

2018 ANNUAL REPORT

PANAMA AMPHIBIAN RESCUE AND CONSERVATION PROJECT



A project partnership between: Cheyenne Mountain Zoo, Houston Zoo, Smithsonian's National Zoological Park, Smithsonian Tropical Research Institute, and Zoo New England.



MISSION

Our mission is to rescue and establish sustainable assurance colonies of amphibian species that are in extreme danger of extinction throughout Panama. We will also focus our efforts and expertise on developing methodologies to reduce the impact of the amphibian chytrid fungus and proceed to reintroduction trials.

GOAL 1: Ensure adequate physical infrastructure and staffing capacity to effectively manage and breed the living collection.

We continued to make progress on increasing the total available frog space in Gamboa. With help from the Cheyenne Mountain Zoo, Zoo New England and numerous volunteers, we emptied two pods of insects in order to make new space for frogs and moved our insect production to swing-space until the new facility is completed. The insect swing space is now operating at maximum capacity and producing surplus food for our collection. The newly outfitted containers will bring us to a total of 7 completely outfitted frog pods and increases our total frog holding space by 30% to 2,800 square feet.

This increase in space is needed in order to accommodate frogs being moved from our facility at the Nispero Zoo in el Valle de Anton. In 2018, we signed an agreement transferring equipment to the newly formed, independent EVACC Foundation and an agreed upon portion of the living collection. We will be closing the El Valle Facility at the Nispero Zoo in early 2019 when our existing agreement with the Nispero Zoo expires and animals will be transferred to the expanded frog space in Gamboa.



Inside a recently outfitted rescue pod. Yellow post-it notes document frogs groups that were tagged and being batched prior to transport to the field as part of a release trail conducted in 2018.

GOAL 2: Manage genetically viable assurance colonies of 12 species in captivity that are at risk of extinction from chytridiomycosis.

We made good progress on reproducing priority species in 2018 (Table 1) and have more than 2,000 frogs in our captive collection. This number is lower than reported in previous years. The decrease in total adult frog numbers is due to reductions of the captive population through release trials, and a split of the captive collection with the EVACC foundation.

Highlights for 2018 include the first F2 Geminis’ dart frogs *Andinobates geminisae*, and much improved success breeding Vicente’s dart frogs *Oophaga vicentei*. Our dart frogs are now living in a pod with custom-made tanks designed to optimize the number of tanks per rack and staff received training on bromeliad husbandry which has dramatically improved our ability to rear *O. vicentei*, which are obligate bromeliad breeders.

Following on from our spindly leg research, we have significantly reduced the incidence of spindly leg syndrome in the collection by using reconstituted reverse osmosis-treated water to rear tadpoles and this has improved the survivorship of offspring. The frogs repatriated from the Atlanta Botanical Gardens are also doing well and we have successfully bred Crowned treefrogs *Triprion spinosa* from these frogs.

In the coming year, captive management priorities will be to breed any unrepresented founders and to start working on F2 generations of frogs. We will need to conduct population management training for our staff now that we are getting into trickier F2 and F3 pairings. We will need to explore the possibility of repatriating genetic representation of *Atelopus zeteki* from US populations in order to increase the genetic representation of this species in Panama.

Table 1: 2018 Population management report card for the 12 priority conservation species maintained by the Panama Amphibian Rescue and Conservation Project.

	Founders alive or represented (Goal = 20)	Pairs Bred to F1 (Goal = 10)	Pairs bred to F2 (Goal = 10)	Total number of frogs in collection (Goal = 300)
<i>Andinobates geminisae</i>	39	19	5	254
<i>Atelopus certus</i>	23	10	2	173
<i>Gastrotheca cornuta</i>	22	12	1	59
<i>Oophaga vicentei</i>	38	13	0	70
<i>Atelopus varius</i> (lowland)	60	9	0	716
<i>Atelopus limosus</i>	21	8	0	117
<i>Craugastor evanesco</i>	45	3	0	81
<i>Atelopus glyphus</i>	16	7	0	258
<i>Triprion spinosa</i>	11	6	6	76
<i>Agalychnis lemur</i>	8	6	0	62
<i>Strabomantis bufoniformis</i>	8	2	0	15
<i>Atelopus varius</i> (highland)	6	4	0	34
<i>Atelopus zeteki</i>	4	5	2	282

Note: This report card reflects the state of the living collection after an institutional split with the newly formed EVACC foundation. Reporting metric methods have been modified slightly to improve clarity.

Key
0-24%
25-49%
50-74%
75-99%
Goal met



Geminis’ dart frog *Andinobates geminisae*

GOAL 3: Research factors to improve long-term sustainability of the captive collections and increase success of release trials.



We began a new project investigating spindly leg syndrome and the role of calcium and phosphate in tap water. This work is being led by Elliott Lassiter (left) and Orlando Garces with support from the Morris Animal Foundation.

Dr. Gina DellaTogna from the InterAmerican University in Panama leads our assisted reproduction research program. Dr. DellaTogna has used hormone treatments that have successfully resulted in offspring from five captive species. She has recruited two Panamanian students, Dionel Rodriguez who is focused on the differences in sperm

quality between wild and captive *Atelopus limosus* and Yineska Otero, who is focused on developing optimal hormone dosing methods to breed two – Rusty Robber frog (*Strabomantis bufoniformis*) and Vanishing Robber frog (*Craugastor evanescens*) that are very difficult species to breed in captivity.

Dr. Luke Linhoff joined our team in 2018 and has begun work to understand the variation and heritability of anti-Bd skin secretions in Panamanian amphibians. This follows on from a field study by Dr. Jamie Voyles and Dr. Cori Richards-Zawacki who found that recovering frogs have evolved more potent anti-Bd skin secretions. Dr. Linhoff will be exploring variation in the antifungal properties of skin secretions in captive frogs, with a long-term goal to selectively breed frogs for resistance traits.

2018 Research Publications involving collaborations with PARC members (bold)

- **Camperio Ciani, J.F., Guerrel J., Baitchman E., Diaz R., Evans M., Ibañez R., Ross H., Klaphake E., Nissen B., Pessier, A.P., Power, M.L., Arlotta, C., Snellgrove, D., Wilson, B. and Gratwicke, B.** (2018) [The relationship between spindly leg syndrome incidence and water composition, overfeeding, and diet in newly metamorphosed harlequin frogs \(*Atelopus* spp.\)](https://doi.org/10.1371/journal.pone.0204314). PLoS ONE 13(10): e0204314. <https://doi.org/10.1371/journal.pone.0204314>
- DiRenzo, G.V., Tunstall, T.S., **Ibañez, R.**, Longo, A.V., Zamudio, K.R. and Lips, K.R., 2018. [External reinfection of a fungal pathogen does not contribute to pathogen growth](#). EcoHealth, pp.1-12.
- Woodhams, D.C., LaBumbard, B.C., Barnhart, K.L., Becker, M.H., Bletz, M.C., Escobar, L.A., Flechas, S.V., Forman, M.E., Iannetta, A.A., Joyce, M.D. and Rabemananjara, F., **Gratwicke, B.**, Vences, M. and Minbiole, K.P.C. 2018. [Prodigiosin, violacein, and volatile organic compounds produced by widespread cutaneous bacteria of amphibians can inhibit two *Batrachochytrium* fungal pathogens](#). Microbial ecology, 75(4), pp.1049-1062.
- Voyles, J., Woodhams, D.C., Saenz, V., Byrne, A.Q., Perez, R., Rios-Sotelo, G., Ryan, M.J., Bletz, M.C., Sobell, F.A., McLetchie, S. and Reinert, L., Rosenblum, E.B., Rollins-Smith, L.A. **Ibañez, R.**, Ray, J.M., Griffith, E.J., **Ross, H.** and Richards-Zawacki, C.L. 2018. [Shifts in disease dynamics in a tropical amphibian assemblage are not due to pathogen attenuation](#). Science, 359(6383), pp.1517-1519.
- **Della Togna, G., Gratwicke, B., Evans, M.**, Augustine, L., Chia, H., Bronikowski, E., Murphy, J.B. and Comizzoli, P., 2018. [Influence of extracellular environment on the motility and structural properties of spermatozoa collected from hormonally stimulated Panamanian golden frog \(*Atelopus zeteki*\)](#). Theriogenology, 108, pp.153-160.

GOAL 4: Begin experimental frog reintroduction trials with surplus offspring.

In 2018 we expanded release trials to 560 surplus-bred harlequin frog species (about 500 *Atelopus varius* and 60 *Atelopus limosus*) at two sites in Panama led by Blake Klocke, a PhD student at George Mason University. These two endangered frog species have declined significantly due to the amphibian chytrid fungus disease. Despite repeated surveys at release sites we were unable to document any long-term survival of released frogs. The goal of these studies was to understand the transition from human care back into the wild and to conduct research into amphibian responses to chytridiomycosis. This work enabled us to better understand the challenges of mark-recapture methods compared to radiotracking and mesocosm releases. Because recapture rates of tagged frogs were so low, we do not recommend this approach.

Radiotracking was an excellent tool to understand short-term dispersal and predation events, but the 0.3g transmitters we have been using are high cost and need to be changed every 20 days. Mesocosms were suitable for medium-term post-release monitoring but the frogs were still susceptible to snake and ant predation. These observations will help to improve post-release monitoring methods and increase understanding of dispersal, sources of mortality, habitat selection and disease dynamics in both the released frogs and the existing amphibian community. Blake is writing up the findings of this research to share with the wider amphibian reintroduction community. We are also collaborating with the Woodhams and Minbiole labs to understand how long it may take released *Atelopus* to regain their skin toxicity after their release to the wild.



January 2018 *Atelopus varius* field release trial team at the Cobre First Quantum Minerals release site in the Donoso area. From Left: Blake Klocke, Heidi Ross, Jorge Guerrel, Orlando Garcés, Eric Klaphake, Elliot Lassiter, Brian Gratwicke, Roberto Ibáñez .

GOAL 5: Cultivate and foster an appreciation for amphibians in the public mindset and work on community engagement at the field level.

We continued our online and exhibit-based offerings at the Punta Culebra Nature Center the Nispero Zoo and the PARC facility in Gamboa. We helped to coordinate and organize events around this year's Golden Frog Festival. We had pro-bono assistance from the public relations company Stratego. The event was covered by 87 different news, TV, radio and online outlets resulting in publicity valued at \$41,000 with a public relations value of \$152,000. Festivities began with open houses at the Punta Culebra Nature Center and the PARC project in Gamboa attended by about 300 people. Caminando Panama hosted the annual La Dorada 5k/15k Trail Run in El Valle de Anton that sold out to about 400 participants for the fourth year in a row. In El Valle de Antón, the Junta Comunal led and organized the 2018 Golden Frog Day Parade, that was complimented by a free entrance day at the Nispero Zoo on August 14, plus a family day at Paseo El Valle. In Panama City Albrook mall and the Biomuseo hosted an interactive exhibition about frogs where we also distributed our very popular 'Anfibios de Panama' posters.

Thirteen independent English and Spanish news stories covering our project appeared in 2018. Our online constituency continued to grow steadily. We now have 5,000 twitter followers, 11,200 Facebook fans, 6,300 instagram Instagram followers. Website visitors increased 36% compared to last year with 61,000 unique visitors (about 16,000 of these were Spanish-speaking).

CALENDARIO DE EVENTOS

EL VALLE DE ANTÓN DOMINGO 12 DE AGOSTO
Carrera La Dorada
6:00 – 11:00AM
Camina o corre 5 a 15km.
MARTES 14 DE AGOSTO
El Nispero
9:00AM – 1:00PM
Dia de la Rana Dorada. Tour guiado a la exhibición de ranas. Entrada gratuita.

PUNTA CULEBRA SÁBADO 11 DE AGOSTO
Dia Familiar
11:00AM – 3:00PM
Actividades: Juegos didácticos sobre anfibios, arte para niños y la exhibición: Las Fabulosas Ranas de Panamá.
FERIA DEL LIBRO 14 - 19 DE AGOSTO
Q?rioso y Rana Dorada
9:00AM – 9:00PM
Estaremos en el stand de SENACYT con actividades didácticas para toda la familia.

GAMBOA DOMINGO 12 DE AGOSTO
Casa Abierta
9:00AM – 5:00PM
Proyecto de Rescate y Conservación de Anfibios
Actividades: Visitas a exhibición de ranas y al laboratorio con expertos en ranas.
ALBROOK MALL Pasillo del koala 1 - 17 DE AGOSTO
Exhibición Anfibios
Horario del mall
Exhibición interactiva para toda la familia. Aprende sobre los anfibios de Panamá.

FESTIVAL DE LA RANA DORADA 2018

Logos: MIA AMBIENTE, Smithsonian, SENACYT, Stratego, Albrook mall, CAMINANDO PANAMA, LA RANA DORADA, FIRST QUANTUM Cobre Panamá

14 | eyl
Martes 14 de agosto 2018 Panamá América

FAUNA. Hoy se conmemora el Día Nacional de la Rana Dorada y en el marco de esta celebración se realizarán varias actividades hasta el 19 de agosto

Un símbolo ecológico y cultural

La rana dorada proviene de El Valle de Antón (Cocle) y del Parque Nacional de Campana (Panamá Oeste).

Fanny Adán

En la tierra y la presencia del hongo quitridio, según el Instituto Smithsonian de Investigaciones Tropicales. El festival busca educar a la población sobre los retos que enfrenta la rana dorada y otros anfibios, pero a la vez busca celebrar su historia, belleza, diversidad y valor ecológico.

Hasta el 19 de este mes el Instituto Smithsonian de Investigaciones Tropicales, el Proyecto de Rescate y Conservación de Anfibios de Panamá y otros instituciones ofrecen charlas, exhibiciones, caminatas y otras actividades interactivas paralelamente en la ciudad de Panamá y en El Valle de Antón.

Por ejemplo, hoy habrá tours guiados a la exhibición de ranas doradas en el Zoológico El Nispero de El Valle de Antón, de 9:00 a.m. a 1:00 p.m.

Más detalles sobre la rana dorada

Las ranas: - Ayudan a controlar las poblaciones de insectos. - Existe un hongo que afecta la salud de los anfibios. - El hongo quitridio está asociado con los anfibios. - El hongo quitridio ya está en Las Tablas, Fortuna, Santa Fe, El Capi, El Valle, Gamboa, Albo de Carrasco, Sani, Nuevo Riego y Barro Colorado. - La rana dorada es en verdad un logo.

Actividad
El Instituto Smithsonian de Investigaciones Tropicales también participará en la Feria Internacional del Libro, del 14 al 19 de agosto, donde grandes y pequeños podrán visitar el stand de la Senacyt donde disfrutarán y aprenderán más de este encantador anfibio. Una especie en supervivencia.

Objetivo
Esta exhibición en estado silvestre y el único lugar donde se la puede observar en estado de naturaleza, es en El Valle de Antón.





Anthony Vega from Miambiente assisting with the released 500 *Atelopus varius* in January 2018. We continued to survey the area for frogs for 6 months post-release. We were able to re-find frogs for about 1 month after release, and re-detection rates for frogs not in mesocosms or tagged with radiotransmitters were very low.

GOAL 6: Ensure the financial sustainability of the project.

We continued to raise funds to support the operational expenditures of this project. About 35% of funds was from project partners, 50% from corporate contributions, including a renewal of our agreement with First Quantum's Cobre Panama. 15% of our funding came from foundations and restricted grants. We have also begun an endowment fund seeded by a long-term supporter of the project that will help to support emergency operational expenses.

Financial Report for Calendar Year 2018*

FUNDING SOURCE	Purpose	2018 Expenses (US\$)
Houston Zoo	Salaries and operating costs	40,405
Minera Panama	Salaries, operating costs, swab analysis	361,520
BBVA	Supplies, travel, meetings, education, internships	33,677
Zoo New England	Salaries	15,000
Cheyenne Mountain Zoo	Salaries	20,000
SCBI and donors	Coordinator salary, supplies, internships, fellows, travel, architect fees	186,987
Mohammed Bin Zayed Species Conservation Fund	Reintroduction Research	24,120
National Geographic Society	Reintroduction Research	25,000
Wood Tiger Fund	Research and program support	45,000
Friends of the National Zoo	Reintroduction Research	2,000
SENACYT	Research	26,422
Morris Animal Foundation	Research	2,162
Total		782,293

*These funds include direct project costs incurred in the calendar year 2018, but do not reflect unexpensed funds or in-kind institutional administrative support, utilities,



Dr. Eric Klaphake from the Cheyenne Mountain Zoo, appraising the health of frogs prior to the release trial.



Jorge Guerrel & Orlando Garcés with a car full of frogs, packed for the release trial.

Donors

In addition to the contributions from project partners, we are grateful to the following donors who have made additional contributions to the project directly: Susan and Frank Mars, Linda Mars, Anne Keiser and Doug Lapp, Sey and Pearl Moskowitz, Stratego, the Woodtiger Fund, The Shared Earth Foundation, The Anele Kolohe Foundation, National Geographic Society, Mohammed Bin Zayed Species Conservation Fund, Cervecería La Rana Dorada, Baton Rouge Zoo, The Smithsonian Women’s Committee and the EVIM foundation.

2018 Online Contributions

Our sincere thanks to the following individuals who contributed \$25 or more online:

Nicole Avendano, Thomas Erik Oscar Bressler, Jared Flinn, Kat Gatrell, Karen Gotshall, Beate Freudenberg, Aditi Naik, Eric Stubbs, Gregory and Alvera Wilson.

Staff

Lead Scientist & International Coordinator - Dr. Brian Gratwicke

Project Director, Panama - Dr. Roberto Ibáñez

Gamboa Amphibian Research and Conservation Center Manager– Jorge Guerrel.

Technical Staff - Lankei Cheucarama, Jennifer Warren, Nancy Fairchild, Estefany Illueca. *Interns* – Amaranto Cabezón, Orlando Garcés, Kathleen Higgins, Valeria Franco, Elliott Lassiter, Karina E. Zurique Mendoza, and Guadalupe Ureña.

Graduate Students Blake Klocke, Alyssa Wetterau. *Post Doctoral Fellows* – Luke Linhoff, Andreas Hertz.

El Valle Amphibian Conservation Center Manager – Heidi Ross.

Technical Staff – Milagro González, Yeisson Muñoz. *Interns* – José Alonso, Erika Herrera.

Steering Committee

Bob Chastain, President and CEO *Cheyenne Mountain Zoo*;

Lee Ehmke, CEO, *Houston Zoo*;

Dr. Steve Monfort, Director *Smithsonian National Zoo and Conservation Biology Institute*;

Dr. Matthew Larsen, Director *Smithsonian Tropical Research Institute*;

John Linehan, President and CEO *Zoo New England*.

Implementation Committee

Dr. Eric Klaphake & Dr. Liza Dadone *Cheyenne Mountain Zoo*; Peter Riger *Houston Zoo*; Dr. Brian Gratwicke *Smithsonian Conservation Biology Institute*, Matthew Evans *Smithsonian’s National Zoological Park*; Dr. Roberto Ibáñez, Jorge Guerrel & Heidi Ross *Smithsonian Tropical Research Institute*; Dr. Eric Baitchman & Bryan Windmiller *Zoo New England*; Dr. Brad Wilson *Atlanta Botanical Gardens*.

2018 Volunteers

Matthew Beedle, Damien Bontemps, Eva Blockstein, Fernando Casanova, Laura Duarte, Patricio Flores, Daniel Gratwicke, Jordan Heinlein, Andreas Hertz, Lucy Howel, Ryan Ikeda, Kas Janssen, Yarelis Jaen, Emma Jane Lawell, Amelia Lindquist, Mireya Mendez, Edward Pini, Genny Skinner, María Gabriela Sánchez, Erin Wood, Hugh Scott Walker.

2018 Golden Frog Festival

Organizer: Jimena Pitty. Organizing Committee: Linette Dutari, Roberto Ibáñez, María L. Prechi, Jorge Alemán, Nelly Florez, Guillermina De Gracia, Sonia Tejada, Álvaro González, Adrián Benedetti, Ana Matilde Ruíz, Ana Endara, Heidi Ross, Lanki Cheucarama.

Participating organizations: Albrook Mall, Caminando Panamá, Ministerio de Ambiente de Panamá, Smithsonian Tropical Research Institute, First Quantum Minerals (Cobre Panama), Fundación Smithsonian, El Nispero Zoo, SENACYT, La Rana Dorada Pub, Stratego.

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