

U.S. Pacific Marine Mammal Stock Assessments: 2024

Northern Elephant Seal *Mirounga angustirostris*: California Breeding Stock

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Table of Contents

Table of Contents	i
List of Tables	ii
List of Figures	ii
Northern Elephant Seal <i>Mirounga angustirostris</i> : California Breeding Stock.....	3
Stock Definition and Geographic Range	3
Population Size	4
Minimum Population Estimate	5
Current Population Trend	5
Current and Maximum Net Productivity Rate	6
Potential Biological Removal.....	6
Fisheries Information.....	6
Other Mortality.....	6
Status of Stock	8
References	9

List of Tables

Table 6. Summary of available information on the mortality and serious injury of northern elephant seals (California breeding stock) in commercial fisheries that might take this species (Carretta, 2023; Carretta et al., 2024; Jannot et al., 2022; NMFS-MML, unpublished estimates based on methods in Breiwick, 2013,). N/a indicates information is not available. Mean annual takes are based on 2018-2022 data unless noted otherwise..... 7

List of Figures

Figure 4. Approximate pelagic range of northern elephant seals including the eastern North Pacific Ocean. Major breeding rookeries occur along the west coast of Baja, California, and the California coast, as described in Lowry et al. (2014)..... 3

Figure 5. Estimated total U.S. stock abundance of northern elephant seals in California, 1958–2023. Circles represent estimates from a population growth rate of 17% (correction factor 4.4) from 1958–1987 and 3.8% (correction factor 4.39) from 1988–present. Pup birth estimates used to derive the total U.S. population estimate are from Stewart et al. (1994), Lowry et al. (1996), Lowry (2002), Lowry et al. (2014), and unpublished data from Sarah Allen, Dan Crocker, Brian Hatfield, Ron Jameson, Bernie Le Boeuf, Mark Lowry, Pat Morris, Guy Oliver, Derek Lee, and William Sydeman. Triangles represent estimates from previous stock assessment reports that used a correction of 3.5 (Barlow et al., 1993; Boveng, 1988). The open diamond represents the population estimate derived from an updated published model (Condit et al., 2022) to estimate the number of adult females and an assumed population growth rate of 3.8% (Lowry et al., 2014)..... 5

Northern Elephant Seal *Mirounga angustirostris*: California Breeding Stock

Stock Definition and Geographic Range

Northern elephant seals breed and give birth primarily on offshore islands (Stewart et al., 1994) in California (U.S.) and Baja California (Mexico) from December to March (Stewart and Huber, 1993). Spatial segregation in foraging areas between males and females is evident from satellite tag data (Le Boeuf et al., 2000). Males migrate to the Gulf of Alaska and western Aleutian Islands along the continental shelf to feed on benthic prey, while females migrate to the central North Pacific and the Gulf of Alaska to feed on pelagic prey (Le Boeuf et al., 2000; Figure 4). Adults return to land between March and August to molt; males return later than females. Adults return to their feeding areas again between their spring / summer molting and their winter breeding season.

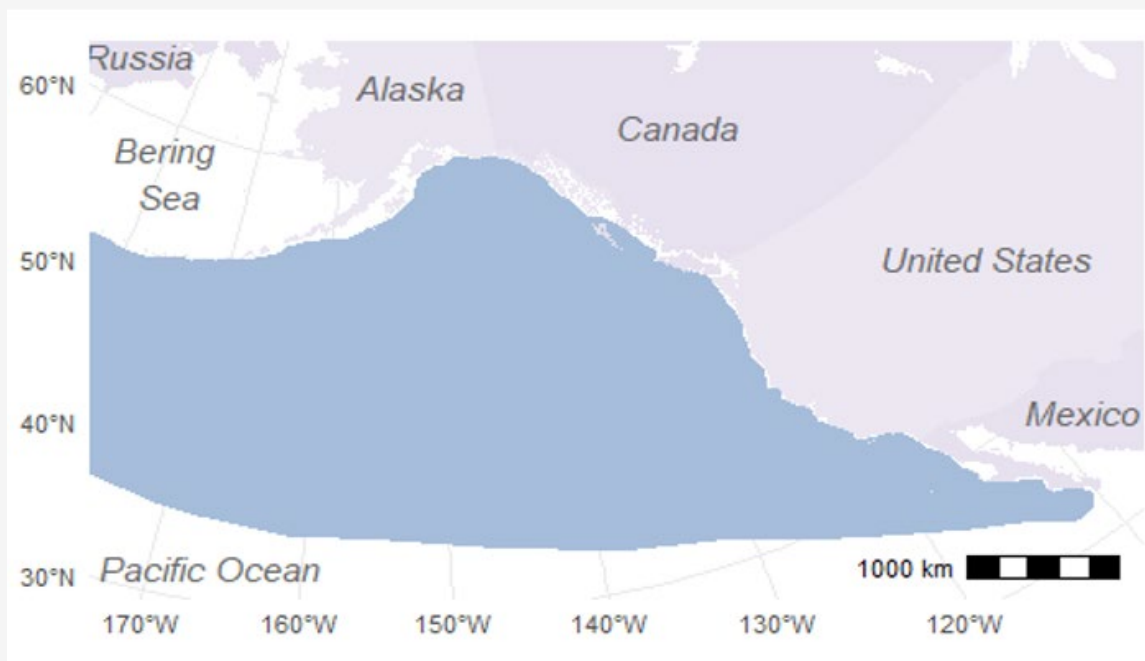


Figure 4. Approximate pelagic range of northern elephant seals including the eastern North Pacific Ocean. Major breeding rookeries occur along the west coast of Baja, California, and the California coast, as described in Lowry et al. (2014).

Populations of northern elephant seals in the U.S. and Mexico have recovered from near extinction following a severe population bottleneck after hunting reduced their numbers to an estimated 10 to 30 individuals, resulting in a substantial loss of genetic diversity (Hoelzel et al., 2002). Although movement and genetic exchange continues between rookeries, most elephant seals return to natal rookeries to breed as they reach reproductive maturity (Huber et al., 1991). The California breeding population is considered demographically distinct from the Baja California population. Therefore, the

California breeding population (subsequently referred to as the U.S. breeding population) is considered to be a separate stock. No international agreements exist for the joint management of this species between the U.S. and Mexico.

Population Size

A census of elephant seals is not possible since all age classes are not ashore simultaneously. The U.S. stock size has been historically estimated by counting the number of pups produced and multiplying by the inverse of the expected ratio of pups to total animals (McCann, 1985). More recently, pup births were estimated using aerial and / or ground counts of adult females present on the rookery during the breeding season (Le Boeuf et al., 2011; Lowry et al., 2014). The number of adult females was estimated based on rookery arrival dates and tenure (Condit et al., 2007). Total number of births were estimated by multiplying the estimated number of adult females by the reported fecundity rate ($F=0.975$; Le Boeuf et al., 2011) derived from the Año Nuevo rookery. The U.S. stock abundance estimate has been historically extrapolated from the estimated total births, which are multiplied by a correction factor based on the best available data at the time (Barlow et al., 1993; Boveng, 1998).

Starting in 2013, correction factors (C_{Pop}) were based on life table data (Lowry et al., 2020) constructed from elephant seal fecundity and survival rates, where approximately 23% of the population is comprised of pups (Cooper & Stewart, 1983; Hindell, 1991; Huber et al., 1991; Reiter & Le Boeuf, 1991; Clinton & Le Boeuf, 1993; Le Boeuf et al., 2019; Pistorius & Bester, 2002; McMahan et al., 2003; Pistorius et al., 2004; Condit et al., 2014). In years when ground counts are only completed at the Channel Islands (i.e., excludes un-surveyed areas in central and northern California), estimates of the total population are calculated as the sum of live and dead pups multiplied by the inverse of the U.S. population that resides at the Channel Islands (81.5%; Lowry et al., 2014).

In 2023, a range-wide survey was conducted during the elephant seal breeding season to count individuals of all age classes. Unlike previous population estimates, the estimate for 2023 implemented an updated model that derives true adult female attendance at rookeries ($N_{Adult\ Females} = 45,536$) from counts of adult females during specific days of the year based on turnover of reproductive females throughout the breeding season (Condit et al., 2022). The number of births ($N_{Births} = 44,398$; 95% CL 42,876–46,308) was calculated using the estimated adult female population and mean fecundity rate ($F=0.975$). As with previous population estimates, the estimated number of births was multiplied by a correction factor ($C_{Pop} = 4.39$; 95% CL 3.87–4.92), assuming a population growth rate of 1.038 (Lowry et al., 2014) along the U.S. Pacific coast. Thus, total population size was estimated as $N_{Total} = C_{Pop} \times N_{Births}$, where $N_{Births} = N_{Adult\ Females} \times F$, resulting in an estimate for 2023 of 194,907 (95% CI 170,185–233,677).

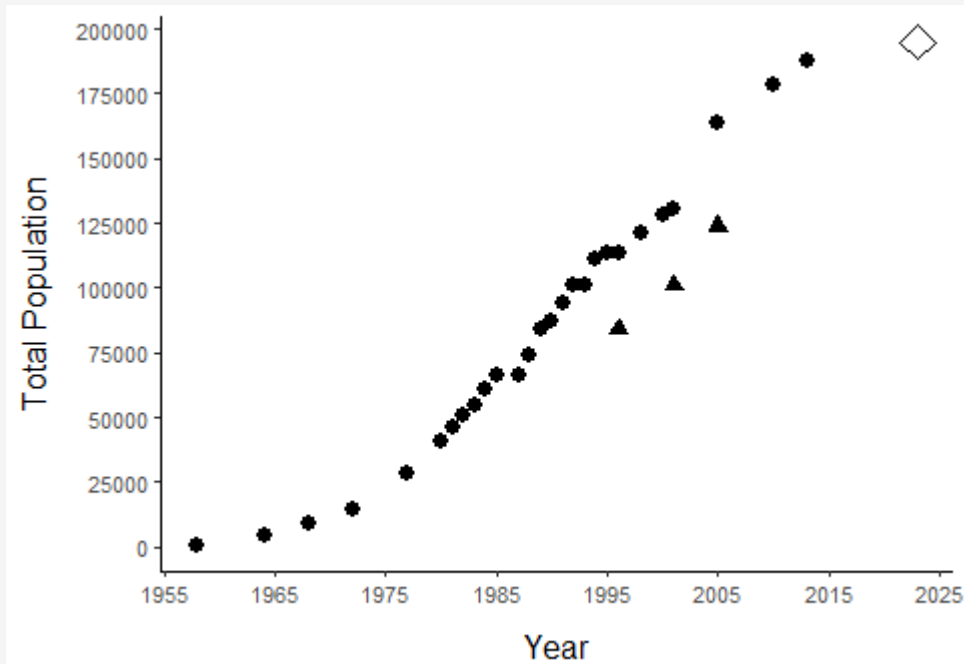


Figure 5. Estimated total U.S. stock abundance of northern elephant seals in California, 1958–2023. Circles represent estimates from a population growth rate of 17% (correction factor 4.4) from 1958–1987 and 3.8% (correction factor 4.39) from 1988–present. Pup birth estimates used to derive the total U.S. population estimate are from Stewart et al. (1994), Lowry et al. (1996), Lowry (2002), Lowry et al. (2014), and unpublished data from Sarah Allen, Dan Crocker, Brian Hatfield, Ron Jameson, Bernie Le Boeuf, Mark Lowry, Pat Morris, Guy Oliver, Derek Lee, and William Sydeman. Triangles represent estimates from previous stock assessment reports that used a correction of 3.5 (Barlow et al., 1993; Boveng, 1988). The open diamond represents the population estimate derived from an updated published model (Condit et al., 2022) to estimate the number of adult females and an assumed population growth rate of 3.8% (Lowry et al., 2014).

Minimum Population Estimate

The minimum population size for northern elephant seals in 2023 can be estimated conservatively as 88,794 seals, which is equal to twice the estimated pup count (to account for the pups and their mothers).

Current Population Trend

The California population is reported to have grown at 3.8% annually since 1988 (Lowry et al., 2014).

Current and Maximum Net Productivity Rate

An annual growth rate of 17% for elephant seals in the U.S. from 1958–1987 is reported by Lowry et al. (2014), but some of this growth is likely due to immigration of animals from Mexico and the consequences of a small population recovering from past exploitation. From 1988–2013, the population is estimated to have grown 3.8% annually (Lowry et al., 2014), which is assumed to have continued through 2023. For this stock assessment report, we use the default maximum theoretical net productivity rate for pinnipeds, or 12% (NMFS, 2023).

Potential Biological Removal

The PBR level for this stock is calculated as the minimum population size (88,794) multiplied by one half the observed maximum net growth rate for this stock ($\frac{1}{2}$ of 12%) x a recovery factor of 1.0 (for a stock of unknown status that is increasing (NMFS, 2023), resulting in a PBR of 5,328 animals per year.

Fisheries Information

A summary of known commercial fishery mortality and serious injury for this stock of northern elephant seals is given in Table 6. Total estimated commercial fishery mortality is ≥ 6.8 elephant seals annually. Although the mortality and serious injury shown in Table 6 occurred in U.S. waters, some may be of seals from Mexico's breeding population that are migrating through U.S. waters.

Other Mortality

Total mortality and serious injury from sources other than commercial fisheries for 2018–2022 includes the following: shootings (4); marine debris entanglement (2); hook and line fisheries (2); research-related (2), dog attack (2); unidentified human interaction (1); harassment (1); vehicle collision (1); tar / oil (6); and vessel strike (1) (Carretta et al., 2024). These other sources of mortality and serious injury total 22 animals, or an average of 4.4 elephant seals annually.

Table 6. Summary of available information on the mortality and serious injury of northern elephant seals (California breeding stock) in commercial fisheries that might take this species (Carretta, 2023; Carretta et al., 2024; Jannot et al., 2022; NMFS-MML, unpublished estimates based on methods in Breiwick, 2013,). N/a indicates information is not available. Mean annual takes are based on 2018-2022 data unless noted otherwise.

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality	Estimated Mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
Alaska Bering Sea and Aleutian Islands Atka Mackerel Trawl	2018–2022	Observer	99%	2	2 (CV=0.085)	0.4 (CV=0.04)
Alaska Bering Sea and Aleutian Islands Flatfish Trawl	2018–2022	Observer	99%	1	1 (n/a)	0.2 (n/a)
CA thresher shark / swordfish drift gillnet fishery	2018–2022	Observer	20–25%	0	2.6 (>0.8)	0.52 (>0.8)
Dungeness Crab Pot Fishery (California)	2020	Stranding	n/a	1	1	0.2
Gillnet fishery, unidentified	2018–2022	Stranding	n/a	3	3	0.6
WA, OR, CA domestic groundfish trawl fishery (includes at-sea hake and other limited-entry groundfish sectors)	2015 2016 2017 2018 2019	Observer	98% to 100% of tows in at-sea hake fishery	n/a	9.2 (>0.8) 4.6 (>0.8) 3.7 (>0.8) 3.4 (>0.8) 3.5 (>0.8)	4.9 (>0.8)
Total annual takes						≥ 6.8 (CV>0.8)

Status of Stock

Northern elephant seals are not listed as "endangered" or "threatened" under the ESA nor designated as "depleted" under the MMPA. Total annual human-caused mortality (commercial fishery (6.8) + other human-caused sources (4.4 = 11.2) is less than the calculated PBR for this stock (5,328); thus, northern elephant seals are not considered a "strategic" stock under the MMPA.

The average rate of incidental commercial fishery related mortality for this stock over the last five years (11.2) is less than 10% of the calculated PBR (533); therefore, the total commercial fishery serious injury and mortality appears to be insignificant and approaching a zero mortality and serious injury rate. The population growth rate between 1958–1987 was 17% annually (Lowry et al., 2014). From 1988–2010, the population grew at an annual rate of 3.8% (Lowry et al., 2014). The population continues to grow, with most births occurring at southern California rookeries (Lowry et al., 2014).

No estimate of carrying capacity is available for this population, and the population status relative to OSP is unknown. There are no known habitat issues that are of concern for this stock. However, expanding pinniped populations in general have resulted in increased human-caused serious injury and mortality, due to shootings, entrapment in power plants, interactions with recreational hook and line fisheries, separation of mothers and pups due to human disturbance, dog bites, and vessel and vehicle strikes (Carretta et al., 2024).

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