revive & restore

GENETIC RESCUE OF ENDANGERED AND EXTINCT SPECIES



Mangrove forest ecosystem

Expanding What's Possible

2026 Annual Report

Dear friends and supporters,

Every year, we're amazed by how much can change in just twelve months, both for the species we work to protect and for the genetic rescue field we're building together with you.

What doesn't change is our mission: to enhance biodiversity and bioabundance through the genetic rescue of endangered and extinct species. What's new is how far that mission now reaches. 2026 was our biggest funding year yet, and every one of our programs grew.

Here are a few moments that made us proud:

- **Genomic Artificial Intelligence Applications (GAIA):** We are proud to have received a $2 million grant from the Bezos Earth Fund to democratize genomic insights for endangered species conservation.
- **Caribbean coral:** For the first time ever, coral restoration practitioners from nine Caribbean countries and territories sat down together to plan the exchange of coral larvae for genetic rescue across the region.
- **Climate Resilience:** We launched our largest inaugural cohort ever, with 10 projects drawn from a record 160 applicants. The program brings new tools to kelp forests, mangroves, seagrass meadows, and salt marshes. Kelp researchers are swapping lessons from California to Tasmania, and mangrove teams are learning from each other from Malaysia to the Bahamas.
- **Amphibians:** We brought six of our amphibian teams together with recovery leaders from Re:wild and the Smithsonian Tropical Research Institute, so the newest tools can reach the frogs and salamanders that need them most.
- **Biotech for Birds:** This fall, in the woods of central Wisconsin, our Lead Scientist Ben Novak achieved a lifelong dream. He recreated a passenger pigeon roost, using 163 tons of pigeon manure and a carefully trimmed canopy. For the first time in more than 140 years, we'll get to see how a forest responds when passenger pigeons return.

What ties all of this together is how we work. We don't fund isolated projects. We build communities where researchers share what they learn instead of competing, and that's how a whole field moves forward faster.

None of this happens alone. To our wonderful team, our partners in the lab and in the field, and to you, our donors and supporters: thank you. You make every one of these moments possible, and we can't wait to show you what comes next.

With gratitude,





Stewart Brand and Ryan Phelan
Photo by James Home, Long Now Foundation
November 9, 2026
Petaluma, CA

Explore our Annual Report



Kenya’s Arabuko-Sokoke Forest, home to a unique coastal elephant population that researchers are helping monitor and protect through non-invasive DNA sampling.

21st Century Challenges	3
Expanding What’s Possible	4
Making it Possible	5
Global Impact Since 2012	6
The Science Behind our Impact	7
Sequencing & Bioinformatics	8
Biobanking & Cell Culturing	11
Advanced Reproductive Techniques	12
Genetic Engineering & Editing	14
Expanding Tools in the Field	16
Where We’re Going in 2027	18
Our Team in Action	21

Wildlife faces increasingly complex threats, from habitat loss and climate change to emerging diseases and declining genetic diversity. Addressing these challenges requires new approaches and an expanded toolbox of solutions.



Illegal Trade



Invasive Species



Genetic Diversity Loss



Wildlife Disease



Climate Change

Our work expands what's possible for conservation by advancing genetic rescue technologies and helping translate scientific innovation into practical solutions for wildlife.

Revive & Restore is a field-building organization catalyzing the responsible development and use of biotechnology for endangered species and ecosystems.

We bring together scientific expertise, cutting-edge research, and conservation partners to tackle challenges that classic conservation approaches alone cannot solve.



A sea turtle hatchling makes its way to the water.

We address conservation's most intractable challenges by bringing together expertise, innovation, and resources to develop and advance new solutions.



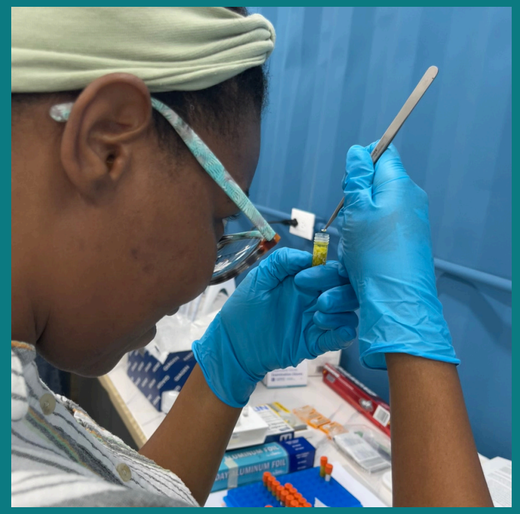
Convene Experts

We bring together leading scientists, conservation practitioners, and institutions across disciplines to identify critical challenges and accelerate collaboration.



Design Solutions

We identify promising technologies and help design innovative research projects that address unmet conservation needs.



Fund Innovation

We invest in high-impact research and emerging technologies, supporting scientific advances that expand the impact of the Genetic Rescue Toolkit.



Enable Application

We work alongside research and conservation partners to move promising technologies toward practical use, making new capabilities available to the species and ecosystems that need them.

Global Impact Since 2012

$50M+
RAISED FOR RESEARCH

118
PROJECTS FUNDED

64
PROJECTS UNDERWAY

195
FOCAL ENDANGERED SPECIES

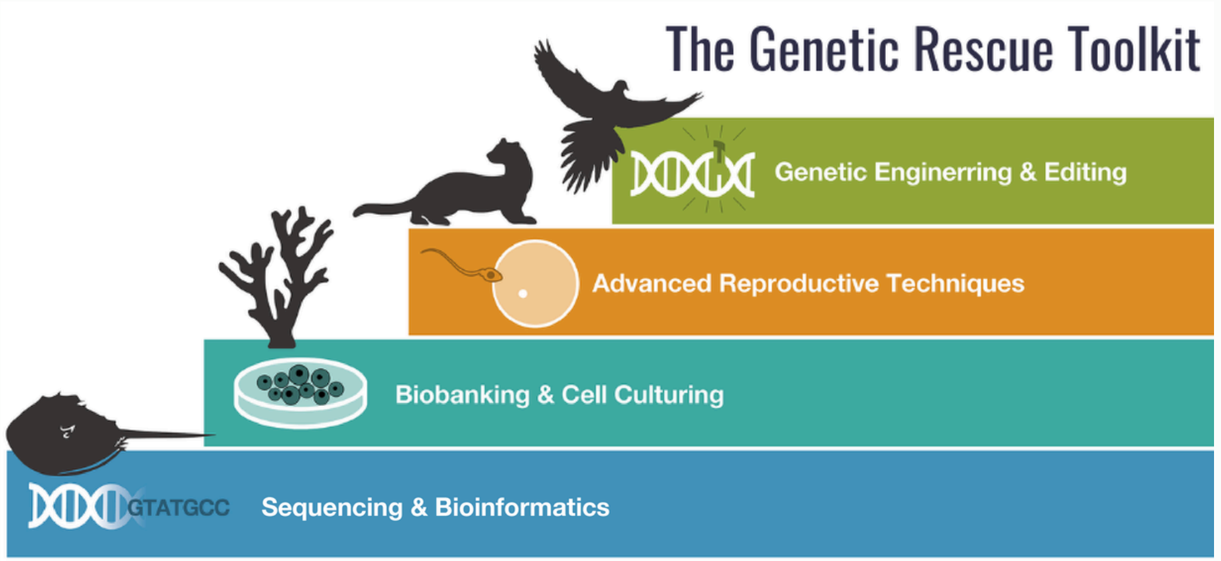
57
GENOMES ASSEMBLED

46
BIOBANKED SPECIES



The Science Behind Our Impact

The global impact we've achieved since 2012 is rooted in our work to expand the tools available to protect endangered species and restore ecosystems. Our Genetic Rescue Toolkit brings together established and emerging technologies from across the life sciences, adapting them to address conservation challenges that classic approaches alone cannot solve.



The following pages highlight advances and breakthroughs from 2026, demonstrating how technologies across the Toolkit are opening new possibilities for species recovery and conservation.

GAIA: Genomic Artificial Intelligence Applications

Research Leads: Ben Novak, Revive & Restore; Erich Jarvis and Giulio Formenti, Rockefeller University; Ayshwarya Subramanium, Cornell University

Developing AI-powered tools to accelerate genome assembly and turn genomic data into actionable conservation insights

What was achieved in 2026?

Revive & Restore launched GAIA with funding from the Bezos Earth Fund's AI for Climate and Nature Grand Challenge. Working with The Rockefeller University, Cornell University, the Wellcome Sanger Institute, Google Research, and Knowledge Futures, the team began developing two AI-powered tools: Jarvis, to accelerate genome assembly, and Genera, to translate genomic insights into conservation actions. A functioning Jarvis prototype is already being tested by genome curators, whose feedback will help improve the AI models. For Genera, the team is testing foundation models and agentic approaches to address conservation questions and refine the tool's capabilities. The project also gained international visibility, building a growing community of advisors, testers, and future users.

What's next?

Jarvis is on track for beta testing in fall 2027, while development and testing of Genera will continue. By the end of 2027, the team aims to apply both tools to the genomes of 50–60 endangered U.S. species in coordination with U.S. Fish & Wildlife Service field biologists. DNA preparation is underway for the first six species, with 14 more expected to arrive at the lab by the end of 2026. Together, these tools will help conservationists process genomic data faster and translate it into decisions that support species recovery.



The GAIA team held a kickoff meeting at The Rockefeller University in January of this year.

Genomic Tools to Find and Protect the Chile Mountains False Toad

Research Leads: Dante Fenolio, San Antonio Zoo Center for Conservation and Research; José Nuñez, Universidad Austral de Chile; José Horacio Grau, Genómica Australis

Building the first chromosome-scale genome and DNA-based search tools for one of the world's rarest and most ancient amphibians

What was achieved in 2026?

The Chile Mountains False Toad (*Telmatobufo venustus*) is a rare, ancient frog threatened by habitat loss, invasive fish, and drought. Scientists assembled its first chromosome-scale genome, revealing an unusual "chromosome within a chromosome" that may offer clues to sex determination. Finding the frogs proved harder: months of fieldwork yielded just six individuals. To improve detection, the team partnered with Chile's SmartGenetics lab to develop a highly sensitive, inexpensive water-based DNA test and trained local partners and forest rangers to collect samples. Working with Blumen AI, they also modeled potential habitat to guide future surveys. Featured in *National Geographic* and *Ranger Rick*, the project has expanded both scientific understanding and public awareness of this elusive species.

What's next?

For the first time, conservationists can detect this elusive frog without seeing it, helping identify priority areas for protection. Next season, the team will use habitat modeling and water sampling to survey rivers on Chile's private reserves. Samples can also reveal invasive salmon and mink, while future tests may detect chytrid fungus. The newly assembled genome, now submitted to public databases, could guide captive breeding if wild populations cannot recover on their own. To sustain these efforts, the team is establishing the Patagonian Frog Conservancy as a nonprofit and developing a website to share findings from surveyed streams. This approach could model how to protect other rare species before they disappear.



Chile Mountains False Toad (*Telmatobufo venustus*)
Photos: Giovanni Lo Curto

Wildlife Genetic Management Hub:

Upscaling Genetic Management of Wildlife Populations

Research Lead: Alexandra Pavlova, Monash University



Zoos Victoria and Monash University teams after Helmeted Honeyeater release at Cardinia (recently established population), May 2025
Photo: Monash University

Learning by doing: Turning population genetics into practical recovery plans for Australia's threatened wildlife, from honeyeaters and possums to fish and wildflowers

What was achieved in 2026?

Led by Dr. Pavlova at Monash University, this Australian Research Council Linkage project unites nine organizations, including Revive & Restore, to translate genomic science into recovery actions for four endangered species: Leadbeater's possum, helmeted honeyeater, Macquarie perch, and button wrinklewort. Partners are applying genetic insights to captive breeding, translocations, population restoration, and monitoring. CSIRO has advanced genome assembly and sequencing across all four species, while other partners are developing tools for routine genetic monitoring. Recent findings confirm successful breeding in restored Macquarie perch populations, improved reproductive success following genetic rescue of helmeted honeyeaters, and identification of genetically suitable founders for Leadbeater's possum recovery. The project is also producing practical frameworks to guide conservation decisions when genetic data are limited.

What's next?

As the project approaches its conclusion in early 2027, researchers in Denmark and the UK are helping develop a "digital twin" of helmeted honeyeater populations to predict long-term genetic health and evaluate management strategies. The team is also working with Diversity Arrays Technology to establish best practices for conservation genetics. These approaches are expanding to other threatened birds, with genetic management plans underway for malleefowl and mallee emu-wrens and trial egg translocations planned to improve genetic diversity in isolated malleefowl populations. Continued support will be essential to analyze the growing body of genetic data and translate findings into recovery actions.

Piloting a Transferable Coral Biobanking Strategy in Puerto Rico

Project Leads: Stacey Williams and Karina Olivieri, Institute for Socio-Economic Research (ISER Caribe); Erinn Muller, Mote Marine Laboratory

Preserving the remaining genetic diversity of Puerto Rico's critically endangered elkhorn coral before it disappears, and creating a model other places can follow

What was achieved in 2026?

Once abundant throughout the Caribbean, the critically endangered elkhorn coral has suffered devastating losses from disease and marine heatwaves. To safeguard its dwindling genetic diversity, Revive & Restore is supporting partners in Puerto Rico to establish a biobank of 200 previously unbanked genotypes. So far, more than 140 have been collected and distributed across multiple facilities for redundancy. Through international training and collaboration, local teams are building long-term biobanking expertise. During August's annual spawning event, local scientists successfully cryopreserved elkhorn coral sperm for the first time in Puerto Rico, producing 80 samples from 10 genotypes with 60–70% post-thaw motility. The effort also produced genetically diverse juvenile corals, now growing in nurseries for future reef restoration.

What's next?

By year's end, the team aims to bank all 200 genotypes and transfer frozen sperm samples to the USDA's National Animal Germplasm Program for long-term storage. Building on Puerto Rico's success, Revive & Restore is developing a practical framework to help coral restoration teams integrate biobanking into their operations, even with limited resources. The framework will address what genetic material to preserve, where to store it, associated costs, and alternatives when ideal infrastructure is unavailable. The team plans to apply this framework to support biobanking decisions in locations including the U.S. Virgin Islands and American Samoa, helping more communities safeguard coral diversity for future restoration.

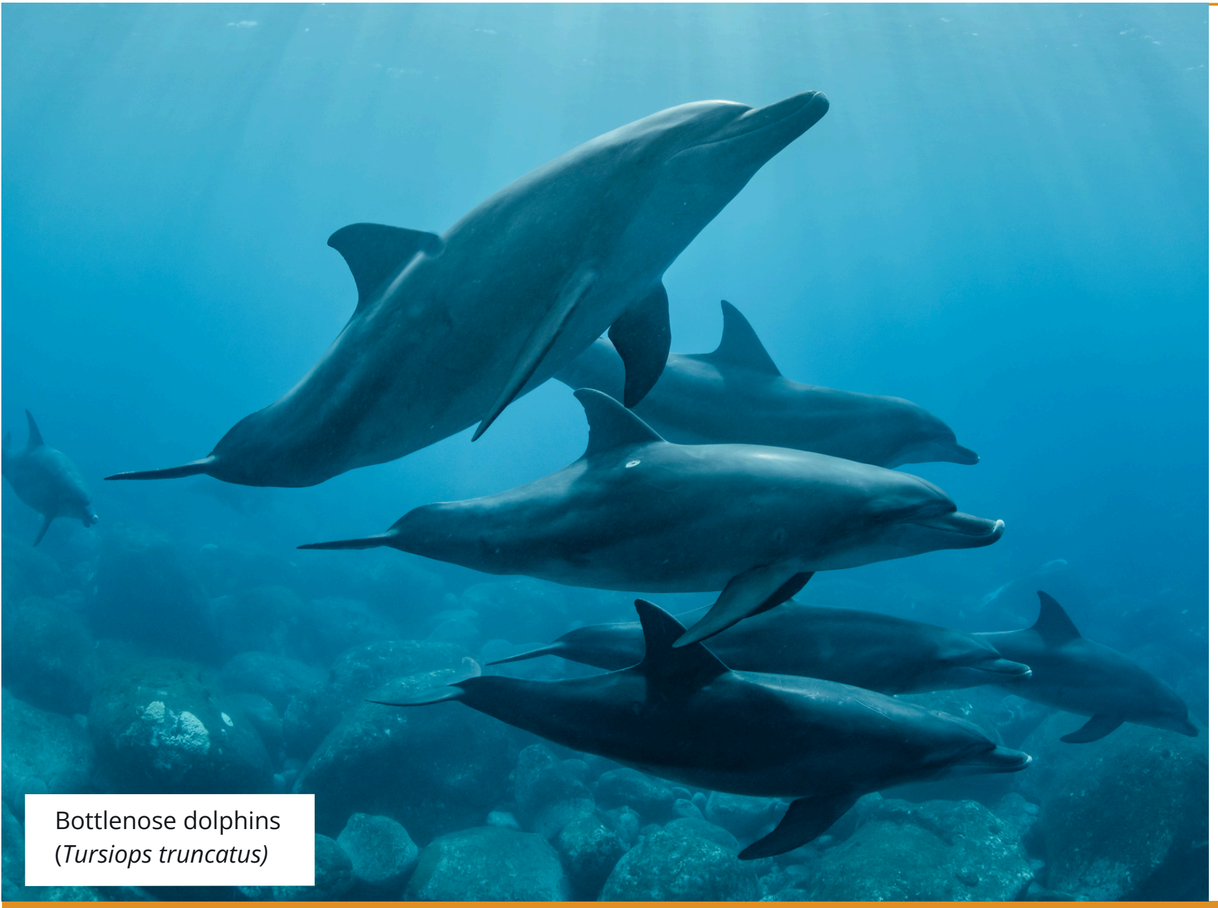


Divers collect fragments from an elkhorn coral colony for biobanking
Photo: Sea Ventures

Generation of Induced Pluripotent Stem Cells from Cetacean Species

Research Lead: Ralf Jauch, Hong Kong University

Achieving induced pluripotent stem cells from dolphins as proof-of-concept models, laying the groundwork for translation to endangered cetacean species



Bottlenose dolphins (*Tursiops truncatus)*

What was achieved in 2026?

Induced pluripotent stem cells (iPSCs), reprogrammed from adult cells and capable of developing into any cell type, offer promising new tools for conservation but have proven difficult to derive in whales and dolphins. In 2026, Revive & Restore's Applied Stem Cell Conservation Fund launched Super Cetaceans, bringing together researchers at the University of Hong Kong and the University of Calgary to develop iPSCs from dolphins and blue whales, respectively. Both teams ultimately aim to generate early germline cells that could support future sperm and egg production. In Hong Kong, a partnership with Ocean Park provides dolphin cells collected during routine veterinary exams, while researchers use AI to optimize reprogramming techniques and identify promising conditions.

What's next?

Over the coming year, the Hong Kong team will continue refining their methods and incorporate protein engineering as they work toward fully characterized dolphin iPSCs. In parallel, they will explore how to guide these cells to become other cell types. This could open doors to studying the unique biology of aquatic mammals, exploring how pollutants affect cetaceans, and developing future reproductive tools. To share the work with the public, the team plans to co-host a seminar with Ocean Park Hong Kong in early 2027 on how stem cell technology can support conservation.

Zebra Finch Germline Transmission

Research Leads: Dr. Erich Jarvis and Dr. Matthew Biegler, Rockefeller University

Achieving a breakthrough in avian reproductive biotechnology to preserve genetic diversity across 60% of global bird species

What was achieved in 2026?

In 2026, Revive & Restore's Biotechnology for Bird Conservation Program reached a major milestone: the first successful germline transmission in zebra finches, a model songbird representing 60% of global avian biodiversity. Researchers at Rockefeller University collected primordial germ cells (PGCs), the precursors of sperm and eggs, from donor embryos, briefly cultured them, and transplanted them into developing host embryos. The resulting germline chimeras successfully produced offspring carrying the donors' genetics, with one male achieving 100% donor transmission across 24 offspring. Published in *Stem Cell Reports*, this breakthrough demonstrates that donor genetics can be passed to future generations without long-term cell culture, establishing a promising pathway for preserving and recovering genetic diversity in threatened songbirds.

What's next?

The next priority is developing reliable methods to maintain zebra finch PGCs in long-term culture while preserving their reproductive potential. Researchers have already identified biological signals that could help optimize culture conditions, laying the groundwork for stable cell growth and precise genome editing. Meanwhile, the successful transmission of donor genetics demonstrates that conservationists can begin biobanking embryonic reproductive tissues before these technologies are fully developed. Building on this milestone, Revive & Restore and its research partners aim to extend these reproductive technologies to a wider diversity of birds, creating new opportunities to restore lost genetic variation and strengthen species threatened by disease, climate change, and extinction.



Zebra Finches (*Taeniopygia guttata*): white birds are mother (front left) and germline surrogate father (back left), and natural-born son (back right); dark bird is the donor-derived son (front right).
Photo: Matt Biegler, Rockefeller University

Engineering Climate Resilience to Secure Kelp Futures

Research Leads: Hugh Goold, University of New South Wales; Melinda Coleman, NSW Department of Primary Industries and Regional Development

Using gene editing to find the genes that let algae survive heat, then translating them into the threatened kelp that anchors Australia's temperate reefs.

What was achieved in 2026?

Golden kelp forms the underwater forests of Australia's Great Southern Reef, supporting coastal industries worth approximately $10 billion annually and storing substantial amounts of carbon. Marine heatwaves threaten these ecosystems, while existing restoration methods are projected to recover only a fraction of anticipated losses. This project explores whether gene editing can improve kelp resilience. Researchers are first studying three marine microalgae species with simpler genomes, systematically knocking out genes and testing their responses to heat, salinity, light, and nutrient stress. Genes linked to stress tolerance could become editing targets in golden kelp. Launched in September as part of the new Climate Resilience program, the project has secured permits, advanced biosafety review, and begun designing CRISPR delivery systems.

What's next?

Over the next two years, researchers will use genome-wide screening and evolution experiments to identify genes that help marine microalgae tolerate climate stress. They will also test two approaches to editing golden kelp: inserting CRISPR machinery as DNA and delivering Cas9 protein directly, which faces fewer regulatory restrictions in Australia. Initial experiments will target visible traits to verify successful editing. Even if kelp editing proves challenging, identified resilience genes could help restoration teams select heat-tolerant kelp and inform decision-support tools such as Reef Adapt. The team is also assessing regulatory pathways for future deployment of gene-edited kelp.



Golden kelp (*Ecklonia radiata*)
Photo source: Great Southern Reef Foundation

Microbial Genetic Rescue for Malaysian Mangroves

Research Leads: Norfarrah Mohamed Alipiah and Natrah Ikhsan, Universiti Putra Malaysia

Harnessing microbial diversity and gene editing to help the microbes that let mangroves store carbon withstand a hotter, saltier future.

What was achieved in 2026?

Mangrove forests store carbon for centuries, supported by soil microbes that regulate carbon storage, nutrient cycling, and ecosystem recovery. Along Malaysia's coast, warming waters, fluctuating salinity, and shrimp aquaculture threaten these microbial communities. Part of Revive & Restore's new Climate Resilience program, this two-year project aims to identify and preserve stress-tolerant microbes and use gene editing to determine which genes support their resilience. Since launching in July, researchers have secured sampling permits, mapped sites across aquaculture outflows and protected mangroves, and developed a genomic analysis pipeline to identify genes linked to nutrient cycling and stress tolerance. In November, the team completed its first field expedition, collecting water and sediment samples to establish baseline conditions and characterize microbial diversity.

What's next?

Next, researchers will analyze field samples to identify microbial traits associated with resilience to heat and salinity stress. The team will culture promising bacteria, test them under stressful conditions, and preserve them in a new regional biobank. The team will then use CRISPR to edit candidate genes in selected bacterial strains, comparing their performance with unedited strains to determine which genes improve stress tolerance. Given that this work is among the first explorations of genetic rescue at the microbial scale, all editing will remain confined to the laboratory, with no environmental release. Researchers also aim to develop affordable tests that regional labs can use to monitor microbial health, potentially expanding this approach across Southeast Asia to strengthen mangrove restoration and blue carbon conservation.



Research team during first field expedition



Environmental sample collection at an aquaculture farm | Photos: AquaHealth Molecular Laboratory, Universiti Putra Malaysia

Expanding Tools in the Field

In addition to the core technologies of the Genetic Rescue Toolkit, Revive & Restore supports the development of innovative tools that help conservationists in the field better understand and protect threatened species.

New Tool | SHERLOCK

Research Lead: Andrea Schreier, University of California, Davis

Through the Wild Genomes Amphibians Program, co-funded by Revive & Restore and the Morris Animal Foundation, researchers developed a rapid, CRISPR-based test for chytridiomycosis, a fungal disease devastating amphibians worldwide. The test, called SHERLOCK, detects genetic material from the disease-causing fungus Batrachochytrium dendrobatidis (Bd) and produces a fluorescent signal within 30–45 minutes. It successfully distinguished Bd from closely related fungi and detected multiple strains, with results matching standard laboratory tests nearly 100% of the time. With additional support from The Nature Conservancy, the team is developing portable, affordable testing equipment, including 3D-printed devices that could reduce instrument costs tenfold. This technology could bring reliable disease detection directly to zoos, wildlife habitats, and ports of entry.



PhD Candidate Diana Muñoz collects a swab from a California Toad (*Anaxyrus boreas halophilus)* to test for Batrachochytrium dendrobatidis DNA using the SHERLOCK assay. Picture: Daniel Macias, U.S. Geological Survey

New Tool | Non-invasive DNA sampling methods for African elephants

Research Lead: Andrew Tighe, University College Dublin, in collaboration with Pwani University

In Kenya's Arabuko-Sokoke Forest, an isolated elephant population has remained largely unstudied because dense vegetation makes counting difficult and traditional sampling methods are risky. With funding from Revive & Restore, researchers have developed a non-invasive approach using DNA collected from elephant dung at a shared waterhole. Their custom-built SNP panel can identify individual elephants, reveal family relationships, and assess inbreeding. Results uncovered two distinct groups: elephants related to nearby savanna populations and a unique coastal lineage.

The team also developed methods to study elephant diets, shared its analysis tools publicly, and trained Kenyan students in genetic techniques. Findings will inform plans for a wildlife corridor connecting isolated populations, while the approach is being adapted to monitor elephants elsewhere, including rare "supertuskers." The result is a new, less invasive way for conservationists to count, track, and protect African elephants.



Andrew Tighe (left) collects scat samples with collaborators



Forest elephants congregate in the only watering hole in the Arabuko-Sokoke Forest

Photos: Gwenaelle Hurpy

Where We're Going in 2027

Climate Resilience, Terrestrial Cohort

In 2026, our Climate Resilience program's focus on marine ecosystems drew an unprecedented 160 letters of intent requesting roughly $52 million, a clear sign of demand for biotechnology that helps species and ecosystems adapt to climate change. The need is just as urgent on land. In 2027, we're seeking partners and funders to help us launch a terrestrial counterpart, with potential focus areas including soil microbes that store carbon and restore degraded drylands; drought tolerance in forests, grasslands, and peatlands; pathogens and invasive species amplified by warming; and resilience in pollinators.

Biotech for Birds Workshop, Japan

In April 2027, Revive & Restore will co-host the fourth meeting of the International Avian Genetic Rescue Consortium in Kumamoto, Japan, alongside Biotech for Bird Conservation principal investigators Drs. Guojen Sheng, Hiroshi Kagami, Yoshiaki Nakamura, and Jae Yong Han. Established in 2021, the Consortium connects conservationists and biotechnologists to advance genetic rescue tools for wild birds. The workshop will unite our funded research teams and international experts to share scientific advances, build partnerships, and develop actionable roadmaps for applying emerging biotechnologies to bird conservation.

RNAi Symposium

In 2027, Revive & Restore will host a virtual symposium exploring the potential of RNA interference (RNAi) technologies for wildlife conservation. RNAi offers a highly targeted, non-heritable way to silence specific genes, creating new opportunities to address threats that classic conservation tools cannot. The symposium will bring together scientists, conservation practitioners, and regulators to explore responsible, evidence-based pathways for translating this technology into practical conservation solutions.

Special Recognition of our Partners & Supporters

Meet the Team



RYAN PHELAN
CO-FOUNDER &
EXECUTIVE DIRECTOR



EMILY HATAS
VICE PRESIDENT



BEN NOVAK
LEAD SCIENTIST



ASHLEE HUTCHINSON
DIRECTOR OF REPRODUCTIVE
TECHNOLOGIES



LIV LIBERMAN
DIRECTOR OF OCEAN &
CLIMATE



MARMEE MANACK
DIRECTOR OF
OPERATIONS



ELIZABETH BENNETT
DIRECTOR OF
COMMUNICATIONS



LIZ YOUNG
GRANTS MANAGER



KAYLAH REEVES
EXECUTIVE ASSISTANT

BOARD OF DIRECTORS

RYAN PHELAN, Co-founder

STEWART BRAND, Co-founder

ANGUS PARKER

BRAD STANBACK

DAVID LANG

ELIZABETH MOORE

JESSICA GREEN

MATTHEW WINKLER

Our Team in Action



1 Liv Liberman and partners at a coral workshop in the Dominican Republic. Photo: Paul Selvaggio



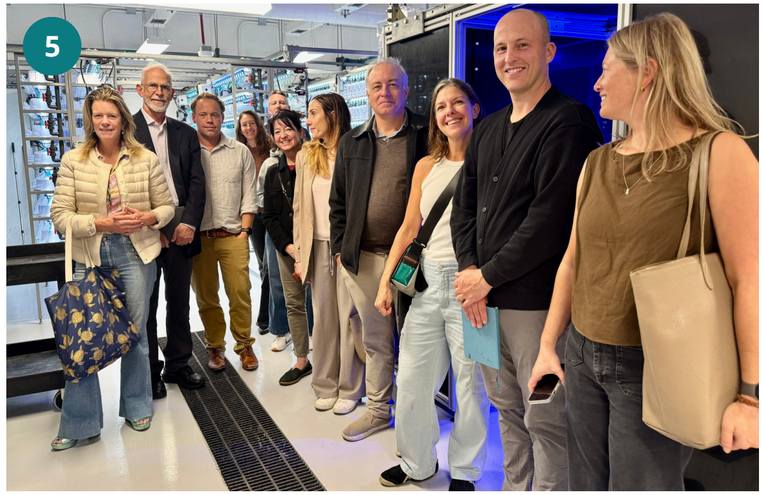
2 Ben Novak at Annual Meeting of the Society for Molecular Biology & Evolution, Copenhagen, Denmark



3 Elizabeth Bennett at SXSW, Austin



4 Staff & Board in Cape May, NJ for annual Horseshoe Crab spawning



5 Staff & Board at Dr. Phil Cleves' coral spawning lab, UC Berkeley

Every breakthrough in genetic rescue begins with community. We are profoundly grateful to the visionary funders, partners, and conservationists around the globe who stand with us to build a more resilient future for Earth’s biodiversity.

DONATE

Revive & Restore is a 501(c)(3) nonprofit
Charity Navigator ★★★★

