- Institute Blog

Passport to the wild

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Have you ever wondered why there are miles and miles of fences lining the I-15 when you drive through the desert in California and Nevada? These fences are saving lives. They have drastically reduced the road fatality rate of an iconic Mojave Desert dwelling reptile, the desert tortoise. Vehicles can crush or fatally injure tortoises within seconds. Even the otherwise protective shell of an adult has no chance when confronted by a vehicle and they have not evolved to outrun this threat either. Fences also protect new arrivals from wandering off into these danger zones.

So where are the new arrivals coming from? Translocating tortoises is another effort that has contributed to aid in the recovery of the species. One example are the hundreds of tortoises that have been released from the Desert Tortoise Conservation Center into a large, contiguous desert area that is south of Las Vegas over the past few years. The Desert Tortoise Conservation Center was operated by the San Diego Zoo from 2009 until its closure end of 2014 in partnership with U.S. FWS, BLM, and NDOW. The releases were part of a controlled and closely monitored effort in collaboration with the U.S. FWS. Releasing tortoises into the wild follows careful consideration and planning.

It uses science-based knowledge to make wildlife-management decisions. The potential benefits of releasing tortoises need to outweigh the risks. Increasing the number of tortoises in a given population can support population sustainability but can also have devastating consequences. The timing of the releases, the age groups released, the release sites, everything is planned in advance to give not only the released tortoises the best chance of survival but also the ones already in the habitat. Therefore, each individual is monitored for one additional critical factor before being released that has the potential to impact the survival of the whole population: health. Imagine, for example, what could happen if you release a tortoises that is carrying an infectious disease. Every animal has to pass strict health assessment criteria in the weeks leading up to the translocation. One of the projects we are currently focusing on is doing follow-up health assessments on several of the released animal after two to seven years in the wild. The health of the released animals will be compared to the health of the native population to monitor the overall outcome.

Crossing borders

Intact Mojave Desert is a beautiful place to visit. From afar it may not appear as much – seemingly bare, rugged terrain, but up closer it is incredible. Many plants and animals have adapted to survive in the harsh environmental conditions and have thrived for thousands of years. They tolerate extreme heat and cold nights, and can go for months on end without water. In recent years, people too are increasingly sharing this precious resource. It is, for example, used for recreation, housing expansion, and to source renewable energy.

To counteract some of the resulting habitat fragmentation, wildlife managers are considering establishing corridors for wildlife and strategically opening up fences or under-passes to allow wildlife to safely cross unnatural borders and reconnect with neighboring populations. Another part of the desert tortoise project we are working on in collaboration with the U.S. FWS is comparing the health of desert tortoises in several neighboring populations close to the Nevada-California state border.

In particular, we are looking at a disease that was discovered in desert tortoise populations in the late twentieth century and is thought to have contributed to population declines: upper respiratory tract disease (URTD). One of the populations being assessed includes hundreds of tortoises that were translocated from the Desert Tortoise Conservation Center in the past few years. So far, the hard work has been done by the on ground field biologists. It is one thing to require health data and samples from individual tortoises for analysis. It is another to actually get the data. Thanks to the experienced field crew we have already made significant progress! They systematically hiked through 100 km^2 of desert terrain and successfully found the target number of desert tortoises. Spotting the well camouflaged tortoises that spend a significant amount of time underground or stay hidden in the shrubs can pose to be a challenge.

Once found, the tortoises receive a health check: they get weighed and measured, get a body condition score, and get several parameters evaluated such as whether or not they have nasal discharge. Each tortoise is also encouraged to open its mouth for an oral swab. We test the oral swabs for disease agents including *Mycoplasma agassizii* and *M. testudineum*, two of the causative agents of URTD, using PCR. The data will help determine whether it is safe from a health perspective for the tortoises to cross the borders and mix with neighboring populations.

Who gave me this cold? Creating a virus catalog for the Safari Park

If you have been traveling during the holidays you have probably been keenly aware of the person behind you coughing on the plane, or sneezing near you in the grocery store. Are they just struggling through an allergic reaction, or are they spreading a virus that in a few weeks may have you clutching a box of tissues and wishing you could breathe normally again? Washing your hands, and maintaining a healthy immune system are probably your best lines of defense against these kinds of viruses, but if you are unlucky enough to get sick you will likely recover within a week or two. However, some viruses can establish latent infections and can turn you into a walking virus distributor for the rest of your life even though you may no longer have any signs of illness. This is known as a latent infection, which is the ability of a virus to lie dormant within a cell and become reactivated at a later time when the host may actively shed the virus and infect others.

This is a common property of viruses in the Herpesviridae family which includes the varicella-zoster virus, commonly known as chicken pox or shingles, the Epstein-Barr virus, commonly known as mononucleosis, and many others. The family is further subdivided into 3 sub-families; alpha, beta, and gamma, and well over 100 herpesviruses have been identified. So it is likely that everyone has come in to contact with a herpes virus or at least heard of these viruses at some point in their life, but did you know that herpesviruses are also present in most animal species? Moreover, some of the herpesviruses found in animals are also associated with serious diseases, such as Malignant Catarrhal Fever (MCF), a fatal disease in ruminant animals.

Much like many human herpes viruses, MCF is spread between animals through direct contact with nasal secretions and other bodily fluids. The puzzling issue with MCF is that one species may carry these viruses asymptomatically while another species may be extremely susceptible to the infection. This is a serious issue for many of the exotic ruminant species here at the San Diego Zoo Safari Park, and the subject I am researching here in the Wildlife Disease Laboratories. Essentially, my goal is to characterize the different herpesviruses present within the park, and also investigate what species may be susceptible to these viruses. If we can identify virus carriers, then we can help prevent the spread of this virus and prevent deadly MCF outbreaks within our collection by simply isolating them from each other. If you have ever visited the San Diego Zoo Safari Park and have seen our beautiful multispecies enclosures, you may be realizing how big of a problem this virus could pose to our collection. While our goal is to display animals as you would see them in the wild, we also need to consider any potentially fatal infections that may be passed between animals when kept together in a zoological setting.

It turns out that even animals should be wary of a stranger sneezing near them!

Of when herpes and its host do not get along

You may be one of the many people that have experienced or at least heard of what herpesviruses can do to a body. Herpesviruses actually have a wide variety of hosts and are distributed around the world. The host can be unaware of their presence or the virus can cause havoc from discomfort to death. In humans, for example, the Varicella Zoster herpesvirus can cause chickenpox and shingles, or reside in a latent form without causing clinical signs. Herpesviruses are also widespread in animal vertebrates. They have been found in mammals, reptiles, birds, and fish. They have even been found in invertebrate species such as oysters. Oftentimes, herpesviruses have favored or natural hosts – their reservoirs.

One group of herpesviruses specializes in infecting artiodactyla or even-toed ungulates such as domestic cattle, sheep, and pigs but also wild or zoo living ruminants such as deer. These herpesviruses belong to the subfamily gammaherpesvirinae and are Malignant Catarrhal Fever (MCF) associated viruses. MCF is a fatal disease in susceptible hosts while reservoir species are subclinically or inapparently infected. The disease can progress so rapidly that the effected animal does not show many clinical signs before death. The virus attacks blood vessel walls and lymphoid tissues and the disease can manifest itself in many different organ systems. Some animals get erosive and ulcerative lesions on the tongue, and in the gastrointestinal and respiratory tracts. Animals may show nasal discharge, crusts around the muzzle and nares, corneal opacity, and even neurological signs.

At the San Diego Zoo Safari Park, there have been sporadic clinical cases in bongo, eastern yellow-backed duiker, and cape blue duiker. Interestingly, the viral strains associated with disease in these cases were also identified in several other species that did not present with clinical signs such as mandarin sika, cuvier's gazelle, southern gerenuk, and eastern giant eland.

The critical step in managing spread of the disease is to prevent reservoir species from passing virus to susceptible hosts. This is especially important when managing captive animals in a multispecies setting. A multispecies enclosure can mimic a natural setting more closely than separating animals by species but oftentimes animals are in closer proximity to each other or encounter each other more frequently than they would in the wild. So how do we know which of the Safari Park animals are potential carriers and which are susceptible? That is what the Bud Heller Conservation Fellow Teagen Partin is working on figuring out!

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