

Lifetime survival rates and senescence in Northern Elephant Seals

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Northern elephant seals (*Mirounga angustirostris*) have dramatically increased and expanded in range since the species' near extinction over a century ago. Research at the Año Nuevo colony in Central California has documented this growth over the last 4 decades, and detailed analyses are revealing the drivers of population change.

In this study, Point Blue and partners documented survival rates of the oldest individuals, testing for age-related declines in survival rates over a seal's lifetime, and comparing overall lifespans of males and females.

We branded seals from 1985-1987 at Año Nuevo State Park, 31 km north of Santa Cruz, California. Branding permits identification of individuals throughout life without deleterious effects, and is more reliable than other methods of marking individuals. We conducted searches for branded seals from 1986 to 2012 at three major breeding colonies: Año Nuevo, Southeast Farallon Island and Point Reyes National Seashore.

In modeling survival we took into account annual survival, cohort differences, temporal variation, and detection probability.

We documented longer lifespans in females and males compared with results from previous studies: 21 years vs. 16 and 15 years vs. 13, respectively. Annual survival of adult females was high from age 5 until age 16, but then declined abruptly. This is a higher rate and a longer duration of "prime" survival than expected, and the first evidence for senescence in survival rates of female seals. Average male survival was lower than females but consistent across all ages. Juvenile survivorship was similar in the two sexes, and close to the average reported across several previous cohorts by other studies.

The Northern elephant seal population size is expected to level out in the near future. Our ongoing studies will document fundamental demographics across this transition to stability and provide details on the factors limiting population growth.

Our next steps are to study fluctuations in vital rates over time by studying other cohorts, then to build population models of the Año Nuevo colony and the entire population of northern elephant seals.

In moving forward, these studies will help clarify relationships between key

Northern elephant seal population dynamics and the factors, such as changes in oceanic conditions that influence those dynamics.

Main Points

Survival rates for females were higher and persisted later in life than previously thought.

Senescence limited lifetime survival in females, but not in males.

Documenting dynamics across the transition to population stability will allow us to build predictive models for future reference of the entire northern elephant seal population.

Studies like this help identify factors affecting population growth that can be affected by changes in oceanic conditions.

Condit, R., Reiter, J., Morris, P. A., Berger, R., Allen, S. G. and Le Boeuf, B. J. 2013. Lifetime survival rates and senescence in northern elephant seals. *Marine Mammal Science*. doi: 10.1111/mms.12025

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