Search for the Missing Sea Otters: 
An Ecological Detective Story

Introduction

by
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The Problem

Sea otters are one of the few cute and cuddly creatures in the ocean. Visitors to the coast of the Pacific Northwest love to watch their antics as they float effortlessly on their backs among the floating fronds of kelp (large algae) or frolic with one another in play. They also have some human-like skills. Sea otters place rocks on their chests and crack mussels and clams on them, one of the few examples of tool use by animals other than primates. They also roll spiny sea urchins between their paws to make them easier to eat. It comes as a shock to many to find that this “poster child of marine near-shore ecology,” as marine ecologist Robert Paine calls them, may be fighting for its survival in some areas of Alaska.

Dr. James Estes, a marine ecologist with the U. S. Geological Survey, and his coworkers recently found that the sea otter population in the Aleutian Islands of Alaska had crashed since 1990. Although wild animal populations always rise and fall to some degree, a decline of this size cried out to be explained.

Dr. Estes and his colleagues began an ecological detective hunt to uncover the cause of the declining otter population. Their investigation would eventually lead to the culprit, revealing a huge slice of the complexity and scale of nature’s interconnectedness: from the sea otter itself to the web of interactions among species in the community around it and to events occurring on vast scales in the open ocean of the North Pacific.

One reason that Dr. Estes and his fellow investigators could eventually come to grips with such a complicated story is that they had been studying sea otters and kelp forest communities across nearly 2,000 miles of Aleutian and Alaskan coast for nearly three decades. During this time, they tracked sea otters’ patterns of movement using tags and surgically implanted radio transmitters. They had conducted regular counts of otters across the region, giving them a large-scale and long-term picture of otter population dynamics. By the late 1970s, the researchers had found that otter populations on many islands had recovered strongly from near extinction a century ago by the fur trade, and there was every expectation that they would continue to be robust. So when they began to find declining populations in the early 1990s, Dr. Estes was surprised and perplexed.

The decline in the sizes of sea otter populations inhabiting the Aleutian Islands, which was observed by Dr. Estes and his group, was indeed large. On some islands the sea otter populations declined by 90 percent in fewer than 10 years (see Figures 1 and 2)! What could cause such a rapid decline in the number of otters in this island chain of Alaska? Over the next several weeks, we will consider this problem from several perspectives. As we work to solve this mystery, keep in mind the following questions.
What factors could be contributing to such a rapid change in the size of sea otter populations? Should we spend federal and state tax dollars to support scientists and others in their investigations of this problem? Are we wasting money on animals that are merely “cute and fuzzy,” or might the loss of sea otters from the Aleutian Islands have effects on other organisms? To begin our search for answers, we first need to know something about sea otter biology and population biology.

![Figure 1](image1.png)

**Figure 1.** Changes in the relative abundance of sea otters at several locations in the Aleutian Islands, Alaska. (Redrawn from Estes et al., 1998.)

![Figure 2](image2.png)

**Figure 2.** Map of the North Pacific Ocean showing the Aleutian Islands and some specific sea otter study sites. (From Estes, J.A., and D.O. Duggins. 1995. “Sea otters and kelp forests in Alaska: generality and variation in a community ecological paradigm.” *Ecological Monographs* 65:75-100. Reproduced with permission of the Ecological Society of America.)
Sea Otters

The sea otter, *Enhydra lutris*, is the smallest marine mammal. Sea otters are distributed throughout the northern Pacific Ocean and are restricted to coastal regions because they collect their food (mostly crabs, clams, mussels, and sea urchins) from the ocean floor. They can remain underwater for only 30 to 90 seconds and so they inhabit areas where depths are shallow enough for short dives to the bottom. Once an otter brings food to the surface, it floats on its back, using its belly as a dinner tray. Otters often use rocks to smash open the hard shells of their prey, an activity that makes them unique among marine mammals.

Sea otters spend much of their time in water that can be as cold as -4°F. Consequently, they have evolved several mechanisms for maintaining a constant body temperature that is higher than that of their surroundings. Unlike other marine mammals (sea lions, for example), sea otters do not use an extra fat layer (blubber) to retain heat. Instead they have a double fur coat. The coat closest to the body of the otter, the underfur, is very fine and traps air. Heat released from the otter’s body warms the trapped air, which serves as insulation. On top of the underfur are guard hairs, which keep the underfur dry. The guard hairs are much longer than those of the underfur and remain waterproof as long as they are clean, so sea otters spend 48 percent of the daylight hours grooming and cleaning their fur. This is the reason oil spills are so dangerous to sea otters. The oil coats the guard hairs and, since oil cannot be easily removed, the underfur becomes wet, loosing its insulative qualities, and the animal dies of hypothermia.

In addition to their two coats of fur, sea otters also keep their body temperature constant by maintaining high metabolic rates. It takes a lot of energy to maintain high metabolic rates. Consequently adult sea otters must consume 30 percent of their body weight each day. A human weighing 150 lbs would need to eat 45 lbs of food each day to do the same!

Sea otters are social animals although they group largely by gender. A group of otters is called a “raft,” probably because they spend much of their time floating on their backs. In Alaska the average size of an otter raft is 100 individuals. Males generally mix with a group of females solely for purposes of mating. Mating is rough business. A male grabs a female with his front paws and flips her, belly-up, onto his belly. The male bites the female’s nose, holding onto her in this fashion during the 30 to 60 minutes of copulation. Newly mated females are easily distinguished by their bloody snouts. This proves to be advantageous for scientists studying sea otters, since particular females can often be identified by their distinctive nose scars. A female is pregnant for approximately five months and gives birth to a single pup. The pup will remain with the mother, initially nursing and later eating prey collected by the mother, until it is approximately 12 months old.

Sea otters used to be found all along the Pacific Rim coastline, from northern Japan, through the Kuril Islands (Russia), the Commander Islands (Russia), the Aleutian Islands (part of Alaska), and down the Alaskan, Canadian, and U.S. mainland coasts to the Baja Peninsula (see Figure 2). In the mid-1700s, Russians began hunting otters for their pelts, and by the late 1700s, the English and Americans had also entered this fur trade. Sea otters were hunted nearly to extinction over the next 100 years. In fact, America purchased Alaska from the Russians in 1867 hoping to gain a greater share of the sea otter fur trade. What America did not realize was that Russia was willing to sell the territory because the otter populations had been reduced to a level where it was no longer economically productive to hunt them.
Before the onset of hunting in the mid-1700s, the estimated number of sea otters worldwide was 300,000 individuals. By the end of the 19th century, the number of remaining sea otters had dropped to approximately 1,000 in Alaska and 20 in California. Hunting of these animals ended with the signing of the International Fur Seal Treaty of 1911. The sea otters that remained in the 1900s were scattered amongst 13 relict populations. Several of these populations died out while those in Alaska flourished. The single population remaining in California has grown slowly and at its peak in 1995 consisted of 2,400 individuals. Presently there are sea otter populations on the Kuril Islands, Commander Islands, Aleutian Islands, and small portions of the mainland coasts of Alaska and California. The total worldwide population is currently estimated to be 150,000 individuals.

References

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Internet

- The Otter Project. [http://www.otterproject.org/index.html](http://www.otterproject.org/index.html)