	100.0
2018	Channel Islands	47,768	95.6	10,795	?	31,808	?	1,804	?	474	?	806	?	45,687	?	93,456	?
	Central California (*Estimate*)[2,3]	*2,193*	*4.4*	?	?	?	?	?	?	?	?	?	?	?	?	?	?
	Northern California (*Estimate*)	*0*	*0.0*	?	?	?	?	?	?	?	?	?	?	?	?	?	?
	California[1] (*Estimate*)	*49,961*	*100.0*	?	?	?	?	?	?	?	?	?	?	?	?	?	?
2019	Channel Islands (Counts + *Estimate*)	*51,094*	*95.2*	10,553	?	37,848	?	2,932	?	5,179	?	7,267	?	63,779	?	114,873	?
	Central California (*Estimate*)[4]	*2,558*	*4.8*	?	?	?	?	?	?	?	?	?	?	?	?	?	?
	Northern California (*Estimate*)[5]	*0*	*0.0*	?	?	?	?	?	?	?	?	?	?	?	?	?	?
	California[1] (Counts + *Estimates*)	*53,652*	*100.0*	?	?	?	?	?	?	?	?	?	?	?	?	?	?
							Steller sea lion										
2016	Channel Islands	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Central California	193	23.2	228	28.6	214	22.3	126	12.6	24	10.3	43	25.7	635	20.1	828	20.8
	Northern California	640	76.8	568	71.4	747	77.7	874	87.4	209	89.7	124	74.3	2,522	79.9	3,162	79.2
	California[1]	833	100.0	796	100.0	961	100.0	1,000	100.0	233	100.0	167	100.0	3,157	100.0	3,990	100.0
	Southern Oregon	2,037	100.0	175	100.0	2,167	100.0	376	100.0	135	100.0	197	100.0	3,050	100.0	5,087	100.0
2017	Channel Islands	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
	Central California	221	28.0	75	19.0	320	32.8	23	2.6	20	7.0	38	23.0	476	17.6	697	20.0
	Northern California	568	72.0	319	81.0	656	67.2	855	97.4	265	93.0	127	77.0	2,222	82.4	2,790	80.0
	California[1]	789	100.0	394	100.0	976	100.0	878	100.0	285	100.0	165	100.0	2,698	100.0	3,487	100.0
	Southern Oregon	1,769	100.0	120	100.0	1,984	100.0	549	100.0	584	100.0	256	100.0	3,493	100.0	5,262	100.0

Table 2. (Continued)

		Live pups		Juveniles		Adult females		Young males		Sub-adult males		Adult males		Non-pup total		Total	
Year	Section	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
2018	Channel Islands	0	?	0	?	0	?	0	?	0	?	0	?	0	?	0	?
	Central California[2]	251	?	166	?	339	?	152	?	32	?	60	?	749	?	1,000	?
	Northern California	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
	California[1]	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

[1] California total does not include southern California mainland.

[2] Only Año Nuevo Island and Farallon Islands were surveyed.

[3] June 25, 2018 counts converted to July 2 peak estimate for Año Nuevo Island (908 pups estimated from 836 counted) and for the Farallon Islands (1,281 pups estimated from 1,180 counted).

[4] Estimate was made from logistic power regression (see methods).

[5] Estimate was based on past data.

Table 3. Percentage distribution across survey areas for each age-sex class of California sea lions during surveys conducted in July 2016 – 2019. *Italics are estimates.*

Year	Section	Island or zone	Live pups (%)	Juveniles (%)	Adult females (%)	Young males (%)	Sub-adult males (%)	Adult males (%)	Non-pup total (%)	Total (%)
2016	Channel Islands	Anacapa Is.	0.2	1.4	1.1	0.2	0.1	0.2	0.9	0.7
		Richardson Rock	0.0	0.7	0.1	0.2	0.1	0.1	0.2	0.1
		San Clemente Is.	2.5	2.6	3.1	1.5	1.5	2.2	2.7	2.6
		San Miguel Is.	48.6	34.1	40.0	27.2	40.8	49.2	39.6	42.3
		San Nicolas Is.	41.5	19.6	32.4	20.2	26.6	29.1	29.7	33.2
		Santa Barbara Is.	4.1	2.5	3.0	3.3	1.8	3.0	2.8	3.2
		Santa Catalina Is.	0.1	0.5	0.5	0.0	0.1	0.1	0.4	0.3
		Santa Cruz Is.	0.0	2.4	1.0	0.0	0.1	0.1	0.8	0.6
		Santa Rosa Is.	0.0	1.6	1.6	0.1	0.4	0.4	1.2	0.9
	Central California	G	0.0	6.7	4.5	8.2	3.1	1.0	4.4	3.1
		F	0.0	2.0	1.5	8.8	3.9	1.5	2.3	1.6
		E	1.5	10.6	7.2	8.4	11.4	6.7	7.9	6.0
		D	1.4	15.0	4.0	18.4	9.2	4.8	6.3	4.8
	Northern California	C	0.0	0.0	0.0	0.1	0.6	1.1	0.5	0.4
		B	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
		A	0.0	0.2	0.0	3.3	0.3	0.2	0.3	0.2
2017	Channel Islands	Anacapa Is.	0.2	1.2	0.8	1.3	0.2	0.2	0.8	0.6
		Richardson Rock	0.0	0.2	0.2	0.1	0.2	0.0	0.2	0.1
		San Clemente Is.	3.1	2.6	4.3	1.6	1.8	3.4	3.4	3.3
		San Miguel Is.	45.1	30.2	38.6	27.0	17.6	27.1	33.1	37.8
		San Nicolas Is.	41.7	16.2	29.3	18.3	27.8	43.9	27.2	32.9
		Santa Barbara Is.	5.8	1.3	3.6	2.0	2.3	4.3	3.0	4.1
		Santa Catalina Is.	0.1	0.3	0.4	0.1	0.0	0.1	0.3	0.2
		Santa Cruz Is.	0.0	1.5	1.2	1.1	0.3	0.1	1.0	0.6
		Santa Rosa Is.	0.0	8.4	2.3	6.9	1.0	0.5	3.4	2.1
	Central California	G	0.0	7.7	5.5	10.1	6.3	1.9	6.1	3.7
		F	0.0	7.7	3.4	4.4	4.3	1.5	4.0	2.5
		E	1.9	14.4	7.1	14.1	23.4	9.1	10.7	7.3
		D	2.0	8.0	3.5	9.4	14.0	6.9	6.1	4.5
	Northern California	C	0.0	0.0	0.0	3.0	0.5	0.8	0.4	0.3
		B	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		A	0.0	0.4	0.0	0.4	0.1	0.1	0.1	0.1
2018	Channel Islands	Anacapa Is.	0.1	?	?	?	?	?	?	?
		Richardson Rock	0.0	?	?	?	?	?	?	?
		San Clemente Is.	2.9	?	?	?	?	?	?	?
		San Miguel Is.	46.7	?	?	?	?	?	?	?
		San Nicolas Is.	42.2	?	?	?	?	?	?	?
		Santa Barbara Is.	3.6	?	?	?	?	?	?	?
		Santa Catalina Is.	0.1	?	?	?	?	?	?	?
		Santa Cruz Is.	0.0	?	?	?	?	?	?	?
		Santa Rosa Is.	0.0	?	?	?	?	?	?	?

Table 3. (Continued)

Year	Section	Island or zone	Live pups (%)	Juveniles (%)	Adult females (%)	Young males (%)	Sub-adult males (%)	Adult males (%)	Non-pup total (%)	Total (%)
2018	Central California[1]	G[2]	*0.0*	?	?	?	?	?	?	?
		F[2]	*0.0*	?	?	?	?	?	?	?
		E[1,3]	*1.8*	?	?	?	?	?	?	?
		D[1,3]	*2.6*	?	?	?	?	?	?	?
	Northern California[2]	C[2]	*0.0*	?	?	?	?	?	?	?
		B[2]	*0.0*	?	?	?	?	?	?	?
		A[2]	*0.0*	?	?	?	?	?	?	?
2019	Channel Islands	Anacapa Is.	0.2	?	?	?	?	?	?	?
		Richardson Rock	0.0	?	?	?	?	?	?	?
		San Clemente Is.	2.6	?	?	?	?	?	?	?
		San Miguel Is.	46.9	?	?	?	?	?	?	?
		San Nicolas Is.	40.2	?	?	?	?	?	?	?
		Santa Barbara Is.[4]	*5.1*	?	?	?	?	?	?	?
		Santa Catalina Is.	0.1	?	?	?	?	?	?	?
		Santa Cruz Is.	0.0	?	?	?	?	?	?	?
		Santa Rosa Is.	0.1	?	?	?	?	?	?	?
	Central California[2]	G[2]	*0.0*	?	?	?	?	?	?	?
		F[2]	*0.0*	?	?	?	?	?	?	?
		E[5]	*2.3*	?	?	?	?	?	?	?
		D[5]	*2.5*	?	?	?	?	?	?	?
	Northern California[2]	C[2]	*0.0*	?	?	?	?	?	?	?
		B[2]	*0.0*	?	?	?	?	?	?	?
		A[2]	*0.0*	?	?	?	?	?	?	?

[1] Only Año Nuevo Island and Farallon Islands were surveyed.

[2] Estimate was based on past data.

[3] June 25, 2018 counts converted to July 2 peak estimate for Año Nuevo Island (908 pups estimated from 836 counted) and for the Farallon Islands (1,281 pups estimated from 1,180 counted).

[4]Estimate based on estimated number of pups at SBI in 2019.

[5]2019 estimate for Año Nuevo Island and the Farallon Islands was derived from the mean proportion represented by Año Nuevo Island for 2016 – 2018 applied to the central California 2019 estimate.

Table 4. Island-area counts by age-sex class and category total for California sea lions, northern elephant seals, northern fur seals, Pacific harbor seals, Steller sea lions, and Guadalupe fur seals from aerial photographs taken at the Channel Islands during July 2016 – 2019. Counts are provided only for island-areas having animals. Refer to Figures 3 and 4 for location of island-areas.

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
California sea lion												
Anacapa Island	680	2016-Jul-05	78	0	67	639	11	650	9	17	743	821
		2017-Jul-09	114	0	132	339	111	450	16	15	613	727
		2018-Jul-07	44	0	200	450	5	455	19	17	691	735
		2019-Jul-05	128	0	114	284	35	319	25	30	488	616
Richardson Rock	103	2016-Jul-06	0	0	33	66	14	80	12	8	133	133
		2017-Jul-25	1	0	26	105	10	115	14	3	158	159
		2018-Aug-07	1	0	38	16	3	19	3	0	60	61
		2019-Jul-07	0	0	28	156	2	158	16	4	206	206
San Clemente Island	404	2016-Jul-08	0	0	12	48	0	48	2	3	65	65
		2017-Jul-08	0	0	47	174	9	183	20	10	260	260
		2018-Jul-06	0	0	31	21	11	32	11	7	81	81
	406	2016-Jul-08	600	0	37	835	22	857	37	102	1,033	1,633
		2017-Jul-08	971	0	96	926	49	975	28	108	1,207	2,178
		2018-Jul-06	934	0	60	795	20	815	32	99	1,006	1,940
		2019-Jul-06	822	1	62	575	16	591	29	109	791	1,613
	407	2016-Jul-08	303	1	33	547	72	619	83	67	802	1,105
		2017-Jul-08	582	1	61	557	65	622	93	81	857	1,439
		2018-Jul-06	520	0	57	477	66	543	58	73	731	1,251
		2019-Jul-06	565	1	37	345	25	370	78	76	561	1,126
	410	2017-Jul-08	0	0	11	26	3	29	0	2	42	42
		2018-Jul-06	0	0	1	3	5	8	4	1	14	14
		2019-Jul-06	0	0	0	3	0	3	3	0	6	6
	411	2016-Jul-08	11	0	42	310	0	310	9	10	371	382
		2017-Jul-08	30	0	77	245	17	262	7	10	356	386
		2018-Jul-06	14	0	95	119	4	123	4	9	231	245
		2019-Jul-06	21	0	39	140	12	152	19	3	213	234
San Miguel Island	A	2016-Jul-06	16	0	400	1,841	433	2,274	328	77	3,079	3,095
		2017-Jul-25	11	0	570	7	767	774	302	53	1,699	1,710
		2018-Aug-07	2	0	593	65	96	161	21	5	780	782
		2019-Jul-07	16	0	451	556	468	1,024	485	100	2,060	2,076
	B	2016-Jul-06	128	0	177	1,774	148	1,922	35	26	2,160	2,288
		2017-Jul-25	382	2	378	1,611	401	2,012	31	25	2,446	2,828
		2018-Aug-07	573	5	821	803	130	933	5	5	1,764	2,337
		2019-Jul-07	397	0	121	477	18	495	2	21	639	1,036

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
California sea lion												
San Miguel Island	C	2016-Jul-06	1,018	6	90	1,780	148	1,928	81	101	2,200	3,218
		2017-Jul-25	1,358	10	131	1,418	119	1,537	23	72	1,763	3,121
		2018-Aug-07	1,341	16	375	954	35	989	3	13	1,380	2,721
		2019-Jul-07	1,183	6	154	1,452	19	1,471	49	99	1,773	2,956
	D	2016-Jul-06	0	0	0	1	1	2	8	8	18	18
		2017-Jul-25	0	0	0	0	5	5	8	24	37	37
		2018-Aug-07	0	0	0	0	0	0	1	0	1	1
		2019-Jul-07	0	0	1	1	4	5	28	33	67	67
	E	2016-Jul-06	0	0	0	1	1	2	28	25	55	55
		2017-Jul-25	0	0	0	0	1	1	9	33	43	43
		2019-Jul-07	0	0	8	15	11	26	42	73	149	149
	F	2016-Jul-06	28	0	17	54	35	89	242	405	753	781
		2017-Jul-25	219	0	39	190	35	225	96	175	535	754
		2018-Aug-07	304	1	151	204	5	209	5	6	371	675
		2019-Jul-07	477	0	132	588	31	619	175	393	1,319	1,796
	G	2016-Jul-06	1,943	16	93	1,483	96	1,579	155	247	2,074	4,017
		2017-Jul-25	2,744	16	91	1,508	49	1,557	56	116	1,820	4,564
		2018-Aug-07	2,957	13	975	1,993	100	2,093	8	24	3,100	6,057
		2019-Jul-07	2,933	4	471	2,149	40	2,189	56	187	2,903	5,836
	H	2016-Jul-06	10,026	177	496	9,017	429	9,446	1,119	1,767	12,828	22,854
		2017-Jul-25	12,752	204	599	7,492	422	7,914	327	643	9,483	22,235
		2018-Aug-07	12,142	137	2,471	8,812	316	9,128	34	82	11,715	23,857
		2019-Jul-07	13,169	185	2,488	9,594	342	9,936	716	1,403	14,543	27,712
	I	2016-Jul-06	224	1	5	352	70	422	733	801	1,961	2,185
		2017-Jul-25	344	2	37	405	54	459	184	292	972	1,316
		2018-Aug-07	312	1	125	229	22	251	9	3	388	700
		2019-Jul-07	538	2	109	421	89	510	365	734	1,718	2,256
	J	2016-Jul-06	3,429	10	199	4,196	267	4,463	804	543	6,009	9,438
		2017-Jul-25	4,516	44	533	3,193	277	3,470	336	196	4,535	9,051
		2018-Aug-07	4,787	69	1,742	2,835	221	3,056	7	22	4,827	9,614
		2019-Jul-07	5,345	24	2,062	4,206	532	4,738	536	406	7,742	13,087
	K	2016-Jul-06	0	1	0	0	4	4	8	25	37	37
		2017-Jul-25	0	1	1	0	2	2	1	2	6	6
		2018-Aug-07	0	4	0	0	0	0	0	0	0	0
		2019-Jul-07	0	0	0	1	2	3	25	69	97	97
	L	2016-Jul-06	148	1	125	1,533	59	1,592	78	34	1,829	1,977
		2017-Jul-25	236	1	955	985	181	1,166	19	11	2,151	2,387
		2018-Aug-07	283	11	1,124	492	121	613	6	3	1,746	2,029

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
California sea lion												
San Miguel Island	L	2019-Jul-07	356	0	386	834	72	906	33	28	1,353	1,709
	M	2016-Jul-06	0	0	0	0	1	1	1	2	4	4
		2017-Jul-25	0	0	1	0	0	0	1	0	2	2
		2019-Jul-07	0	0	0	0	0	0	6	0	6	6
	N	2016-Jul-06	0	0	0	0	2	2	3	1	6	6
		2017-Jul-25	0	0	26	0	15	15	21	11	73	73
		2019-Jul-07	0	0	5	0	15	15	92	35	147	147
	O	2016-Jul-06	548	0	35	606	11	617	3	80	735	1,283
		2017-Jul-25	541	5	45	457	21	478	9	52	584	1,125
		2018-Aug-07	622	1	160	651	11	662	3	4	829	1,451
		2019-Jul-07	740	3	55	477	2	479	3	70	607	1,347
San Nicolas Island	A	2016-Jul-05	126	0	58	336	65	401	32	16	507	633
		2017-Jul-08	219	6	59	157	99	256	26	20	361	580
		2018-Aug-07	328	2	9	84	8	92	1	3	105	433
		2019-Jul-08	278	0	142	236	98	334	72	36	584	862
	B	2016-Jul-05	377	0	8	380	20	400	7	31	446	823
		2017-Jul-08	732	1	32	454	13	467	1	36	536	1,268
		2018-Aug-07	624	3	21	277	9	286	1	5	313	937
		2019-Jul-08	705	2	30	359	5	364	2	38	434	1,139
	C	2016-Jul-05	419	0	13	430	145	575	248	159	995	1,414
		2017-Jul-08	619	13	14	298	109	407	220	204	845	1,464
		2018-Aug-07	644	7	31	288	25	313	10	7	361	1,005
		2019-Jul-08	615	2	39	286	21	307	210	244	800	1,415
	D	2016-Jul-05	2,340	14	47	1,938	44	1,982	37	159	2,225	4,565
		2017-Jul-08	3,759	27	107	1,922	61	1,983	15	168	2,273	6,032
		2018-Aug-07	3,303	26	107	1,268	71	1,339	13	29	1,488	4,791
		2019-Jul-08	3,530	6	216	1,700	20	1,720	55	166	2,157	5,687
	E	2016-Jul-05	409	1	26	628	87	715	191	146	1,078	1,487
		2017-Jul-08	747	1	52	413	87	500	183	202	937	1,684
		2018-Aug-07	537	3	81	538	46	584	10	5	680	1,217
		2019-Jul-08	654	0	96	434	47	481	181	219	977	1,631
	F	2016-Jul-05	1,620	10	62	1,625	49	1,674	36	141	1,913	3,533
		2017-Jul-08	2,512	9	73	1,309	43	1,352	21	156	1,602	4,114
		2018-Aug-07	2,227	12	102	1,110	52	1,162	11	23	1,298	3,525
		2019-Jul-08	2,452	9	166	1,259	38	1,297	49	184	1,696	4,148
	G	2016-Jul-05	111	0	7	188	54	242	290	235	774	885
		2017-Jul-08	98	1	6	73	87	160	192	238	596	694
		2018-Aug-07	108	6	30	116	13	129	4	2	165	273

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
California sea lion												
San Nicolas Island	G	2019-Jul-08	118	0	42	103	41	144	219	241	646	764
	H	2016-Jul-05	2,259	10	84	2,186	93	2,279	83	282	2,728	4,987
		2017-Jul-08	2,989	16	105	1,550	58	1,608	63	253	2,029	5,018
		2018-Aug-07	2,923	8	128	1,594	47	1,641	7	30	1,806	4,729
		2019-Jul-08	3,092	20	261	1,547	65	1,612	58	294	2,225	5,317
	I	2016-Jul-05	819	4	46	640	66	706	151	169	1,072	1,891
		2017-Jul-08	1,039	5	43	455	46	501	181	175	900	1,939
		2018-Aug-07	867	7	35	319	8	327	0	9	371	1,238
		2019-Jul-08	1,040	1	78	488	24	512	106	193	889	1,929
	J	2016-Jul-05	1,672	12	131	2,090	80	2,170	134	164	2,599	4,271
		2017-Jul-08	2,229	14	117	1,323	76	1,399	49	187	1,752	3,981
		2018-Aug-07	2,334	9	148	1,397	38	1,435	3	15	1,601	3,935
		2019-Jul-08	2,272	13	240	1,371	57	1,428	94	196	1,958	4,230
	K	2016-Jul-05	0	0	2	36	37	73	200	170	445	445
		2017-Jul-08	0	0	1	0	67	67	180	205	453	453
		2018-Aug-07	0	0	0	0	0	0	1	0	1	1
		2019-Jul-08	0	0	2	2	6	8	139	270	419	419
	L	2016-Jul-05	3,244	11	142	3,184	45	3,229	165	359	3,895	7,139
		2017-Jul-08	4,294	20	205	2,422	102	2,524	105	353	3,187	7,481
		2018-Aug-07	4,562	9	217	2,056	70	2,126	18	16	2,377	6,939
		2019-Jul-08	4,285	14	395	2,383	82	2,465	76	313	3,249	7,534
	M	2016-Jul-05	1,458	1	107	2,260	104	2,364	317	255	3,043	4,501
		2017-Jul-08	1,978	3	96	1,487	139	1,626	313	285	2,320	4,298
		2018-Aug-07	2,453	0	150	1,168	12	1,180	2	16	1,348	3,801
		2019-Jul-08	2,339	7	368	1,398	88	1,486	225	330	2,409	4,748
	N	2016-Jul-05	0	0	1	4	2	6	4	6	17	17
		2017-Jul-08	0	1	0	0	7	7	25	31	63	63
		2019-Jul-08	0	0	0	0	1	1	5	14	20	20
	O	2016-Jul-05	0	0	0	2	0	2	0	1	3	3
		2017-Jul-08	0	0	0	0	0	0	1	2	3	3
		2019-Jul-08	0	0	0	0	0	0	1	0	1	1
	P	2017-Jul-08	0	0	0	0	0	0	4	13	17	17
		2019-Jul-08	0	0	0	0	0	0	3	2	5	5
	Q	2016-Jul-05	90	1	205	2,403	377	2,780	465	152	3,602	3,692
		2017-Jul-08	152	3	915	1,254	598	1,852	670	238	3,675	3,827
		2018-Aug-07	151	1	396	517	100	617	28	3	1,044	1,195
		2019-Jul-08	213	2	736	894	346	1,240	625	279	2,880	3,093

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
California sea lion												
Santa Barbara Island	A	2016-Jul-05	993	3	66	958	10	968	30	77	1,141	2,134
		2017-Jul-08	2,124	11	40	904	18	922	13	94	1,069	3,193
		2018-Jul-07	1,158	7	44	957	11	968	1	100	1,113	2,271
		2018-Aug-07	1,145	1	27	485	0	485	0	15	527	1,672
	B	2016-Jul-05	6	0	16	57	74	131	58	52	257	263
		2017-Jul-08	11	2	9	82	67	149	78	49	285	296
		2018-Jul-07	2	0	7	36	21	57	55	58	177	179
		2018-Aug-07	6	0	2	22	19	41	6	3	52	58
	C	2016-Jul-05	125	0	10	154	60	214	17	19	260	385
		2017-Jul-08	176	0	14	157	10	167	3	21	205	381
		2018-Jul-07	183	0	11	208	2	210	1	16	238	421
		2018-Aug-07	111	0	1	38	0	38	1	3	43	154
	D	2016-Jul-05	356	0	19	445	38	483	13	58	573	929
		2017-Jul-08	664	0	33	405	33	438	36	57	564	1,228
		2018-Jul-07	452	0	16	420	20	440	11	49	516	968
		2018-Aug-07	337	0	29	232	3	235	1	9	274	611
	E	2016-Jul-05	1	0	10	55	28	83	40	47	180	181
		2017-Jul-08	0	0	47	56	48	104	56	50	257	257
		2018-Jul-07	0	0	19	3	40	43	26	36	124	124
		2018-Aug-07	0	0	5	3	0	3	0	0	8	8
Santa Catalina Island	502C	2016-Jul-08	31	0	22	259	2	261	8	11	302	333
		2017-Jul-08	54	0	35	153	7	160	0	8	203	257
		2018-Jul-06	58	0	71	118	10	128	3	8	210	268
		2019-Jul-06	66	0	48	197	4	201	11	15	275	341
	502D	2019-Jul-06	0	0	1	0	0	0	0	3	4	4
	506	2016-Jul-08	0	0	3	20	0	20	0	0	23	23
		2017-Jul-08	0	0	0	20	0	20	0	1	21	21
		2018-Jul-06	0	0	9	10	0	10	0	0	19	19
	522	2017-Jul-08	0	0	0	0	3	3	0	0	3	3
		2018-Jul-06	0	0	4	4	2	6	0	0	10	10
		2019-Jul-06	0	0	11	2	0	2	0	1	14	14
Santa Cruz Island	641	2017-Jul-09	0	0	138	26	11	37	4	1	180	180
		2019-Jul-05	0	0	20	16	0	16	1	0	37	37
	648	2016-Jul-05	0	0	52	192	0	192	1	2	247	247
		2017-Jul-09	0	0	14	166	33	199	1	1	215	215
		2019-Jul-05	0	0	43	156	0	156	1	4	204	204
	655	2016-Jul-05	0	0	62	375	2	377	6	10	455	455

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
California sea lion												
Santa Cruz Island	655	2017-Jul-09	0	0	12	325	50	375	21	5	413	413
		2018-Aug-08	1	0	23	97	6	103	6	2	134	135
		2019-Jul-05	1	0	26	82	4	86	5	2	119	120
Santa Rosa Island	615A	2019-Jul-09	0	0	0	0	1	1	0	0	1	1
	617	2016-Jul-06	0	0	7	129	1	130	1	2	140	140
		2017-Jul-09	0	0	291	403	247	650	20	3	964	964
		2018-Aug-08	0	0	83	176	8	184	7	0	274	274
		2019-Jul-09	0	0	249	194	13	207	7	2	465	465
	621B	2017-Jul-09	0	0	5	0	0	0	0	0	5	5
		2019-Jul-09	0	0	3	0	0	0	1	0	4	4
	621C	2016-Jul-06	0	0	1	20	0	20	0	2	23	23
		2017-Jul-09	0	0	10	1	10	11	0	0	21	21
	621D	2016-Jul-06	0	0	0	0	0	0	1	0	1	1
		2017-Jul-09	0	0	485	24	109	133	1	2	621	621
		2019-Jul-09	0	0	30	15	3	18	2	2	52	52
	622C	2017-Jul-09	0	0	0	0	0	0	0	1	1	1
	622D	2016-Jul-06	7	0	49	271	5	276	7	5	337	344
		2017-Jul-09	15	0	99	272	191	463	30	10	602	617
		2018-Aug-08	15	0	31	92	7	99	10	0	140	155
		2019-Jul-09	25	0	94	394	60	454	24	7	579	604
	622E	2016-Jul-06	3	0	21	461	0	461	13	19	514	517
		2017-Jul-09	5	0	44	294	37	331	12	10	397	402
		2018-Aug-08	0	0	1	5	6	11	12	1	25	25
		2019-Jul-09	0	0	1	16	13	29	12	4	46	46
	624A	2016-Jul-06	0	0	0	0	0	0	2	2	4	4
		2017-Jul-09	0	0	0	0	1	1	1	0	2	2
		2019-Jul-09	0	0	0	41	5	46	2	2	50	50
	624B	2017-Jul-09	0	0	1	0	0	0	4	1	6	6
		2019-Jul-09	1	0	1	1	1	2	6	3	12	13
	624C	2016-Jul-06	0	0	0	0	0	0	8	3	11	11
		2017-Jul-09	2	0	12	11	4	15	4	1	32	34
		2018-Aug-08	3	0	2	31	1	32	0	0	34	37
		2019-Jul-09	8	0	179	116	16	132	22	7	340	348
	625A	2016-Jul-06	0	0	0	0	0	0	1	1	2	2
		2017-Jul-09	0	0	0	4	5	9	9	1	19	19
		2019-Jul-09	0	0	6	13	1	14	11	3	34	34

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
California sea lion												
Santa Rosa Island	626	2016-Jul-06	0	0	0	0	0	0	0	1	1	1
		2019-Jul-09	0	0	0	0	0	0	1	0	1	1
Northern elephant seal												
Anacapa Island	660	2016-Jul-05	0	0	1	0	0	0	0	0	1	1
	680	2017-Jul-09	0	0	0	0	0	0	0	1	1	1
San Clemente Island	406	2016-Jul-08	0	0	0	0	1	1	3	0	4	4
		2017-Jul-08	0	0	0	0	0	0	2	2	4	4
		2018-Jul-06	0	0	0	0	0	0	8	1	9	9
		2019-Jul-06	0	0	0	0	0	0	2	2	4	4
	407	2016-Jul-08	0	0	0	0	0	0	0	1	1	1
San Miguel Island	A	2016-Jul-06	0	0	1	0	3	3	71	50	125	125
		2017-Jul-25	0	0	6	0	2	2	52	43	103	103
		2018-Aug-07	0	0	12	0	1	1	3	24	40	40
		2019-Jul-07	0	0	1	0	10	10	47	46	104	104
	B	2016-Jul-06	0	0	0	0	0	0	12	1	13	13
		2017-Jul-25	0	0	1	0	2	2	27	21	51	51
		2018-Aug-07	0	0	9	0	3	3	4	23	39	39
		2019-Jul-07	0	0	0	0	1	1	0	0	1	1
	C	2016-Jul-06	0	0	1	0	11	11	262	80	354	354
		2017-Jul-25	0	0	0	0	1	1	3	4	8	8
		2018-Aug-07	0	0	22	0	7	7	25	31	85	85
		2019-Jul-07	0	0	10	0	54	54	141	78	283	283
	D	2016-Jul-06	0	0	0	0	1	1	44	0	45	45
		2017-Jul-25	0	0	2	0	2	2	79	70	153	153
		2018-Aug-07	0	0	8	0	4	4	52	45	109	109
		2019-Jul-07	0	0	1	0	6	6	14	4	25	25
	E	2016-Jul-06	0	0	4	0	15	15	128	24	171	171
		2017-Jul-25	0	0	6	0	1	1	88	54	149	149
		2018-Aug-07	0	0	13	0	7	7	41	39	100	100
		2019-Jul-07	0	0	5	0	26	26	109	63	203	203
	F	2016-Jul-06	0	0	0	0	1	1	57	20	78	78
		2017-Jul-25	0	0	1	0	2	2	55	28	86	86
		2018-Aug-07	0	0	11	0	2	2	35	25	73	73
		2019-Jul-07	0	0	2	0	5	5	57	49	113	113
	G	2016-Jul-06	0	0	4	0	7	7	138	54	203	203
		2017-Jul-25	0	0	11	0	5	5	52	74	142	142
		2018-Aug-07	0	0	33	0	7	7	61	72	173	173
		2019-Jul-07	0	0	1	0	19	19	64	58	142	142

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
Northern elephant seal												
San Miguel Island	H	2016-Jul-06	0	0	4	0	22	22	594	201	821	821
		2017-Jul-25	0	0	14	0	5	5	283	401	703	703
		2018-Aug-07	0	0	54	0	15	15	210	289	568	568
		2019-Jul-07	0	0	7	0	28	28	336	325	696	696
	I	2016-Jul-06	0	0	1	0	12	12	260	128	401	401
		2017-Jul-25	0	0	6	0	6	6	98	135	245	245
		2018-Aug-07	0	0	10	0	6	6	59	102	177	177
		2019-Jul-07	0	0	3	0	12	12	134	128	277	277
	J	2016-Jul-06	0	0	1	0	3	3	191	149	344	344
		2017-Jul-25	0	0	6	0	6	6	153	228	393	393
		2018-Aug-07	0	0	25	0	5	5	101	221	352	352
		2019-Jul-07	0	0	1	0	11	11	147	183	342	342
	K	2016-Jul-06	0	0	0	0	3	3	197	37	237	237
		2017-Jul-25	0	0	2	0	2	2	79	46	129	129
		2018-Aug-07	0	0	5	0	3	3	30	50	88	88
		2019-Jul-07	0	0	5	0	20	20	276	93	394	394
	L	2016-Jul-06	0	0	0	0	1	1	44	40	85	85
		2017-Jul-25	0	0	6	0	1	1	29	52	88	88
		2018-Aug-07	0	0	14	0	6	6	19	38	77	77
		2019-Jul-07	0	0	2	0	2	2	32	25	61	61
	M	2016-Jul-06	0	0	1	0	2	2	85	21	109	109
		2017-Jul-25	0	0	1	0	6	6	38	25	70	70
		2018-Aug-07	0	0	3	0	0	0	11	14	28	28
		2019-Jul-07	0	0	4	0	8	8	57	12	81	81
	N	2016-Jul-06	0	0	0	0	1	1	26	1	28	28
		2017-Jul-25	0	0	1	0	0	0	6	0	7	7
		2018-Aug-07	0	0	5	0	1	1	19	4	29	29
		2019-Jul-07	0	0	1	0	8	8	56	4	69	69
San Nicolas Island	A	2016-Jul-05	0	0	1	0	3	3	50	14	68	68
		2017-Jul-08	0	0	1	0	2	2	21	2	26	26
		2018-Aug-07	0	0	3	0	4	4	8	17	32	32
		2019-Jul-08	0	0	0	0	0	0	10	22	32	32
	B	2016-Jul-05	0	0	0	0	3	3	1	0	4	4
		2017-Jul-08	0	0	0	0	0	0	21	2	23	23
		2018-Aug-07	0	0	2	0	0	0	1	2	5	5
	C	2016-Jul-05	0	0	0	0	2	2	40	1	43	43
		2017-Jul-08	0	0	0	0	4	4	11	10	25	25

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
Northern elephant seal												
San Nicolas Island	C	2018-Aug-07	0	0	0	0	0	0	2	1	3	3
		2019-Jul-08	0	0	2	0	0	0	7	4	13	13
	D	2016-Jul-05	0	0	1	0	3	3	74	2	80	80
		2017-Jul-08	0	0	1	0	8	8	50	22	81	81
		2018-Aug-07	0	0	6	0	2	2	22	20	50	50
		2019-Jul-08	0	0	1	0	3	3	58	27	89	89
	E	2016-Jul-05	0	0	0	0	6	6	71	9	86	86
		2017-Jul-08	0	0	2	0	2	2	71	33	108	108
		2018-Aug-07	0	0	2	0	1	1	27	24	54	54
		2019-Jul-08	0	0	5	0	6	6	71	39	121	121
	F	2016-Jul-05	0	0	0	0	2	2	57	3	62	62
		2017-Jul-08	0	0	1	0	9	9	7	7	24	24
		2018-Aug-07	0	0	2	0	0	0	4	12	18	18
		2019-Jul-08	0	0	0	0	0	0	2	1	3	3
	G	2016-Jul-05	0	0	0	0	0	0	34	4	38	38
		2017-Jul-08	0	0	1	0	4	4	11	4	20	20
		2019-Jul-08	0	0	2	0	3	3	14	6	25	25
	H	2016-Jul-05	0	0	1	0	0	0	7	1	9	9
		2017-Jul-08	0	0	0	0	4	4	13	17	34	34
		2018-Aug-07	0	0	3	0	4	4	2	0	9	9
		2019-Jul-08	0	0	0	0	0	0	6	7	13	13
	I	2016-Jul-05	0	0	0	0	0	0	17	3	20	20
		2017-Jul-08	0	0	0	0	1	1	8	14	23	23
		2018-Aug-07	0	0	0	0	1	1	2	2	5	5
		2019-Jul-08	0	0	0	0	1	1	9	2	12	12
	J	2016-Jul-05	0	0	0	0	1	1	26	3	30	30
		2017-Jul-08	0	0	0	0	6	6	34	25	65	65
		2018-Aug-07	0	0	3	0	1	1	10	29	43	43
		2019-Jul-08	0	0	1	0	6	6	15	8	30	30
	K	2016-Jul-05	0	0	2	0	10	10	277	42	331	331
		2017-Jul-08	0	0	1	0	79	79	134	50	264	264
		2018-Aug-07	0	0	11	0	2	2	81	63	157	157
		2019-Jul-08	0	0	3	0	19	19	198	73	293	293
	L	2016-Jul-05	0	0	0	0	0	0	4	0	4	4
		2017-Jul-08	0	0	0	0	2	2	1	0	3	3
		2018-Aug-07	0	0	0	0	0	0	2	0	2	2
		2019-Jul-08	0	0	0	0	0	0	2	0	2	2

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
Northern elephant seal												
San Nicolas Island	M	2016-Jul-05	0	0	1	0	4	4	178	26	209	209
		2017-Jul-08	0	0	1	0	14	14	124	72	211	211
		2018-Aug-07	0	0	8	0	1	1	51	60	120	120
		2019-Jul-08	0	0	1	0	20	20	121	92	234	234
	N	2016-Jul-05	0	0	1	0	2	2	18	2	23	23
		2017-Jul-08	0	0	2	0	3	3	31	10	46	46
		2018-Aug-07	0	0	0	0	0	0	3	1	4	4
		2019-Jul-08	0	0	0	0	3	3	25	17	45	45
	O	2016-Jul-05	0	0	1	0	0	0	94	25	120	120
		2017-Jul-08	0	0	0	0	5	5	54	25	84	84
		2018-Aug-07	0	0	4	0	1	1	8	22	35	35
		2019-Jul-08	0	0	1	0	6	6	66	14	87	87
	P	2016-Jul-05	0	0	0	0	0	0	8	0	8	8
		2017-Jul-08	0	0	0	0	1	1	13	2	16	16
		2018-Aug-07	0	0	2	0	0	0	1	1	4	4
		2019-Jul-08	0	0	1	0	4	4	36	9	50	50
	Q	2016-Jul-05	0	0	1	0	12	12	136	38	187	187
		2017-Jul-08	0	0	1	0	28	28	86	54	169	169
		2018-Aug-07	0	0	4	0	3	3	19	57	83	83
		2019-Jul-08	0	0	1	0	1	1	72	62	136	136
Santa Barbara Island	A	2018-Aug-07	0	0	0	0	3	3	0	0	3	3
	B	2016-Jul-05	0	0	0	0	1	1	6	0	7	7
		2018-Jul-07	0	0	0	0	2	2	1	0	3	3
	C	2018-Aug-07	0	0	0	0	0	0	1	0	1	1
	D	2016-Jul-05	0	0	0	0	1	1	1	1	3	3
		2017-Jul-08	0	0	0	0	0	0	4	3	7	7
Santa Rosa Island	611	2016-Jul-06	0	0	1	0	3	3	34	0	38	38
		2017-Jul-09	0	0	0	0	2	2	31	6	39	39
		2019-Jul-09	0	0	0	0	4	4	28	11	43	43
	612	2017-Jul-09	0	0	0	0	0	0	0	3	3	3
		2018-Aug-08	0	0	0	0	0	0	2	0	2	2
	621B	2016-Jul-06	0	0	0	0	3	3	42	9	54	54
		2017-Jul-09	0	0	0	0	4	4	25	14	43	43
		2018-Aug-08	0	0	0	0	0	0	7	3	10	10
		2019-Jul-09	0	0	0	0	2	2	29	24	55	55
	621C	2016-Jul-06	0	0	0	0	1	1	1	0	2	2
		2017-Jul-09	0	0	1	0	2	2	11	1	15	15
		2018-Aug-08	0	0	0	0	0	0	0	2	2	2

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
Northern elephant seal												
Santa Rosa Island	621D	2016-Jul-06	0	0	0	0	5	5	14	0	19	19
		2017-Jul-09	0	0	0	0	3	3	9	14	26	26
		2019-Jul-09	0	0	2	0	0	0	30	28	60	60
	622A	2017-Jul-09	0	0	0	0	0	0	1	0	1	1
	622B	2016-Jul-06	0	0	0	0	3	3	48	8	59	59
		2017-Jul-09	0	0	0	0	2	2	46	19	67	67
		2018-Aug-08	0	0	1	0	0	0	15	2	18	18
		2019-Jul-09	0	0	0	0	3	3	44	15	62	62
	622C	2016-Jul-06	0	0	0	0	0	0	0	2	2	2
	622D	2016-Jul-06	0	0	0	0	1	1	156	99	256	256
		2017-Jul-09	0	0	1	0	0	0	131	78	210	210
		2018-Aug-08	0	0	6	0	4	4	33	75	118	118
		2019-Jul-09	0	0	1	0	6	6	83	110	200	200
	622E	2017-Jul-09	0	0	0	0	2	2	15	2	19	19
		2018-Aug-08	0	0	0	0	0	0	2	0	2	2
		2019-Jul-09	0	0	0	0	2	2	7	0	9	9
	624A	2016-Jul-06	0	0	0	0	0	0	13	4	17	17
	624B	2016-Jul-06	0	0	3	0	4	4	98	22	127	127
		2017-Jul-09	0	0	0	0	3	3	35	55	93	93
		2018-Aug-08	0	0	15	0	9	9	19	13	56	56
		2019-Jul-09	0	0	0	0	1	1	21	37	59	59
	624C	2016-Jul-06	0	0	0	0	15	15	181	48	244	244
		2017-Jul-09	0	0	3	0	13	13	124	109	249	249
		2018-Aug-08	0	0	14	0	5	5	50	89	158	158
		2019-Jul-09	0	0	1	0	13	13	77	120	211	211
	625A	2016-Jul-06	0	0	1	0	1	1	68	17	87	87
		2017-Jul-09	0	0	1	0	3	3	76	39	119	119
		2018-Aug-08	0	0	2	0	0	0	11	30	43	43
		2019-Jul-09	0	0	0	0	6	6	65	33	104	104
	625B	2016-Jul-06	0	0	2	0	4	4	119	34	159	159
		2017-Jul-09	0	0	1	0	8	8	60	35	104	104
		2019-Jul-09	0	0	0	0	7	7	20	8	35	35
	625C	2016-Jul-06	0	0	0	0	0	0	1	0	1	1
		2017-Jul-09	0	0	0	0	0	0	27	38	65	65
		2019-Jul-09	0	0	1	0	4	4	51	22	78	78
	626	2016-Jul-06	0	0	2	0	16	16	108	69	195	195
		2017-Jul-09	0	0	1	0	8	8	51	56	116	116
		2019-Jul-09	0	0	2	0	9	9	55	33	99	99

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
Northern fur seal												
San Miguel Island	H	2016-Jul-06	1,326	42	32	1,072	180	1,252	300	113	1,697	3,023
		2017-Jul-25	1,935	219	18	636	150	786	224	224	1,252	3,187
		2018-Aug-07	1,452	181	36	633	131	764	112	78	990	2,442
		2019-Jul-07	1,314	25	34	974	82	1,056	193	308	1,591	2,905
	O	2016-Jul-06	971	4	6	750	167	917	219	86	1,228	2,199
		2017-Jul-25	670	7	11	247	63	310	137	205	663	1,333
		2018-Aug-07	839	8	8	523	126	649	50	92	799	1,638
		2019-Jul-07	637	0	14	609	18	627	49	145	835	1,472
Pacific harbor seal												
Anacapa Island	660	2016-Jul-05										46
		2017-Jul-09										25
		2019-Jul-05										10
	670	2016-Jul-05										30
Richardson Rock	103	2016-Jul-06										1
		2017-Jul-25										4
		2018-Aug-07										2
San Clemente Island	402	2016-Jul-08										2
		2017-Jul-08										2
		2018-Jul-06										6
	404	2017-Jul-08										33
		2018-Jul-06										17
	406	2016-Jul-08										14
		2017-Jul-08										16
		2018-Jul-06										12
		2019-Jul-06										7
	407	2016-Jul-08										4
		2017-Jul-08										5
		2018-Jul-06										4
		2019-Jul-06										2
	411	2016-Jul-08										6
		2017-Jul-08										15
		2018-Jul-06										5
		2019-Jul-06										4
San Miguel Island	A	2016-Jul-06										38
		2017-Jul-25										2
		2018-Aug-07										7
		2019-Jul-07										13

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
Pacific harbor seal												
San Miguel Island	B	2016-Jul-06										8
	C	2016-Jul-06										45
		2017-Jul-25										18
		2018-Aug-07										22
		2019-Jul-07										23
	D	2016-Jul-06										99
		2017-Jul-25										19
		2019-Jul-07										38
	E	2016-Jul-06										58
		2017-Jul-25										17
		2018-Aug-07										16
		2019-Jul-07										33
	F	2016-Jul-06										39
		2017-Jul-25										3
		2018-Aug-07										8
		2019-Jul-07										9
	G	2016-Jul-06										2
		2017-Jul-25										1
		2018-Aug-07										6
	H	2016-Jul-06										16
		2017-Jul-25										34
		2018-Aug-07										33
	I	2016-Jul-06										1
		2018-Aug-07										1
		2019-Jul-07										2
	J	2016-Jul-06										129
		2017-Jul-25										54
		2018-Aug-07										33
		2019-Jul-07										29
	K	2016-Jul-06										1
	L	2016-Jul-06										88
		2017-Jul-25										5
		2018-Aug-07										26
		2019-Jul-07										29
	M	2016-Jul-06										21
		2019-Jul-07										3
	N	2016-Jul-06										157
		2017-Jul-25										77

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
						Pacific harbor seal						
San Miguel Island	N	2018-Aug-07										56
		2019-Jul-07										75
San Nicolas Island	C	2016-Jul-05										50
		2017-Jul-08										19
		2019-Jul-08										22
	D	2016-Jul-05										7
		2017-Jul-08										18
		2018-Aug-07										4
		2019-Jul-08										7
	E	2016-Jul-05										11
		2017-Jul-08										2
		2018-Aug-07										4
		2019-Jul-08										24
	F	2016-Jul-05										18
		2017-Jul-08										12
		2019-Jul-08										3
	G	2018-Aug-07										1
	I	2018-Aug-07										7
		2019-Jul-08										1
	J	2016-Jul-05										12
		2017-Jul-08										4
		2018-Aug-07										6
		2019-Jul-08										7
	K	2017-Jul-08										1
		2019-Jul-08										1
	L	2016-Jul-05										62
		2017-Jul-08										79
		2019-Jul-08										2
	M	2016-Jul-05										9
		2017-Jul-08										6
		2019-Jul-08										2
	N	2016-Jul-05										106
		2017-Jul-08										64
		2019-Jul-08										66
	O	2016-Jul-05										66
		2017-Jul-08										47
	Q	2016-Jul-05										96
		2017-Jul-08										38

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
Pacific harbor seal												
San Nicolas Island	Q	2018-Aug-07										30
		2019-Jul-08										55
Santa Barbara Island	B	2016-Jul-05										7
		2017-Jul-08										10
	C	2016-Jul-05										1
	D	2016-Jul-05										28
		2017-Jul-08										3
		2018-Jul-07										10
Santa Catalina Island	502D	2019-Jul-06										8
Santa Cruz Island	643	2016-Jul-05										27
		2019-Jul-09										44
	647	2016-Jul-05										48
		2017-Jul-09										38
		2019-Jul-09										36
	653	2016-Jul-05										52
		2019-Jul-09										24
	655	2016-Jul-05										20
		2017-Jul-09										17
		2018-Aug-08										19
	656	2016-Jul-05										134
		2017-Jul-09										118
		2018-Aug-08										56
	658	2016-Jul-05										35
		2018-Aug-08										11
		2019-Jul-09										3
Santa Rosa Island	611	2019-Jul-09										9
	615A	2016-Jul-06										72
		2017-Jul-09										47
		2018-Aug-08										30
		2019-Jul-09										21
	617	2017-Jul-09										1
		2019-Jul-09										2
	621B	2016-Jul-06										9
		2019-Jul-09										5
	621C	2016-Jul-06										23
		2017-Jul-09										10
		2018-Aug-08										4
	621D	2016-Jul-06										8

Table 4. (Continued)

Island/Rock	Area	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
Pacific harbor seal												
Santa Rosa Island	622A	2016-Jul-06										1
	622B	2016-Jul-06										3
		2017-Jul-09										1
		2019-Jul-09										4
	622D	2016-Jul-06										10
		2017-Jul-09										5
	624A	2016-Jul-06										97
		2017-Jul-09										55
		2018-Aug-08										7
		2019-Jul-09										33
	624B	2016-Jul-06										1
	625A	2016-Jul-06										5
		2017-Jul-09										3
	625B	2016-Jul-06										8
		2017-Jul-09										14
		2019-Jul-09										26
	625C	2017-Jul-09										4
	626	2016-Jul-06										149
		2017-Jul-09										126
		2019-Jul-09										48
Steller sea lion												
Anacapa Island	680	2019-Jul-05	0	0	3	0	0	0	0	0	3	3
Guadalupe fur seal												
San Nicolas Island	H	2019-Jul 08	0	0	0		1[1]		0	0	1	1

[1]For Guadalupe fur seals, unable to differentiate between adult females and young males.

Table 5. California sea lion, northern elephant seal, northern fur seal, and Pacific harbor seal age/sex class and/or category totals counted from photographs of haulout sites within Area H at San Miguel Island taken during aerial photographic surveys conducted in July-August 2016 – 2019. No counts obtained for blank cells and only sites with animals are included. Refer to Figure 5 for location of haulout sites.

Survey date	Haulout site	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
California sea lion											
2016-Jul-06	40	1,092	2	48	1,001	18	1,019	34	140	1,241	2,333
	41	455	2	11	332	1	333	6	48	398	853
	52	396	1	20	465	11	476	6	47	549	945
	53	901	3	56	960	24	984	30	112	1,182	2,083
	54	3,772	60	121	2,970	85	3,055	199	362	3,737	7,509
	55	85	0	9	167	0	167	0	24	200	285
	56	1,667	17	68	1,657	2	1,659	23	186	1,936	3,603
	57	53	1	8	71	0	71	0	17	96	149
	58	959	53	119	893	55	948	168	162	1,397	2,356
	59	255	1	6	230	0	230	1	31	268	523
	60	391	37	30	271	233	504	652	638	1,824	2,215
2017-Jul-25	40	1,298	1	52	884	38	922	13	64	1,051	2,349
	41	528	2	24	335	24	359	13	36	432	960
	52	454	1	52	400	11	411	6	23	492	946
	53	1,238	13	44	775	19	794	1	63	902	2,140
	54	5,075	110	120	2,233	74	2,307	15	138	2,580	7,655
	55	106	0	74	281	1	282	0	22	378	484
	56	2,011	20	70	1,507	25	1,532	4	104	1,710	3,721
	57	53	0	20	97	3	100	1	8	129	182
	58	1,302	22	120	566	94	660	28	29	837	2,139
	59	270	1	7	191	0	191	4	16	218	488
	60	417	34	16	223	133	356	242	140	754	1,171
2018-Aug-07	40	1,479	0	154	1,134	5	1,139	4	13	1,310	2,789
	41	590	0	61	457	5	462	2	9	534	1,124
	52	563	0	103	443	11	454	1	4	562	1,125
	53	1,135	5	240	971	13	984	4	7	1,235	2,370
	54	4,162	67	396	2,403	60	2,463	9	17	2,885	7,047
	55	167	0	189	336	0	336	0	3	528	695
	56	2,108	43	369	1,883	24	1,907	2	12	2,290	4,398
	57	55	0	78	117	2	119	1	0	198	253
	58	1,166	11	780	615	162	777	8	7	1,572	2,738
	59	347	1	33	231	2	233	0	3	269	616
	60	370	10	68	222	32	254	3	7	332	702

Table 5. (Continued)

Survey date	Haulout site	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
California sea lion											
2019-Jul-07	40	1,470	0	81	986	6	992	7	123	1,203	2,673
	41	531	4	22	375	0	375	1	44	442	973
	52	468	1	54	341	1	342	3	38	437	905
	53	1,315	4	157	871	12	883	8	91	1,139	2,454
	54	5,175	125	325	3,066	43	3,109	28	291	3,753	8,928
	55	122	0	129	212	0	212	0	21	362	484
	56	2,299	13	224	1,545	10	1,555	7	152	1,938	4,237
	57	55	0	51	78	2	80	0	11	142	197
	58	1,014	28	1,336	1,745	134	1,879	443	298	3,956	4,970
	59	369	0	11	198	1	199	0	30	240	609
	60	351	10	98	177	133	310	219	304	931	1,282
Northern elephant seal											
2016-Jul-06	52	0		0	0	3	3	5	0	8	8
	53	0		0	0	2	2	8	0	10	10
	54	0		2	0	10	10	457	172	641	641
	56	0		0	0	0	0	1	0	1	1
	58	0		2	0	7	7	120	25	154	154
	60	0		0	0	0	0	3	4	7	7
2017-Jul-25	52	0	0	0	0	0	0	1	0	1	1
	53	0	0	1	0	0	0	2	0	3	3
	54	0	0	2	0	3	3	182	301	488	488
	56	0	0	1	0	0	0	1	0	2	2
	58	0	0	8	0	2	2	92	99	201	201
	60	0	0	2	0	0	0	5	1	8	8
2018-Aug-07	40	0	0	2	0	0	0	0	0	2	2
	41	0	0	3	0	0	0	0	0	3	3
	54	0	0	19	0	2	2	176	264	461	461
	56	0	0	10	0	6	6	22	4	42	42
	58	0	0	13	0	7	7	11	21	52	52
	60	0	0	7	0	0	0	1	0	8	8
2019-Jul-07	52	0	0	0	0	0	0	5	0	5	5
	54	0	0	2	0	14	14	181	256	453	453
	58	0	0	3	0	14	14	137	57	211	211
	60	0	0	2	0	0	0	13	12	27	27
Northern fur seal											
2016-Jul-06	58	6	0	27	5	104	109	117	3	256	262
	60	1,320	42	5	1,067	76	1,143	183	110	1,441	2,761
2017-Jul-25	56	0	0	0	0	1	1	0	0	1	1
	58	7	0	1	2	62	64	87	57	209	216
	60	1,928	219	17	634	87	721	137	167	1,042	2,970

Table 5. (Continued)

Survey date	Haulout site	Live pups	Dead pups	Juveniles	Adult females	Young males	Adult females & young males	Sub-adult males	Adult males	Non-pups	Total live
Northern fur seal											
2018-Aug-07	58	0	0	0	0	38	38	45	12	95	95
	60	1,452	181	36	633	93	726	67	66	895	2,347
2019-Jul-07	58	8	0	6	3	65	68	143	84	301	309
	60	1,306	25	28	971	17	988	50	224	1,290	2,596
Pacific harbor seal											
2016-Jul-06	53										7
	56										8
	57										1
2017-Jul-25	40										1
	52										1
	53										10
	55										1
	56										16
	57										5
2018-Aug-07	53										5
	55										5
	56										19
	57										4

Table 6. California sea lion, Steller sea lion, and northern fur seal age/sex class and/or categorical totals counted from aerial photographs taken during surveys conducted within seven zones in central and northern California and in southern Oregon for surveys conducted in June or July 2016 – 2018 (refer to map in Figure 1 for location of zones). Some zones required more than one day to survey due to weather conditions.

Section	Zone	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
California sea lions											
Northern California	A	2016 Jul 14	0	0	11	10	204	27	17	269	269
	A	2017 Jul 14	1	0	48	2	39	9	4	102	103
	B	2016 Jul 15	0	0	0	0	3	3	15	21	21
	B	2017 Jul 15	0	0	0	0	0	3	3	6	6
	C	2016 Jul 17 & 25	0	0	2	0	8	56	94	456	456
	C	2017 Jul 15	0	0	3	0	262	42	48	355	355
Central California	D	2016 Jul 18	522	1	721	2,251	1,155	817	405	5,349	5,871
	D	2017 Jul 16	1,027	1	903	1,547	814	1,131	437	4,832	5,859
	D[1]	2018 Jun 26	1,180	2	1,686	1,811	1,196	624	551	5,868	7,048
	E	2016 Jul 17 & 20	546	3	506	4,098	528	1,013	565	6,710	7,256
	E	2017 Jul 16	990	4	1,622	3,183	1,224	1,894	570	8,493	9,483
	E[1]	2018 Jun 26	836	1	1,572	1,297	515	271	317	3,972	4,808
	F	2016 Jul 17	1	0	98	824	549	344	125	1,940	1,941
	F	2017 Jul 16	3	0	863	1,514	385	349	97	3,192	3,195
	G	2016 Jul 17 & 18	4	0	319	2,554	515	276	87	3,751	3,755
	G	2017 Jul 16	5	0	863	2,475	879	511	122	4,850	4,855
Southern Oregon	OR	2016 Jul 15	0	0	1	0	162	27	28	218	218
	OR	2017 Jul 15	0	0	5	0	23	26	11	65	65
Steller sea lions											
Northern California	A	2016 Jul 14	537	3	462	523	572	104	73	1,734	2,271
	A	2017 Jul 14	454	4	250	435	577	172	77	1,511	1,965
	B	2016 Jul 15	103	2	97	224	249	93	50	713	816
	B	2017 Jul 15	114	0	50	221	167	66	39	543	657
	C	2016 Jul 17 & 25	0	0	9	0	53	12	1	79	79
	C	2017 Jul 15	0	0	19	0	111	27	11	168	168
Central California	D	2016 Jul 18	46	0	214	61	118	15	18	426	472
	D	2017 Jul 16	57	0	48	146	15	12	16	237	294
	D[1]	2018 Jun 26	76	1	143	142	134	20	28	467	543
	E	2016 Jul 17 & 20	147	2	14	153	8	9	25	209	356
	E	2017 Jul 16	164	0	27	174	8	8	22	239	403
	E[1]	2018 Jun 26	175	0	23	197	18	12	32	282	457
Southern Oregon	OR	2016 Jul 15	2,037	9	175	2,167	376	135	197	3,050	5,087
	OR	2017 Jul 14 & 15	1,769	3	120	1,984	549	584	256	3,493	5,262

Table 6. (Continued)

Northern fur seals											
Central California	D[2]	2016 Jul 18	763	0	6	358	204	89	92	749	1,512
	D[2]	2017 Jul 16	1,138	0	1	751	92	247	247	1,338	2,476
	D[1,2]	2018 Jun 26	150	0	15	310	104	129	208	766	916

[1]Only Año Nuevo Island and the Farallon Islands were surveyed in 2018.
[2]Northern fur seals were only found on Southeast Farallon Island.

Table 7. Northern elephant seal, northern fur seal, Steller sea lion, Pacific harbor seal, and Guadalupe fur seal age/sex class and/or category totals counted from aerial photographs taken during surveys conducted at each of the Channel Islands in southern California in July and August 2016 – 2019.

Year	Island or Rock	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
					Northern elephant seal						
2016	Anacapa Island	2016-Jul-05	0		1	0	0	0	0	1	1
	San Clemente Island	2016-Jul-08	0		0	0	1	3	1	5	5
	San Miguel Island	2016-Jul-06	0		17	0	82	2,109	806	3,014	3,014
	San Nicolas Island	2016-Jul-05	0		9	0	48	1,092	173	1,322	1,322
	Santa Barbara Island	2016-Jul-05	0		0	0	2	7	1	10	10
	Santa Rosa Island	2016-Jul-06	0		9	0	56	883	312	1,260	1,260
	Channel Islands total		0		36	0	189	4,094	1,293	5,612	5,612
2017	Anacapa Island	2017-Jul-09	0		0	0	0	0	1	1	1
	San Clemente Island	2017-Jul-08	0		0	0	0	2	2	4	4
	San Miguel Island	2017-Jul-25	0		63	0	41	1,042	1,181	2,327	2,327
	San Nicolas Island	2017-Jul-08	0		11	0	172	690	349	1,222	1,222
	Santa Barbara Island	2017-Jul-08	0		0	0	0	4	3	7	7
	Santa Rosa Island	2017-Jul-09	0		8	0	50	642	469	1,169	1,169
	Channel Islands total		0		82	0	263	2,380	2,005	4,730	4,730
2018	San Clemente Island	2018-Jul-06	0		0	0	0	8	1	9	9
	San Miguel Island	2018-Aug-07	0		224	0	67	670	977	1,938	1,938
	San Nicolas Island	2018-Aug-07	0		50	0	20	243	311	624	624
	Santa Barbara Island	2018-Jul-07	0		0	0	2	1	0	3	3
	Santa Barbara Island[1]	2018-Aug-07	0		0	0	3	1	0	4	4
	Santa Rosa Island	2018-Aug-08	0		38	0	18	139	214	409	409
	Channel Islands total[1]		0		312	0	107	1,061	1,503	2,983	2,983
2019	San Clemente Island	2019-Jul-06	0		0	0	0	2	2	4	4
	San Miguel Island	2019-Jul-07	0		43	0	210	1,470	1,068	2,791	2,791
	San Nicolas Island	2019-Jul-08	0		18	0	72	712	383	1,185	1,185
	Santa Barbara Island[2]	Estimate[2]	0		0	0	1	4	1	6	6
	Santa Rosa Island	2019-Jul-09	0		7	0	57	510	441	1,015	1,015

Table 7. (Continued)

Year	Island or Rock	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
					Northern elephant seal						
2019	Channel Islands total[2]		0		68	0	340	2,698	1,895	5,001	5,001
					Northern fur seal						
2016	San Miguel Island	2016-Jul-06	2,297	46	38	1,822	347	519	199	2,925	5,222
2017	San Miguel Island	2017-Jul-25	2,605	226	29	883	213	361	429	1,915	4,520
2018	San Miguel Island	2018-Aug-07	2,291	189	44	1,156	257	162	170	1,789	4,080
2019	San Miguel Island	2019-Jul-07	1,951	25	48	1,583	100	242	453	2,426	4,377
					Steller sea lion						
2019	Anacapa Island	2019-Jul-05	0	0	3	0	0	0	0	3	3
					Pacific harbor seal						
2016	Anacapa Island	2016-Jul-05									76
	Richardson Rock	2016-Jul-06									1
	San Clemente Island	2016-Jul-08									26
	San Miguel Island	2016-Jul-06									702
	San Nicolas Island	2016-Jul-05									437
	Santa Barbara Island	2016-Jul-05									36
	Santa Cruz Island	2016-Jul-05									316
	Santa Rosa Island	2016-Jul-06									386
	Channel Islands total										1,980
2017	Anacapa Island	2017-Jul-09									25
	Richardson Rock	2017-Jul-25									4
	San Clemente Island	2017-Jul-08									71
	San Miguel Island	2017-Jul-25									230
	San Nicolas Island	2017-Jul-08									290
	Santa Barbara Island	2017-Jul-08									13
	Santa Cruz Island	2017-Jul-09									173
	Santa Rosa Island	2017-Jul-09									266
	Channel Islands total										1,072

Table 7. (Continued)

Year	Island or Rock	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
					Pacific harbor seal						
2018	Richardson Rock	2018-Aug-07									2
	San Clemente Island	2018-Jul-06									44
	San Miguel Island	2018-Aug-07									208
	San Nicolas Island	2018-Aug-07									52
	Santa Barbara Island	2018-Jul-07									10
	Santa Cruz Island	2018-Aug-08									86
	Santa Rosa Island	2018-Aug-08									41
	Channel Islands total										443
2019	Anacapa Island	2019-Jul-05									10
	San Clemente Island	2019-Jul-06									13
	San Miguel Island	2019-Jul-07									254
	San Nicolas Island	2019-Jul-08									190
	Santa Barbara Island[2]	Estimate[2]									20
	Santa Catalina Island	2019-Jul-06									8
	Santa Cruz Island	2019-Jul-09									107
	Santa Rosa Island	2019-Jul-09									148
	Channel Islands total[2]										750
					Guadalupe fur seal						
2019	San Nicolas Island	2019-Jul-08	0	0	0		1[3]		0	1	1

[1]Santa Barbara Island: August 07 data was not included in Channel Islands total.

[2]Santa Barbara Island: 2019 Estimates for each northern elephant seal age/sex class and for Pacific harbor seal total live derived from mean of 2016 - 2018 data; Non-pup total and Total live are the sum of age/sex class estimates.

[3]For Guadalupe fur seals, unable to differentiate between adult females and young males.

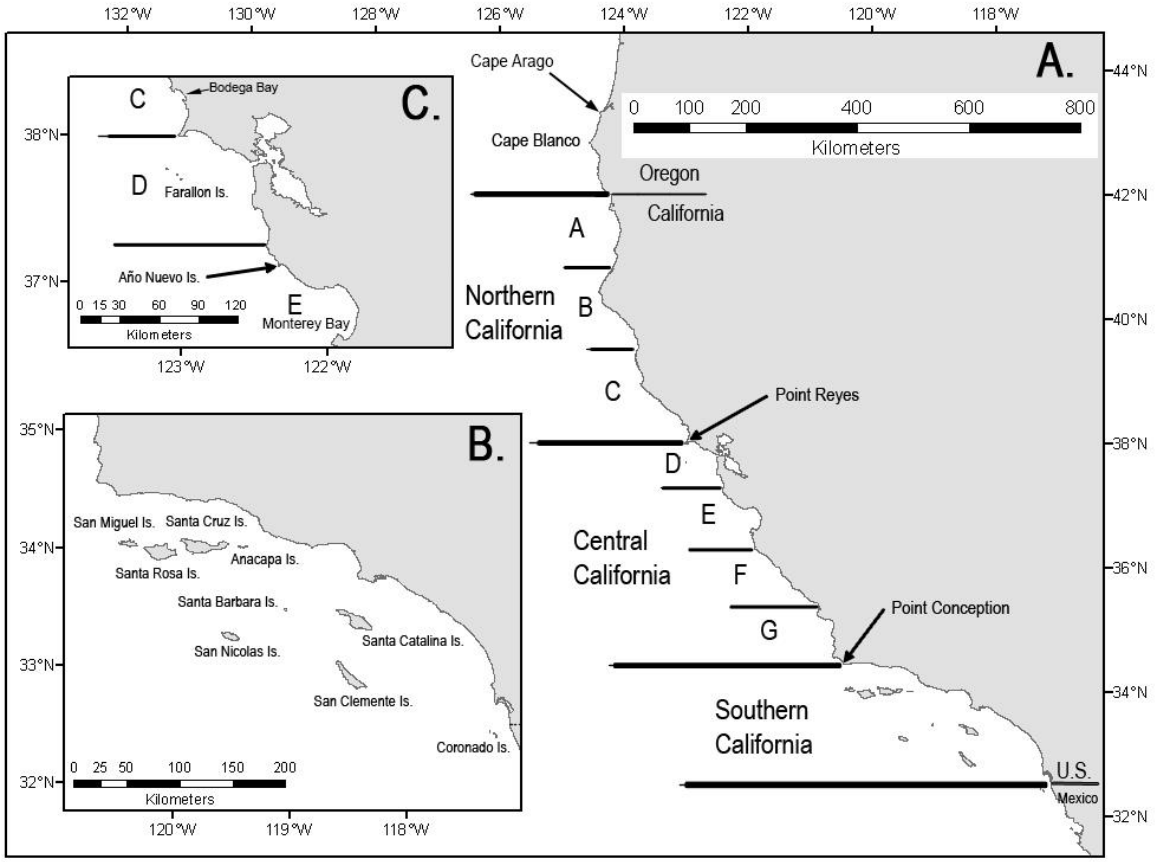

Figure 1. A. Map of California shoreline showing strata of the coastline comprised of four sections (southern, central, and northern California, and southern Oregon) and zones A through G within central and northern California. B. Map of southern California showing names and location of the Channel Islands. Not shown are Castle Rock (located 1 km from the NW shoreline of San Miguel Island), Richardson Rock (located 10 km NW from Point Bennett, San Miguel Island), and Gull Island (located 1.4 km from Punta Arena, Santa Cruz Island). C. Map of coastline from Monterey Bay to Bodega Bay showing location of rookeries at Año Nuevo Island and the Farallon Islands.

Figure 2. Partenavia P-68 Observer used by SWFSC to conduct aerial photographic surveys of pinnipeds, with Mark Lowry standing next to it just before his last aerial photographic survey on August 8, 2018.

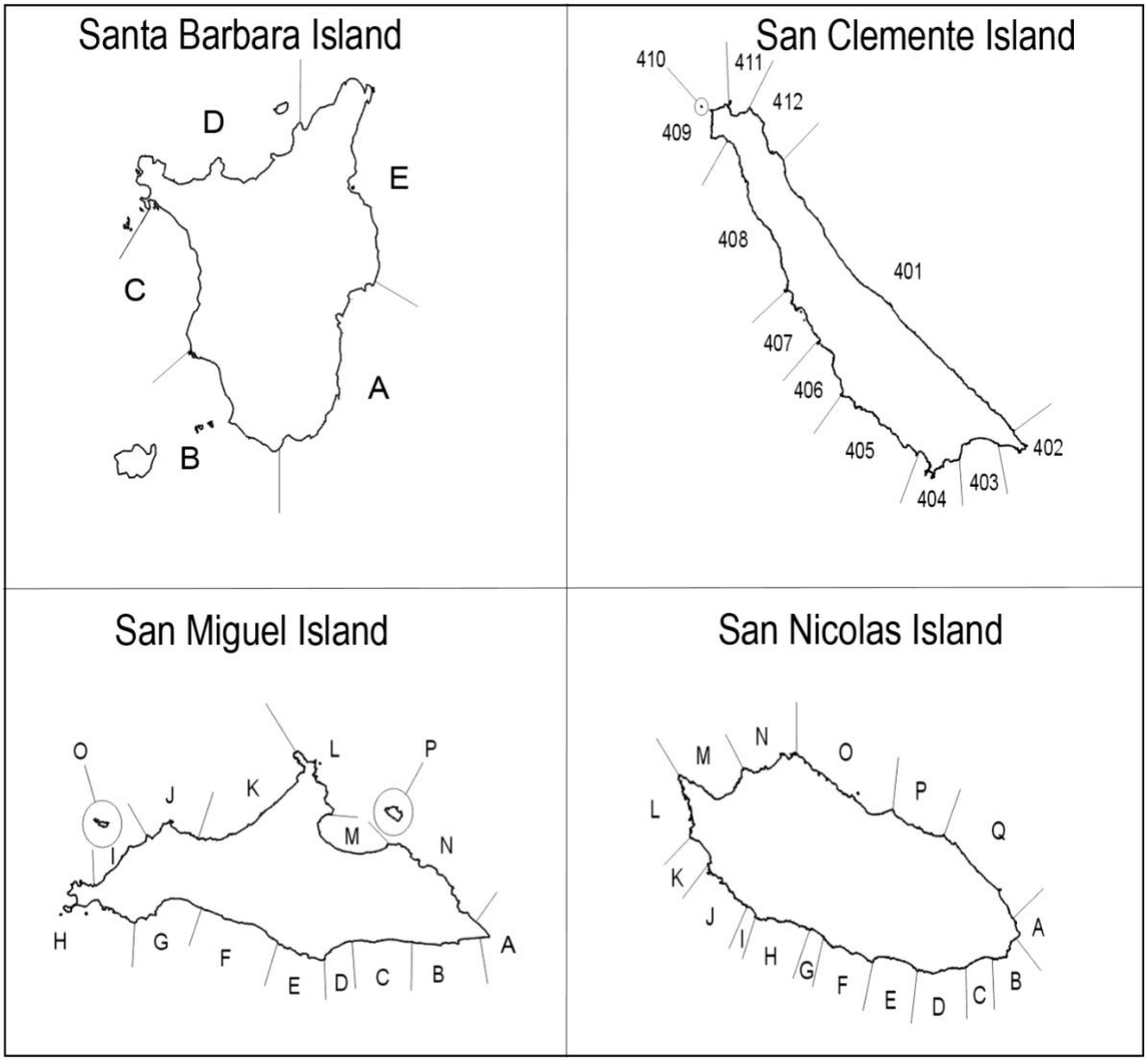

Figure 3. Area codes for Santa Barbara Island, San Clemente Island, San Miguel Island, and San Nicolas Island. Area codes for San Clemente Island are from Bonnell et al. (1980). Refer to Appendix 1 for geographical positions (i.e., latitude and longitude) of area boundaries.

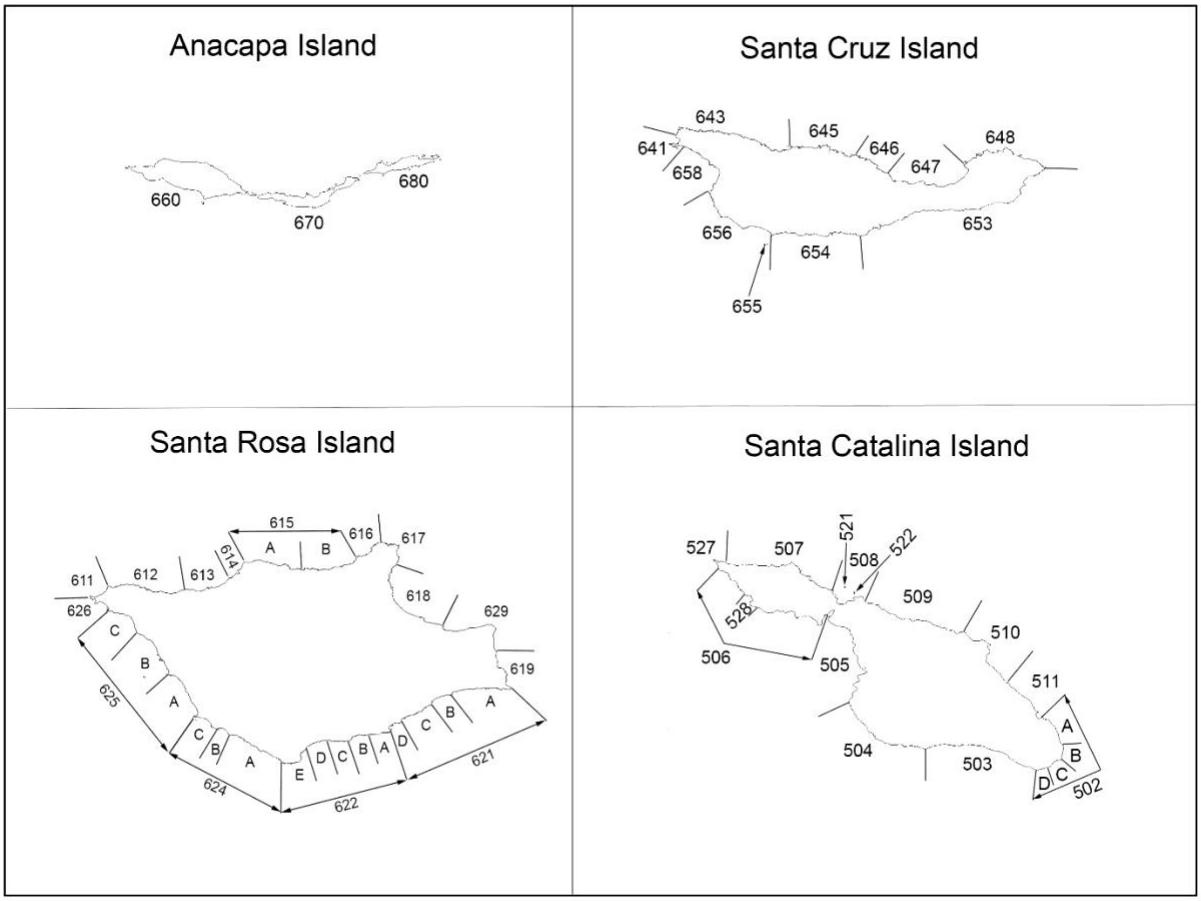

Figure 4. Area codes for Santa Catalina Island, Santa Cruz Island, Anacapa Island, and Santa Rosa Island from Bonnell et al. (1980). Areas 615, 621, 622, 624, and 625 at Santa Rosa Island and area 502 at Santa Catalina Island (Bonnell et al., 1980) were divided into subareas areas. Area 502C at Santa 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.

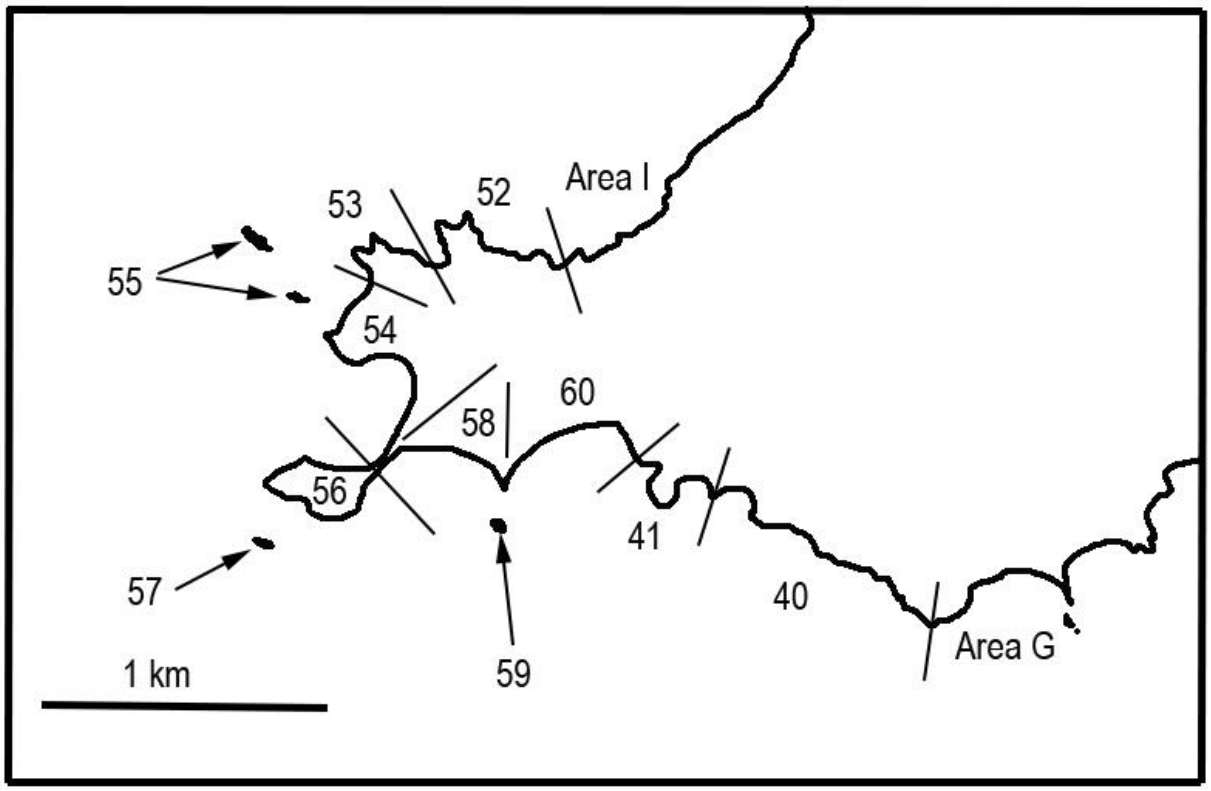

Figure 5. Haulout site codes within Area H (Point Bennett and southwest shoreline) at San Miguel Island, California.

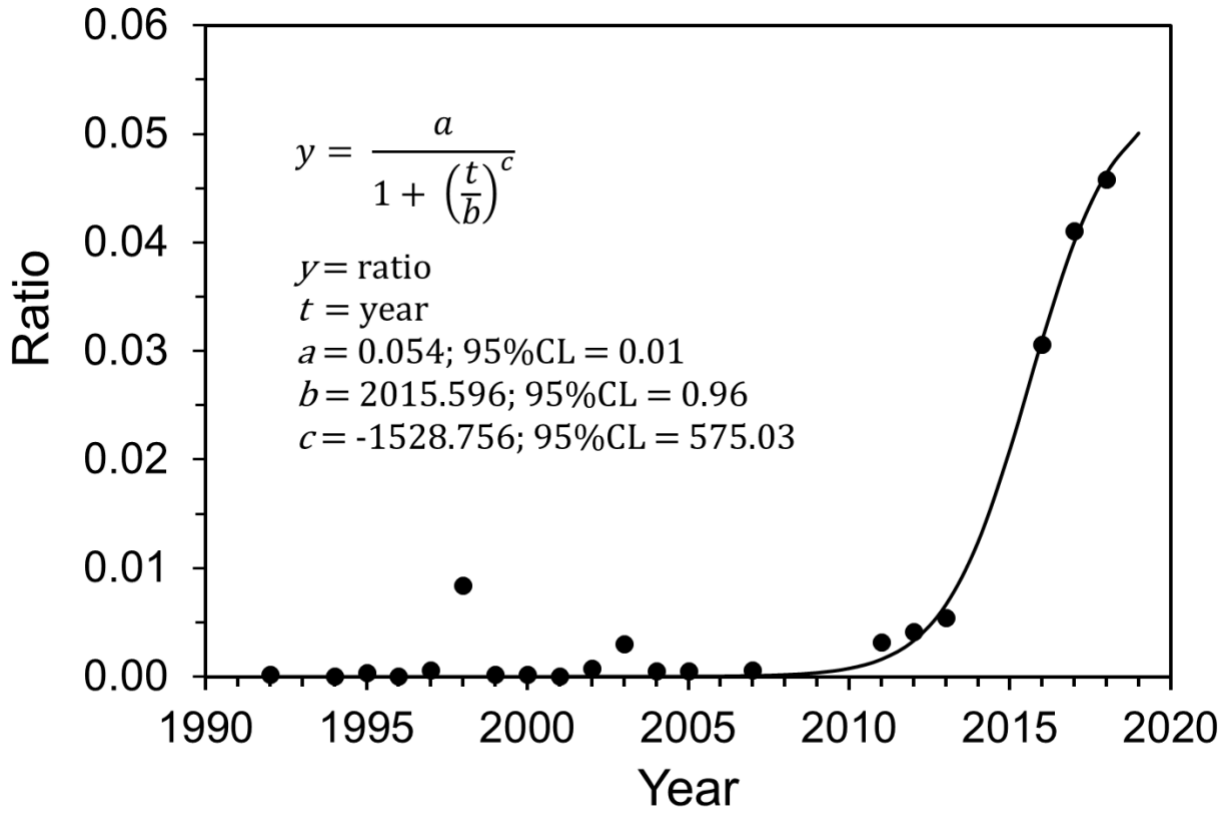

Figure 6. Logistic power regression derived from the ratio of California sea lion pups counted at Año Nuevo Island plus the Farallon Islands in central California to those counted at the Channel Islands in southern California for estimating the number of pups in the U.S. population residing at Año Nuevo Island and the Farallon Islands in central California from the count of pups at the Channel Islands in southern California during 2014, 2015, and 2019.

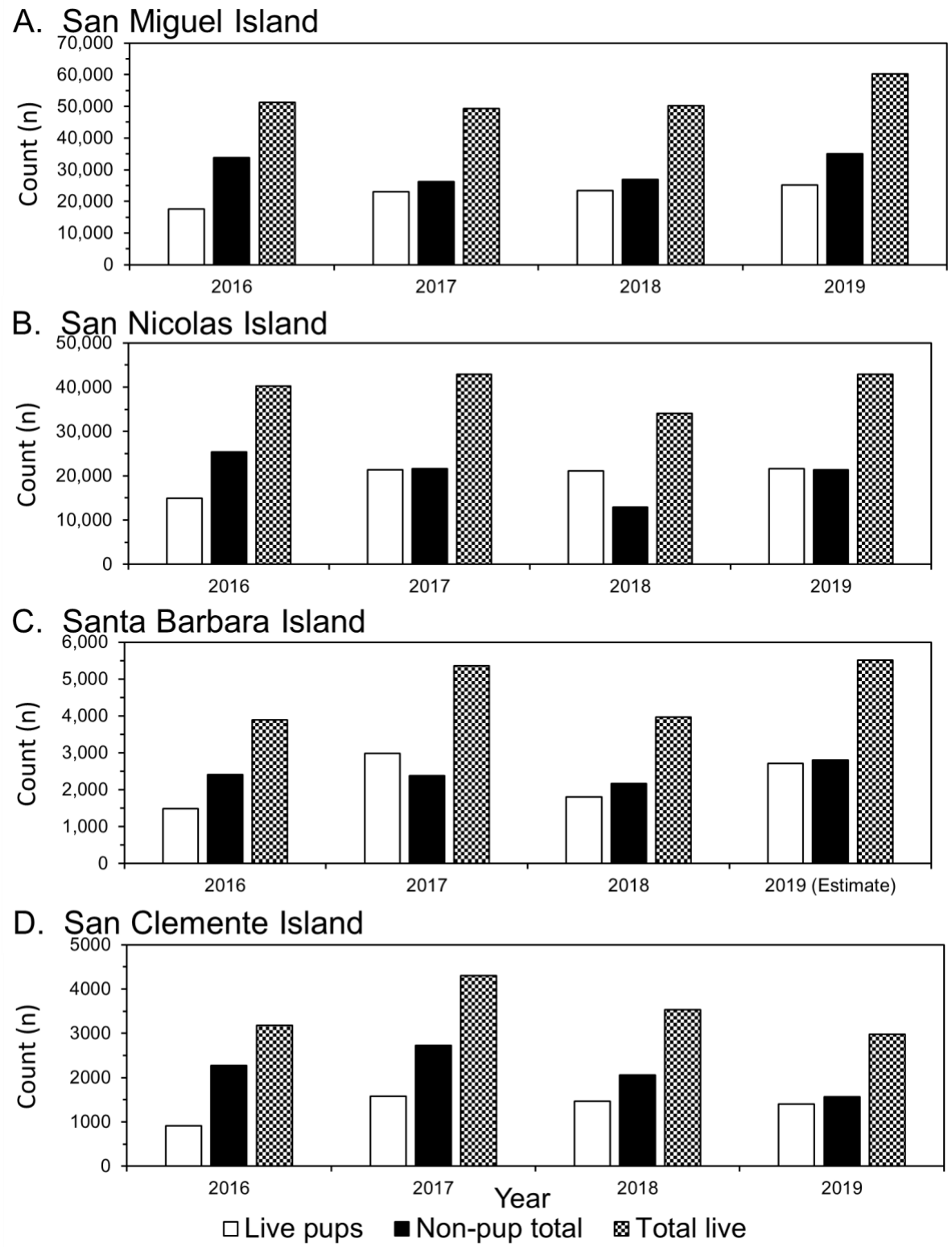

Figure 7. California sea lion pups, non-pups, and total counted or estimated at (A) San Miguel Island, (B) San Nicolas Island, (C) Santa Barbara Island, and (D) San Clemente Island during July or August 2016 – 2019.

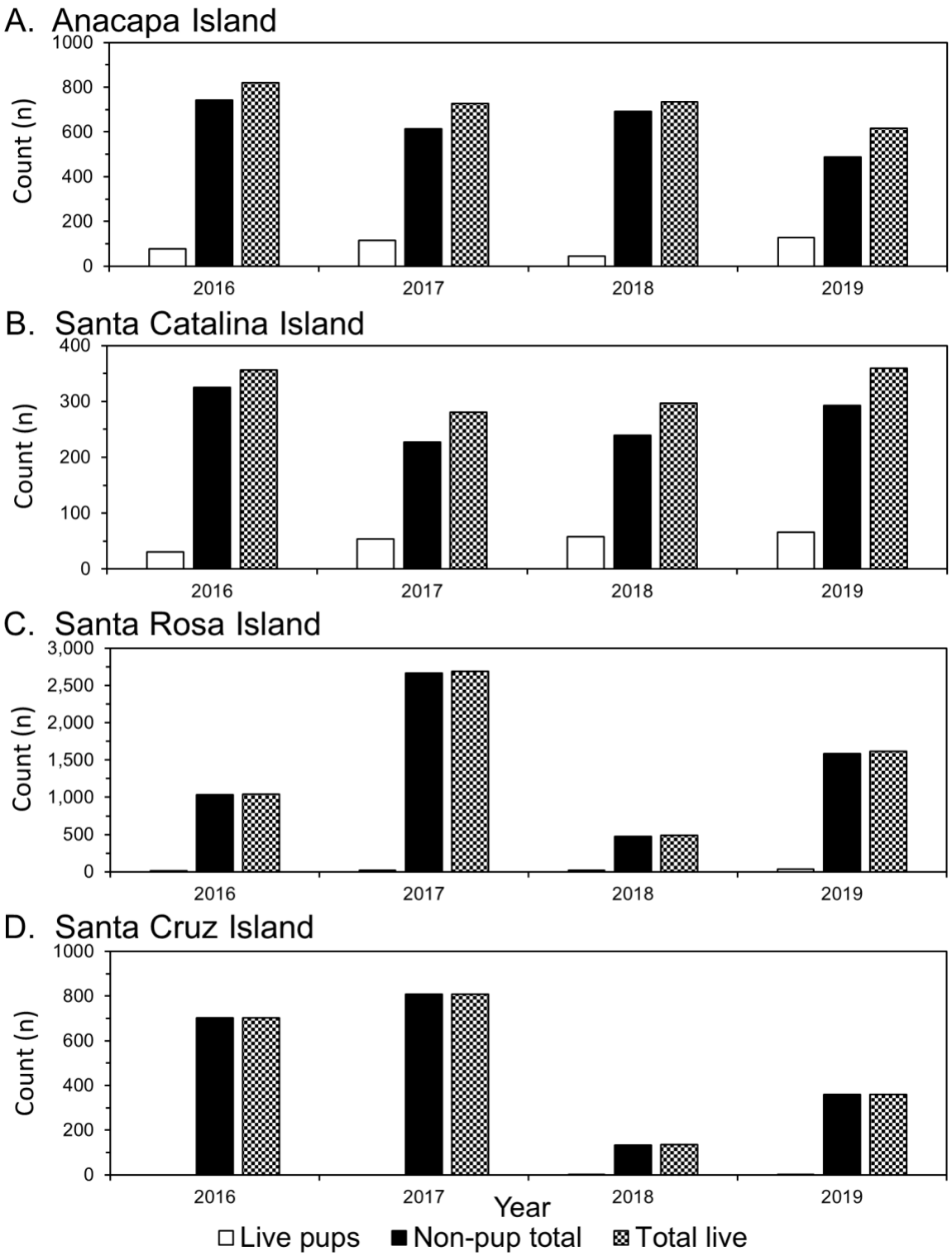

Figure 8. California sea lion pups, non-pups, and total counted at (A) Anacapa Island, (B) Santa Catalina Island, (C) Santa Rosa Island, and (D) Santa Cruz Island during July or August 2016 – 2019.

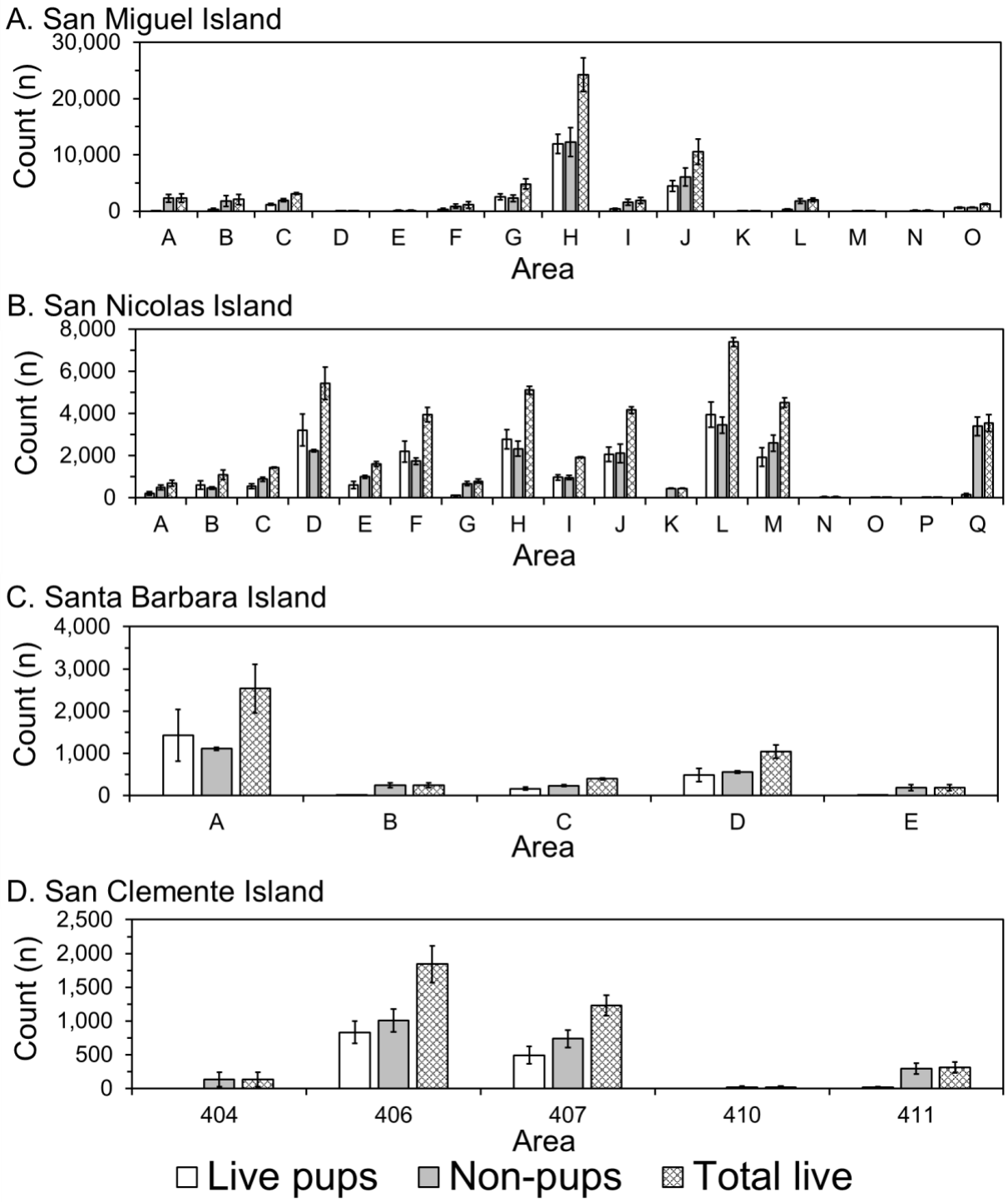

Figure 9. Intra-island distribution of California sea lions during July 2016 – 2019 at (A) San Miguel Island, (B) San Nicolas Island, (C) Santa Barbara Island, and (D) San Clemente Island showing mean number of pups, non-pups, and total live (pups + non-pups) counted (±1 SD) at areas of each island. August 2018 surveys were omitted for San Miguel Island and San Nicolas Island. Refer to Figure 3 for location of areas.

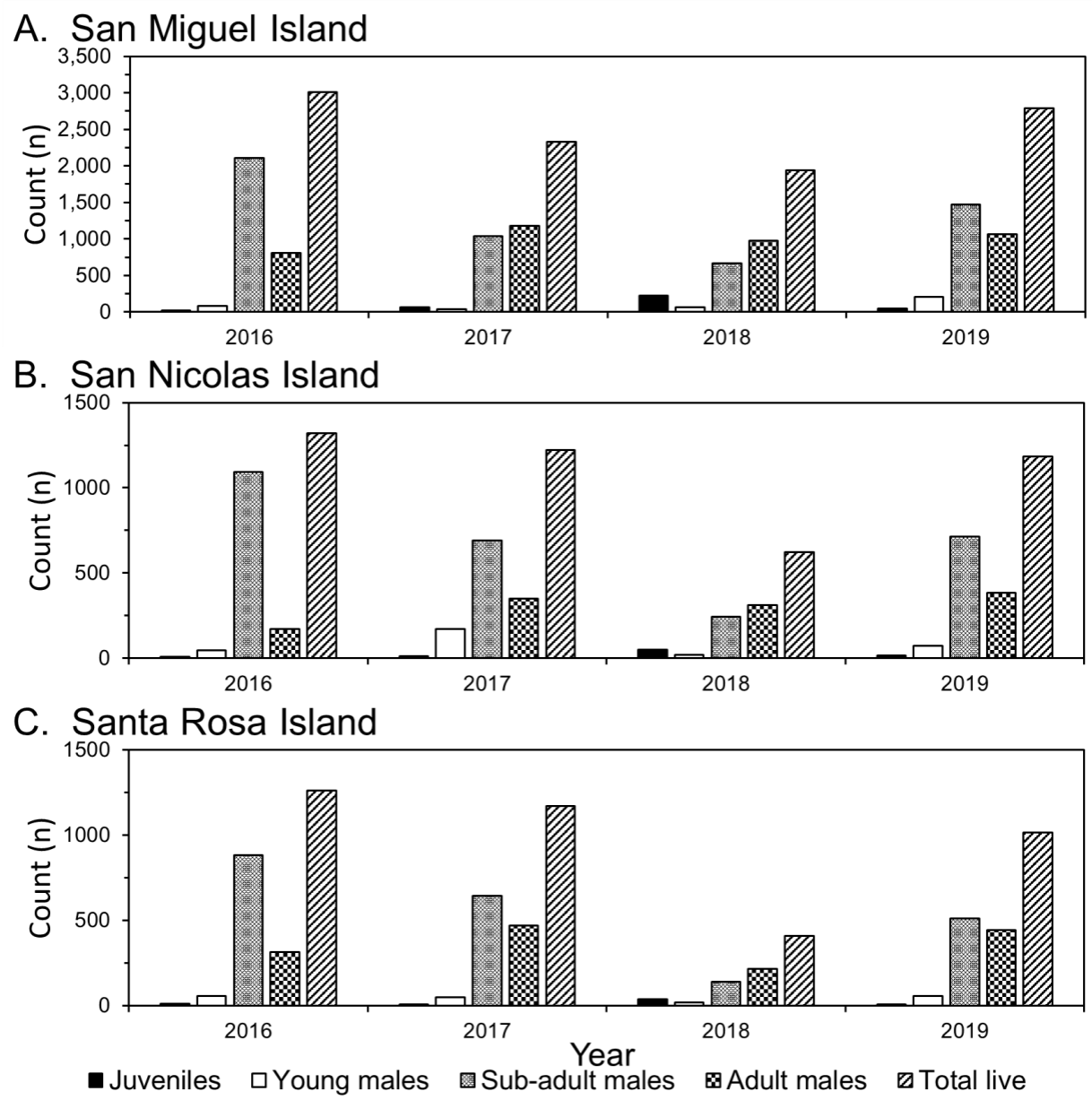

Figure 10. Northern elephant seals counted at (A) San Miguel Island, (B) San Nicolas Island, and (C) Santa Rosa Island during July 2016, 2017, and 2019, or August 2018.

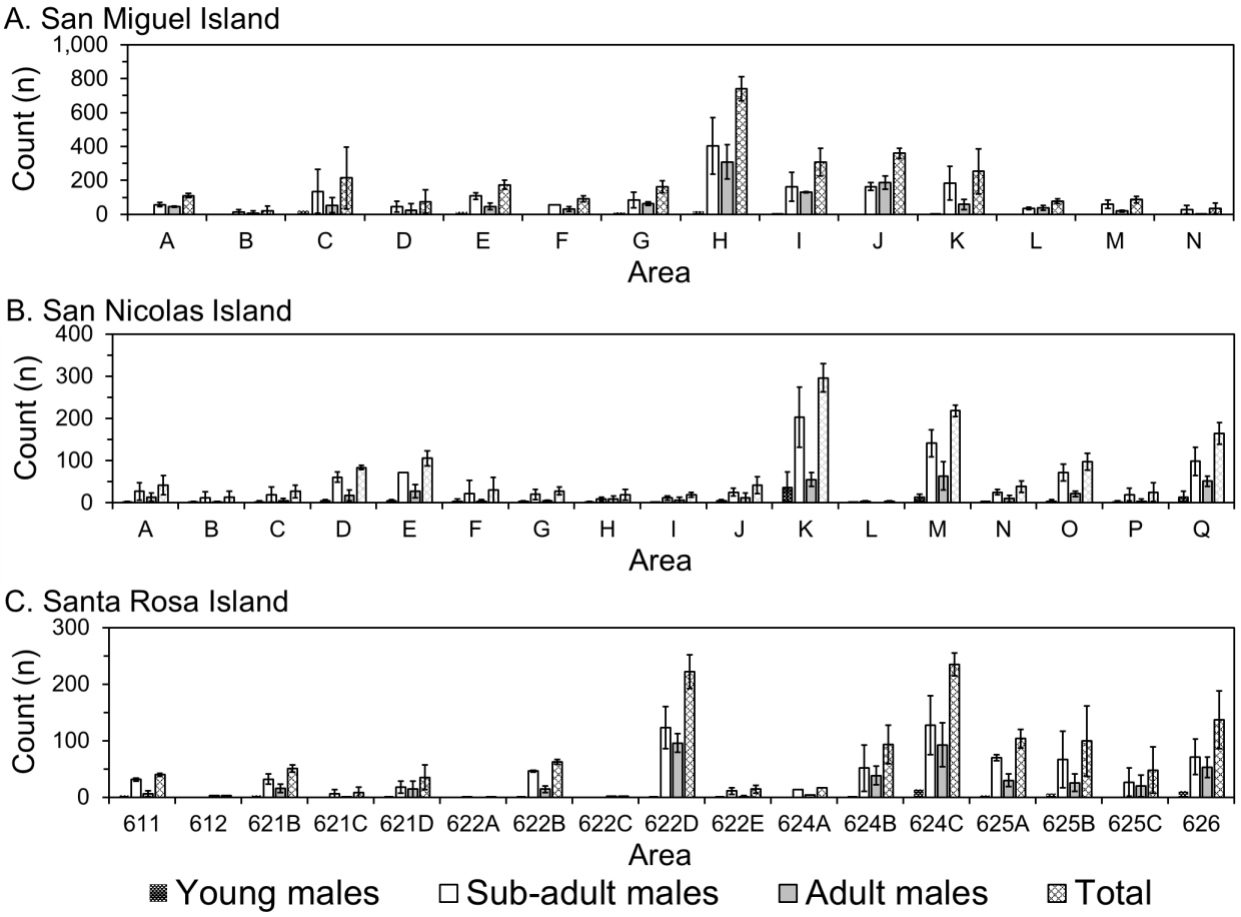

Figure 11. Intra-island distribution of northern elephant seals during July 2016 – 2019 at (A) San Miguel Island, (B) San Nicolas Island, and (C) Santa Rosa Island showing mean number (±1 SD) of young males, sub-adult males, adult males, and total counted at areas of each island. August 2018 surveys were omitted for San Miguel Island and San Nicolas Island. Refer to Figure 3 for location of areas.

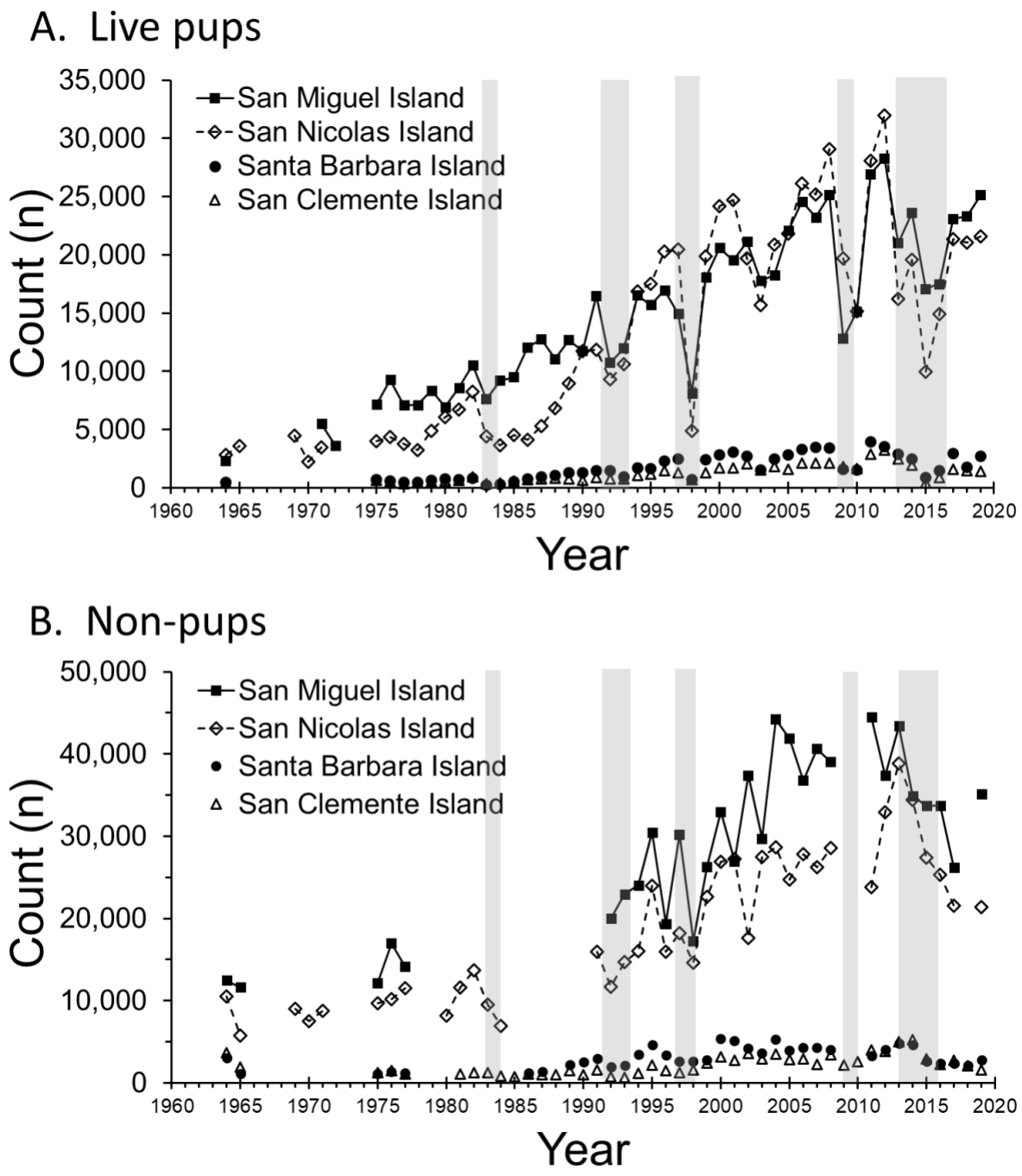

Figure 12. (A) California sea lion counts of live-pups and (B) counts of non-pups at four Channel Islands rookeries during 1964 – 2019. Shaded areas show warm-water El Niño events and the 2013 – 2016 marine heatwave. Appendices 3 and 4 have the data used in the figure.

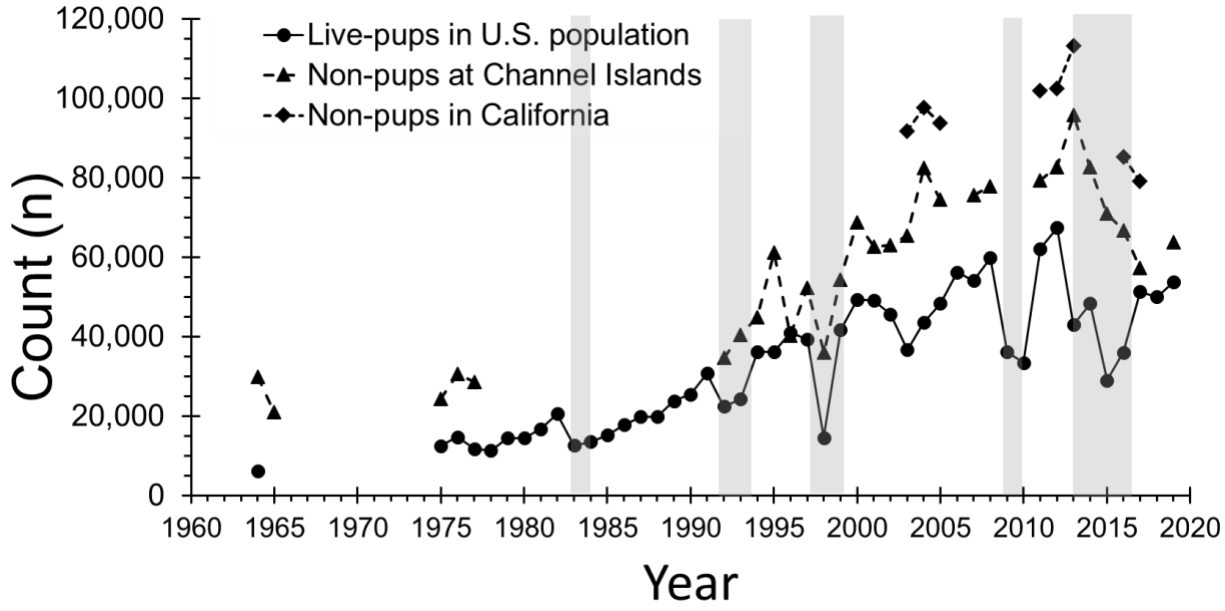

Figure 13. California sea lion pups counted in the U.S. population, non-pups at the Channel Islands in southern California, and non-pups in California (excluding southern California mainland) in 1964 – 2019. Shaded areas show warm-water El Niño events and the 2013 – 2016 marine heatwave. Appendices 3 and 4 have the data used in the figure.

Appendix 1. Geographical positions (expressed in degrees decimal) for area code boundaries within each of the Channel Islands.

		Waypoint #1		Waypoint #2	
Island	Area	Latitude	Longitude	Latitude	Longitude
San Miguel Island	A	34.032	-120.310	34.019	-120.311
	B	34.019	-120.311	34.020	-120.327
	C	34.020	-120.327	34.019	-120.354
	D	34.019	-120.354	34.015	-120.359
	E	34.015	-120.359	34.020	-120.376
	F	34.020	-120.376	34.030	-120.404
	G	34.030	-120.404	34.025	-120.428
	H	34.025	-120.428	34.037	-120.441
	I	34.037	-120.441	34.051	-120.423
	J	34.051	-120.423	34.057	-120.382
	K	34.057	-120.382	34.076	-120.369
	L	34.076	-120.369	34.059	-120.355
	M	34.059	-120.355	34.049	-120.336
	N	34.049	-120.336	34.032	-120.310
	O	34.055	-120.438		
	P	34.058	-120.334		
San Nicolas Island	A	33.234	-119.437	33.223	-119.438
	B	33.223	-119.438	33.220	-119.445
	C	33.220	-119.445	33.217	-119.456
	D	33.217	-119.456	33.217	-119.479
	E	33.217	-119.479	33.219	-119.496
	F	33.219	-119.496	33.227	-119.517
	G	33.227	-119.517	33.230	-119.522
	H	33.230	-119.522	33.233	-119.546
	I	33.233	-119.546	33.237	-119.550
	J	33.237	-119.550	33.251	-119.564
	K	33.251	-119.564	33.259	-119.573
	L	33.259	-119.573	33.279	-119.579
	M	33.279	-119.579	33.280	-119.550
	N	33.280	-119.550	33.285	-119.528
	O	33.285	-119.528	33.267	-119.486
	P	33.267	-119.486	33.259	-119.466
	Q	33.259	-119.466	33.234	-119.437
Santa Barbara Island	A	33.476	-119.028	33.465	-119.036
	B	33.465	-119.036	33.473	-119.044
	C	33.473	-119.044	33.481	-119.047
	D	33.481	-119.047	33.486	-119.034
	E	33.486	-119.034	33.476	-119.028
San Clemente Island	401	33.001	-118.548	32.830	-118.361
	402	32.830	-118.361	32.820	-118.371
	403	32.820	-118.371	32.812	-118.404
	404	32.812	-118.404	32.815	-118.439

Appendix 1. (Continued)

Island	Area	Waypoint #1		Waypoint #2	
		Latitude	Longitude	Latitude	Longitude
San Clemente Island (Continued)	405	32.815	-118.439	32.852	-118.500
	406	32.852	-118.500	32.885	-118.520
	407	32.885	-118.520	32.918	-118.546
	408	32.918	-118.546	33.012	-118.593
	409	33.012	-118.593	33.036	-118.596
	411	33.036	-118.596	33.033	-118.575
	412	33.033	-118.575	33.001	-118.548
	410	33.034	-118.614		
Santa Rosa Island	611	34.001	-120.250	34.008	-120.238
	612	34.008	-120.238	34.007	-120.186
	613	34.007	-120.186	34.013	-120.159
	614	34.013	-120.159	34.024	-120.147
	615A	34.024	-120.147	34.020	-120.097
	615B	34.020	-120.097	34.029	-120.070
	616	34.029	-120.070	34.037	-120.055
	617	34.037	-120.055	34.023	-120.045
	618	34.023	-120.045	33.983	-120.013
	629	33.983	-120.013	33.967	-119.978
	619	33.967	-119.978	33.943	-119.969
	621A	33.943	-119.969	33.938	-120.008
	621B	33.938	-120.008	33.932	-120.021
	621C	33.932	-120.021	33.921	-120.042
	621D	33.921	-120.042	33.915	-120.049
	622A	33.915	-120.049	33.912	-120.068
	622B	33.912	-120.068	33.909	-120.076
	622C	33.909	-120.076	33.909	-120.090
	622D	33.909	-120.090	33.903	-120.106
	622E	33.903	-120.106	33.894	-120.117
	624A	33.894	-120.117	33.912	-120.156
	624B	33.912	-120.156	33.917	-120.166
	624C	33.917	-120.166	33.925	-120.180
	625A	33.925	-120.180	33.952	-120.199
	625B	33.952	-120.199	33.979	-120.219
	625C	33.979	-120.219	33.993	-120.238
	626	33.993	-120.238	34.001	-120.250
Santa Cruz Island	643	34.069	-119.923	34.057	-119.791
	645	34.057	-119.791	34.043	-119.713
	646	34.043	-119.713	34.029	-119.693
	647	34.029	-119.693	34.036	-119.609
	648	34.036	-119.609	34.053	-119.565
	649	34.053	-119.656	34.034	-119.521
	653	34.034	-119.521	33.960	-119.722

Appendix 1. (Continued)

Island	Area	Waypoint #1 Latitude	Waypoint #1 Longitude	Waypoint #2 Latitude	Waypoint #2 Longitude
Santa Cruz Island (Continued)	654	33.960	-119.722	33.960	-119.818
	656	33.960	-119.818	34.008	-119.887
	658	34.008	-119.887	34.055	-119.911
	641	34.055	-119.911	34.069	-119.923
	655	33.951	-119.826		
Anacapa Island	660	34.010	-119.427		
	670	34.004	-119.393		
	680	34.015	-119.365		
Santa Catalina Island	507	33.477	-118.596	33.453	-118.502
	508	33.453	-118.502	33.443	-118.473
	509	33.443	-118.473	33.417	-118.390
	510	33.417	-118.390	33.373	-118.351
	511	33.373	-118.351	33.344	-118.318
	502A	33.344	-118.318	33.320	-118.303
	502B	33.320	-118.303	33.309	-118.305
	502C	33.309	-118.305	33.301	-118.317
	502D	33.301	-118.317	33.299	-118.327
	503	33.299	-118.327	33.317	-118.423
Santa Catalina Island	504	33.317	-118.423	33.357	-118.488
	505	33.357	-118.488	33.432	-118.507
	506	33.432	-118.507	33.470	-118.602
	527	33.470	-118.602	33.477	-118.596
	528	33.434	-118.563	33.448	-118.578
	521	33.463	-118.491		
	522	33.451	-118.487		

Appendix 2. California sea lion, Steller sea lion, and northern fur seal age/sex class and categorical totals counted from aerial photographs taken during surveys conducted within seven zones in central and northern California and in southern Oregon for surveys conducted in June or July 2016 – 2018 (refer to map in Figure 1 for location of zones). Note: In 2018, only Año Nuevo Island and the Farallon Islands were surveyed.

Section	Zone	Haulout name	Haulout latitude (°N)	Haulout longitude (°W)	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
California sea lion														
Central California	G	Rocky Point	34.564	120.640	2016-Jul-18	0	0	21	73	59	46	19	218	218
		Rocky Point	34.564	120.640	2017-Jul-16	0	0	38	0	145	111	22	316	316
		Lion Rock, Point Sal	34.899	120.666	2016-Jul-18	3	0	22	329	31	13	9	404	407
		Lion Rock, Point Sal	34.899	120.666	2017-Jul-16	0	0	86	81	249	90	12	518	518
		Point San Luis Breakwater	35.156	120.750	2016-Jul-17	0	0	16	310	12	11	5	354	354
		Point San Luis Breakwater	35.156	120.750	2017-Jul-16	0	0	149	650	35	37	17	888	888
		Pecho Rock	35.179	120.817	2016-Jul-17	0	0	49	275	141	22	5	492	492
		Pecho Rock	35.179	120.817	2017-Jul-16	1	0	154	502	100	20	5	781	782
		Lion Rock	35.217	120.872	2016-Jul-17	1	0	203	1,493	184	58	33	1,971	1,972
		Lion Rock	35.217	120.872	2017-Jul-16	4	0	401	1,175	261	131	34	2,002	2,006
		Pup Rock	35.217	120.870	2016-Jul-17	0	0	8	74	88	126	16	312	312
		Pup Rock	35.217	120.870	2017-Jul-16	0	0	35	67	89	122	32	345	345
	F	White Rock	35.533	121.089	2016-Jul-17	0	0	3	90	1	4	0	98	98
		Point Piedras Blancas (south rocks)	35.660	121.269	2016-Jul-17	0	0	16	109	32	49	6	212	212
		Point Piedras Blancas (Lighthouse rocks)	35.665	121.289	2016-Jul-17	1	0	55	547	422	103	27	1,154	1,155
		Point Piedras Blancas (Lighthouse rocks)	35.665	121.289	2017-Jul-16	3	0	657	1,072	231	109	23	2,076	2,079
		0.45 km SSE of Cape San Martin	35.885	121.462	2016-Jul-17	0	0	7	18	11	45	16	97	97
		Cape San Martin 3	35.888	121.465	2017-Jul-16	0	0	2	0	19	27	9	57	57
		Cape San Martin 2	35.889	121.470	2016-Jul-17	0	0	0	0	0	6	1	7	7
		Cape San Martin 2	35.889	121.470	2017-Jul-16	0	0	4	0	17	32	2	55	55
		Cape San Martin 1	35.891	121.474	2016-Jul-17	0	0	13	45	10	6	5	79	79
		Cape San Martin 1	35.891	121.474	2017-Jul-16	0	0	56	99	2	2	3	162	162
		4.2 km ESE of Lafler Rock	36.173	121.698	2017-Jul-16	0	0	0	0	0	10	20	30	30

Appendix 2. (Continued)

Section	Zone	Haulout name	Haulout latitude (°N)	Haulout longitude (°W)	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
California sea lion														
Central California	F	0.6 km ESE Grimes Point	36.202	121.731	2016-Jul-17	0	0	4	15	58	87	48	212	212
		0.6 km NW of Lafler Rock	36.202	121.731	2017-Jul-16	0	0	14	42	67	25	9	157	157
		Cooper Point	36.250	121.841	2016-Jul-17	0	0	0	0	15	44	22	81	81
		Point Sur	36.306	121.900	2017-Jul-16	0	0	1	0	3	56	25	85	85
	E	Lobos Rocks	36.455	121.937	2016-Jul-17	0	0	18	87	10	13	5	133	133
		Lobos Rocks	36.455	121.937	2017-Jul-16	0	0	77	45	98	60	8	288	288
		Sea Lion Rocks, Point Lobos	36.517	121.956	2016-Jul-17	0	0	58	197	30	26	22	333	333
		Sea Lion Rocks, Point Lobos	36.517	121.956	2016-Jul-17	0	0	1	37	0	2	2	42	42
		Sea Lion Rocks, Point Lobos	36.517	121.956	2017-Jul-16	0	0	371	22	292	145	33	863	863
		Cypress Point	36.579	121.978	2016-Jul-17	0	0	2	43	1	12	12	70	70
		Cypress Point	36.579	121.978	2017-Jul-16	0	0	223	24	22	23	23	315	315
		Bird Rock, Cypress Point	36.593	121.965	2016-Jul-17	0	0	31	216	31	33	14	325	325
		Bird Rock, Cypress Point	36.593	121.967	2017-Jul-16	2	0	332	228	101	81	13	755	757
		Monterey Breakwater	36.609	121.890	2016-Jul-20	0	0	22	92	14	13	1	142	142
		Monterey Breakwater	36.609	121.891	2017-Jul-16	0	0	82	96	15	36	9	238	238
		Point Piedras Blancas (South rocks)	36.660	121.269	2017-Jul-16	0	0	129	301	46	88	6	570	570
		Año Nuevo Island	37.108	122.337	2016-Jul-17	546	3	374	3,426	442	914	509	5,665	6,211
		Año Nuevo Island	37.108	122.337	2017-Jul-16	988	4	537	2,768	696	1,549	484	6,034	7,022
		Año Nuevo Island	37.108	122.337	2018-Jun-26	836	1	1,572	1,297	515	271	317	3,972	4,808
	D	Southeast Farallon Islands	37.699	123.003	2016-Jul-18	522	1	721	2,250	1,135	809	405	5,320	5,842
		Southeast Farallon Islands	37.699	123.003	2017-Jul-16	1,027	1	829	1,529	760	1,120	432	4,670	5,697
		Southeast Farallon Islands	37.699	123.003	2018-Jun-26	1,180	2	1,673	1,806	1,185	622	550	5,836	7,016
		North Farallons 2	37.764	123.098	2017-Jul-16	0	0	18	0	0	0	0	18	18
		North Farallons 3	37.767	123.100	2017-Jul-16	0	0	12	10	18	6	1	47	47

Appendix 2. (Continued)

Section	Zone	Haulout name	Haulout latitude (°N)	Haulout longitude (°W)	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
California sea lion														
Central California	D	North Farallon Islands	37.768	123.101	2016-Jul-18	0	0	0	0	6	1	0	7	7
		North Farallon Islands	37.768	123.099	2016-Jul-18	0	0	0	1	0	2	0	3	3
		North Farallon Islands	37.768	123.099	2018-Jun-26	0	0	9	5	11	0	1	26	26
		North Farallons 1	37.768	123.099	2017-Jul-16	0	0	27	8	7	2	0	44	44
		North Farallon Islands	37.772	123.107	2016-Jul-18	0	0	0	0	14	5	0	19	19
		North Farallon Islands	37.772	123.107	2018-Jun-26	0	0	4	0	0	2	0	6	6
		North Farallons 4	37.772	123.107	2017-Jul-16	0	0	12	0	3	0	0	15	15
		Pier 39, San Francisco	37.813	122.412	2017-Jul-16	0	0	5	0	26	3	4	38	38
Northern California	C	Bodega Rock	38.298	123.048	2016-Jul-25[1]	0	0						296	296
		Bodega Rock	38.298	123.048	2017-Jul-15	0	0	3	0	262	41	38	344	344
		Northwest Cape	38.515	123.262	2016-Jul-17	0	0	0	0	6	0	0	6	6
		Fish Rocks	38.800	123.592	2016-Jul-17	0	0	2	0	2	56	94	154	154
		Fish Rocks	38.800	123.592	2017-Jul-15	0	0	0	0	0	1	10	11	11
	B	Sugarloaf Island, Cape Mendocino	40.439	124.415	2016-Jul-15	0	0	0	0	0	0	2	2	2
		Cape Mendocino, Rock 2	40.445	124.412	2017-Jul-15	0	0	0	0	0	3	3	6	6
		Cape Mendocino-Rock 2	40.445	124.412	2016-Jul-15	0	0	0	0	3	3	13	19	19
	A	Turtle Rocks 2	41.133	124.185	2017-Jul-15	0	0	0	0	1	0	0	1	1
		Reading Rock	41.340	124.178	2016-Jul-14	0	0	11	10	178	6	2	207	207
		Reading Rock	41.340	124.178	2017-Jul-15	0	0	3	0	16	0	0	19	19
		Castle Rock, Point Saint George	41.762	124.247	2016-Jul-14	0	0	0	0	1	0	0	1	1
		Castle Rock, Point Saint George	41.764	124.248	2017-Jul-14	1	0	2	2	4	1	0	9	10
		Castle Rock Shoals, Point Saint George	41.765	124.244	2017-Jul-14	0	0	43	0	18	8	4	73	73
		Castle Rock, Point Saint George	41.765	124.244	2016-Jul-14	0	0	0	0	25	21	15	61	61

Appendix 2. (Continued)

Section	Zone	Haulout name	Haulout latitude (°N)	Haulout longitude (°W)	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
California sea lion														
Southern Oregon	OR	Orford Reef, Best Rock	42.791	124.596	2016-Jul-15	0	0	0	0	0	0	1	1	1
		Cape Arago, Shell Island	43.313	124.401	2016-Jul-15	0	0	1	0	162	23	25	211	211
		Point Arago, Shell Island	43.313	124.401	2017-Jul-15	0	0	5	0	22	19	9	55	55
		Point Arago, Simpson Reef #1	43.313	124.408	2017-Jul-15	0	0	0	0	0	5	1	6	6
		Cape Arago	43.315	124.403	2016-Jul-15	0	0	0	0	0	4	2	6	6
		Point Arago, Shell Island Reef	43.315	124.401	2017-Jul-15	0	0	0	0	1	2	1	4	4
Steller sea lion														
Central California	E	Sea Lion Rocks, Point Lobos	36.517	121.956	2017-Jul-16	0	0	0	0	0	1	0	1	1
		Año Nuevo Island	37.108	122.337	2017-Jul-16	164	0	27	174	8	7	22	238	402
		Año Nuevo Island	37.108	122.337	2016-Jul-17	147	2	14	153	8	9	25	209	356
		Año Nuevo Island	37.108	122.337	2018-Jun-26	175	0	23	197	18	12	32	282	457
	D	Southeast Farallon Islands	37.699	123.003	2016-Jul-18	46	0	67	61	36	6	13	183	229
		Southeast Farallon Islands	37.699	123.003	2017-Jul-16	42	0	12	108	10	10	13	153	195
		Southeast Farallon Islands	37.699	123.003	2018-Jun-26	76	1	70	142	54	16	21	303	379
		North Farallon Islands	37.764	123.098	2018-Jun-26	0	0	15	0	7	0	2	24	24
		North Farallons 2	37.764	123.098	2017-Jul-16	12	0	5	3	0	0	0	8	20
		North Farallon Islands	37.765	123.099	2016-Jul-18	0	0	0	0	2	0	1	3	3
		North Farallon Islands	37.767	123.100	2018-Jun-26	0	0	7	0	11	0	1	19	19
		North Farallons 3	37.767	123.100	2017-Jul-16	0	0	22	15	2	1	1	41	41
		North Farallon Islands	37.768	123.101	2016-Jul-18	0	0	0	0	2	0	0	2	2
		North Farallon Islands	37.768	123.099	2016-Jul-18	0	0	23	0	34	6	1	64	64
		North Farallon Islands	37.768	123.099	2018-Jun-26	0	0	1	0	6	2	0	9	9
		North Farallons 1	37.768	123.099	2017-Jul-16	3	0	2	7	3	1	0	13	16
		North Farallon Islands	37.772	123.107	2016-Jul-18	0	0	124	0	44	3	3	174	174
		North Farallon Islands	37.772	123.107	2018-Jun-26	0	0	50	0	56	2	4	112	112

Appendix 2. (Continued)

Section	Zone	Haulout name	Haulout latitude (°N)	Haulout longitude (°W)	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
					Steller sea lion									
	D	North Farallons 4	37.772	123.107	2017-Jul-16	0	0	7	13	0	0	2	22	22
Northern California	C	Bodega Rock	38.298	123.048	2016-Jul-25[1]								4	4
		Bodega Rock	38.298	123.048	2017-Jul-15	0	0	19	0	110	23	5	157	157
		Northwest Cape	38.515	123.262	2016-Jul-17	0	0	9	0	53	11	1	74	74
		Northwest Cape	38.515	123.262	2017-Jul-15	0	0	0	0	1	3	3	7	7
		Fish Rocks	38.800	123.592	2016-Jul-17	0	0	0	0	0	1	0	1	1
		Cove Rock	39.140	123.741	2017-Jul-15	0	0	0	0	0	1	3	4	4
	B	Sea Lion Rock, Soldier Frank Point	39.760	123.841	2016-Jul-16	0	0	15	0	23	10	6	54	54
		Sea Lion Rock, Soldier Frank Point	39.760	123.841	2017-Jul-15	0	0	1	0	2	2	4	9	9
		High Tip	39.922	123.955	2016-Jul-16	0	0	0	0	0	0	1	1	1
		Point No Pass	39.968	123.992	2016-Jul-16	0	0	4	0	33	9	2	48	48
		4 km SE of Punta Gorda	40.235	124.330	2016-Jul-16	0	0	0	0	14	3	3	20	20
		4.0 km SE of Punta Gorda	40.235	124.330	2017-Jul-15	0	0	1	0	32	4	1	38	38
		3.5 km SE of Punta Gorda	40.239	124.334	2016-Jul-16	0	0	26	0	127	21	6	180	180
		3.5 km SE of Punta Gorda	40.239	124.334	2017-Jul-15	0	0	2	0	43	16	4	65	65
		Punta Gorda	40.264	124.366	2016-Jul-16	0	0	0	0	0	11	2	13	13
		Sea Lion Rock	40.310	124.353	2017-Jul-15	0	0	0	0	2	9	7	18	18
		Sugarloaf Island, Cape Mendocino	40.438	124.413	2016-Jul-15	103	2	47	224	27	21	25	344	447
		Sugarloaf Island, Cape Mendocino	40.439	124.415	2017-Jul-15	114	0	27	221	29	21	20	318	432
		Cape Mendocino-Rock 4	40.441	124.414	2016-Jul-15	0	0	2	0	0	1	1	4	4
		Cape Mendocino, Rock 1	40.443	124.422	2017-Jul-15	0	0	15	0	45	9	1	70	70
		Cape Mendocino-Rock 1	40.443	124.422	2016-Jul-15	0	0	0	0	2	5	2	9	9
		Cape Mendocino-Rock 3	40.444	124.412	2016-Jul-15	0	0	1	0	0	0	1	2	2
		Cape Mendocino, Rock 2	40.445	124.412	2017-Jul-15	0	0	4	0	14	5	1	24	24
		Cape Mendocino-Rock 2	40.445	124.412	2016-Jul-15	0	0	2	0	23	12	1	38	38

Appendix 2. (Continued)

Section	Zone	Haulout name	Haulout latitude (°N)	Haulout longitude (°W)	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
Steller sea lion														
Northern California	B	Cape Mendocino, Rock 5	40.448	124.407	2017-Jul-15	0	0	0	0	0	0	1	1	1
	A	0.7 km S of Scotty Point	41.095	124.166	2017-Jul-15	0	0	1	0	6	3	5	15	15
		0.5 km N of Scotty Point	41.106	124.166	2017-Jul-15	0	0	0	0	0	0	1	1	1
		1.0 km NW of Scotty Point	41.107	124.172	2017-Jul-15	0	0	7	0	3	2	0	12	12
		1.4 km N of Scotty Point	41.109	124.164	2016-Jul-14	0	0	0	0	1	2	0	3	3
		Cone Rock	41.109	124.186	2017-Jul-15	0	0	7	0	23	0	1	31	31
		1.0 km N of Scotty Point	41.111	124.164	2017-Jul-15	0	0	42	0	74	8	5	129	129
		1.1 km N of Scotty Point	41.111	124.164	2016-Jul-14	0	0	3	0	31	8	3	45	45
		0.8 km S of Palmers Point	41.123	124.164	2016-Jul-14	0	0	13	0	81	8	2	104	104
		0.7 km SSE of Palmers Point	41.124	124.163	2016-Jul-14	0	0	0	0	0	0	1	1	1
		0.5 km S of Palmers Point	41.125	124.165	2017-Jul-15	0	0	0	0	0	1	2	3	3
		Turtle Rocks	41.131	124.183	2016-Jul-14	0	0	12	0	133	6	2	153	153
		Turtle Rocks 1	41.131	124.183	2017-Jul-15	0	0	8	0	64	26	1	99	99
		Turtle Rocks	41.133	124.185	2016-Jul-14	0	0	18	0	110	5	2	135	135
		Turtle Rocks 2	41.133	124.185	2017-Jul-15	0	0	15	0	79	5	3	102	102
		Reading Rock	41.340	124.178	2016-Jul-14	0	0	46	0	42	5	1	94	94
		Reading Rock	41.340	124.178	2017-Jul-15	0	0	51	0	32	3	0	86	86
		2.9 km SSE of False Klamath Rock	41.568	124.103	2017-Jul-15	0	0	4	0	5	3	1	13	13
		3.0 km SSE of False Klamath Rock	41.568	124.103	2017-Jul-15	0	0	0	0	1	0	0	1	1
		Castle Rock, Point Saint George	41.762	124.247	2016-Jul-14	0	0	1	0	0	1	1	3	3
		Castle Rock, Point Saint George	41.764	124.248	2017-Jul-14	0	0	0	0	0	0	1	1	1
		Castle Rock Shoals, Point Saint George	41.765	124.244	2017-Jul-14	0	0	7	0	10	36	4	57	57
		Castle Rock, Point Saint George	41.765	124.244	2016-Jul-14	0	0	334	0	43	58	19	454	454
		Star Rock, Saint George Reef	41.775	124.292	2016-Jul-14	0	0	0	0	1	2	1	4	4

Appendix 2. (Continued)

Section	Zone	Haulout name	Haulout latitude (°N)	Haulout longitude (°W)	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
Steller sea lion														
Northern California	A	Star Rock, Saint George Reef	41.775	124.292	2017-Jul-14	0	0	0	0	0	2	1	3	3
		SW Seal Rock, Saint George Reef	41.813	124.352	2017-Jul-14	454	4	55	435	0	8	40	538	992
		SW Seal Rock, Saint George Reef	41.814	124.352	2016-Jul-14	537	3	19	523	0	3	36	581	1,118
		NW Seal Rock, Saint George Reef	41.836	124.375	2016-Jul-14	0	0	16	0	130	6	5	157	157
		NW Seal Rock, Saint George Reef	41.836	124.375	2017-Jul-14	0	0	53	0	280	75	12	420	420
Southern Oregon	OR	Crook Point, Mack Reef	42.240	124.414	2016-Jul-15	0	0	0	0	0	1	1	2	2
		Crook Point, Mack Reef	42.240	124.414	2017-Jul-14	0	0	0	0	0	0	1	1	1
		Rogue River Reef, Rock 5	42.436	124.464	2016-Jul-15	0	0	0	0	3	6	6	15	15
		Rogue Reef, Rock 1	42.444	124.480	2016-Jul-15	0	0	0	0	1	2	0	3	3
		Rogue River Reef, Pyramid Rock	42.444	124.469	2016-Jul-15	882	3	25	920	0	0	64	1,009	1,891
		Rogue River Reef, Pyramid Rock	42.444	124.469	2017-Jul-14	676	1	30	817	0	0	59	906	1,582
		Rogue River Reef, Needle Rock	42.448	124.484	2016-Jul-15	98	0	2	108	0	1	7	118	216
		Rogue River Reef, Needle Rock	42.448	124.484	2017-Jul-14	69	0	1	74	4	3	10	92	161
		Rogue River Reef, Double Rock	42.449	124.490	2016-Jul-15	0	0	0	0	1	21	18	40	40
		Rogue River Reef, Double Rock	42.449	124.490	2017-Jul-14	0	0	0	0	14	9	3	26	26
		Rogue River Reef, Rock 1	42.461	124.494	2017-Jul-14	0	0	0	0	3	4	4	11	11
		1.07 km WNW Hubbard Mound	42.479	124.439	2016-Jul-15	0	0	0	0	0	0	1	1	1
		1.07 km WNW Hubbard Mound	42.479	124.439	2017-Jul-14	0	0	0	0	0	1	3	4	4
		Orford Reef, Rock 3	42.775	124.605	2017-Jul-15	0	0	0	0	0	1	1	2	2
		Orford Reef, Rock 3	42.775	124.605	2016-Jul-15	0	0	0	0	0	3	0	3	3
		Orford Reef, Steamboat Rock	42.776	124.604	2017-Jul-15	0	0	0	0	0	7	2	9	9
		Orford Reef, West Canonical Rock	42.778	124.600	2016-Jul-15	141	0	6	180	0	0	8	194	335
		Orford Reef, West Conical Rock	42.778	124.601	2017-Jul-15	124	0	12	157	0	0	7	176	300
		Orford Reef, Arch Rock	42.779	124.597	2016-Jul-15	154	0	14	203	0	5	7	229	383

Appendix 2. (Continued)

Section	Zone	Haulout name	Haulout latitude (°N)	Haulout longitude (°W)	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
Steller sea lion														
Southern Oregon	OR	Orford Reef, Arch Rock	42.779	124.597	2017-Jul-15	115	1	22	161	10	4	14	211	326
		Orford Reef, Seal Rock	42.787	124.594	2016-Jul-15	228	3	8	257	0	3	10	278	506
		Orford Reef, Seal Rock	42.787	124.595	2017-Jul-15	257	0	9	246	0	1	14	270	527
		Orford Reef, Rock 1	42.788	124.600	2017-Jul-15	1	0	0	1	0	1	3	5	6
		Orford Reef, Rock 1	42.789	124.600	2016-Jul-15	0	0	0	0	0	0	1	1	1
		Orford Reef, Best Rock	42.791	124.596	2016-Jul-15	17	0	2	35	11	3	8	59	76
		Orford Reef, Best Rock	42.791	124.596	2017-Jul-15	39	1	3	54	0	16	11	84	123
		Orford Reef, Long Brown Rock	42.791	124.606	2016-Jul-15	514	3	6	460	0	2	34	502	1,016
		Orford Reef, Long Brown Rock	42.791	124.606	2017-Jul-15	487	0	16	473	0	4	28	521	1,008
		Orford Reef, Large Brown Rock	42.792	124.601	2016-Jul-15	0	0	4	0	0	3	1	8	8
		Orford Reef, Large Brown Rock	42.792	124.601	2017-Jul-15	0	0	1	0	11	11	2	25	25
		Orford Reef, Northwest Rock	42.803	124.613	2017-Jul-15	0	0	0	0	0	4	0	4	4
		Cape Blanco, Black Rock	42.824	124.584	2016-Jul-15	0	0	9	0	48	1	1	59	59
		Cape Blanco, Black Rock	42.824	124.584	2017-Jul-15	0	0	2	0	38	114	2	156	156
		Blacklock Point, 0.27 km SW of Tower	42.875	124.546	2016-Jul-15	0	0	0	0	1	3	0	4	4
		Cat and Kittens Rock	43.108	124.445	2016-Jul-15	0	0	0	0	0	0	1	1	1
		Cape Arago	43.313	124.408	2016-Jul-15	0	0	0	0	1	0	0	1	1
		Cape Arago, Shell Island	43.313	124.401	2016-Jul-15	0	0	53	0	57	45	23	178	178
		Point Arago, Shell Island	43.313	124.401	2017-Jul-15	1	0	18	1	332	333	72	756	757
		Point Arago, Simpson Reef #1	43.313	124.408	2017-Jul-15	0	0	0	0	35	37	9	81	81
		Cape Arago	43.315	124.403	2016-Jul-15	3	0	17	4	160	12	3	196	199
		Cape Arago	43.315	124.401	2016-Jul-15	0	0	26	0	27	23	2	78	78
		Point Arago, Shell Island Reef	43.315	124.401	2017-Jul-15	0	0	6	0	16	15	6	43	43
		Cape Arago	43.318	124.407	2016-Jul-15	0	0	3	0	66	1	1	71	71

Appendix 2. (Continued)

Section	Zone	Haulout name	Haulout latitude (°N)	Haulout longitude (°W)	Survey date	Live pups	Dead pups	Juveniles	Adult females	Young males	Sub-adult males	Adult males	Non-pup total	Total live
Steller sea lion														
Oregon	OR	Point Arago, Simpson Reef #2	43.318	124.407	2017-Jul-15	0	0	0	0	86	19	5	110	110

[1]Counts provided by Joe Mortenson.

Appendix 3. Historical counts and estimates of California sea lion pups used in figures 12 and 13. Data are from Lowry and Maravilla-Chavez (2005), Lowry et al., (2017a and 2017b), and this report. No census data was available for blank cells.

	Channel Islands												Central California					
Year	San Miguel Island	San Nicolas Island	Santa Barbara Island	San Clemente Island	Richardson Rock	Santa Rosa Island	Santa Cruz Island	Anacapa Island	Santa Catalina Island	4 Channel Islands main rookeries total[a]	Other Channel Islands total[b]	Southern CA total	Año Nuevo Island	Farallon Islands	Other Central CA haulouts total	Central CA total	Northern CA total	United States total
1964	2,350	2,852	497	414		0	0	0	0	6,113	0	6,113						6,113
1965		3,604																
1969		4,501																
1970		2,271																
1971	5,496																	
1972	3,641																	
1975	7,166	3,990	711	632	0	0	0	0	0	12,499	0	12,499						12,499
1976	9,269	4,381	582	512	3	0	0	0	0	14,744	5	14,749						14,749
1977	7,095	3,773	492	351	0	0	0	0	0	11,711	0	11,711				1		11,712
1978	7,128	3,241	465	465						11,299		11,299						11,299
1979	8,359	4,880	625	549						14,413		14,413						14,413
1980	6,950	6,096	773	619						14,438		14,438						14,438
1981	8,601	6,704	730	666						16,701		16,701						16,701
1982	10,537	8,244	818	941						20,540		20,540		2				20,540
1983	7,619	4,405	237	353						12,614		12,614		2				12,614
1984	9,228	3,631	280	411						13,550		13,550		1				13,550
1985	9,516	4,524	543	609						15,192		15,192						15,192
1986	12,065	4,157	796	718						17,736		17,736						17,736
1987	12,760	5,321	917	782						19,780		19,780						19,780
1988	11,077	6,843	1,089	803						19,812		19,812						19,812
1989	12,704	8,951	1,307	795						23,757		23,757						23,757
1990	11,741	11,766	1,286	629						25,422		25,422						25,422
1991	16,503	11,827	1,504	913						30,747		30,747						30,747
1992	10,753	9,348	1,470	789			0			22,360		22,360	4			4		22,364
1993	11,985	10,595	949	745						24,274		24,274	0			0		24,274

Appendix 3. (Continued)

	Channel Islands												Central California					
Year	San Miguel Island	San Nicolas Island	Santa Barbara Island	San Clemente Island	Richardson Rock	Santa Rosa Island	Santa Cruz Island	Anacapa Island	Santa Catalina Island	4 Channel Islands main rookeries total[a]	Other Channel Islands total[b]	Channel Islands total	Año Nuevo Island	Farallon Islands	Other Central CA haulouts total	Central CA total	Northern CA total	United States total
1994	16,539	16,889	1,688	1,067						36,183		36,183	1			1		36,184
1995	15,711	17,512	1,647	1,189						36,059		36,059	3	11		14		36,073
1996	16,962	20,285	2,326	1,468						41,041		41,041	3			3		41,044
1997	14,941	20,488	2,467	1,326						39,222		39,222	1	22		23		39,245
1998	8,111	4,885	707	682						14,385		14,385	51	55	12	121	0	14,506
1999	18,074	19,878	2,410	1,326						41,688		41,688	4	3	0	7	0	41,695
2000	20,609	24,167	2,851	1,735						49,362		49,362	6	4	0	10	0	49,372
2001	19,552	24,741	3,061	1,722						49,076		49,076	2	0	0	2	0	49,078
2002	21,126	19,719	2,697	2,081			0		0	45,623		45,623	5	29	1	35	0	45,658
2003	17,765	15,702	1,528	1,549		0	2	5	0	36,544	7	36,551	48	48	13	109	1	36,661
2004	18,278	20,866	2,484	1,839		0	0	1		43,467	1	43,468	11	10	1	22	0	43,490
2005	22,088	21,799	2,827	1,587		0	0	4	0	48,301	4	48,305	11	11	4	26	0	48,331
2006	24,583	26,154	3,277	2,130						56,144		56,144						56,144
2007	23,234	25,198	3,473	2,146	2	0	0	6	0	54,051	6	54,057	13	12	6	31		54,088
2008	25,148	29,052	3,424	2,144		0	0	6	0	59,768	6	59,774						59,774
2009	12,806	19,697	1,597	1,813						35,913		35,913	75	71	2	148	0	36,061
2010	15,131	15,131	1,508	1,680						33,450		33,450						33,450
2011	26,953	28,087	3,941	2,883		0	1	32	17	61,864	50	61,914	52	136	7	195	1	62,110
2012	28,289	31,972	3,558	3,220	1	3	0	50	31	67,039	85	67,124	94	174	8	276	0	67,400
2013	21,014	16,225	2,918	2,458		3	0	48	20	42,615	71	42,686	92	141	0	233	0	42,919
2014	23,607	19,587	2,498	1,927		1	0	52	19	47,619	72	47,691				590		48,281
2015	17,084	9,963	864	385		0	1	40	11	28,296	52	28,348				594		28,942
2016	17,508	14,944	1,481	914	0	10	0	78	31	34,847	119	34,966	546	522	5	1,073	0	36,039
2017	23,103	21,367	2,975	1,583	1	22	0	114	54	49,028	190	49,218	988	1,027	10	2,025	1	51,243
2018	23,323	21,061	1,795	1,468	1	18	1	44	58	47,647	121	47,768	908	1,281	4	2,193	0	49,961

Appendix 3. (Continued)

	Channel Islands												Central California					
Year	San Miguel Island	San Nicolas Island	Santa Barbara Island	San Clemente Island	Richardson Rock	Santa Rosa Island	Santa Cruz Island	Anacapa Island	Santa Catalina Island	4 Channel Islands main rookeries total[a]	Other Channel Islands total[b]	Channel Islands total	Año Nuevo Island	Farallon Islands	Other Central CA haulouts total	Central CA total	Northern CA total	United States total
2019	25,154	21,593	2,710	1,408	0	34	1	128	66	50,865	229	51,094	1,206	1,348	4	2,558	0	53,652

[a]4 Channel Islands main rookeries are San Miguel Island, San Nicolas Island, Santa Barbara Island, and San Clemente Island.

[b]Other Channel Islands are Anacapa Island, Santa Cruz Island, Santa Rosa Island, Santa Catalina Island, and Richardson Rock.

Appendix 4. Historical counts of California sea lion non-pups used in figures 12 and 13. Data are from Lowry et al. (2017a and 2017b), and this report. No census data was available for blank cells.

	Channel Islands														
Year	San Miguel Island	San Nicolas Island	Santa Barbara Island	San Clemente Island	Richardson Rock	Santa Rosa Island	Santa Cruz Island	Anacapa Island	Santa Catalina Island	4 Channel Islands main rookeries total[a]	Other Channel Islands total[b]	Channel Islands total	Central CA total	Northern CA total	California total
1964	12,456	10,539	3,062	3,637		0	89		92	29,694	181	29,875			
1965	11,641	5,771	1,100	1,900		125	401		35	20,412	561	20,973			
1966															
1967															
1968															
1969		9,056													
1970		7,522													
1971		8,806													
1972															
1973															
1974															
1975	12,192	9,649	1,104	1,239	131	0	25	0	0	24,184	156	24,340			
1976	16,965	10,159	1,382	1,463	323	111	239		14	29,969	687	30,656			
1977	14,122	11,534	1,200	1,067	305	0	185	0	106	27,923	596	28,519			
1978															
1979															
1980		8,211											4,272	214	
1981		11,645		1,119									7,935	0	
1982		13,680		1,280									11,208	1	
1983		9,535		1,274											
1984		6,966		841											
1985				739											
1986			1,241	1,106											
1987			1,349	1,034											
1988				999											

Appendix 4. (Continued)

	Channel Islands														
Year	San Miguel Island	San Nicolas Island	Santa Barbara Island	San Clemente Island	Richardson Rock	Santa Rosa Island	Santa Cruz Island	Anacapa Island	Santa Catalina Island	4 Channel Islands main rookeries total[a]	Other Channel Islands total[b]	Channel Islands total	Central CA total	Northern CA total	California total
1989			2,240	1,460											
1990			2,549	960											
1991		15,929	2,974	1,560											
1992	19,970	11,680	1,956	737	116		145			34,343	261	34,604			
1993	22,939	14,698	2,101	637						40,375	0	40,375			
1994	24,041	16,020	3,429	1,205	184					44,695	184	44,879			
1995	30,491	23,967	4,592	2,185						61,235	0	61,235			
1996	19,375	15,917	3,360	1,519						40,171	0	40,171			
1997	30,238	18,195	2,603	1,238						52,274	0	52,274			
1998	17,286	14,591	2,616	1,554						36,047	0	36,047	20,708	4,354	
1999	26,305	22,672	2,806	2,392	190					54,175	190	54,365	13,250	302	
2000	32,985	26,917	5,412	3,177	199					68,491	199	68,690	17,306	230	
2001	26,960	27,222	5,168	2,793	408					62,143	408	62,551	21,959	1,421	
2002	37,417	17,600	4,224	3,563		0	145		95	62,804	240	63,044	27,998	1,377	
2003	29,718	27,468	3,632	2,961	240	89	602	713	32	63,779	1,676	65,455	21,879	4,438	91,772
2004	44,215	28,657	5,311	3,473	212	40	258	355		81,656	865	82,521	14,125	1,026	97,672
2005	41,896	24,701	3,945	2,851	220	19	241	457	132	73,393	1,069	74,462	18,566	740	93,768
2006	36,779	27,801	4,324	2,935											
2007	40,629	26,199	4,260	2,250	387	28	709[c]	826	357	73,338	2,307	75,645	24,316		
2008	39,036	28,560	4,021	3,407	327	536	375	1,263	211	75,024	2,712	77,736			
2009				2,128									34,140	5,569	
2010				2,562											
2011	44,460	23,815	3,316	3,973	282	900	1,025	1,065	399	75,564	3,671	79,235	22,293	333	101,861
2012	37,371	32,878	4,014	3,828	216	1,581	1,571	1,018	238	78,091	4,624	82,715	18,986	713	102,414
2013	43,377	38,839	4,819	4,970		768	1,469	1,146	426	92,005	3,809	95,814	17,257	70	113,141

Appendix 4. (Continued)

	Channel Islands														
Year	San Miguel Island	San Nicolas Island	Santa Barbara Island	San Clemente Island	Richardson Rock	Santa Rosa Island	Santa Cruz Island	Anacapa Island	Santa Catalina Island	4 Channel Islands main rookeries total[a]	Other Channel Islands total[b]	Channel Islands total	Central CA total	Northern CA total	California total
2014	34,898	34,446	4,629	5,229	513	897	870	888	322	79,202	3,490	82,692			
2015	33,698	27,363	2,589	2,906	187	568	1,674	1,219	695	66,556	4,343	70,899			
2016	33,748	25,342	2,411	2,271	133	1,033	702	743	325	63,772	2,936	66,708	17,750	746	85,204
2017	26,149	21,549	2,380	2,722	158	2,670	808	613	227	52,800	4,476	57,276	21,367	463	79,106
2018			2,168	2,063				691	239						
2019	35,123	21,349	2,805	1,571	206	1,584	360	488	293	60,848	2,931	63,779			

[a] 4 Channel Islands main rookeries are San Miguel Island, San Nicolas Island, Santa Barbara Island, and San Clemente Island.

[b] Other Channel Islands are Anacapa Island, Santa Cruz Island, Santa Rosa Island, Santa Catalina Island, and Richardson Rock.

[c] *Erratum notification: Lowry et al. 2017a has incorrect California sea lion count data for Santa Cruz Island on July 10, 2007. The correct count data is as follows: Pups = 0; Juveniles = 309; Adult females = 370; Young males = 13; Adult females or young males = 383; Sub-adult males = 13; Adult males = 4; Non-pup total = 709; Total live = 709.*