

Saving Species

VOL. 2 | 2018

SAN DIEGO ZOO GLOBAL

INSTITUTE FOR CONSERVATION RESEARCH



Hawaii's 'Alalā: Recovering an Iconic Species

While the 'alalā is the flagship species for the breeding and release program managed by our Hawaii Endangered Bird Conservation Program and its partners, many of the state's birds are close to extinction. Hawaii is home to more than one-third of federally listed endangered bird species, and the race is on to save them.



“With the ‘alalā virtually extinct in the wild, the breeding program has become critical and the fate of the species hangs on its success.” – RON SWAISGOOD, Ph.D.

PARTNERING TO SAVE HAWAII’S NATIVE BIRDS

∥ **Allison Alberts**, Ph.D., Chief Conservation and Research Officer, San Diego Zoo Global

Bringing species back from the brink of extinction is the goal of San Diego Zoo Global, and our partners are essential to this critical endeavor. In the 25-year history of the Hawaii Endangered Bird Conservation Program, the focus has been on husbandry, breeding, and reintroducing Hawaiian bird species back into native habitat. At the Keauhou and Maui Bird Conservation Centers, we care for the ‘alalā, or Hawaiian crow, as well as the puaiohi, palila, kiwikiu, ‘akeke‘e, and ‘akikiki.



Since 1993, we are proud to say that the collaborative effort has reared more than 1,130 birds from 16 species, with 810 birds successfully released into protected or restored habitat throughout Hawaii. The work is ongoing and involves collaborating with partners to protect forests, remove invasive predators, restore the native plants and trees these birds need to survive, and monitor released birds. We are grateful to government agencies and NGOs; individual, corporate, and foundation donors; local landowners, communities, and schools; and our dedicated staff who are committed to saving Hawaii’s iconic bird species.

HOW YOU CAN HELP

Our field research teams all over the world rely on the generosity of donors like you to help achieve San Diego Zoo Global’s vision to lead the fight against extinction. To learn ways you can help, please call Maggie Aleksic at 760-747-8702, ext. 5762, or email maleksic@sandiegozoo.org.

ON THE COVER

Since Fall 2017, when 11 ‘alalā were released into the Pu‘u Maka‘ala Natural Area Reserve on the island of Hawaii, the forest reverberates once again with their raucous calls, the dominant voices here. As important seed dispersers of native plants, they will also help revitalize their ecosystem.



‘Alalā Conservation:

Back from the Brink

\\ By **Ron Swaisgood**, Ph.D., Brown Endowed Director of Recovery Ecology

Opportunities—and challenges—like these don’t come around often. The year is 2002 and the last ‘alalā, or Hawaiian crow, has just been seen in Kona. With the ‘alalā virtually extinct in the wild, the breeding program has become critical and the fate of the species hangs on its success. Our story is the long and eventful path that brought us to today, when we once again have ‘alalā flying free in the wild, filling the air with their raucous and distinctive calls after the forests had gone quiet for nearly two decades.

Once common throughout their range on the island of Hawaii, the ‘alalā’s precipitous decline began more than a century ago. Facing a perfect storm of threats from invasive predators, disease, and habitat destruction, the ‘alalā seemed destined to follow the fate of the other four native Hawaiian corvid species and disappear forever.

The ‘alalā breeding program was formally established in 1993 by The Peregrine Fund, then transferred to us in 2000. It is the flagship program for our Hawaii Endangered Bird Conservation Program, managed in partnership with the U.S. Fish and Wildlife Service (USFWS) and the State of Hawaii Division of Forestry and Wildlife (DOFAW).

Initially, our team faced daunting decisions about husbandry and breeding. No one had much previous experience with these birds, so we had to develop new protocols, often with little information about the species’ ecology and behavior in the wild. Specialists from husbandry science, veterinary medicine, wildlife diseases, behavioral ecology, and other areas worked together to develop best practices for care and breeding, often learning “on the fly.”

Now, we are embarking on the most critical phase of ‘alalā recovery: release and reestablishment in the wild. Partnerships and collaborations are vital to success, so a multipartner working group was established, and together we devised a reintroduction plan. First, our partners at USFWS and DOFAW and others worked to address threats in ‘alalā habitat, including large-scale efforts to remove invasive predators and restore habitat. After we were unable to successfully reintroduce ‘alalā in 2016, we released 11 young ‘alalā to the Pu‘u Maka‘ala Natural Area Reserve on the island of Hawaii in 2017.

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Six months later, these 11 birds are flying free and thriving, becoming more wild each day as they adapt to their native forests. And we are busy studying them and learning lessons that will help us improve our approach for the next releases, which will come later this year. How do 'ālalā learn to forage and avoid predators successfully? How can our pre-release programs be improved to better prepare them for life in the wild? We are studying personality types to improve reintroduction

success, enhancing our antipredator training methods, and identifying nutrients in the berries and insects the 'ālalā are eating. Ultimately, this will help us predict how many 'ālalā an area can support.

All of this research is critical for future success. For now, we are just happy that 'ālalā are once again filling the canopy with their rambunctious antics and, as important seed dispersers, will soon be keeping native forests healthy.



CONNECTING STUDENTS WITH 'ĀLALĀ CONSERVATION

By **Maggie Reinbold**, Director of Community Engagement

An exciting program debuted for middle school students and teachers from Hawaii's Volcano Charter School of Arts & Sciences. To learn more about saving the 'ālalā, they connected with our team to focus on the role native birds play in regenerating and maintaining healthy Hawaiian forests.

After the students visited the Keauhou Bird Conservation Center to meet 'ālalā, they designed and conducted experiments with native seeds back on their home campus. Since 'ālalā are important seed dispersers, native fruit seeds that have passed through their digestive tract were planted and compared with seeds harvested directly from native fruit. Students also planted their seedlings on campus in support of native wildlife.

The support of local communities is essential for recovery of 'ālalā, an ecologically and culturally significant species. Through our new 'Ālalā Reintroduction Community Inquiry Program, local science teachers who attend our Teacher Workshops in Conservation Science use curricular activities designed to enhance students' critical thinking skills, increase their interest in careers related to species recovery, and encourage appreciation of their unique natural heritage.



RECOVERING 'AKIKIKI & 'AKEKE'E: AROUND-THE-CLOCK CARE

While we continue to care for 'alalā, other endemic Hawaiian birds also need our attention. The 'akikiki (left) and 'akeke'e, tiny endangered Hawaiian honeycreepers found only on Kauai, have been facing a similar plight to the 'alalā's. Over the past few decades, they have been rapidly disappearing from the native forest and may be lost forever without intervention.

Because of this, we recently started a major effort to save them from extinction. The Kauai Forest Bird Recovery Project

team scoured the rough, mountainous terrain, locating the few remaining nests and collecting 'akikiki and 'akeke'e eggs by climbing 40-foot ladders. We incubate these tiny, jelly bean-sized eggs at a precise temperature and humidity until the eggs hatch. We then hand-feed chicks once per hour until they are old enough to eat on their own. Similar to the recovery plan for 'alalā, we hope to one day release both species back into their native forest home.

WHY GENETIC DIVERSITY MATTERS

By **Barbara Durrant, Ph.D.**, Henshaw Endowed Director of Reproductive Sciences

Maintaining the genetic diversity of the 'alalā population depends on maximizing reproductive success in underrepresented individuals. To ensure that as many males as possible have the opportunity to contribute to current or future generations, it is critical to preserve semen from all adult birds. The Maui Bird Conservation Center staff were trained in semen collection and cryopreservation techniques and four valuable males are now represented in the Frozen Zoo®. Going forward, eligible males will be sampled annually to provide semen for artificial insemination when their genes are needed in the population.



SEQUENCING THE 'ALALĀ GENOME

By **Oliver Ryder, Ph.D.**, Kleberg Endowed Chair of Conservation Genetics

Inbreeding and reproductive performance are concerns for the surviving 'alalā population, which is descended from a small number of individuals. Genome sequence analysis has contributed insights into genetic risk factors in other avian species, so a collaborative project on 'alalā genome sequence variation has been initiated by our Conservation Genetics team, the Hawaii Endangered Bird Conservation Program, University of Hawaii at Hilo, University of St. Andrews in Scotland, and the Smithsonian Conservation Biology Institute. Pacific Biosciences provided long-read DNA sequencing to produce a reference genome for a male 'alalā, named Hō'ike i ka pono. Initial efforts to evaluate genes associated with immunity against infection were facilitated by the quality of the genome assembly. Additional studies are under way to evaluate the impact of inbreeding across the 'alalā genome.





“Through dedication and hard work, the ‘alalā has been rescued from extinction to more than 125 birds today, where once fewer than 20 remained in the 1990s.”

– BRYCE MASUDA

‘ALALĀ BREEDING PROGRAM: DECADES OF DEDICATION

By **Bryce Masuda**, Conservation Program Manager, Recovery Ecology

In the late 1990s, ‘alalā were rapidly disappearing from their native forest home on the island of Hawaii and the situation was dire: fewer than 20 birds remained in the wild. It became clear that urgent measures were necessary to prevent this unique Hawaiian crow species from disappearing forever. The challenging task of moving birds from the wild to breeding facilities to prevent their imminent extinction was undertaken. Similar to a hospital’s “emergency room,” this was a last resort to save the only remaining Hawaiian crow species. In 2002, the last ‘alalā disappeared from the wild, and from that point the remaining ‘alalā were being cared for in breeding centers.

When ‘alalā first arrived at the Keauhou Bird Conservation Center, little was known about the conditions necessary for this intelligent species to thrive under managed and intensive care. To understand their needs, the birds were carefully observed by remotely monitored video cameras and one-way glass windows.

Such intensive efforts are needed only for the most critically endangered species. This approach would not be successful without passionate staff, supportive partners, and an engaged local community—and a willingness to do whatever it takes to save a species.

From the team’s detailed observations, we learned how to set up the right environment for ‘alalā to be comfortable with their surroundings and begin to thrive. Today, we play matchmaker by choosing mates based on genetics and behavior. We also carefully observe the breeding behavior of ‘alalā on a closed-circuit video system. If a female does not incubate her eggs properly, we remove the eggs from her nest and artificially incubate them in our facility. Once eggs hatch, we feed chicks on a specific diet and schedule, from 6 a.m. to 8 p.m., until they are old enough to eat on their own.

Through dedication and hard work, the ‘alalā has been rescued from extinction to more than 125 birds today, where once fewer than 20 remained in the 1990s. The success of our breeding program has been rewarding for our team, our partners, and the local community. Now that the ‘alalā population has increased, we are excited to be embarking on the next stage of recovery—reestablishing the species in the wild.

PICTURED LEFT TO RIGHT: PUAIOHI, PALĪLA, AND ‘ALALĀ EGG REPLICAS



DID YOU KNOW?

With around-the-clock care from our team, we have been fortunate to raise 44 ‘akikiki and 7 ‘akeke’e chicks so far. Our hope is that future releases of these species will help the recovery of both wild populations.



A startling sight: The 299th and 300th puaiohi chicks hatched and raised at the Maui Bird Conservation Center in 2009. The final releases came in 2017, after an intensive propagation effort, and the wild population is now estimated at a stable 500 birds. It is quite an achievement for a species never before bred successfully in managed care to be raising young in the wild. As we continue to monitor them, we believe it is a job well done!



At the Keauhou Bird Conservation Center in Volcano, Hawaii, an adaptive management approach guides our decisions. For example, we consider how mate choice affects reproduction outcomes; how knowledge of personality types can improve breeding and reintroduction success; and how antipredator training for 'ala'ala influences the development of behavioral competence in release candidates.



Since 1993, 810 birds from 10 species have been released into protected or restored habitat throughout Hawaii. This includes 240 puaiohi, or Kauai thrush, released on Kauai, which now help comprise a stable wild population. Thanks to the reintroduction program for nēnē, or Hawaiian goose, the wild population now has risen to more than 3,000 birds over five islands, with 442 released by San Diego Zoo Global.

The 'ala'ala is part of a larger program to breed and reintroduce several other native endangered avian species, like the 'akikiki and 'akeke'e (right). Unfortunately, the perfect storm of threats applies to many other Hawaiian species, making Hawaii home to more than one-third of all federally listed endangered bird species.



STEP BY STEP: PREPARING THE 'ALALĀ FOR LIFE IN THE WILD

By **Alison Greggor**, Ph.D., Postdoctoral Associate, Recovery Ecology

MONITORING THE 'IO PROJECT

By **James Sheppard**, Ph.D., Scientist, Recovery Ecology

The 'io is an endangered hawk, one of Hawaii's two resident raptors. Despite its ecological importance, we know relatively little about 'io movement patterns. We are embarking on a project with the U.S. Geological Survey to investigate where 'io move and how they interact with 'alalā. Our goal in the Ellen Browning Scripps Foundation Spatial Ecology Laboratory is to help save species by evaluating mapping assessments and spatial data.

By deploying lightweight GPS tags on 'io in current and future 'alalā release sites, we will learn more about what habitat 'io need to survive, while also pinpointing the risk of 'alalā predation. The tags emit real-time notifications of 'io movements, alerting us when they enter current 'alalā habitat where potential predator-prey interactions may occur. Our goal as well as our challenge is to save this beautiful hawk along with the 'alalā!





Reintroductions can be a risky business. Animals bred in managed care may lack crucial survival skills for life in the wild, and habitats at release sites can vary in their ability to support a new population. In our work with 'alalā on the island of Hawaii, we strive to address both sides of the release challenge.

Before release, we conduct behavioral training to boost 'alalā survival skills. While in our care, we train birds to recognize their only native predator, the 'io, or Hawaiian hawk. By staging a mock predation event—placing a live 'io next to an 'alalā enclosure while playing 'io calls and 'alalā alarm calls—we recreate how 'alalā would have historically learned about their main predator. This strategy was successful last fall, when our second release group of 11 'alalā successfully drove off an 'io hunting in their territory. We also give

them opportunities to forage on native fruits from an early age, allowing us to track individual progress and release readiness. Within the conservation breeding flock we encourage strong nest-building and parenting behaviors, so preparations for a self-sustaining lifestyle begin even before release candidates hatch.

Meanwhile, to address 'alalā habitat needs, we gather data on how the birds use the forests after release. Currently, we are using a newly acquired Near Infrared Spectroscopy machine to analyze the nutritional quality of native fruits and help us identify key areas for conservation. Additionally, by mapping assessments of habitat quality onto 'alalā post-release spatial movements and behavior, we can predict which areas the 'alalā prefer and begin to understand when and why they seek out certain plant species.

Together, these integrated efforts will help us release stronger and better-prepared birds into optimal habitats, improving chances for survival. With such an endangered species, every step we take is critical and every day they thrive is another victory for birds and researchers.



“With such an endangered species, every step we take is critical and every day they thrive is another victory for birds and researchers.”—ALISON GREGGOR, Ph.D.

CONSERVATION ACHIEVEMENTS

HONORS AND AWARDS

Dr. Gabriel Miller (Global Partnerships) was invited to serve as a Design Advocate at the 2017 Design Forward Conference in San Diego, where he hosted a discussion on Sustainable Innovation.

Ekwoge Abwe (Central Africa Program manager) was elected Secretary General of the African Primatological Society at its inaugural congress in Abidjan, Côte d'Ivoire.

Dr. Allison Alberts (Chief Conservation & Research Officer, Institute for Conservation Research) was invited to serve on the Advisory Board of the Mohamed bin Zayed Species Conservation Fund. The Fund provides \$1.5 million in funding to 180 projects annually.

HIGHLIGHTED PUBLICATIONS

The fight to end extinction happens on a variety of fronts. Our San Diego Zoo Global conservation scientists and researchers work to lead this fight in every capacity, whether studying the smallest cells or working with the biggest animals. From rescuing endangered amphibians and examining genomes of Sumatran rhinos, to surveying consumers in order to protect saiga antelope and monitoring logging concessions to conserve jaguars in Peru, here's what we've published lately:

Amphibians are facing a global extinction crisis. Conservationists are confronting the rapid loss of species with a wide range of approaches, including rescuing dwindling populations and managing them in protective care. This review discusses the variety of tools available for monitoring and promoting female amphibian reproduction, including ultrasound, hormone analysis, and assisted reproduction.

Calatayud, N. E., M. Stoops, and **B. S. Durrant**. 2018. Ovarian control and monitoring in amphibians. *Theriogenology* 109: 70-81.

An examination of complete mitochondrial genomes suggests that the two Sumatran rhinoceros subspecies might be different enough from each other to warrant managing them separately for conservation purposes. However, given the low numbers of individual Sumatran rhinos remaining, and the limited time we have to help them, it may be necessary to manage both subspecies as part of a metapopulation in order to save the species from extinction.

Steiner, C. C., **M. L. Houck**, and **O. A. Ryder**. 2018. Genetic variation of complete mitochondrial genome sequences of the Sumatran rhinoceros [*Dicerorhinus sumatrensis*]. *Conservation Genetics* 19: 397-408.

The Critically Endangered saiga antelope faces an uncertain future, with ongoing demand for its horns in

traditional Chinese medicine. We surveyed consumers to better understand this trade. Younger respondents had the highest prevalence of recent consumption, with bottled saiga horn "cooling water" as the most popular product. Conservation starts with people, and this exploratory study will help guide future efforts toward behavioral change interventions.

Theng, M., **J. Glikman**, and E. Milner-Gulland. 2018. Exploring saiga horn consumption in Singapore. *Oryx* 52: 1-8.

We set out to determine whether responsibly managed logging areas ("concessions") adequately protected local species. Two case studies of Forest Stewardship Council-certified logging concessions in Guatemala and Peru show healthy jaguar populations at densities comparable to protected areas. These concessions provide important habitat for many species, creating less impact and conflict than alternatives such as agriculture or cattle ranching, while still providing economic opportunities. They also play an important role in maintaining landscape connectivity between protected areas, helping avoid the problems that come with habitat fragmentation.

Tobler, M. W., R. Garcia Anleu, S. E. Carrillo-Percecastegui, G. Ponce Santizo, J. Polisar, A. Zuñiga Hartley, and I. Goldstein. 2018. Do responsibly managed logging concessions adequately protect jaguars and other large and medium-sized mammals? Two case studies from Guatemala and Peru. *Biological Conservation* 220: 245-253.

Note: San Diego Zoo Global staff names are bolded above.

CONSERVATION PARTNERSHIPS

SAN DIEGO ZOO GLOBAL'S 'ALALĀ CONSERVATION PARTNERS

Saving Hawaiian birds such as the 'alalā from extinction is a challenging undertaking that would not be possible without strong and diverse partners. Efforts to save the 'alalā began 25 years ago, as a partnership between the U.S. Fish and Wildlife Service, the State of Hawaii Division of Forestry and Wildlife, The Peregrine Fund, and others. Today, our partnerships have expanded to include local, national, and international agencies, organizations, and universities, which all play key roles in the recovery of the 'alalā:

U.S. Fish and Wildlife Service
State of Hawaii Division of
Forestry and Wildlife
The Peregrine Fund
Kamehameha Schools
Three Mountain Alliance
U.S. Geological Survey
Hawaii Volcanoes National Park

University of Hawaii at Hilo
University of St. Andrews
Pacific Biosciences
Smithsonian Conservation
Biology Institute
Hawaii Forest Institute
Panaewa Rainforest Zoo and Gardens
Kupu Hawaii

We also thank the following for their support of reintroduction efforts for the 'alalā:

National Fish and Wildlife Foundation
Max and Yetta Karasik Foundation
Moore Family Foundation
Fred Baldwin Memorial Foundation
John M. Ross Foundation at Bank of Hawaii
UL Innovative Education Award
American Forests
Hawaiian Airlines
Anonymous Donors

Support through the Hawaii Community Foundation:

Atherton Family Foundation
Career Connected Learning
Hawaii STEM Learning Partnership



"There is a shared and strong connection between the people, plants, animals, and landscapes of Hawaii. By returning the 'alalā to the wild, we are welcoming home a family member that has been away from the forest for a long time and fulfilling our responsibilities as stewards of this land."

BRYCE MASUDA, CONSERVATION PROGRAM MANAGER, RECOVERY ECOLOGY



WHAT'S News



RECOVERY ECOLOGY

Our field team conducted research on the effect of artificial light on Stephens kangaroo rat behavior, to help guide management decisions surrounding the impact of light pollution.



PLANT CONSERVATION

Working with CalFire and Safari Park Horticulture, our team initiated invasive plant removal within coastal cactus wren habitat on the Safari Park Biodiversity Reserve.



POPULATION SUSTAINABILITY

Our researchers led a group of engineers to Churchill, Canada, to deploy an Unmanned Aerial System for mapping sea ice changes and assessing their impact on polar bear populations.



CONSERVATION GENETICS

Our geneticists traveled to Baja California, Mexico, to carry out genetic analysis and paternity testing on California condors at the Sierra San Pedro Martir reintroduction site.



REPRODUCTIVE SCIENCES

Using state-of-the-art laboratory techniques, our team successfully created a ring-tailed lemur embryo from an immature oocyte retrieved postmortem.



DISEASE INVESTIGATIONS

Our pathologists began a large-scale epidemiology study of free-ranging desert tortoises to better understand associations between *Mycoplasma* infections and tortoise health.



COMMUNITY ENGAGEMENT

Our educators visited local schools in Hawaii involved in a collaborative community-based project focused on the 'alalā and its role in native plant seed germination.



GLOBAL PARTNERSHIPS

Our team met with the *Twiga Walinzi* (Giraffe Guards) in northern Kenya to train them in distance sampling methods and establish new walking transects and trail camera designs.

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