Revised 12/15/2003

CALIFORNIA SEA LION (*Zalophus californianus californianus*): U.S. Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The California sea lion *Zalophus californianus* includes three subspecies: *Z. c. wollebaeki* (on the Galapagos Islands), *Z. c. japonicus* (in Japan, but now thought to be extinct), and *Z. c. californianus* (found from southern Mexico to southwestern Canada; herein referred to as the California sea lion). The breeding areas of the California sea lion are on islands located in southern California, western Baja California, and the Gulf of California (Figure 1). These three geographic regions are used to separate this subspecies into three stocks: (1) the United States stock begins at the U.S./Mexico border and extends northward into Canada; (2) the Western Baja California stock extends from the U.S./Mexico border to the southern tip of the Baja California Peninsula; and (3) the Gulf of California stock which includes the Gulf of California from the southern tip of the Baja California peninsula and across to the mainland and extends to southern Mexico (Lowry et al. 1992). Some movement has been documented between these geographic stocks, but rookeries in the United States are widely separated from the major rookeries of western Baja California, Mexico. Males from western Baja California rookeries may spend most of the year in the United States. Genetic differences have been found between the U.S. stock and the Gulf of California stock (Maldonado et al. 1995). There are no international agreements for joint management of California sea lions between the U.S., Mexico, and Canada.

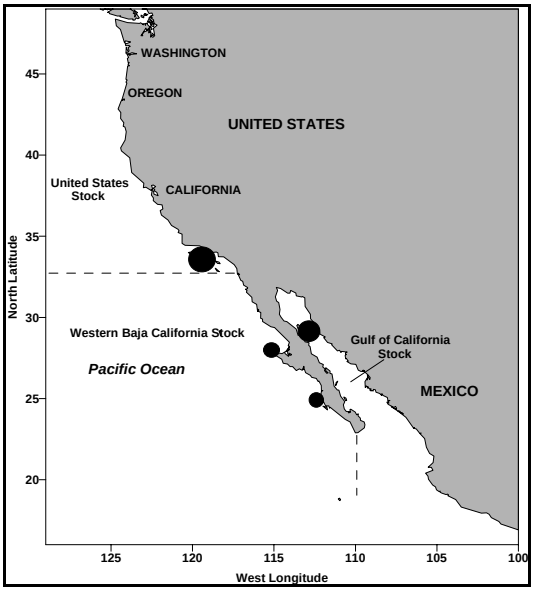

Figure 1. Geographic range of California sea lions showing stock boundaries and locations of major rookeries. The United States stock ranges north into Canadian waters.

POPULATION SIZE

The entire population cannot be counted because all age and sex classes are never ashore at the same time. In lieu of counting all sea lions, pups are counted during the breeding season (because this is the only age class that is ashore in its entirety), and the number of births is estimated from the pup count. The size of the population is then estimated from the number of births and the proportion of pups in the population.

Censuses are conducted in July after all pups have been born. To estimate the number of pups born, the pup count in 2001 (49,078) was adjusted for an estimated 15% pre-census mortality (Boveng 1988; Lowry et al. 1992), giving an estimated 56,440 live births in the population. The fraction of newborn pups in the population (23.1% to 23.8%) was estimated from a life table derived for the northern fur seal (*Callorhinus ursinus*) (Boveng 1988, Lowry et al. 1992) which was modified to account for the growth rate of this California sea lion population (5.4% to 6.1% yr^{-1}, respectively, see below). Multiplying the number of pups born by the inverse of these fractions (4.32 to 4.20) results in population estimates ranging from 244,000 to 237,000 (respectively).

Minimum Population Estimate

The minimum population size was determined from counts of all age and sex classes that were ashore at all the major rookeries and haulout sites during the 2001 breeding season. The minimum population size of the U.S. stock is 138,881(NMFS unpubl. data). It includes all California sea lions counted during the July 2001 census at the four rookeries in southern California and at the haulout sites located between Point Conception and the Oregon/California border. *An additional unknown number of California sea lions are at sea or hauled out at locations that were not censused.*

Current Population Trend

Records of pup counts from 1975 to 2001 (Figure 2) were compiled from the literature, NMFS reports, unpublished NMFS data, and Lowry 1999 (the literature up to 1992 is listed in Lowry et al. 1992). Pup counts from 1975

through 2001 were examined for four rookeries in southern California and for haulouts in central and northern California. Log-linear interpolation between adjacent counts was used to estimate counts for rookeries when they were not censused in a given year: (1) 1980 at Santa Barbara Is.; (2) 1978-1980 at San Clemente Is.; (3) 1978, 1979, 1988, and 1989 at San Nicolas Is. The mean was used when more than one count was available for a given rookery. Also, an index was used for San Miguel Island because some years lacked data for certain areas. Three major declines in the number of pups counted occurred during El Niño events in 1983, 1992-93, and 1998 (Figure 2). A regression of the natural logarithm of the pup counts against year indicates that the counts of pups increased at an annual rate of 5.4% between 1975 and 2001. When pup counts for El Niño years (1983, 1992, 1993, and 1998) are removed from the 1975-2001 time series, the count of pups increased at an annual rate of 6.1%.

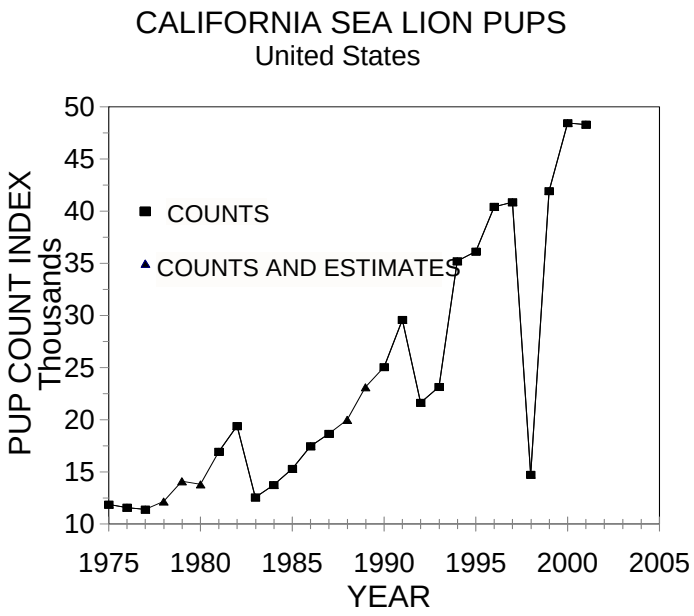

Figure 2. U. S. pup count index for California sea lions (1975-2001).

The 1975-2001 time series of pup counts shows the effect of three El Niño events on the sea lion population. Pup production decreased by 35 percent in 1983, 27 percent in1992, and 64 percent in 1998. After the 1992-93 and 1997-98 El Niños, pup production rebounded by 52 percent and 185 percent, respectively, but there was no rebound after the 1983-84 El Niño (Figure 2). Unlike the 1992-93 and 1997-98 El Niños, the 1983-84 El Niño affected adult female survivorship (DeLong et al 1991) which prevented the rebound in pup production after the event was over because there were fewer adult females available in the population to produce a pup (it took five years for pup production to return to the 1982 level). Other characteristics of El Niños are higher pup and juvenile mortality rates (DeLong et al 1991, NMFS unpubl. data) which affect future recruitment into the adult population for the affected cohorts. The long term effects of the 1992-93 event, which resulted in fewer females being recruited into the adult population, is manifested in lower net productivity rates for 1997 and 1999 (relative to 1997; Figure 2) because fewer females reached reproductive age (females reach reproductive age at three to five years). The severity, timing, length, and frequency of future El Niños will govern the growth rate of the sea lion population in the future.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

The rate of net production is greater than the observed growth rate because human-related mortalities take a fraction of the net production. Net productivity was, therefore, calculated for 1980-2001 as the realized rate of population growth (increase in pup counts from year *I* to year *I*+1, divided by pup count in year *I*) plus human related mortalities (fishery and non-fishery mortalities in year *I* divided by population size in year *I*). For California sea lions, the total mortalities estimated from NMFS, California Dept. of Fish and Game, Columbia River Area observer programs, and reports from stranding programs and from salmon net pen fisheries were 1,967, 1,967, 1,967, 4,344, 2,476, 2,364, 4,417, 2,847, 3,753, 2,315, 2,757, 1,905, 3,522, 2,039, 948, 834, 1,166, 1,558, 1,587, 1,560, 1,672 and 1,373 for 1980 to 2001, respectively (Miller et al. 1983; Hanan et al. 1988; Hanan and Diamond 1989; Brown and Jeffries 1993; Barlow et al. 1994, Julian 1997, Julian and Beeson 1998, Cameron and Forney 1999, NMFS unpubl. data).

Between 1980 and 2001 the net production rate averaged 15.1% (Figure 3). A regression (thin line) shows a slight increase in net production rates, but the regression is strongly influenced by the El Niño years (1983, 1992, and 1998) and the high net production rate during El Niño recovery years (1994 and 1999). When El Niño years (1983, 1992, 1993, and 1998) and El Niño recovery years (1994 and 1999) are removed, the regression line shows a slight decrease (thick line) and net production averages 12.5%. Maximum net productivity rates cannot be estimated from available data.

POTENTIAL BIOLOGICAL REMOVAL

The potential biological removal (PBR) level for this stock is calculated as the minimum population size (138,881) times one half the default maximum net growth rate for pinnipeds (½ of 12%) times a recovery factor of 1.0 (for a stock of unknown status that is growing, Wade and Angliss 1997); resulting in a PBR of 8,333 sea lions per year.

ANNUAL HUMAN-CAUSED MORTALITY

Historical Depletion

Records of historic exploitation of California sea lions include harvest for food by native Californians in the Channel Islands 4,000-5,000 years ago (Stewart et al. 1993) and for oil and hides in the mid 1800s (Scammon 1874). More recent exploitation of sea lions for pet food, target practice, bounty, trimmings, hides, reduction of fishery depredation, and sport are reviewed in Helling (1984), Cass (1985), Seagers et al. (1985), and Howorth (1993). Lowry et al. (1992) stated that there were few historical records to document the effects of such exploitation on sea lion abundance.

Fisheries Information

California sea lions are killed incidentally in set and drift gillnet fisheries (Hanan et al. 1993; Barlow et al. 1994; Julian 1997; Julian and Beeson, 1998, Cameron and Forney 1999; Table 1). Detailed information on these fisheries is provided in Appendix 1. Mortality estimates for the California the set and drift gillnet fisheries are included in Table 1 for the five most recent years of monitoring, 1997-2001 (Julian 1997; Cameron and Forney 1999, 2000; Carretta 2001, 2002). A controlled experiment during 1996-97 demonstrated that the use of acoustic warning devices (pingers) reduced sea lion entanglement rates considerably within the drift gillnet fishery (Barlow and Cameron 2003). However, entanglement rates increased again during the 1997 El Niño and continued during 1998. The reasons for the increase in entanglement rates are unknown. However, it has been suggested that sea lions may have foraged further offshore in response to limited food supplies near rookeries, which would provide opportunity for increased interactions with the drift gillnet fishery. Because of interannual variability in entanglement rates, additional years of data will be required to fully evaluate the effectiveness of pingers for reducing mortality of this particular species. Mortality estimates from the drift gillnet fishery are based on 1997-2001 observer data (~20% observer coverage). Estimates of mortality for the halibut/angel shark set gillnet fishery in southern California are based on 1991-94 kill rates and current levels of fishing effort, except for the Monterey portion of the fishery, which was observed in 1999 and 2000 (Table 1). Mortalities from these and other fisheries result in an average estimate of 1,476 (CV = 0.03) California sea lions taken annually (Table 1).

Logbook and observer data, and fisher reports, indicate that mortality of California sea lions occurs, or has occurred in the past, also in the following fisheries: (1) California, Oregon, and Washington salmon troll fisheries; (2) Oregon and Washington non-salmon troll fisheries; (3) California herring purse seine fishery; (4) California anchovy, mackerel, and tuna purse seine fishery; (5) California squid purse seine fishery, (6) Washington, Oregon, California and British Columbia, Canada salmon net pen fishery, (7) Washington, Oregon, California groundfish trawl fishery, and (8) Washington, Oregon and California commercial passenger fishing vessel fishery (NMFS 1995, M. Perez pers. comm, and P. Olesiuk pers. comm.). The OR Columbia River gillnet fishery has been reduced to such levels that California sea lion mortality, if any, is negligible (J. Scordino, per. comm.). The California and Oregon/Washington Marine Mammal Stranding Network databases maintained by the National Marine Fisheries Service contain records of human-related fishery mortalities of stranded California sea lions. These records show that at least five additional mortalities and nine injuries occurred in 2001 as a result of fishing net entanglement and two additional mortalities and six injuries from hook and line fisheries.

Drift gillnet fisheries for swordfish and sharks exist along the entire Pacific coast of Baja California, Mexico and may take animals from the same population. Quantitative data are available only for the Mexican swordfish drift gillnet fishery, which uses vessels, gear, and operational procedures similar to those in the U.S. drift gillnet fishery, although nets may be up to 4.5 km long (Holts and Sosa-Nishizaki 1998). The fleet increased from two vessels in 1986 to 31 vessels in 1993 (Holts and Sosa-Nishizaki 1998). The total number of sets in this fishery in 1992 can be estimated from data provided by these authors to be approximately 2700, 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; Julian and Beeson, 1998), but species-specific information is not available for the Mexican fisheries. Previous efforts to convert the Mexican swordfish driftnet fishery to a longline fishery have resulted in a mixed fishery, with 20 vessels alternately using

longlines or driftnets, 23 using driftnets only, 22 using longlines only, and seven with unknown gear type (Berdegué 2002).

Table 1. Summary of available information on the mortality and serious injury of California sea lions in commercial fisheries that might take this species (Cameron and Forney 1999, 2000; Carretta 2001; 2002, M. Perez per. comm, Appendix 1). Mean annual takes are based on 1997-2001 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 driftnet fishery for sharks and swordfish	1997 1998 1999 2000 2001	observer	23.0% 20.0% 20.0% 22.9% 20.4%	36 23 6 13 2	201(0.34) 114 (0.23) 30 (0.36) 50 (0.43) 9 (0.69)	81 (0.19)
CA set gillnet fishery for halibut and angel shark	1997 1998 1999 2000 2001	extrapolated estimate	0% 0% 4% 1.8% 0%	- - 13 28 0	1,206 (0.06)[1] 1,228 (0.07)[1] 1,360 (0.07)[1] 1,346 (0.07)[1] 1,194 (0.07)[1]	1,267 (0.03)[1]
WA, OR, CA domestic groundfish trawl fishery (At-sea processing Pacific whiting fishery only)	1997 1998 1999 2000 2001	observer	65.7% 77.3% 68.6% 80.6% 96.2%	0 1 1 0 0	0 1 (0.48) 3 (0.55) 0 0	0.8 (0.43)
WA, OR salmon net pen fishery	1997 1998 1999 2000 2001	MMAP n/a		9 12 n/a	9 12 n/a	11
Canada: BC salmon pen fishery	1997 1998 1999 2000 2001	MMAP		52 88 134 217 88	52 88 134 217 88	116
Minimum total annual takes						1,476 (0.03)

[1] The California set gillnets were not observed after 1994; mortality was extrapolated from effort estimates and previous entanglement rates, except for Monterey Bay, where 20-25% of the fishery was observed in 1999 and 2000. Changes in the distribution of effort in this fishery add considerable uncertainty to these estimates and associated CVs are likely to be underestimated.

Other Mortality

California sea lions that were injured by entanglement in gillnet and other man-made debris have been observed at rookeries and haulouts (Stewart and Yochem 1987, Oliver 1991). The proportion of those entangled ranged from 0.08% to 0.35% of those present on land, with the majority (52%) entangled with monofilament gillnet material. Data from a marine mammal rehabilitation center showed that 87% of 87 rescued California sea lions were entangled in 4-4.5 inch square-mesh monofilament gillnet (Howorth 1994). Of California sea lions entangled in gillnets, 0.8% in set gillnets and 5.4% in drift gillnets were observed to be released alive from the net by fishers during 1991-95 (Julian and Beeson 1998). Clearly, some are escaping from gillnets; however, the rate of escape from gillnets, as well as the mortality rate of these injured animals, is unknown.

Live strandings and dead beach-cast California sea lions have also been observed with gunshot wounds in California (Lowry and Folk 1987, Deiter 1991, Barocchi et al. 1993, Goldstein et al. 1999). A summary of records for 2001 from the California Marine Mammal Stranding Network (CMMSN) and the Oregon and Washington stranding databases shows the following non-fishery related mortality: boat collision (three mortalities), entrainment in power

plants (21 mortalities), and shootings (54 mortalities and three injuries). Stranding records are a gross underestimate of injury and mortality. However, CMMSN stranding records indicate a higher mortality rate as a result of shootings and hook and line entanglements during the1997-98 El Niño period (115 shootings, 26 hook and line entanglements) than during the 1995-96 non-El Niño period (61 shootings, five hook and line entanglements). There are currently no estimates of the total number of California sea lions being killed or injured by guns, boat collisions, entrainment in power plants, marine debris, or gaffs, but the minimum number in 2001 was 78.

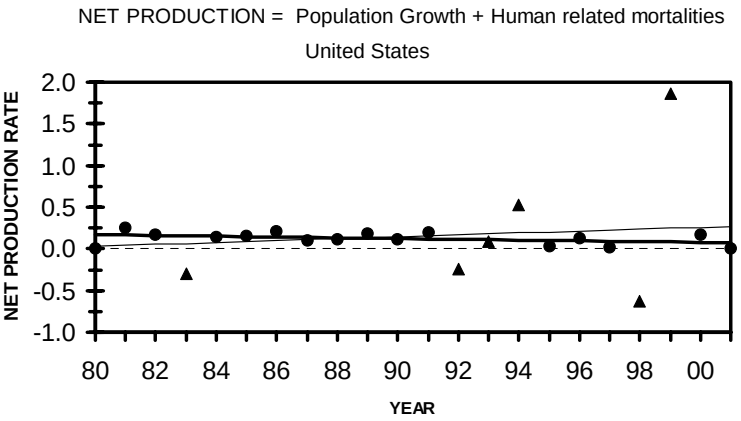

Figure 3. Net production rates and regression lines estimated from pup counts with corrections for incidental human-related mortalities. Thick line excludes El Niño years and El Niño recovery years (i.e., triangles); thin line includes all years.

Several Pacific Northwest treaty Indian tribes have promulgated tribal regulations allowing tribal members to exercise treaty rights for subsistence harvest of sea lions. Current estimates of annual take are zero to two animals per year.

Sea lion mortalities in 1998 along the central California coast have recently been linked to the algal-produced neurotoxin domoic acid (Scholin et al. 2000). Future mortalities may be expected to occur, due to the periodic nature of such harmful algal blooms.

STATUS OF STOCK

Lowry et al. (1992) concluded that there was no evidence of a density dependent signal in counts of California sea lions between 1983 and 1990, and that it was not possible to determine the status of this stock relative to OSP. They are not listed as "endangered" or "threatened" under the Endangered Species Act or as "depleted" under the MMPA. They are not considered a "strategic" stock under the MMPA because total human-caused mortality (1,483 fishery-related mortalities plus 78 from other sources) is less than the PBR (8,333). The total fishery mortality and serious injury rate for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The population has been growing recently at 5.4% to 6.1% per year.

REFERENCES

Barlow, J., R. W. Baird, J. E. Heyning, K. Wynne, A. M. Manville II, L. F. Lowry, D. Hanan, J. Sease, and V. N. Burkanov. 1994. A review of cetacean and pinniped mortality in coastal fisheries along the west coast of the USA and Canada and the east coast of the Russian Federation. Rept. Int. Whaling Comm., Special Issue 15:405-425.

Barlow, J. and G. A. Cameron. 2003. Field experiments show that acoustic pingers reduce marine mammal bycatch in the California drift gillnet fishery. Marine Mammal Science 19(2):265-283.

Barocchi, M., L. E. Morgan, and K. D. Hanni. 1993. Frequency of fishery interactions among live stranded pinnipeds in central and northern California. (abstract). Tenth Biennial Conference on the Biology of Marine Mammals, Galveston TX, November 11-15, 1993.

Berdegué, J. 2002. Depredación de las especies pelágicas reservadas a la pesca deportiva y especies en peligro de extinción con uso indiscriminado de artes de pesca no selectivas (palangres, FAD's, trampas para peces y redes de agallar fijas y a la deriva) por la flota palangrera Mexicana. Fundación para la conservación de los picudos. A.C. Mazatlán, Sinaloa, 21 de septiembre.

Boveng, P. 1988. Status of the California sea lion population on the U.S. west coast. Admin. Rep. LJ-88-07. Southwest Fisheries Science Center, National Marine Fisheries Service, P.O. Box 271, La Jolla, CA 92038. 26 pp.

Brown, R. F. and S. J. Jeffries. 1993. Preliminary report on estimated marine mammal mortality in Columbia River fall and winter salmon gillnet fisheries, 1991-1992. Columbia River Area Marine Mammal Observer Program, 53 Portway St., Astoria, OR. 13 pp.

Cameron, G. A. and K. A. Forney. 1999. Preliminary estimate of cetacean mortality in the California gillnet fisheries for 1997 and 1998. Paper SC/51/04 presented to International Whaling Commission, May 1998 (unpublished). 14 pp.

Cameron, G.A. and K.A. Forney. 2000. Preliminary estimates of cetacean mortality in California/Oregon Gillnet Fisheries for 1999. Report SC/52/O24 presented to the Scientific Committee of the International Whaling Commission, June 2000 (unpublished). 12p. [Available from Southwest Fisheries Science Center, National Marine Fisheries Service, 8604 La Jolla Shores Drive, La Jolla, CA 92037, USA.]

Carretta, J.V. 2001. Preliminary estimates of cetacean mortality in California gillnet fisheries for 2000. Report SC/53/SM9 presented to the Scientific Committee of the International Whaling Commission, June 2001 (unpublished). 21p. [Available from Southwest Fisheries Science Center, National Marine Fisheries Service, 8604 La Jolla Shores Drive, La Jolla, CA 92037, USA.].

Carretta, J.V. 2002. Preliminary estimates of cetacean mortality in California gillnet fisheries for 2001. Report SC/54/SM12 presented to the Scientific Committee of the International Whaling Commission, April 2002 (unpublished). 22p. [Available from Southwest Fisheries Science Center, National Marine Fisheries Service, 8604 La Jolla Shores Drive, La Jolla, CA 92037, USA.].

Cass, V.L. 1985. Exploitation of California sea lions, Zalophus californianus, prior to 1972. Marine Fisheries Review 47:36-38.

Deiter, R. L. 1991. Recovery and necropsy of marine mammal carcasses in and near the Point Reyes national Seashore, May 1982-March 1987. In J. E. Reynolds III and D. K. Odell (editors), Marine mammal strandings in the United States, Proceedings of the second marine mammal stranding workshop, Miami, Florida, December 3-5-1987. p. 123-141. NOAA Technical Rept. NMFS 98.

Goldstein, T., S. P. Johnson, A. V. Phillips, K. D. Hanni, D. A. Fauquier, and F. M. D. Gulland. 1999. Aquatic Mammals 25:43-51.

DeLong, R. L., G. A. Antonelis, C. W. Oliver, B. S. Stewart, M. S. Lowry, and P. K. Yochem. 1991. Effects of the 1982-1983 El Niño on several population parameters and diet of California sea lions on the California Channel Islands. In F. Trillmich and K. A. Ono (editors), Pinnipeds and El Niño: Responses to environmental stress. p. 166-172. Springer-Verlag, Berlin Heidelberg New York.

Hanan, D. A., and S. L. Diamond. 1989. Estimates of sea lion, harbor seal, and harbor porpoise mortalities in California set net fisheries for the 1986-87 fishing year. Final Report. Cooperative agreement No. NA-86-ABH-00018. NOAA/NMFS SWR, January 1989. 10 pp.

Hanan, D. A., D. B. Holts, and A. L. Coan, Jr. 1993. The California drift gill net fishery for sharks and swordfish, 1981-82 through 1990-91. Calif. Dept. Fish and Game Fish. Bull. No. 175. 95 p.

Hanan, D. A., J. P. Scholl, and S. L. Diamond. 1988. Estimates of sea lion and harbor seal mortalities in California set net fisheries for 1983, 1984, and 1985. Final Report. Cooperative agreement No. NA-86-ABH-00018. NOAA/NMFS SWR October 1988. 10 pp.

Helling, H.E. 1984. A follow-up report on available data for California and Stellar sea lion (Zalophus californianus), Eumetopias jubata) exploitation prior to 1950. Administrative Report LJ-84-45C. National Marine Fisheries Service, Southwest Fisheries Center, La Jolla, CA 92037. 10pp.

Holts, D. and O. Sosa-Nishizaki. 1998. Swordfish, *Xiphias gladius*, fisheries of the eastern North Pacific Ocean. *In*: I. Barrett, O. Sosa-Nishizaki and N. Bartoo (eds.). Biology and fisheries of swordfish, *Xiphias gladius*. Papers from the International Symposium on Pacific Swordfish, Ensenada Mexico, 11-14 December 1994. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 142, 276 pp.

Howorth, P.C. 1993. Commercial collection of pinnipeds in the California Channel Islands, 1877-1981. *In:* Hochberg, F. G. (editor), Third California Islands Symposium: Recent Advances in Research in the California Islands. Santa Barbara, CA, Santa Barbara Museum of Natural History. pp.

Howorth, P. C. 1994. Entanglement of marine mammals in synthetic debris. In W. L. Halvorson and G. J. Maender (editors), The Fourth California Islands Symposium: Update on the status of resources, p. 111-121.

Julian, F. 1997. Cetacean mortality in California gill net fisheries: Preliminary estimates for 1996. Paper SC/49/SM02 presented to the International Whaling Commission, September 1997 (unpublished). 13 pp.

Julian, F. And M. Beeson. 1998. Estimates for marine mammal, turtle, and seabird mortality for two California gillnet

fisheries: 1990-1995. Fish. Bull. 96:271-284.
Lowry, M. S. 1999. Counts of California sea lion (*Zalophus californianus*) pups from aerial color photographs and from the ground: a comparison of two methods. Marine Mammal Science 15:143-158.
Lowry, M. S. and R. L. Folk. 1987. Feeding habits of California sea lions from stranded carcasses collected at San Diego County and Santa Catalina Island, California. Admin. Rep. LJ-87-15. Southwest Fisheries Science Center, National Marine Fisheries Service, P.O. Box 271, La Jolla, CA 92038. 33 pp.
Lowry, M. S., P. Boveng, R. J. DeLong, C. W. Oliver, B. S. Stewart, H. DeAnda, and J. Barlow. 1992. Status of the California sea lion (*Zalophus californianus californianus*) population in 1992. Admin. Rep. LJ-92-32. Southwest Fisheries Science Center, National Marine Fisheries Service, La Jolla, CA 92038. 34 pp.
Maldonado, J. E., F. O. Davila, B. S. Stewart, E. Greffen, and R. K Wayne. 1995. Intraspecific genetic differentiation in California sea lions (*Zalophus californianus*) from southern California and the Gulf of California. Mar. Mamm. Sci. 11(1):46-58.
Miller, D. J., M. J. Herder, and J. P. Scholl. 1983. California marine mammal-fishery interaction study, 1979-1981. Administrative Rept. LJ-83-13C. Southwest Fisheries Science Center, National Marine Fisheries Service, P.O. Box 271, La Jolla, CA. 233 p.
NMFS. 1995. Environmental assessment of proposed regulations to govern interactions between marine mammals and commercial fishing operations, under Section 118 of the Marine Mammal Protection Act. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources, June 1995. 139 pp. + 4 Appendices.
Oliver, C. W. 1991. 1988-1991 field studies on pinnipeds at San Clemente Island. Admin. Rep. LJ-91-27. Southwest Fisheries Science Center, National Marine Fisheries Service, P.O. Box 271, La Jolla, CA 92038. 33 pp.
Scammon, C.M. 1874. The marine mammals of the north-western coast of North America, described and illustrated: Together with an account of the American whale fishery. John H. Carmany and Company, San Francisco, CA. 319p.
Scholin, C. A., Gulland, F., Doucette, G. J., Benson, S., Busman, M., Chavez, F. P., Cordaro, J., DeLong, R., De Vogelaere, A., Harvey, J., Haulena, M., Lefebvre, K., Lipscomb, T., Loscutoff, S., Lowenstine, L. J., Marin III, R., Miller, P. E., McLellan, W. A., Moeller, P. D. R., Powell, C. L., Rowles, T., Silvagni, P., Silver, M., Spraker, T., Trainer, V., and Van Dolah, F. M. 2000. Mortality of sea lions along the central California coast linked to a toxic diatom bloom. Nature, 403:80-84.
Seagers, D.J., D.P. DeMaster, and R.L. DeLong. 1985. A survey of historic rookery sites for California and northern sea lions in the Southern California Bight. Administrative Report LJ-85-13, National Marine Fisheries Service, Southwest Fisheries Center, 8604 La Jolla Shores Dr., La Jolla, CA.
Stewart, B. S. and P. K. Yochem. 1987. Entanglement of pinnipeds in synthetic debris and fishing net and line fragments at San Nicolas and San Miguel Islands, California, 1978-1986. Marine Pollution Bulletin 18:336-339.
Stewart, B.S., P.K.Yochem, R.L. DeLong, and G.A. Antonelis. 1993. Trends in Abundance and Status of Pinnipeds on the Southern California Channel Islands. *In:* Hochberg, F. G. (editor), Third California Islands Symposium: Recent Advances in Research in the California Islands. Santa Barbara, CA, Santa Barbara Museum of Natural History. pp 501-516.