

Vaccination of Hawaiian Monk Seals



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*“An ounce of prevention is worth a pound of cure.”
-Benjamin Franklin*



NOAA’s Hawaiian Monk Seal Research Program is developing a plan to protect the critically endangered monk seal from a catastrophic disease outbreak. An outbreak could set back recovery efforts for decades or eliminate hope for the species all together. Developing a wildlife vaccination program is complex but may prove the difference in the battle against extinction.

Why vaccinate?

Infectious disease is a risk to all wildlife populations, but not all infectious diseases are the same. Our focus is on a family of viruses known as morbillivirus. Morbillivirus is widespread and outbreaks of the disease have caused the deaths of thousands of dolphins and seals in other parts of the world. Tens of thousands of seal mortalities have occurred in outbreaks in Europe since the 1980’s, and this virus has also been detected in seals from the Northeast United States (Duignan *et al.* 2014). Information on the most recent outbreak of morbillivirus in dolphins along the Atlantic coast of the United States can be found at:

<http://www.nmfs.noaa.gov/pr/health/mmume/midatltdolphins2013.html>.

Most people are familiar with morbilliviruses already: this virus family includes measles, against which children are routinely immunized, and distemper, which is part of a core vaccination series for pet dogs. One thing that all forms of morbillivirus have in common is that vaccination is an effective preventive strategy. The success of vaccination in preventing morbillivirus infections in humans, pets and livestock led us to consider it for monk seals.

Risk factors for monk seals

Concerns for monk seal disease risk stretches beyond just the small population size of seals. There are a number of factors that make our program concerned about the potential for an outbreak and push us to reduce the risk.

1. **IMMUNITY:** Decades of population health monitoring indicate that monk seals do not carry antibodies to morbillivirus in their blood, so their immune systems are unlikely to protect them from contracting the disease.

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“We are laying the foundation for a vaccination plan against other vaccine preventable diseases that may become a threat in the future.”

2. **GENETIC DIVERSITY:** There is little genetic diversity within the remaining population of approximately 1,100 Hawaiian monk seals. This loss of diversity is not the result of inbreeding, but combined with a small total population size it limits the flexibility of individuals to respond to a newly introduced disease.

3. **EXPOSURE RISKS ON LAND:** Sources of exposure for monk seals include ocean and land-dwelling mammals. While canine distemper is not common in dogs in Hawaii, an infected dog roaming a beach off-leash has the potential to transmit the infection to a seal.

4. **EXPOSURE RISKS AT SEA:** Exposure to morbillivirus has been detected in marine mammals in North Pacific and Alaskan waters, including those that reside within Hawaiian waters, migrate through our region, or occasionally swim off-course from their natural habitats.

5. **VIRUS SPREAD:** Morbillivirus is spread through the air by respiratory contact, so animals must be in close contact for transmission to occur. A common behavior seen between monk seals is a sneeze. Our program has been examining how much contact occurs among monk seals and results show that it is enough to sustain an outbreak.

6. **THE UNKNOWN:** We do not know the exact mechanism of morbillivirus transmission across marine mammal populations, nor do we know the severity of the disease should a monk seal be exposed. However, a vaccine has been found to be safe and effective when used in captive Hawaiian monk seals. Despite the uncertainties, vaccination appears to be a safer course of action than the alternative – a vulnerable population.

Wildlife Vaccination: From Concept to Application

In order to determine a safe, sensible approach to such a severe disease threat, years of investigation were required. Selection of a suitable vaccine required that it be protective, but could not cause the illness. Trials first determined the safety and effectiveness of a vaccine made for ferrets. After deeming it safe for common seals and worthy of further study, advanced trials were conducted in captive Hawaiian monk seals. Vaccinated seals showed no adverse effects other than occasional mild swelling at the site of the injection, and produced antibodies in their blood at levels which are expected to be sufficiently protective.

We are not yet vaccinating wild seals. Effective vaccination will be a two-pronged approach: (1) vaccination of seals handled during regular research activities and (2) preparedness for large-scale vaccination efforts in the face of an outbreak.

Ongoing research shows that response vaccination alone is likely insufficient to contain the outbreak in this species. Hence, we are hopeful that in the future, vaccination efforts will be piggybacked with other research activities in order to get a head start on building immunity within the population.

However, we want to be prepared should an outbreak occur in the meantime. So we have developed a plan that specifies how we would respond to an outbreak.

Vaccination Drill 2015

The NOAA Hawaiian Monk Seal Research Program will hold a 3-day vaccination drill in July to train and rehearse the communication structure, data collection practices, and logistics for a large-scale vaccination effort. Teams will not touch the seals, but will estimate the number of seals that could be vaccinated in two days. The scope of the

plan is large, but we will focus on Oahu and the Northwestern Hawaiian Islands using the help of staff and volunteers already positioned in these two areas. This drill will not only initiate the training process, but also identify gaps in the plan that may need revision.

Forward Thinking

Through this project, we are laying the foundation for a vaccination plan against other vaccine preventable diseases that may become a threat in the future. For example, we know that West Nile virus can cause mortality in monk seals. It is not yet present in Hawaii, and we are hopeful that it will never be an issue. But this morbillivirus-focused effort also prepares us for disease threats that may emerge as significant for monk seal conservation in the future.

More Information

The following scientific review papers are excellent sources of information on morbillivirus infections in marine mammals:

Duignan, P. et al. 2014. Phocine distemper virus: current knowledge and future directions. *Viruses* 6, 5093-5134; doi:10.3390/v6125093.

Van Bresse, M. et al. 2014. Cetacean morbillivirus: current knowledge and future directions. *Viruses* 6, 5145-5181; doi:10.3390/v6125145.