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NORTHERN ELEPHANT SEAL (*Mirounga angustirostris*): California Breeding Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Northern elephant seals breed and give birth in California (U.S.) and Baja California (Mexico), primarily on offshore islands (Stewart et al. 1994), from December to March (Stewart and Huber 1993). Spatial segregation in foraging areas between males and females is evident from satellite tag data (Le Beouf 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 pelagic areas in the Gulf of Alaska and the central North Pacific to feed on pelagic prey (Le Beouf et al. 2000). Adults return to land between March and August to molt, with males returning later than females. Adults return to their feeding areas again between their spring/summer molting and their winter breeding seasons.

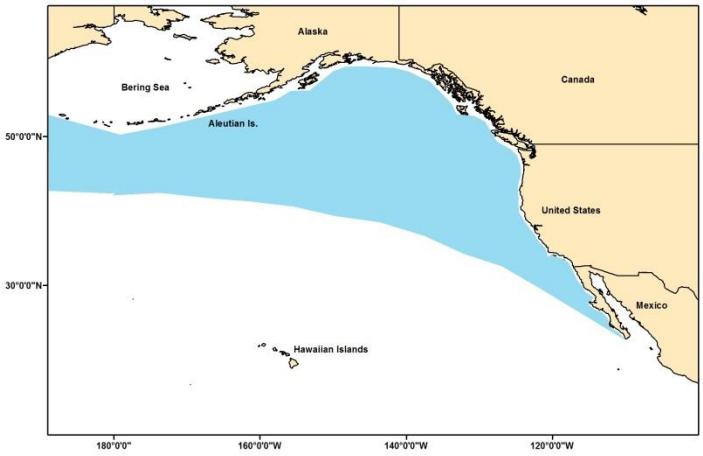

Figure 1. Pelagic range of northern elephant seals in the eastern North Pacific. Major breeding rookeries occur along the west coast of Baja California and the California coast, as described in Lowry et al. (2014).

Populations of northern elephant seals in the U.S. and Mexico have recovered after being nearly hunted to extinction (Stewart et al. 1994). Northern elephant seals underwent a severe population bottleneck and loss of genetic diversity when the population was reduced to an estimated 10-30 individuals (Hoelzel *et al*. 2002). Although movement and genetic exchange continues between rookeries, most elephant seals return to natal rookeries when they start breeding (Huber et al. 1991). The California breeding population is now demographically isolated from the Baja California population. No international agreements exist for the joint management of this species by the U.S. and Mexico. The California breeding population is considered here to be a separate stock.

POPULATION SIZE

A complete population count of elephant seals is not possible because all age classes are not ashore simultaneously. Elephant seal population size is estimated by counting the number of pups produced and multiplying by the inverse of the expected ratio of pups to total animals (McCann 1985). Based on counts of elephant seals at U.S. rookeries in 2010, Lowry *et al*. (2014) reported that 40,684 pups were born. Lowry *et al*. (2014) applied a multiplier of 4.4 to extrapolate from total pup counts to a population estimate of approximately 179,000 elephant seals. This multiplier is derived from life tables based on published elephant seal fecundity and survival rates, and reflects a population with approximately 23% pups (Cooper & Stewart, 1983; Le Boeuf & Reiter, 1988; Hindell, 1991; Huber et al., 1991; Reiter & Le Boeuf, 1991; Clinton & Le Boeuf, 1993; Le Boeuf et al., 1994; Pistorius & Bester, 2002; McMahon et al., 2003; Pistorius et al., 2004; Condit et al., 2014).

Minimum Population Estimate

The minimum population size for northern elephant seals in 2010 can be estimated very conservatively as 81,368 seals, which is equal to twice the observed pup count (to account for the pups and their mothers) .

Current Population Trend

The 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 to 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 to 2010, the population is estimated to have grown 3.8% annually (Lowry et al. 2014). For this stock assessment report, we use the default maximum theoretical net productivity rate for pinnipeds, or 12% (Wade and Angliss 1997).

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (81,368) times one half the observed maximum net growth rate for this stock (½ of 12%) times a recovery factor of 1.0 (for a stock of unknown status that is increasing, Wade and Angliss 1997) resulting in a PBR of 4,882 animals per year.

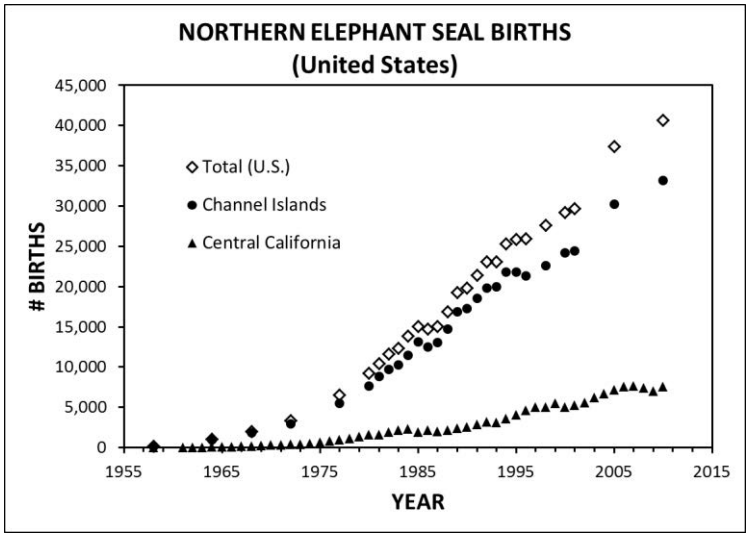

Figure 2. Estimated number of northern elephant seal births in California 1958-2010. Multiple independent estimates are presented for the Channel Islands 1988-91. Estimates are from Stewart et al. (1994), Lowry et al. (1996), Lowry (2002), Lowry et al. (2014), and unpublished data from Sarah Allen, Dan Crocker, Brian Hatfield, Ron Jameson, Bernie Le Boeuf, Mark Lowry, Pat Morris, Guy Oliver, Derek Lee, and William Sydeman.

HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Serious Injury Guidelines

NMFS uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to distinguish serious from non-serious injury (Angliss and DeMaster 1998, Andersen et al. 2008, NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*".

Fisheries Information

A summary of known commercial fishery mortality and serious injury for this stock of northern elephant seals is given in Table 1. More detailed information on these fisheries is provided in Appendix 1.

Table 1. 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 and Enriquez 2009, 2010, 2012a, 2012b, Carretta *et al*. 2014a). n/a indicates information is not available. Mean annual takes are based on 2008-2012 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)
CA thresher shark/swordfish drift gillnet fishery	2008	observer data	13.5%	0	0	0 (n/a)
	2009		13.3%	0	0	
	2010		11.9%	0	0	
	2011		19.5%	0	0	
	2012		18.6%	0	0	

Fishery Name	Year(s)	Data Type	Percent Observer Coverage	Observed Mortality	Estimated Mortality (CV in parentheses)	Mean Annual Takes (CV in parentheses)
CA halibut and white seabass set gillnet fishery	2008 2009 2010 2011 2012	observer data	0% 0% 12.5% 8.0% 5.5%	n/a n/a 0 0 0	n/a n/a 0 0 0	0 (n/a)
CA small-mesh drift gillnet fishery for white seabass, yellowtail, barracuda, and tuna	2010 2011 2012	observer data	0.7% 3.3% 4.6%	0 0 0	0 0 0	0 (n/a)
WA, OR, CA domestic groundfish trawl fishery (includes at-sea hake and other limited-entry groundfish sectors)	2005 2006 2007 2008 2009	observer data	98% to 100% of tows in at-sea hake fishery Generally less than 30% of landings observed in other groundfish sectors	0 1 3 7 2	0 (n/a) 1 (n/a) 3 (n/a) 9 (n/a) 2 (n/a)	3 (n/a)
Unknown gillnet fishery	2008-2012	stranding	n/a	1	1 (n/a)	≥1
Total annual takes						≥4.0 (n/a)

Although all of the mortality in Table 1 occurred in U.S. waters, some may be of seals from Mexico's breeding population that are migrating through U.S. waters.

Other Mortality

For the period 2008-2012, mortality and serious injuries from the following non-commercial fishery sources were documented: shootings (9); marine debris entanglement (7); hook and line fisheries (3); power plant entrainment (2); research-related (1); tar/oil (1); and vessel strike (1) (Carretta *et al*. 2014b). These non-commerical fishery sources of mortality and serious injury total 24 animals, or an average of 4.8 elephant seals annually (Carretta *et al*. 2014b).

STATUS OF STOCK

Northern elephant seals are not listed as "endangered" or "threatened" under the Endangered Species Act nor designated as "depleted" under the MMPA. Because their annual human-caused mortality (≥8.8) is much less than the calculated PBR for this stock (4,882), northern elephant seals are not considered a "strategic" stock under the MMPA. The average rate of incidental fishery mortality for this stock over the last five years ≥4.0) also appears to be less than 10% of the calculated PBR; therefore, the total fishery mortality appears to be insignificant and approaching a zero mortality and serious injury rate. The population growth rate between 1958 and 1987 was 17% annually (Lowry *et al*. 2014). From 1988 to 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, entrainment 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. 2014b).

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