



# AMONG FRIENDS

Friends of the Elephant Seal Member Newsletter



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[www.elephantseal.org](http://www.elephantseal.org)

Summer

2016

## Juvenile Haul-Out

## The Genetic Bottleneck

In the fall, the rookery beaches are crowded with juvenile elephant seals. Why? It's clear why the seals come for birthing, mating and molting but what advantages do they gain from the juvenile haul out?

It's only the young seals, those not yet old enough to participate in the birthing/mating process, who are here during the fall haul out. These juveniles come on land biannually at roughly equal intervals. In the spring, on land for a month-long molt, they feel the earth's strong gravitational pull. After the molt, they return to live in the ocean's buoyant environment for five months and then return to the rookery for the fall haul out. After a month on land, where gravity again significantly impacts their bodies, they return to the sea for another five months.

While on land important physiological changes occur. Their bones, especially those in their front flippers, their rib cages, and their sternum are strengthened and grow. Without strong front flippers the seals would have great difficulty moving effectively on land. And without a strong sternum and rib cage the seals wouldn't be able to develop a strong chest cavity. It's the chest cavity that helps support their weight while on land. It's likely their rib cage would collapse when they are on land without that strong chest cavity.

There are additional advantages for seals participating in the fall

The northern elephant seals were heavily hunted between 1820 and 1880, primarily for the oil obtained from their blubber. While still numerous by mid-century, they were widely regarded as extinct in the early 1880s. Sixteen were found on the Baja California mainland in 1884 and killed for museum specimens. Eight were found on Isla de Guadalupe in 1892, seven of which were taken for museums. Later evidence indicates a total population possibly as few as 20, certainly fewer than 100 by 1900. Such a severe reduction in the population results in a "genetic bottleneck."

Genes are segments of DNA that are templates for complex proteins that determine the traits of the organism. There are more than 20,000 genes in human DNA. The offspring receives a copy of each gene from each parent. Generally, within the species there will be alternative forms of each gene, or alleles. Some alleles are much more common than others. New forms are introduced by mutation, primarily from DNA replication errors. Most of the new alleles are deleterious or neutral in consequence but some are beneficial. The deleterious genes are slowly removed from the species by selection – the lower fitness of the individuals resulting in relatively fewer reproducing offspring. Both mutation and selection operate slowly, requiring hundreds to thousands of generations for significant change.

*(Continued on page 2)*

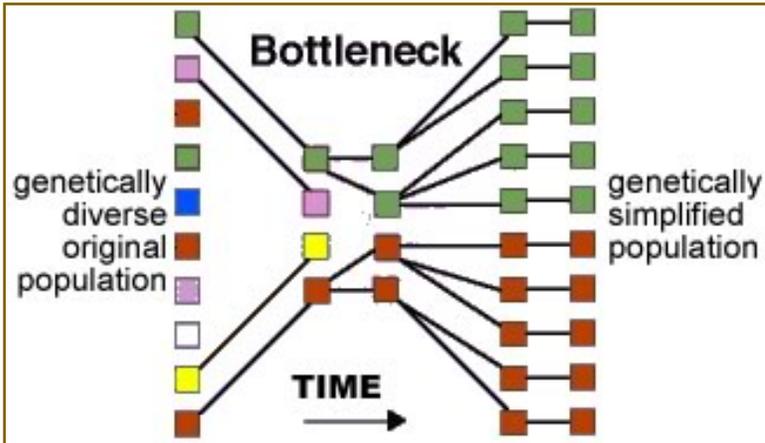
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Family Reunion, May 10, 2016

**Genetic Bottleneck** (Continued from page 1)

When the population of a species becomes very small, chance, unimportant in a large population, becomes dominant and many of the low frequency alleles are lost, reducing the genetic diversity of the species. This is the genetic bottleneck.



How is this loss of genetic diversity detrimental? Genetic diversity is important to a species because some alleles that may be neutral or even somewhat detrimental at one time, may allow the species to prosper in a changed environment. Sexual reproduction – the combining of DNA from two parents in the offspring – is the mechanism that produces new combinations of genes and hence new ways of adapting to that changing environment.

An added complication for small populations is inbreeding. Given the bottleneck population size, inbreeding will of necessity occur, but the mating strategy of the elephant seal – harems dominated by older males who are important breeders for at most a few years – means there is almost no parent-child or sibling-sibling mating involved. On the other hand, very few males contribute to the genetic stock of the pups. While a common consequence of genetic bottleneck and inbreeding is a reduction in reproductive ability, that does not seem to be a problem for the elephant seals.

What does all this mean for the northern elephant seal? A study of 159 seals from five rookeries found no diversity in 24 genes. A similar study of southern elephant seals found multiple alleles in over one-fourth of 18 genes studied. A paternity study of both northern and southern elephant seals found some variation in DNA but much less for the NES. Limited data from northern elephant seal bones in museums indicate a higher frequency of multiple alleles before the bottleneck. This low level of genetic diversity bodes ill for their ability to adapt to environmental changes in the future.

It is important to consider the range of things that constitute their environment. The internal environment of the seal – the body-borne pathogens and parasites – is very important. Indeed, a widely discussed hypothesis holds that the evolution of sexual reproduction was driven by the need to protect offspring from pathogens and parasites that had adapted in the parent, overcoming its

DNA based defenses. A new generation means different DNA and the pathogens and parasites begin their adaptation again. This defense does not work if the parents have nearly identical DNA, making the species particularly vulnerable to disease and parasites.

Their external environment includes ocean temperature, salinity, currents, and pollutants; the location of both prey and predator; and the quality and quantity of suitable land bases. Not all environmental changes require genetic modification. If prey change their location many seals will adjust their foraging location accordingly, revise their diet, or both. As sea level rises and beach area is lost many will find new beaches and adapt to the crowding. Genetics based adaptation to the changes brought about by global warming would be impossible, even for seals with a rich variety of genes, because of the short time scale for those changes.

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**Juvenile Haul-out** (Continued from page 1)

haul out. Once on the beach they can stop diving and rest. Visiting the rookery twice a year helps their bodies prepare for the trials ahead when they join the breeding population. This includes not only the energy expended on the trip to and from the rookery, but also adapting to the challenges of a prolonged fast and exercising muscles and connective tissue needed for land movement. As the seals move into adulthood they simply shift their arrival from fall to early winter. By age four, most females will have joined the breeding population so there are usually more males on the beach during this period. This creates a ready group of young seals eager to hone their fighting skills by sparring with other males thus preparing them for the fights of the future.



## Stranded Weaned Pups

The Piedras Blancas rookery is a natural habitat for elephant seals so we do not interfere with the animals unless they have been injured by human behavior. However, beyond the boundaries of the rookery, injured or stranded animals do receive assistance from The Marine Mammal Center located in Morro Bay.

Animals stranded along our coast may be from Mexico, the Channel Islands or any central coast rookery. They may be suffering from malnutrition, injury, northern elephant seal skin disease, pneumonia, or parasites such as lungworm. When troubled animals are spotted along our coastline, the Marine Mammal Center rescue team is called upon to assess the situation and, when appropriate, bring the animal in for treatment. Along with condition, the size and weight of the animal for its age are used to determine treatment. A stranded weaner that weighs between 75 and 100 pounds would be a candidate for dietary rescue.



At the local treatment center, the rescued animals are tube fed a mixture called a fish milkshake and given electrolytes subcutaneously. Usually, within 24 hours the animal is stabilized, and is driven up to the Marine Mammal Center headquarters in Sausalito, California where it will continue treatment and be taught to recognize, hunt, and eat fish. This process has several steps. It begins by exposing the weaners to fish, usually thawed Pacific herring that is fed to them by tongs or pulled along by a string to imitate the movement of live prey. Over time, the young animals get curious and bite the fish. They then must be taught to position and orient the fish so it can be swallowed. In some cases live fish and squid are provided to help pique the seal's instinct to catch live prey. In the wild, the seal will have to react quickly to catch available food, so the final series of lessons include throwing fish into pools which forces the weaners to compete for food. At this point, the young seals are eating about 11 to 14 pounds of fish, or 10% of their body weight, per day. Once any other issues are reme-

died, and the hunting skill is mastered, the weaners are ready to return to the sea. The release weight of 110 pounds or more seems small to us, but we know that weaners leaving the rookery at much less than the average 225 pounds still learn to fish and survive.



Many yearlings, returning in early April from their second trip to sea, are no larger than the weaners departing the rookery on their first migration, but these yearlings have survived! An orange numbered tag is attached to the rear flipper to identify a rehabilitated seal. These tags have been sighted on healthy seals years after release.

This year, the Marine Mammal Center has rescued 225 elephant seals, the most in its forty-one year history. Experts believe this is primarily related to the El Niño storms earlier in the year and the warmer waters persisting off our coast. For additional information visit [www.MarineMammalCenter.org](http://www.MarineMammalCenter.org)



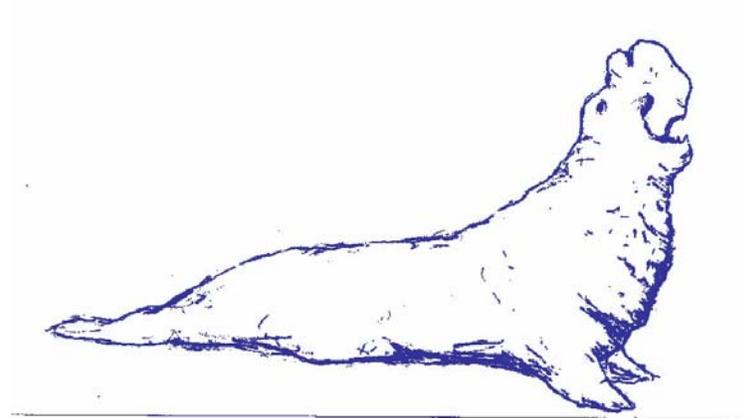
Credit photos: Marine Mammal Center.

### New Webcam!

State Parks has installed a new camera and the picture quality has greatly improved. There will be other changes in the near future so please be patient if you find it not working.



**Friends of the Elephant Seal**  
**Post Office Box 490**  
**Cambria, California 93428**



## Become a Docent

- Great work environment
- Fascinating creatures on the beach
- Interesting visitors on the boardwalk
- In-depth training and continuing education
- Satisfaction in protection of the seals and in helping visitors to appreciate their wonders



Visit our website for information and application.  
[www.elephantseal.org](http://www.elephantseal.org)

### Volunteer Training Dates:

Basic Training in San Simeon.

Saturday, September 10, 2016

Advanced Training in San Simeon.

Saturday, October 8, 2016

Saturday, October 15, 2016

Saturday, October 22, 2016

## Calendar

**January** - Females continue to arrive. Peak of births usually occurs during the last half of month.

**February** - Births end early in the month. The peak of mating is around Valentine's Day. Females begin leaving.

**March** - Last adults leave. Weaned pups teach themselves how to swim.

**April**—Females and juveniles return to molt.

**May** – Females and juveniles molt

**June** - Subadult males return to molt.

**July** - Subadult and adult males molt.

**August** - Last of males molt.

**September and October** - Young-of-the-year and juveniles haul out to rest.

**November** - Juveniles joined by subadult males. Mature males begin arriving at the end of the month.

**December** - Bulls continue to return. Females arrive. The first birth is usually mid-month.

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