

Studying the Decline of the Steller Sea Lion: Population Sampling

As a result of this dramatic decline of the Western stock and the listing of the Steller sea lion under the Endangered Species Act scientists at federal agencies like the National Marine Fisheries Service and at Universities have spent a lot of time and effort studying these animals. Researchers have looked at many possible explanations for what might have caused the decline only in the west, and not in the east, and why the western stock is still not recovering. However, it has been very difficult to find out why the western Steller sea lion population has declined so much. Why is it so difficult? These are the main reasons:

1) **Its history:** The decline has happened mostly in the past, when people and scientist were not that interested in the Steller sea lion. No one was paying much attention to what was happening along the Aleutian Islands, and as a result not much information on Steller sea lions was collected. Now the decline is only continuing in the westernmost Aleutian Islands, and the rest of the western stock in the US appears more or less stable at low numbers (though it is not increasing).

2) **Inaccessible:** The western Steller sea lion is mostly found along the Aleutian Islands, and this remote and inhospitable area (to us humans) is very difficult for scientists to reach. Steller sea lions are also very large and dangerous, and as a result it is very hard to capture them and study them. Imagine even trying to get the weight of an animal, since you can't just ask them to step onto a scale.

3) **CSI: no 'corpus delicti':** *Corpus delicti* is a Latin term used in *crime scene investigations*. A corpus delicti is the object of a crime, for example the dead body in a murder investigation. The decline of the Steller sea lion is almost like a *crime scene investigation* without a *corpus delicti*: scientists hardly ever find bodies of dead sea lions that they might analyze for diseases or evidence of starvation. This is very different from a situation many are familiar with along the West Coast of the U.S. in California, Oregon and even Washington, where every year hundreds and sometimes thousands of seals and sea lions affected by diseases or starvation show up on our beaches. Such starving or sick animals are sometimes cared for by stranded animal rescue networks and rehabilitation centers, but often die on beaches, where researchers sometimes inspect the dead bodies. From samples collected from these dead bodies, scientists may then determine whether the animal died because it was sick or suffered from starvation. Without the bodies of dead Steller sea lions (without the *corpus delicti*), scientists can't easily tell whether diseases or starvation played a major role in the population decline.

4) **Now you see me - now you don't:** the easiest way for us to work with Steller sea lions is to capture animals at the rookeries during the summer time, when the sea lions gather there to breed and the females nurse their young. However, we may be missing out on the animals that are the problem. It could very well be that only healthy animals that are in good shape show up at the rookeries to mate and give birth. Therefore, we may not see sick animals that easily, or maybe not even at all.

As you can see, it is difficult to study the past population decline, but even trying to figure out why the Steller sea lion numbers are not increasing right now is difficult. Given these difficulties, it is maybe not surprising that scientists have not been able to figure out why the western Steller sea lion population collapsed. Scientists have not found a *smoking gun* that would point the finger at any single reason there are now fewer sea lions. For example,

researchers have tried to find diseases in the Sea lion population, they have measured the level of pollutants that may reduce the fertility (the ability to have pups) of female sea lions, and they have also looked at the possibility of animals starving or not reproducing as much because they cannot find enough fish - maybe the fishing industry catches too many of the same fish that the sea lions eat. You may remember already reading that Steller sea lions eat a lot of pollock and Atka mackerel. Pollock is a fish that is harvested in huge amounts by very large trawlers in the North Pacific Ocean and the Bering Sea. Trawlers are specialized fishing boats that pull very large fishing nets through the water. The opening of these nets can be as wide as 100 meters (300 feet) or more. Every year, these very large trawlers harvest about 2.5 billion pounds of pollock in the United States. This pollock fishery alone makes up more than one-third of the weight of all fish caught every year in the United States. There are quite a few scientists and fisheries managers that believe that this intense fishing for pollock in Alaskan waters is the main reason Steller sea lions have declined and are not recovering. However, they have very little hard evidence to go by, because it is almost impossible to prove that the sea lions cannot find enough fish just because these big trawlers are collecting so much. Instead, researchers have looked at many other possible reasons for the decline, like diseases and even predation by animals that eat sea lions, such as killer whales and sharks. It is known that sea lions die for many different reasons. Known reasons include death by drowning from getting entangled in old fishing gear and garbage floating at sea (did you know that plastic packing bands are a big problem that kills quite a few sea lions?), death from collisions with large ships such as container transport ships, and death resulting from attacks by animals that eat sea lions. For example, salmon sharks and pacific sleeper sharks are thought to attack and eat sea lions. Killer whales have also been seen attacking and killing sea lions, but killer whales also eat many other marine mammals such as grey whale calves, various species of dolphins, sea otters and harbor seals. Inside of the stomach of a dead killer whale that had washed up on the beach in Prince William Sound in Alaska, scientists found the plastic identification marks that are used by researchers on Steller sea lions (see below). They found tags from at least 14 different Steller sea lion pups that this killer whale had apparently eaten within the past year. Even that however was not considered a smoking gun, since 14 missing sea lions can hardly account for a drop from 200,000 to 45,000 animals, or so researchers thought.

So, researchers have not found any evidence for diseases or other health effects, or large numbers of sea lions being eaten by predators, and have therefore decided that the only possible reason left is the one that is most difficult to prove: lack of fish. But we have to remember that the evidence pointing the finger at lack of fish is very indirect and not very strong. In a jury deliberating evidence from a *Crime Scene Investigation*, it is doubtful whether the lack of evidence could ever result in a conviction.

Given the lack of good answers to this day, what can we do to learn more about these animals in such remote locations, and solve the puzzle of the disappearing sea lions?

Research on the Steller sea lion:

The most important information that scientists and wildlife managers need to have any chance at solving this puzzle is information on how many animals there are, how many are born each year, and how many die each year. That's because quite simply, if more animals die than are born, then the population declines. If more are born than die, then the population increases. If we had things our way, we would also know how each animal dies. How can we do this?

Counting sea lions:

You may already have an idea how we can count sea lions: we can fly along most of the Alaskan coastline and count the animals we see. This is not an easy thing to do, since the coastline of all Aleutian Islands, the Alaskan Peninsula, the Gulf of Alaska and Prince William Sound, all the way down Southeast Alaska towards Canada is much longer than the entire coastline of the rest of the United States combined! That is a lot of flying, a lot of photos, and a lot of counting that has to be done. However, when we add the count of all sea lions from all photos, we still do not have a full count of the whole population. That is because at any given time, many animals are not 'hauled-out', but are instead swimming around in the water, probably looking for fish. In the summer we count more animals than in the winter. This is because the weather for flying and counting is better, but also because the animals spend more time hauled out on rookeries. However, even during the summer when many sea lions meet in the rookeries to mate, give birth, and suckle, many animals are gone. For example, those females that have a pup that is older than a few weeks start to go back in the water for a few hours at first, and for a whole day later in the summer. This is so they can eat enough of the food they need to make milk they feed their pup. Very young pups stays 'at home' in the rookery and patiently await the return of their mom. Older pups also begin to go into the water while their mom is out feeding herself. So, during a small period early in the summer it is possible to count most pups because they don't go into the water yet, but it is impossible to count all older animals at any one time. Counts of animals therefore have to be corrected to account for those that are absent. Because it is so difficult to do a complete aerial survey around the entire North Pacific Rim, scientists only do a complete count about every five years. At other times, scientists only count in a few select areas that are observed more closely. These areas are called '*trend sites*'. However, while it is possible to count most newborn pups in a year, it is much more difficult to figure out how many animals have died from one year to the next, especially when only the counts from trend sites are available. This is for many reasons: animals move around between rookeries and haul-outs. For example, we recently saw an animal at our study location at Sea Lion Caves near Florence on the Oregon coast that was born and marked on Forrester Island in South-East Alaska. Nevertheless, we can get a pretty good idea of the basic sea lion population numbers from these aerial surveys: we can estimate how many there are, how many pups are born, and maybe we can even guess how many animals die from year to year.