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California Sea Otters

by
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Information on the size, distribution, and productivity of the California sea otter population is broadly relevant to two federally mandated goals: removing the population's listing as threatened under the Endangered Species Act (ESA) and obtaining an "optimal sustainable population" under the Marine Mammal Protection Act. Except for the population in central California, sea otters (*Enhydra lutris*) were hunted to extinction between Prince William Sound, Alaska, and Baja California (Kenyon 1969). Wilson et al. (1991), based on variations in cranial morphology, recently assigned subspecific status (*E. l. nereis*) to the California sea otter. Furthermore, mitochondrial DNA analysis has revealed genetic differences among populations in California, Alaska, and Asia (NBS, unpublished data).

In 1977, the California sea otter was listed as threatened under the ESA, largely because of its small population size and perceived risks from such factors as human disturbance, competition with fisheries, and pollution. Because of unique threats and growth characteristics, the California population is treated separately from sea otter populations elsewhere in the North Pacific.

Courtesy: D. Buchnich

Sea otter (*Enhydra lutris*).

Survey Design

Data on the size and distribution of the California sea otter population have been gathered for more than 50 years. In 1982 we developed a survey technique in which individuals in most of the California sea otter's range are counted from shore by groups of two observers using binoculars and spotting scopes. Supplemental data for each sighting include group size, activity, number and size of pups, and habitat. Areas that cannot be counted from shore are surveyed from a low-flying aircraft. Rangewide surveys are done in late spring and mid-autumn.

Population Trends, 1914-93

The California sea otter population has increased steadily through most of the 1900's (Fig. 1). Rate of increase was about 5% per year until the mid-1970's. Although only one survey was completed between 1976 and 1982, the collective data suggest that population growth had ceased by the mid-1970's, and that the population may have declined by as much as 30% between the mid-1970's and early 1980's. Counts made since 1983 have increased at about 5%-6% per year. In spring 1993, 2,239 California sea otters were counted.

The California sea otter's lineal range (distance along the 9-m [5-fathom] isobath between the northernmost and southernmost sightings) has also increased, although more slowly and erratically than the population size (data summarized by Riedman and Estes 1990). The

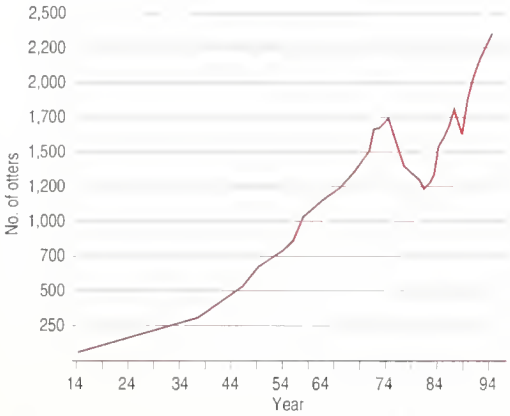

Fig. 1. Trends in abundance of the California sea otter population, 1914-93.

direction of range expansion was predominately southward before 1981, but northward thereafter. Comparison between spring surveys conducted in 1983 and 1993 (Fig. 2) is sufficient to draw several conclusions. First, the population's range limits changed little during this 10-year period, even though large numbers of individuals accumulated near the range peripheries. Second, population density increased throughout this time, although rates of increase were lowest near the center of the range. Finally, the relative abundance of individuals has remained largely unchanged (compare Fig. 2a [1983] with Fig. 2b [1993], noting the similarity in forms of distributions for kilometer segments 10-21).

Although the number of dependent pups counted in spring surveys almost doubled between 1983 and 1993, the geographic range within which these pups were born has changed very little (Fig. 2). Rate of annual pup production ranged from 0.14 to 0.28, but in most years it varied between 0.18 and 0.21. There are no obvious trends in rate of annual pup production between 1983 and 1993. Although the incremental change in the population from one year to the next appeared positively related to the annual number of births, this relationship cannot be shown to be statistically significant.

Implications

From the mid-1970's to the early 1980's, the California sea otter population ceased growing and probably declined. Entanglement mortality in a coastal set-net fishery was the likely cause of this decline (Wendell et al. 1985). Restrictions were imposed on the fishery in 1982, and the population apparently responded by resuming its prior rate of increase.

The maximum rate of increase for sea otter populations is about 20% per year. Except for the California otters, all increasing populations for which data are available have grown at about this rate (Estes 1990). These patterns, coupled with the absence of any size- or density-related reduction in growth rates, make the relatively slow rate of increase in the California population perplexing.

Although the ultimate reason for disparate growth rates among sea otter populations is unknown, we believe that causes relate more to increased mortality than diminished reproduction. While it is difficult to compare population-level reproductive rates between sea otters in Alaska and California, longitudinal studies of

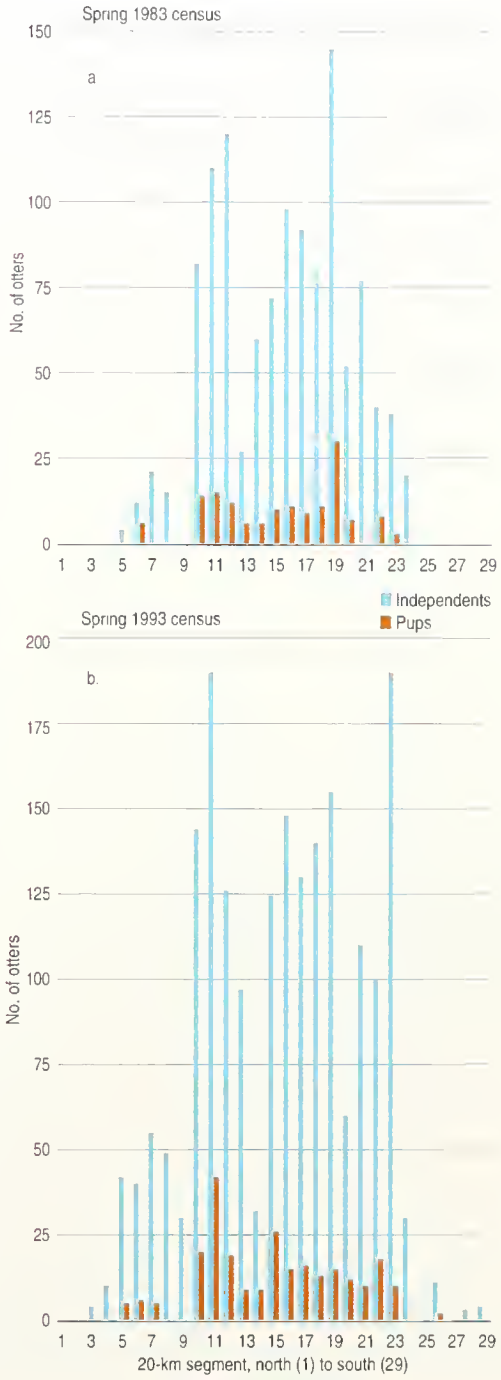

Fig. 2. Distribution and abundance of California sea otters in 1983 (a) and 1993 (b). Data are from the spring surveys.

marked individuals in the two regions indicate that both age of first reproduction and annual birth rate of adult females are similar. Furthermore, the close similarity between the theoretical maximum rate of increase and observed rates of population increase for sea otters in Washington, Canada, and portions of Alaska suggests that mortality from birth to senescence in these populations is quite low. In contrast, rates of mortality in the California sea otter are comparatively high, with an estimated 40%-50% of newborns lost before weaning (Siniff and Ralls 1991; Jameson and Johnson 1993; Riedman et al. 1994). This alone would significantly depress a population's potential rate of increase. Furthermore, the age composition of beach-cast carcasses in California indicates that most postweaning deaths occur well in advance of physiological senescence (Pietz et al. 1988; Bodkin and Jameson 1991). These patterns likely explain the depressed rate of increase in the California sea otter population.

Although the demographic patterns of mortality in California sea otters are becoming clear, the causes of deaths remain uncertain. There is growing evidence for the importance of predation by great white sharks (*Carcharodon carcharias*). Contaminants may also be having a detrimental effect on California sea otters, although as yet there is no direct evidence for this. However, polychlorinated biphenyl (PCB) and DDT levels, known to be high in the California Current, are also high in the liver and muscle tissues of California sea otters (Bacon 1994). Of particular concern are that average PCB levels in California sea otters approach those that cause reproductive failure in mink, which are in the same family as otters; and preweaning pup losses are especially high in primiparous (*see* glossary) females. This latter point may be significant because environmental contaminants that accumulate in fat can be transferred via milk in extraordinarily high concentrations, especially to the first-born young in species such as the sea otter which has prolonged sexual immaturity.

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White-tailed Deer in the Northeast

by
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Populations of white-tailed deer (*Odocoileus virginianus*) have changed significantly during the past 100 years in the eastern United States (Halls 1984). After near extirpation in the eastern states by 1900, deer numbers increased during the first quarter of this century. The effects of growing deer populations on forest regeneration and farm crops have been a concern to foresters and farmers for the past 50 years.

In recent years, deer management plans have been designed to maintain deer populations at levels compatible with all land uses. Conflicts, however, between deer and forest management or agriculture still exist in the Northeast. Areas that were once exclusively forests are now a mixture of forest, farm, and urban environments that create increased interactions and conflicts between humans and deer, including deer-vehicle collisions. Management of deer near urban environments presents a unique challenge for local resource managers (Porter 1991).

This report describes trends in abundance of white-tailed deer in the northeastern United States, relationships between harvest and population estimates, and conflicts between deer and other resources.

Data Surveys

We contacted biologists in each of 13 northeastern states to acquire estimates of deer population size, harvest, and deer-vehicle collisions. We featured harvest data for antlered deer from