Bird flu has decimated flocks — but not at San Diego zoos. Here's how they keep condors, penguins and more safe.

Safari Park, San Diego Zoo and SeaWorld have not seen any of the animals in their collections infected in the three years since the deadly H5N1 strain of avian flu was first detected in wild birds in the U.S.

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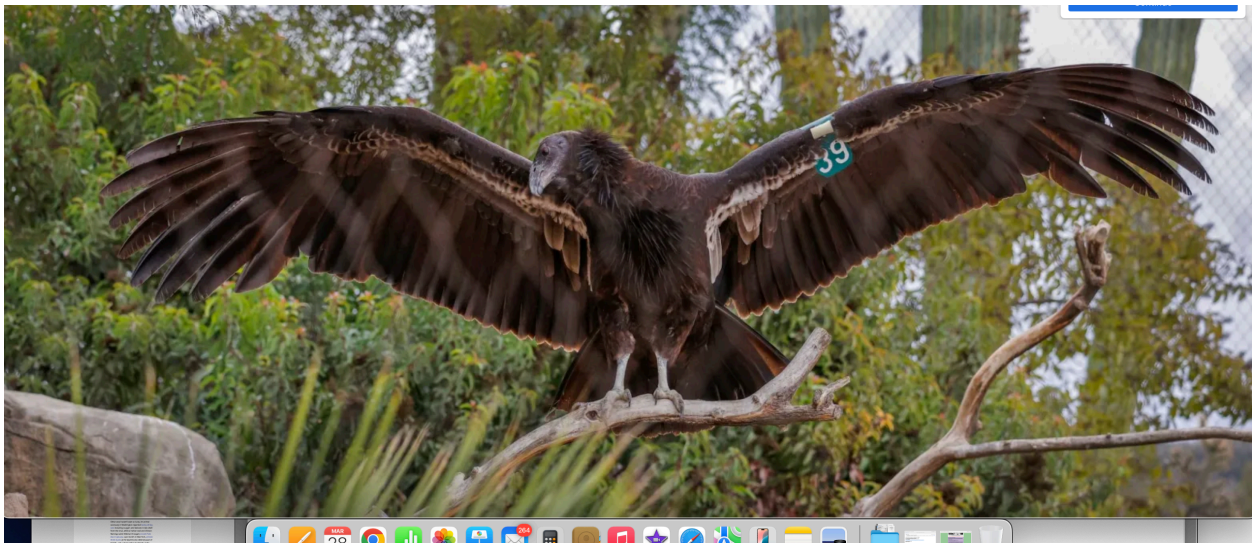

A California condor named "Wesonah" speads his wings at the Condor Ridge habitat at San Diego Zoo Safari Park. After 21 condors in the wild died from bird flu in 2023, condors living at the park and at other zoos were vaccinated. (Charlie Neuman / For The San Diego Union-Tribune)

These days, carnivorous birds like endangered California condors and animals like tigers are enjoying a higher grade of beef at mealtime at the San Diego Zoo and San Diego Safari Park. Zoo officials figure it's a safer bet when it comes to bird flu.

The menu adjustment is just the latest change the parks have implemented as they've tried to prevent the spread of a deadly avian flu that's killing birds and mammals around the globe.

Three years of working to protect exotic and endangered animals in captivity has been no small feat for experts at the two parks and at SeaWorld San Diego. With the spread of bird flu showing no sign of abating, they have tailored methods to protect animals with as little disruption as possible.

And things have gone well. So far, none of the birds or animals in the collections of the zoo, Safari Park or SeaWorld have tested positive for the strain of the virus now causing outbreaks, called H5N1.

That's notable, given that 11 dead wild birds found on the sprawling grounds of Safari Park have tested positive for the virus since 2022, when the outbreak reached California. Whenever dead birds are found,

Officials credit close surveillance of wild migratory birds, a slew of biosecurity measures — and a little luck. Other zoos haven't been so lucky. An animal sanctuary in Washington reported losing 20 big cats including cougars and bobcats in late 2024 from the virus, while a harbor seal and Chilean flamingo were felled at Chicago's Lincoln Park Zoo in January. Last month in New York, at least three ducks at the Queens Zoo died because of bird flu, and a dozen other dead birds at the Bronx Zoo were being tested.

For those managing animal care, their No. 1 concern remains virus transmission from infected wild birds. So they've put measures in place to try to minimize contact between wild birds and birds in their collections. "We drain and clean the flamingo pond at least weekly so… any kind of bird waste is gone," said Eric Otjen, vice president of zoological operations at SeaWorld. Workers look for nests of wild birds to remove, and the park has installed metal spikes on railings and the tops of buildings to discourage roosting.

San Diego sits on the Pacific Flyway, a north- south route taken by migratory birds that can travel from Alaska south to South America. Wild birds that make the twice-a-year migration are considered a risk because they can be infected and show no signs of illness. Waterfowl such as ducks and geese can be of particular concern.

This foursome at Mombasa Lagoon shows the challenge of trying to protect Safari Park birds from possible infections. Two wild great white American pelicans, left, sit right next to a pair of Dalmatian pelicans, which are in the park's collection. (Charlie Neuman / For The San Diego Union-Tribune)

A wild bird surveillance program run by the U.S. Department of Agriculture serves as an early-warning system of flu infections. It shows San Diego County had 36 positive tests for highly pathogenic H5N1 bird flu from dead wild birds since 2022 — including six positives this year

from samples collected in late 2024.During migration months, Safari Park staff relocates some birds into netted or covered habitat spaces — but fewer birds than they moved earlier in the outbreak. Moving birds can be disruptive to natural behaviors such as nest building and choosing mates. Teams perform a risk assessment of each habitat every year and determine mitigation steps from there.

“We’re trying to be good stewards, you know,” said Dr. Hendrik Nollens, vice president of wildlife health for San Diego Zoo Wildlife Alliance. “We’re trying to balance mitigating the risk and balancing that with allowing the natural behaviors.”

Closely monitoring wild birds

The Safari Park is a popular stop for migrating birds, which can spread bird flu through saliva, nasal secretions and feces. On any given day, wild birds can be seen next to birds in the park’s collection. “We have decades of information on the wild birds that show up at the zoo and then show up at Safari Park. Over the years, we’ve learned which of these species actually are prone or susceptible or likely to carry avian influenza,” Nollens said. “Because it turns out not every wild migratory bird is as risky — it’s not a homogenous risk.”

Lessons learned in the last three years have shaped protective measures. No longer are the tires of delivery trucks bringing supplies to the parks being sanitized for fear they might carry the virus from places like poultry farms. Bird flu has decimated commercial poultry flocks, resulting in the culling of tens of millions of birds.

Walk-through aviaries remain open to guests, and employees only have to wear personal protective gear like gloves and masks if they’re handling sick or dead wildlife found on park grounds. Instead, officials look at known ways the virus is being spread, such as consuming raw milk from infected dairy cows. And even though bird flu has not been detected in beef cattle, the parks are now only buying human-grade beef — a higher quality that is more closely regulated. “That supply chain obviously is closely scrutinized and monitored and tested by the USDA,” Nollens said.

The parks were already avoiding feeding raw poultry and raw eggs to their birds because of concerns over virulent Newcastle disease, a different virus fatal to birds that occasionally circulates in Southern California, he said. At one point, officials worried about zoo visitors who had bird pets at home — but “we’ve learned that’s not a realistic concern to us,” he added. Every report of a positive test anywhere spurs officials to review their biosecurity measures to make sure they aren’t missing anything. “With every positive, whether it’s a poultry operation or a wild flock or at another zoo, we try to learn, if it is even known, how the virus was introduced, how did it come in, to make sure that we have checked that box,” Nollens said.

View of a group of greater flamingos in their habitat at the San Diego Zoo Safari Park. At right is the Park’s Delta area. At times, park workers block off the deep end of the area to make it less attractive to migratory birds. (Charlie Neuman / For The San Diego Union-Tribune)

When the outbreak reached Southern California, SeaWorld San Diego temporarily halted its bird-rescue program in October 2022 out of concern wild birds would carry the virus onto its property. They restarted it after several months, although they no longer take in sick western gulls or ducks — common carriers of the virus, Otjen said.

Employees who respond to rescue calls don long gloves, aprons, masks and goggles. The marine park has taken other steps, such as installing covered trash cans in hopes of deterring hungry sea gulls. New flamingo feeding troughs boast a design that is too tall for ducks or gulls to get into — a change that wasn't prompted by concerns about bird flu but still helps keep wild birds away from the food, he said.

Permanent netting was installed over the Magellanic penguin habitat, which keeps outside birds from getting into the area. SeaWorld's flamingos remain in an outdoor habitat with a pool but can be moved if there's a need, Otjen said. "We are focusing on how we make sure there are as few wild birds that come into the park as possible," he said.

The long history of bird flu

Bird flu is thought to have been around for hundreds of years. In 1878, an illness that killed poultry in Italy and other parts of Europe was described as a "fowl plague." By 1955 it was determined to be a type A influenza virus, and in 1981, it became known as avian influenza, according to the U.S. Centers for Disease Control and Prevention.

The H5N1 subtype of the virus can be traced back to poultry in Scotland in 1959 and in geese in China in 1996, which then spread to poultry farms. Since then, there have been multiple waves of intercontinental transmission of the virus.

Infections have led to the death and slaughter of more than 633 million poultry birds worldwide between 2005 and 2024, according to the World Animal Health Information System, which tracks official data on epidemiologically important diseases.

The virus also has reportedly sickened 70 people in the U.S. in the past year, and is known to have caused one death in Louisiana. That patient contracted H5N1 after exposure to birds in a backyard flock and wild birds, state and federal officials said. In a commentary published in the journal Nature in January, three scientists warned that the threat of H5N1 "looms over global biodiversity" and likely has killed "multiple millions of wild animal individuals."

But accounting for actual deaths is difficult, the authors note, because of "a pervasive lack of monitoring, testing and reporting — particularly in inaccessible areas and in disadvantaged countries."

Condor deaths lead to inoculation effort

A California condor named Squapuni grips the netting of the enclosure at the Condor Ridge exhibit at San Diego Zoo Safari Park. All the condors at the park have been vaccinated against bird flu. (Charlie Neuman / For The San Diego Union-Tribune)

The deaths of 21 critically endangered California condors in 2023 in Arizona prompted a different type of response. For the first time ever, federal officials approved the emergency use of a vaccine against bird flu, and gave permission for trials to test the vaccines' safety and effectiveness. After an initial test of the vaccine on black vultures showed promise, the U.S. Fish and Wildlife Service conducted a trial involving 25 California condors —10 birds got two shots, 10 birds got one and five birds served as the control group.

What it found suggested that the vaccine may reduce the severity of an infection and the risk of death, and that two shots were the best bet. Based on the results, regulators in December 2023 said they would move forward with plans to vaccinate captivity managed and free-flying condors.

As of mid-March, 282 condors had received at least one injection of the vaccine, with 182 of those fully vaccinated, a spokesperson for the U.S. Fish and Wildlife Service said.They are generally trying to vaccinate all California condors, she said. Antibody titers invaccinated condors — a gauge of their immunity — are being monitored, and the results will inform future vaccination plans, the spokesperson added.

All of the condors at Safari Park have now received the vaccines, a park spokesperson said, while a condor at the San Diego Zoo remains unvaccinated. Still, the 2023 deaths in Arizona dealt a blow to the ongoing condor recovery effort, with one official saying it set the conservation work back 10 years. The species was on the brink of extinction in 1982, when 22 surviving condors in the wild were captured and put into a captive breeding program. Starting in 1992, condors began to be reintroduced in California and later in Arizona and Baja California. As of late December, there were more than 560 condors in captivity and in the wild.

For his part, Nollens said he would be open to considering vaccinating other zoo animals if that option becomes available in the future, "at least in some scenarios."

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