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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). Males feed near the eastern Aleutian Islands and in the Gulf of Alaska, and females feed further south, south of 45EN (Stewart and Huber 1993; Le Boeuf et al. 1993). 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.

Populations of northern elephant seals in the U.S. and Mexico were all originally derived from a few tens or a few hundreds of individuals surviving in Mexico after being nearly hunted to extinction (Stewart et al. 1994). Given the very recent derivation of most rookeries, no genetic differentiation would be expected. Although movement and genetic exchange continues between rookeries, most elephant seals return to their 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.

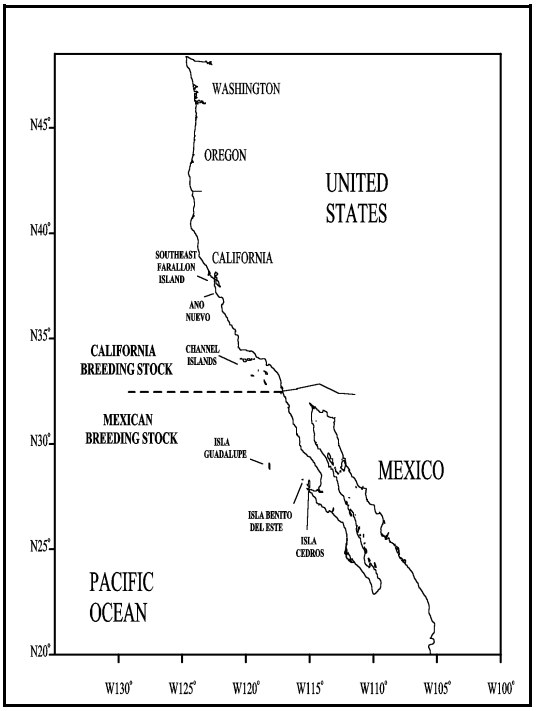

Figure 1. Stock boundary and major rookery areas for northern elephant seals in the U.S. and Mexico.

POPULATION SIZE

A complete population count of elephant seals is not possible because all age classes are not ashore at the same time. Elephant seal population size is typically estimated by counting the number of pups produced and multiplying by the inverse of the expected ratio of pups to total animals (McCann 1985). Stewart et al. (1994) used McCann's multiplier of 4.5 to extrapolate from 28,164 pups to a population estimate of 127,000 elephant seals in the U.S. and Mexico in 1991. The multiplier of 4.5 was based on a non-growing population. Boveng (1988) and Barlow et al.(1993) argue that a multiplier of 3.5 is more appropriate for a rapidly growing population such as the California stock of elephant seals. Based on the estimated 24,000 pups born in California in 1994-96 (Fig. 2) and this 3.5 multiplier, the California stock was approximately 84,000 in 1996.

Minimum Population Estimate

The minimum population size for northern elephant seals can be estimated very conservatively as 51,625, twice the observed pup count (to account for the pups and their mothers) plus the peak number of males and juveniles counted at the Channel Island (Lowry, pers. comm.) and Año Nuevo (Le Boeuf 1996) sites in 1996. More sophisticated methods of estimating minimum population size could be applied if the variance of the multiplier used to estimate population size were known.

Current Population Trend

Based on trends in pup counts, northern elephant seal colonies were continuing to grow in California through 1994 but appear to be stable or slowly decreasing in Mexico (Stewart et al. 1994). The number of pups born appears

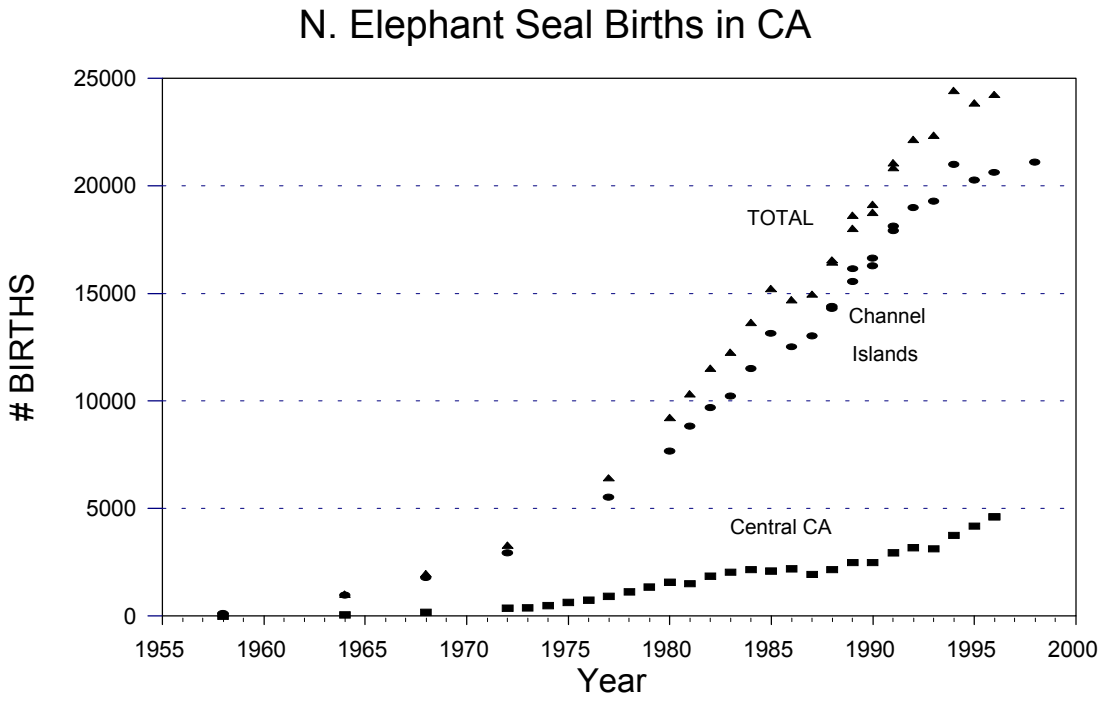

Figure 2. Estimated number of northern elephant seal births in California 1958-98. Multiple independent estimates are presented for the Channel Islands 1988-91. Total and central California counts are not yet available for 1998. Estimates are from Stewart et al. (1994), Lowry et al. (1996), and unpublished data from S. Allen, B. Hatfield, R. Jameson, B. Le Boeuf, M. Lowry, and W. Sydeman.

to be leveling off in California over the last five years (Fig. 2). More time is required to determine whether the reduction in growth at the California rookeries is temporary (as was observed in 1985) or whether it represents an approach to carrying capacity.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Although growth rates as high as 16% per year have been documented for elephant seal rookeries in the U.S. from 1959 to 1981 (Cooper and Stewart 1983), much of this growth was supported by immigration from Mexico. The highest growth rate measured for the whole U.S./Mexico population was 8.3% between 1965 and 1977 (Cooper and Stewart 1983). A continuous growth rate of 8.3% is consistent with an increase from approximately 100 animals in 1900 to the current population size. The "maximum estimated net productivity rate" as defined in the Marine Mammal Protection Act (MMPA) would therefore be 8.3%. In California, the net productivity rate appears to have declined in recent years [Figure 3; net production rate was calculated as the realized rate of population growth (increase in pup abundance from year *i* to year *i+1*, divided by pup abundance in year *i*) plus the harvest rate (fishery mortality

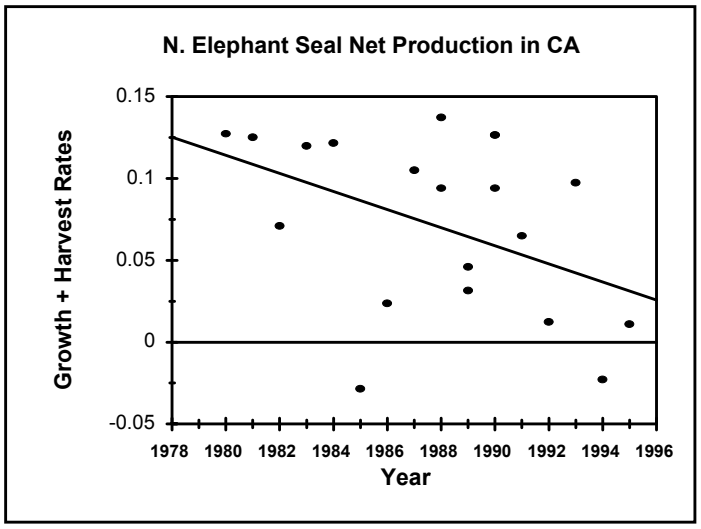

Figure 3. Net production rates for northern elephant seals in California based on pup births and fishery mortality. Annual mortality for 1980-1987 is assumed to be 300, the average of 1988-90 values (Perkins et al. 1994).

in year *i* divided by population size in year *i*)].

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (51,625) times one half the observed maximum net growth rate for this stock (½ of 8.3%) 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 2,142.

HUMAN-CAUSED MORTALITY

Fisheries Information

A summary of known fishery mortality and injury for this stock of northern elephant seals is given in Table 1. More detailed information on these fisheries is provided in Appendix 1. Because the set gillnet fishery has undergone dramatic reductions and redistributions of effort and because that fishery has not been observed since 1994, average annual mortality for that fishery cannot be accurately estimated for the recent years (1995-98). Rough estimates for 1995-1998 have been made by extrapolation of prior kill rates using recent effort estimates (Table 1). Preliminary set gillnet observations in Monterey Bay from April to September 1999 included 3 elephant seals in 24.6% of the sets for a rough extrapolated estimate of 12 mortalities in this half-year period. Stranding data reported to the California Marine Mammal Stranding Network in 1995-98 include elephant seal injuries caused by hook-and-line fisheries (2

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 (Julian 1997; Julian and Beeson 1998; Cameron and Forney 1999; Perez, in prep.; NMFS unpubl. data). n/a indicates information is not available. Mean annual takes are based on 1994-98 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/OR thresher shark/swordfish drift gillnet fishery	1994 1995 1996 1997 1998	observer data	17.9% 15.6% 12.4% 22.8% 20.2%	22 14 4 8 4	123 (0.23) 90 (0.25) 37 (0.55) 45 (0.33) 20 (0.44)	33 (0.27)[1]
CA angel shark/halibut and other species large mesh (>3.5") set gillnet fishery	1991 1992 1993 1994 1995 1996 1997 1998	observer data extrapo-lated estimate	9.8% 12.5% 15.4% 7.7% 0.0% 0.0% 0.0% 0.0%	3 7 11 2 - - - -	30 (0.55) 51 (0.35) 70 (0.27) 16 (0.66) 47 (0.29) [2] 46 (0.23) [2] 60 (0.24) [2] 70 (0.26) [2]	n/a
WA, OR, CA groundfish trawl	1991-95	observer data	54-73%	0	0,0,0,0,0	0
WA Willapa Bay drift gillnet fishery (salmon)	1991	personal communication	n/a	2	2	n/a
Chehalis River salmon setnet fishery	1993	personal communication	n/a	4	4	n/a
Total annual takes						>33.0 (0.27)

[1] Only 1997-98 mortality estimates are included in the average because of gear modifications implemented within the fishery as part of a 1997 Take Reduction Plan. Gear modifications included the use of net extenders and acoustic warning devices (pingers). Following these changes in the fishery, entanglement rates of northern elephant seals declined.

[2] The CA set gillnets were not observed after 1994; mortality was extrapolated from effort estimates and previous entanglement rates.

injuries) and gillnet fisheries (1 injuries). The average estimated annual mortality for northern elephant seals in these fisheries for the five most recent years of monitoring (1994-98) is likely to be substantially greater than 33 (the number estimated for the drift gillnet fishery alone) but, based on extrapolations from previous years, is not likely to be more than two or three times greater (ie. less than 100).

Although all of the mortalities 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. Similar drift gillnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and probably take northern elephant seal. Quantitative data are available only for the Mexican swordfish drift gillnet fishery, which has increased from two vessels in 1986 to 29 vessels in 1992 (Sosa-Nishizaki et al. 1993). The total number of sets in this fishery in 1992 can be estimated from data provided by these authors to be approximately 2,700, with an observed rate of marine mammal bycatch of 0.13 animals per set (10 marine mammals in 77 observed sets; Sosa-Nishizaki et al. 1993). This overall mortality rate is similar to that observed in California driftnet fisheries during 1990-95 (0.14 marine mammals per set), but species-specific information is not available for the Mexican fisheries. There are currently efforts underway to convert the Mexican swordfish driftnet fishery to a longline fishery (D. Holts, pers. comm.). The number of set-gillnet vessels in this part of Mexico is unknown. The take of northern elephant seals in other North Pacific fisheries that have been monitored appears to be trivial (Barlow et al. 1993, 1994).

Other Mortality

The California Marine Mammal Stranding database maintained by the National Marine Fisheries Service, Southwest Region, contains the following records of human-related elephant seal mortalities and injuries in 1995-98: (1) boat collision (1 injury), (2) automobile collision (5 mortalities), and (3) shootings (3 mortalities). Protective measures were taken to prevent future automobile collisions in the vicinity of Piedras Blancas/San Simeon (Hatfield and Rathbun 1999).

STATUS OF STOCK

A review of elephant seal dynamics through 1991 concluded that their status could not be determined with certainty, but that they might be within their Optimal Sustainable Population (OSP) range (Barlow et al. 1993). They are not listed as "endangered" or "threatened" under the Endangered Species Act nor as "depleted" under the MMPA. Because their annual human-caused mortality is much less than the calculated PBR for this stock (2,142), they would not be considered a "strategic" stock under the MMPA. The average rate of incidental fishery mortality for this stock over the last 5 years 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 is continuing to grow and fishery mortality is relatively constant. There are no known habitat issues that are of particular concern for this stock.

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