

Alaska Crime Scene Investigations



Data: Temperature Profiles

Below are different types of temperature profiles that a scientist would expect to see for different types of mortalities. Notice how the temperature always starts off at about 37°C (98.6°F), the normal body temperature for sea lions, and then cools down to the same temperature as the ambient (surrounding) air or seawater.

The first two profiles are from carcass testing where researchers used dead California sea lions to test the Life History Transmitter (LHX) and cooling.

Slow Cooling (Starvation, Disease)

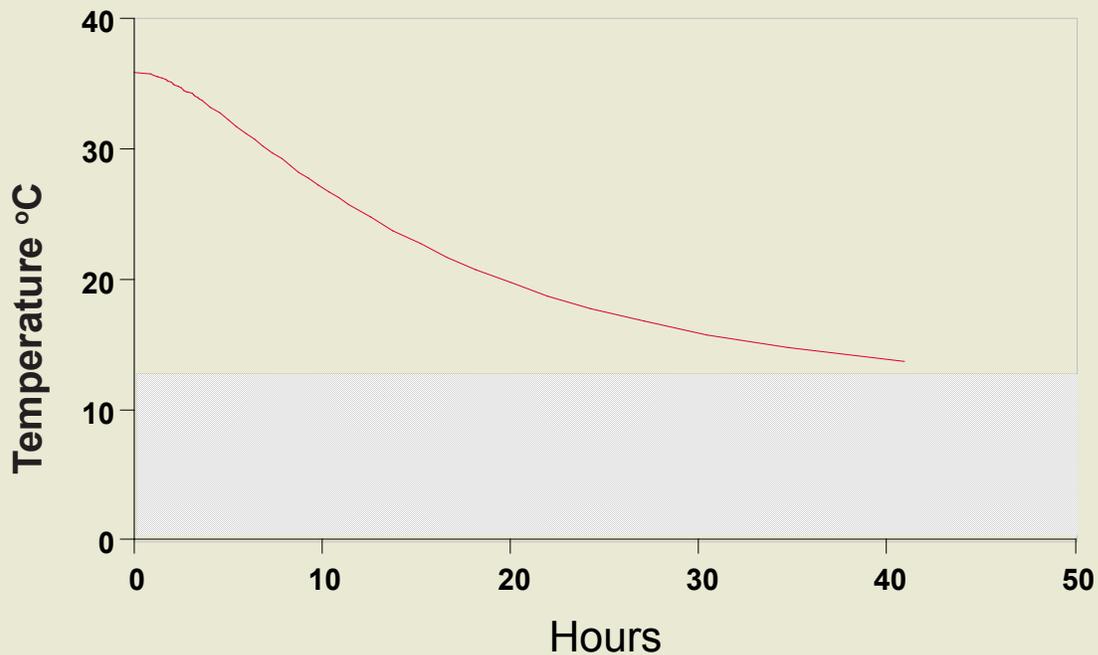


Figure 1: The figure above shows actual temperatures that the tags recorded from the body of an adult male California sea lion that had just died, into which scientists then inserted two LHX tags. The animal had a body mass (weight) of 184 kg, and after it died the intact body was left to cool in water of about 12.5°C (represented by the grey shaded area). After it had cooled, the body was transported out to sea and deposited in about 100m of water in Monterey Bay to test decomposition at sea. Even though it only took about 2 days for the body to cool to the temperature of surrounding water, it took about 7 weeks for the two LHX tags to come out of the decomposing carcass, float to the surface of the ocean and begin to transmit their data.

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Slow Cooling for Smaller Sea Lion (Starvation, Disease)

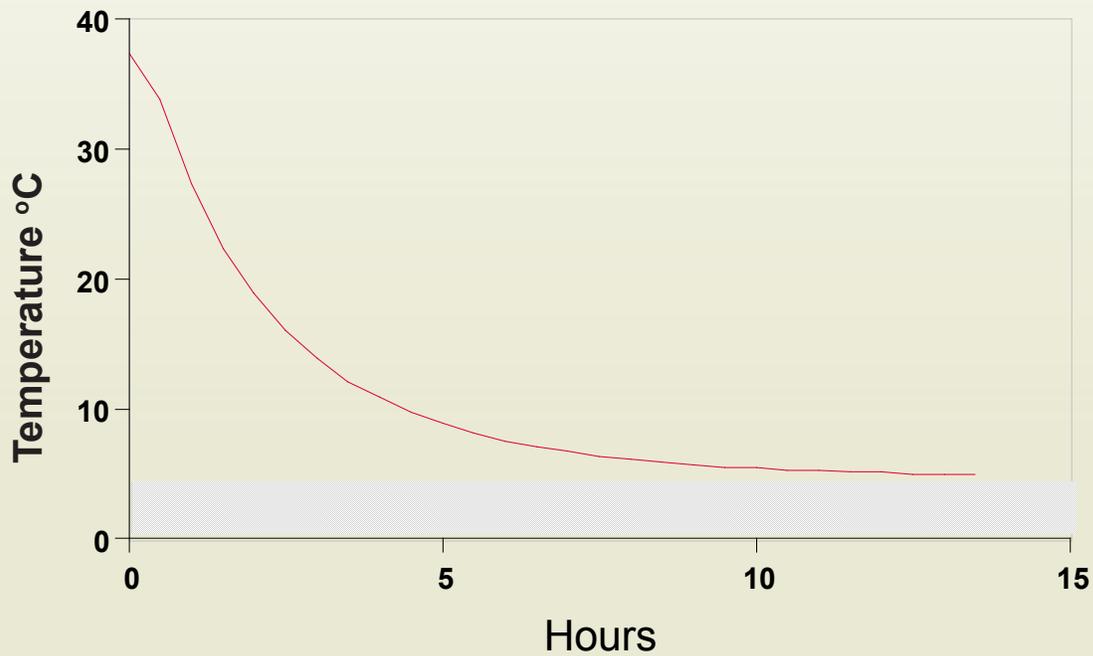


Figure 2: The figure above shows actual temperatures inside of the dead body of a very small California sea lion that had been found dead on the beach. This animal had a body mass (weight) of only about 15 kg. Scientists warmed up the body to 37°C and after inserting a thermometer to simulate the LHX tag, allowed the whole carcass to cool in seawater of about 4.5°C (shown by the grey shaded box). Notice how much faster this body cooled (about 15 hours) compared to that of the large male shown in Figure 1. This is because cooling goes faster for smaller bodies, and in colder water.

Massive Trauma (Predation; Tag ejected)

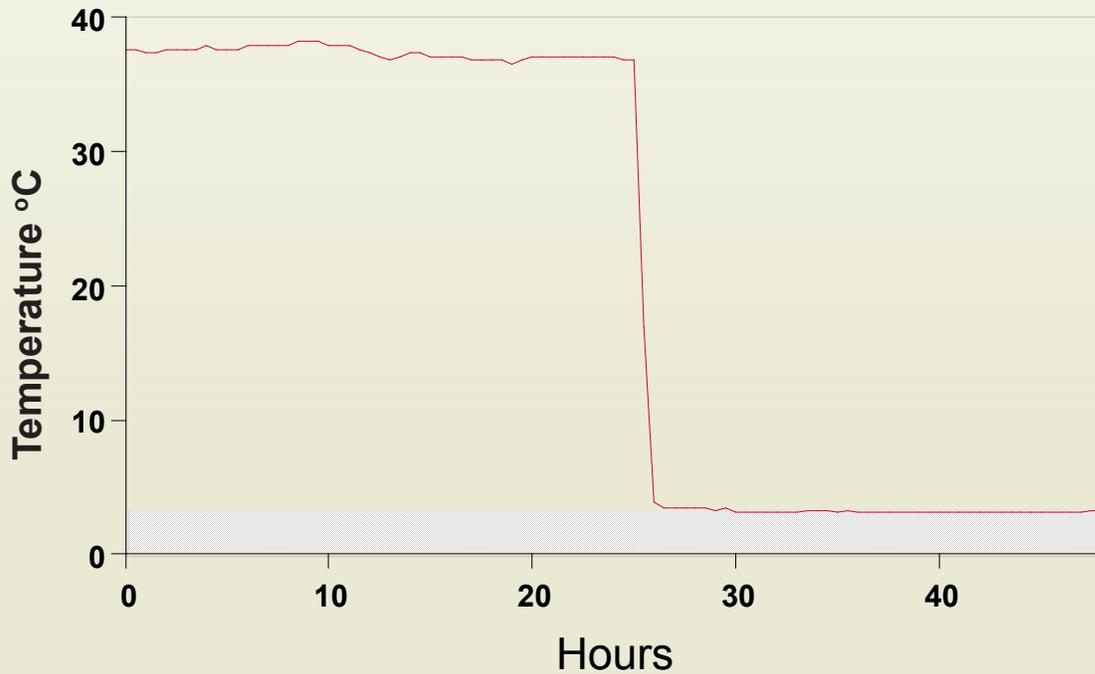


Figure 3: The figure above shows actual temperatures that were recorded by an LHX tag at the time this particular Steller sea lion died in Prince William Sound, Alaska. Within a very short time the tag recorded an abrupt drop from 37°C to about 4°C (grey shaded area), the temperature of the ocean at the time, and a location this event occurred. Scientists believe that this very sudden change happens when a predator like a shark or killer whale tears apart its prey, and the LHX tag is instantly released into the surrounding water. This is also confirmed by the fact that the LHX tag sensed light and began to uplink data to a satellite at exactly that time. Scientists call this “death at sea by acute, massive trauma” (injury).

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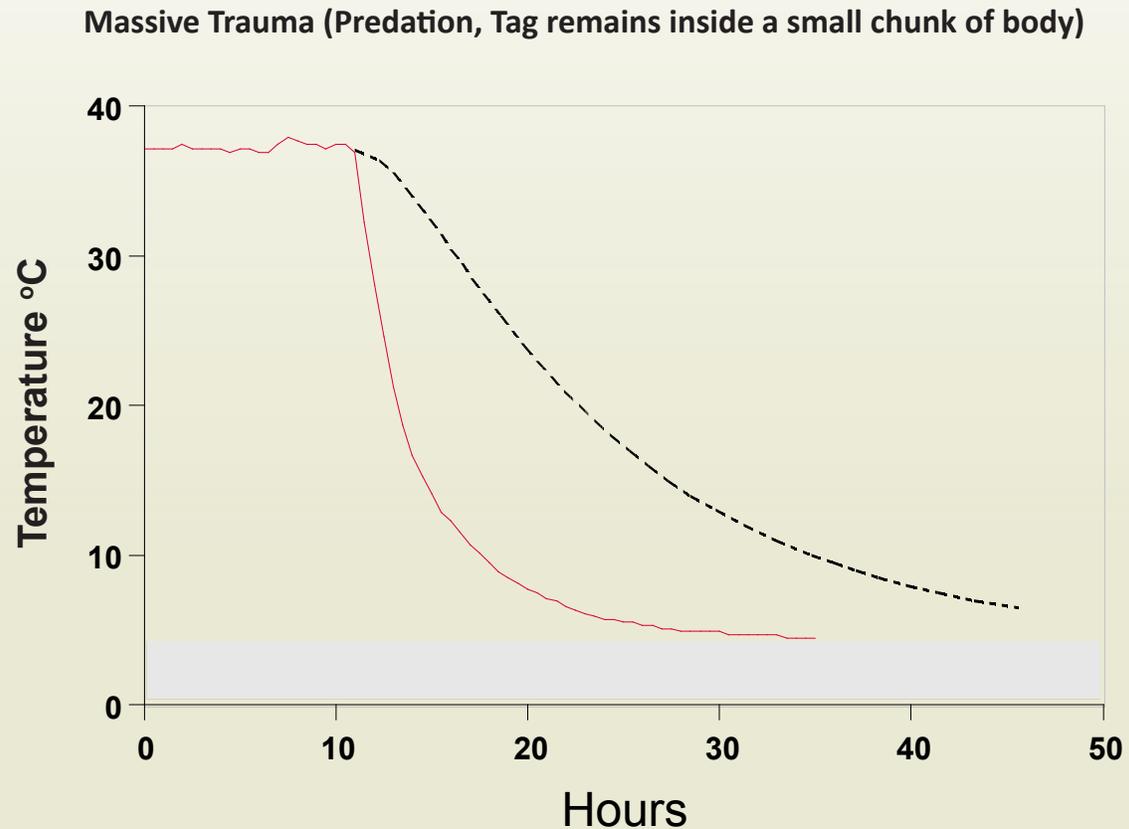


Figure 4: The red line in the figure above shows actual temperatures recorded by another LHX tag from a different Steller sea lion that died in Resurrection Bay, Alaska. The slow cooling might suggest that this animal died from a cause other than predation. However, scientists were suspicious about how quickly the temperature dropped. This animal should have had a body mass of at least about 150 kg. Carcass testing showed that in waters of about 4.5°C (grey shaded area) cooling for a carcass of 150 kg should have been much slower as shown by the dotted black line (compare this figure to Figures 1 and 2 above, but notice the different time scales!). Scientists concluded that this animal was also killed by predators, but that this LHX tag remained inside of a piece of body with a mass of only 25 kg. This is also consistent with this LHX tag sensing light about 2 weeks after the animal died, much faster than the 5 weeks average time for tags to come out of intact carcasses.