

QUARTERLY PUBLICATION OF THE EUROPEAN ASSOCIATION OF ZOOS AND AQUARIA

# ZOOQUARIA

AUTUMN 2018

ISSUE 102

## AMAZING AMPHIBIANS

CELEBRATING A DECADE OF  
AMPHIBIAN CONSERVATION



### A giant challenge

BUILDING A FUTURE FOR THE CHINESE GIANT SALAMANDER

### Taking a Leap

PROTECTING DARWIN'S FROG IN CHILE



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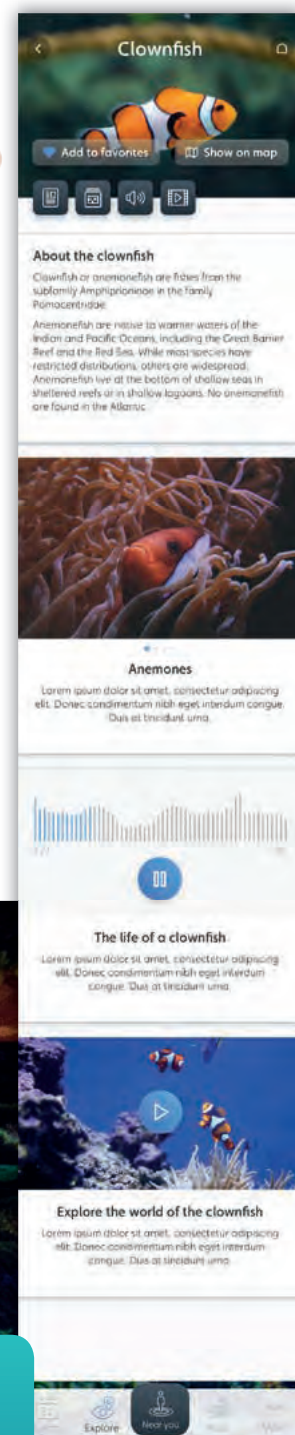
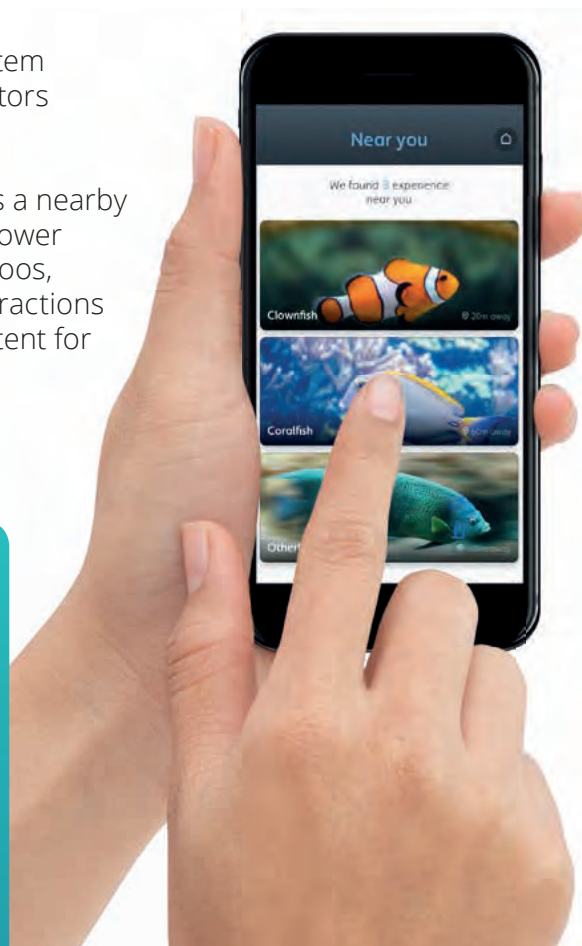
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Zooquaria

**EDITORIAL BOARD:**

**Executive Director** Myfanwy Griffith (Myfanwy.Griffith@eaza.net)

**Managing Editor** David Williams-Mitchell (David.Williams-Mitchell@eaza.net)

**Editor** Joanna Swinnerton

**Editorial Staff** Katharina Herrmann, William van Lint

**Designer** Louise Tait

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EAZA Executive Office, PO Box 20164, 1000 HD Amsterdam, The Netherlands.

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## FROM THE DIRECTOR'S CHAIR

I am delighted to share with you this special issue on amphibians. It comes 10 years after our EAZA Conservation Campaign: Year of the Frog, which was launched after alarming declines of amphibians were presented at a 2005 conference. At the closing of the campaign, it had raised over €418,000 for amphibian conservation, 40 per cent of which was granted to the global Amphibian Ark (AArk) to help it maintain its vital central coordinating role in amphibian *ex situ* conservation. Ten years on, this issue of *Zooquaria* looks at the current status of amphibian conservation, the lasting impacts of the campaign, and if more still needs to be done.

This issue contains a range of examples from EAZA Members about how the campaign initiated their amphibian conservation activities. These diverse activities also now demonstrate a long-term commitment to amphibian conservation for both native species and those from further afield. They also highlight the complexities of amphibian conservation, not least that in some cases conservation of one species of amphibian may mean eradication of another. Conservation is not always easy, and it is reassuring to know that EAZA Members have the scientific and practical knowledge to confidently make these difficult decisions and achieve positive conservation outcomes. In addition to the specific examples given, the EAZA Conservation Database infographic on page 23 nicely summarises EAZA contributions to amphibian conservation over the 10-year period. It is great to be able to share the fact that registered funding for amphibians has risen to €3.9 million. These funds have supported not only direct species conservation efforts but also projects related to research, conservation education and ecosystem restoration.

On page 18 our Amphibian TAG Chair, Gerardo Garcia, provides a more detailed summary of the campaign and what the TAG has done, and continues to do for Amphibian management and conservation.

The 2005 conference also gave rise to the Amphibian Conservation Action Plan (ACAP). This plan was updated in 2015 and is available online at <http://www.amphibians.org/publications/amphibian-conservation-action-plan/>. The ACAP is the global conservation roadmap for amphibians and has clear chapters outlining priority actions that need to take place to secure remaining frog, toad, salamander, newt and caecilian populations. I encourage everyone to look at the ACAP and work to incorporate appropriate priority actions into their institutional practice and activities.

What becomes evident when reading the various excellent, thought-provoking articles in this issue is that effective amphibian conservation requires collaborative solutions. With the proportion of amphibian species threatened with extinction now at over 30 per cent (making them the most globally threatened vertebrate group) it is vital that

effective collaboration produces conservation impact. The interconnected work of AArk, the Amphibian Survival Alliance (ASA) and the IUCN Species Survival Commission Amphibian Specialist Group (IUCN SSC ASG) is one example of effective collaboration in action. It is great to know that EAZA and its Members are involved in supporting each of these groups, either through provision of scientific expertise, capacity building, rescue efforts, outreach, communications or funds (and here I take the opportunity to give special thanks to Leipzig Zoo, Germany, Belfast Zoo, Northern Ireland, and Nordens Ark, Sweden, who responded to my recent request for funds made in my capacity as a Global Council member of ASA).

It is also clear from reading the articles that there is still a need to do more if we wish to safeguard precious amphibian biodiversity. Many authors call for an expansion of activities to include:

- connecting zoos and aquariums to existing global amphibian networks such as AArk, ASA and ASG;
- supporting effective collaborations between the scientific community and practitioners in zoos and aquariums, particularly with institutions based in developing countries and in need of more research capacity;
- institutions in countries with low amphibian diversity helping to establish breeding facilities in partner institutions in high-diversity range countries, and potentially receiving exhibit animals from these institutions once range-country populations produced surplus; and
- supporting the Red Listing process for the thousands of amphibians in need so that it can continue to guide strategic actions.

EAZA and its Members are well placed to respond to these calls and I encourage everyone to use their expertise, experience and connections to become (more) involved in amphibian conservation.

As you read on you will notice that not all of our articles are amphibian-focused, but we couldn't miss the timely opportunity to celebrate some non-amphibian births and hatchings, divert a little of the conservation spotlight to one of our current Silent Forest Campaign species, the Javan green magpie, and provide updates from the highly successful EAZA Annual Conference and WAZA Conference.

  
**Myfanwy Griffith**  
Executive Director, EAZA

## NOTICEBOARD

The EAZA Council met at the EAZA Annual Conference held in Athens (see p. 8) on 21 September. The following decisions were made regarding changes in the Membership of the Association and outcomes of screenings under the EAZA Accreditation Programme:

### New Applicants

- i) *Temporary Member (2 years)*
  - (1) Parco Faunistico Valcorba, Italy
- ii) *Move from Temporary to Full Membership*
  - (1) Biotropica, France
  - (2) Exmoor Zoo, UK
  - (3) Terra Natura Murcia, Spain
- iii) *Associate Member: Zoo/Aquarium*
  - (1) Auckland Zoo, New Zealand
  - (2) Taipei Zoo, Taiwan
- iv) *Associate Member: Membership Organisation*
  - (1) Association of Hungarian Zoos – MASZ (Magyar Állatkertek Szövetsége), Hungary
- v) *Candidate for Membership*
  - (1) Parc Animalier de Bouillon, Belgium
  - (2) Belgrade Zoo, Serbia

### Existing Members

- i) *Maintain Full Membership*
  - (1) Zoo Leipzig, Germany
  - (2) Bioparco Roma, Italy
  - (3) Berlin Zoo, Germany
- ii) *Reinstate to Full Membership*
  - (1) Monde Sauvage, Belgium
- iii) *Withdrawing Members*
  - (1) Aquarium Tropical de la Porte Dorée, France (Full)
  - (2) Union des Conservateurs d'Aquarium – UCA, France (Associate)
  - (3) Al Wabra Wildlife Reservation, Qatar (Associate)
  - (4) Bears in Mind (Associate)

### Corporate Members

- v) *New Members*
  - (1) Nautilus-UK, UK
  - (2) IFA Skyfast, Belgium
  - (3) Granovit, Switzerland
  - (4) Close to Bone, Belgium

### vi) *Withdrawing Corporate Members*

- (1) TAA Group GmbH Co. KG, Germany
- (2) IC EAU, Switzerland

The Council also approved updated or newly created Terms of Reference for the EAZA Council, the Membership and Ethics Committee, the Communications Committee, the Education Committee and the National Associations Committee.

### An Extraordinary Meeting of the Annual General Meeting

was also held the same day. This meeting was convened following the failure to achieve quorum at the Annual General Meeting held in April 2018 in Antwerp for changes to the constitutions proposed by the Executive Committee. The new meeting required a simple majority of present voting Members to adopt the proposed changes. The Members voted unanimously to adopt the changes to the Constitution. For further details on the changes, visit the EAZA Member Area website (AGM/meetings/Athens).

### Council Elections

The term of the current EAZA Council expires at the Spring Council meeting, which will be held in Jersey in April 2019. A new Council will then be installed following elections running at the end of 2018 and into the early part of 2019.

The EAZA Executive Office will make contact with National Associations (where the National Association is a Member of EAZA), with Members in countries with no Member National Association, and with Members who are the sole EAZA representatives in their country to outline the process for nominating and electing Council members during November.

Nominated or elected members of Council will be informed of the outcome of elections in March

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<b>Arie Blok Animal Nutrition</b>	<a href="http://www.arielok.nl">www.arielok.nl</a>
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<b>Brogarden</b>	<a href="http://www.brogarden.eu">www.brogarden.eu</a>
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<b>Clax Italia</b>	<a href="http://www.claxitalia.com">www.claxitalia.com</a>
<b>Close to Bone</b>	<a href="http://www.closetobone.be">www.closetobone.be</a>
<b>Crossborder Animal Services</b>	<a href="http://www.crossborderanimalservices.com">www.crossborderanimalservices.com</a>
<b>Deerns</b>	<a href="http://www.deerns.com">www.deerns.com</a>
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<b>Ray Hole Architects</b>	<a href="http://www.rayhole-architects.com">www.rayhole-architects.com</a>
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2019, and the nominations will be ratified or rejected by the Annual General Meeting, also to be held in April in Jersey. A process is also opening for the nomination of candidates for the role of EAZA Chair.

If you have any questions regarding these elections, please contact EAZA Director of Communications and Membership David Williams-Mitchell.



## NEW ARRIVALS

### KIWI HATCHED IN THE NETHERLANDS

THE HATCHING OF A NORTH ISLAND KIWI (*Apteryx mantelli*) in Vogelpark Avifauna on 18 September is a first for the Netherlands and is also the first chick to hatch in the SSP in 2018. (EAZA and AZA zoos participate in the SSP for this species, as all kiwis outside New Zealand are managed as one population.)

Avifauna started its work with this species in 2007 when a male arrived from Frankfurt (CB Frankfurt 2005), which could be displayed at the nocturnal house. In 2008 a potential breeding pair arrived from Frankfurt (both CB Frankfurt 2007), but unfortunately the female died in 2009, so they never bred. However, the 'male' in the nocturnal house then started to produce eggs! Since this female was closely related to the male in Avifauna,

another male was needed. In 2014, a male (CB 2012) arrived from the Smithsonian Conservation Biology Institute in the US, so we once more had a potential breeding pair.

It was 2017 before the first fertile eggs were laid, but unfortunately the chicks died in the egg before hatching. The first clutch in 2018 was fertile again, and a first chick hatched on 29 June in the incubator (it is advised to take eggs away from the male on day 40–45), but unfortunately the chick was weak and unable to feed itself and it died within 14 days.

In the meantime a second clutch was successfully incubated by the male, and it was decided that the eggs should be left with the male for the entire incubation period (which for kiwis is

74–84). On 18 September, after 76 days, a chick hatched weighing 178 grams. Kiwi chicks hatch with a large external yolk sac, which is gradually absorbed through their navel over their first 10 days of life. This means they do not have to go outside to feed for the first few days, so the chick was left with the male that was still incubating a second egg.

After six days the chick was moved to its own enclosure where it could be monitored closely and start to forage for food itself. After the ninth day the chick started to gain weight and on 2 October it passed the 200 gram mark, so this looks very promising and the keepers in Avifauna are convinced this chick will survive to adulthood. In the meantime, our fingers are still crossed for the second egg.



## ASIATIC LION CUBS BORN IN ROTTERDAM

AT THE END OF 2014, a genetically important male Asiatic lion (a direct descendant of wild parents) from Singapore was imported to Blijdorp Zoo, Rotterdam, the Netherlands. Six months later, in June 2015, Blijdorp opened a new exhibit with all the necessary features in place for breeding.

Mating occurred with the females, but unfortunately one of the females appeared to be too old and the other female had a history of not rearing her cubs. The latter female gave birth in our new enclosure, but unfortunately, as predicted, she did not care for her cubs. On the positive side, our male from Singapore proved to be fertile.

After consulting the EEP coordinator, we received a 10-year, non-proven, female from Berlin. Matings have been observed, but so far without success. Because our oldest female had to be euthanised (because of geriatric health problems) we consulted the EEP coordinator again with a request for a new female. We received a recommendation for a genetically important, eight-year-old non-proven female from Krakow. At first we were a



little sceptical about receiving another non-proven female, but the protocol is that the EEP's interests always prevail over an institution's interests. In March 2018 the female (Lalana) from Krakow arrived in Rotterdam Zoo. After a quarantine period of 30 days we introduced her to the male, and after they bonded, we introduced the two other females, one at a time. We

observed matings shortly after introduction and were delighted to welcome four cubs (1 DNS) on 21 August. Fortunately Lalana turned out to be an excellent first-time mother. So after a difficult and disappointing start in our new exhibit we are now happy to welcome the first surviving offspring from our genetically important male from Singapore.

## CAESAREAN DELIVERY FOR L'HOEST'S MONKEY AT LA PALMYRE ZOO



A FEMALE L'HOEST'S MONKEY (*Allochrocebus lhoesti*) was born at La Palmyre Zoo, France, in July via an emergency caesarean performed on her nine-year old mother. Once dystocia (difficult delivery) had been confirmed, the veterinary team had to intervene very quickly to assist in the birth.

Because the juvenile didn't present a

sufficient grasping reflex and as her mother was an inexperienced primiparous female, the vet decided hand-rearing would be in the best interests of the newborn.

She was put in an incubator at the zoo nursery where she was fed by the keepers. A few days later, her incubator was put in the corridor of the monkey

building, in front of the L'Hoest's monkeys' cage. Early placement close to their natal group allows hand-reared juveniles to have visual and auditory contact with their peers and usually makes their reintroduction easier once they are weaned.

The juvenile is now in a small cage and receives six bottles of milk and two bowls of fruit per day. First observations show that she is reacting positively to the presence of the other L'Hoest's monkeys, who are themselves very interested in this new juvenile.

Classified as Vulnerable on the IUCN Red List, the species is threatened by deforestation and hunting for bushmeat. Currently 66 individuals (31.33.2) are hosted in 13 European institutions and only six births have been recorded in the last 12 months, making this most recent juvenile very important for the long-term conservation of the species.



# GREECE IS THE WORD

A REPORT FROM THE MEGARON IN ATHENS, WHERE THIS YEAR'S EAZA ANNUAL CONFERENCE TOOK PLACE

David Williams-Mitchell, EAZA Director of Communications and Membership

More than 830 delegates from 365 institutions and 55 countries came together in Athens in September for five days of discussion, decision-making, study and networking at the EAZA Annual Conference. The event began on Tuesday 18 September with the TAG Chairs and EEP Coordinators meetings, followed by a lively icebreaker event, which this year was held in the open-air atrium of the conference venue. And what a venue! The Megaron, the largest concert and conference complex in Greece, and almost certainly the largest venue EAZA has used, sits in the centre of Athens and was able to provide a full suite of rooms while simultaneously hosting concerts upstairs; no mean feat, and one that was handled seamlessly by the venue managers.

This huge space started to look considerably smaller on Wednesday morning as delegates arrived for the opening plenary session and were welcomed by EAZA Chair Thomas Kauffels. Thomas reminded delegates of the new Regional Collection Plans and EEP structures and highlighted some of the work carried out by the Association to increase transparency and our presence at the European Union and CITES. He also called for an increase in participation in the democratic processes

of the Association, with a step change in communication and publishing of research. Thomas also paid tribute to Tine Griede from Van Hall Larenstein, who passed away recently.

The Prefect of Eastern Attica, Dr Petros Phillipou, welcomed delegates to Athens and encouraged EAZA Members to explore the city; he also congratulated host Attica Zoological Park, which is located in his constituency, on the continued development of their conservation, education and research work. Dr Phillipou was followed by the CEO and owner of the park, Jean-Jacques Lesueur, who pointed out that this was the first EAZA conference to completely avoid the use of single-use plastics in the catering of the event. Jean-Jacques explained the history of the park, which, with the help of family and friends, he built as a birds-only facility and opened in 2000. Jean-Jacques spoke of the benefits and support he had received from EAZA, and thanked the Association for the support it had given him for almost two decades.

Keynote speaker Dr Gaetano Leone, Coordinator of the United Nations Environment Programme's Mediterranean Action Plan, introduced the work of his group, which is based in Athens, to protect the marine

environment of the region. Dr Leone spoke about the 2030 Sustainable Development agenda of the United Nations, and pointed out that the international community is falling behind seriously in the implementation of the 2020 goals. As with EAZA, the United Nations is the product of its Members, and we all need to work together to ensure that we manage to get plastic pollution of the seas under control; we should aim to be remembered as the generation that took action to make huge changes in our lifestyle and ensure a future for nature. UNEP's Mediterranean Action Plan could be helped by the involvement of EAZA Members, and Dr Leone called for regional institutions to take part and to influence the post-2020 agenda.

EAZA Executive Director Myfanwy Griffith also provided her summary of the work of EAZA over the past 12 months. Much of the work outlined in the EAZA Strategy 2017–2020 is on target for timely completion across the four focal areas. She also showed how the EAZA Executive Office staff has grown considerably, with the expansion of the Programme, Population Management, Accreditation, EU Policy and Communications departments. The expansion also applies to our





Membership, which has now reached 416 Members in 47 countries. Myfanwy also introduced the training opportunities available at the conference, which included courses on social media, crisis communications, fundraising and ZIMS for Studbooks, and other training that has been developed by the EAZA Academy, including the European Professional Zookeeper Qualification Framework (EPZQF). Conservation contributions from Members were also covered, with a considerable increase in funding for *in situ* projects, as well as strong contributions in working time.

The end of the plenary marked the beginning of the main business of the conference, the TAG and Committee meetings that will help define the work of the Association over the next 12 months. It was gratifying to see active and well-attended meetings across the board, testament to the motivation and professionalism of EAZA Member staff working towards the goals of the new population management structure.

Wednesday afternoon's plenary looked at two important focal areas of the EAZA strategy, communications and conservation campaigns. Dr Fiona Lethbridge of the UK Science Media Centre gave a presentation of how her organisation works to bridge the communications gap between the media and scientists, with the aim of increasing the accuracy of reporting and promoting better public understanding of difficult, controversial or complex scientific practice and research. EAZA Director of Communications and Membership David Williams-Mitchell followed this

talk with an introduction to the work on communications framing carried out by the Public Interest Research Centre, an important project aimed at helping NGOs and environmental champions to move conversations away from the typical media frames of the economy, politics and power, and towards promoting the intrinsic value of nature.

The second half of the plenary looked at progress made by the Silent Forest Campaign, EAZA's two-year action to help protect Southeast Asian bird species from the ravages of the songbird trade. Thomas Ouhel and Simon Bruslund, prime movers in the campaign, provided a clear summary and enthusiastic encouragement for EAZA Members to get more involved, all while modelling particularly fetching Javan green magpie and Nyas Hill myna costumes! Ian Singleton, of Swiss NGO PanEco, introduced the Orang-utan Haven project, aimed at protecting and rehabilitating rescued Sumatran orang-utans (*Pongo abelii*), but with additional space, funded by the Silent Forest campaign, for the breeding of Sumatran laughing thrush (*Garrulax bicolor*), straw-headed bulbul (*Pycnonotus zeylanicus*) and other important and highly threatened species.

Thursday's business, as usual, concluded in mid-afternoon to allow delegates to enjoy a visit to the host zoo. Attica Zoo, which covers 20 acres of the countryside of Spata, not far from Athens, is host to a large collection of birds, mammals and reptiles, and delegates were treated to fine bird and dolphin demonstrations by knowledgeable and passionate staff.

Friday is traditionally a busy part of the conference schedule, with a plenary and the all-important meeting of EAZA Council. The plenary, chaired by Dr Christina Hvilsom of Copenhagen Zoo and EAZA Research Committee Chair Dr Zjef Pereboom of Antwerp Zoo, provided eight presentations covering a wide range of perspectives on the new Biobank Working Group. The speakers introduced the science (molecular biology), the veterinary practice, population management applications, potential legislative obstacles (Nagoya), research applications, and *in situ* conservation support that the biobank project offers, as well as showing the links that the project has with external organisations. The data recording aspect of the project was also introduced. The project is plainly becoming an important resource for zoos and conservationists and

will continue to develop as techniques and participation improve.

In the afternoon, the Association's Extraordinary General Meeting passed changes to the EAZA Constitution, and following this important decision, the EAZA Council was convened to discuss and provide decisions on a number of issues. These can be seen in the Noticeboard section at the beginning of this issue of *Zooquaria*.

Saturday's first plenary looked at animal welfare and was chaired by Dr Holly Farmer of Paignton Zoo and Chair of the Animal Welfare Working Group. Holly introduced the work of the group, and was followed by Dr Robert Young of Salford University in the UK, who presented his work on the use of sound monitoring and recording to measure behaviour and welfare in a wide range of species. Dr Lisa Holmes and Graeme Dick presented on the use of GPS tracking technology to monitor animal behaviour and welfare, such as roaming distances in the wild and in zoos; they also presented the results of an experiment conducted by placing GPS trackers on delegates attending the zoo visit on Thursday. Dr Gerardo Garcia of Chester Zoo in the UK presented his work on the use of thermal imaging technology to gauge animal welfare, including reading the stress levels of animals under a number of conditions, and to provide optimal conditions for individual species.

Late in the afternoon, EAZA Chair Thomas Kauffels closed out the conference with the presentation of five lifetime achievement awards, presented by close colleagues to Leif Blomqvist, Lydia Kolter, Nate Flessness, Tine Griede, Nick Lindsay and Bryan Carroll. Jean-Jacques Lesueur presented the EAZA flag to the 2019 host of the EAZA Annual Conference, Luis Angel Martinez of Bioparco Valencia. The final plenary was followed by an excellent dinner, which included a demonstration of local dance as well as one of a more inclusive nature, at the Vorres Museum adjacent to Mt. Hymettos.

EAZA would like to thank the staff and management of Attica Zoological Park, the conference organiser Convin, and all of the speakers and delegates. You can find the proceedings of the conference on the EAZA Member Area website, and video recordings of all plenaries on the EAZA YouTube channel. We look forward to seeing you in Valencia!



# SONGBIRD ON THE BRINK

HOW THE THREATENED ASIAN SONGBIRD ALLIANCE HAS BROUGHT THE JAVAN GREEN MAGPIE BACK FROM THE BRINK OF EXTINCTION

Andrew Owen, Curator of Birds at Chester Zoo, EEP Coordinator for the Javan Green Magpie and Co-Vice-Chair (conservation breeding & reintroduction) IUCN Asian Songbird Trade Specialist Group

The warm, humid afternoon air was thick and oppressive. It was filled with sounds: the annoying buzz of a mosquito too close to my ear, the mechanical whirrs and screams of cicadas starting their evening serenade, a Javan gibbon's call echoing through the distant forest – but no birdsong could be heard.

It was 2014 and I was with a team of Indonesian biologists, searching some of Java's most remote forests for the Javan green magpie (*Cissa thalassina*), one of Southeast Asia's most threatened and elusive species. So far, our searches had been in vain. Rumours of birds surviving in these ancient forests were nothing more than that; and worse still, we heard stories of bird trappers getting there months or years before us to catch the last remaining birds.

Suddenly the unmistakable loud ringing call of a Javan green magpie 'Ekek geling!' was heard in deep vegetation, no more than 100 metres from us, quickly answered by a second bird. Then silence. We could barely control our emotions and our hearts raced as we desperately scanned the forest for any sign of movement or a glimpse of a bright green bird behind the green wall of vegetation. We waited until nightfall and returned to the forest at dawn the next day, but to no avail; this mysterious bird had eluded us again.

We left the forest with mixed feelings – disappointed to have not actually seen the bird, but elated by the knowledge that it still existed. Prior to our encounter, it had been almost 10 years since it had last been seen in the wild by an ornithologist.

The Javan green magpie really is a species teetering on the brink of extinction. It was given full species status in 2012, when *Cissa thalassina* was recognised for its taxonomic uniqueness, separated from other green magpies by its distinctive morphology and vocalisations.

Soon after this revision, it became clear that the species was rapidly disappearing, and that without urgent action it would be lost for ever.

Through the direction of TASA, EAZA's very own Threatened Asian Songbird Alliance, a plan was hatched – to find and rescue any Javan green magpies from the trade, or those that might be held by private bird keepers and establish an assurance population.

Cikananga Wildlife Centre, with its threatened-bird conservation-breeding aviaries, was the obvious choice to

pioneer this project, as a number of EAZA zoos were already actively supporting their work and were able to help guide the project.

### FIRST STEPS

After months of searching, a few individuals were found in remote villages in the hands of private keepers or on dirty market stalls. These birds were often long-term captives with no provenance of when or where they were trapped. Their faded dull-blue plumage was the only indication of the time they had spent in captivity.

Maggies of the genus *Cissa* are unique in that they require a certain yellow pigment (lutein) obtained from their mainly invertebrate diet to maintain their vibrant colouration of bright apple-green plumage and coral-red bill and feet. Without this, they fade to washed-out, pale blue versions of their former selves.

Within a few months of arriving at the breeding centre and receiving the correct natural diet, the birds started to regain their beautiful colours and were showing signs of breeding.

The first chick was hatched and successfully reared in 2013, and in the years that followed, more founder birds were rescued, husbandry skills were perfected by local staff trained and mentored by EAZA zoo avian managers and volunteers, and breeding has increased.

With the population steadily growing, the next step was to establish a network of satellite populations in the region with good zoological institutions working together to build a strong 'safety-net' population.

However, in 2014, disaster struck, when during a series of night-time raids on the Cikananga centre, a total of 142 Critically Endangered birds were stolen. Only one Javan green magpie was taken, but the thefts, thought to have been carried out by gangs linked to the illicit illegal bird trade, decimated the breeding programme for the equally rare Black-winged myna (*Acridotheres melanopterus*).

These shocking events only increased our urgent need to move birds and reduce the risk, so in 2014, the Taman Safari Indonesia (TSI) zoo near the city of Bogor, received five birds from Cikananga. TSI is a

large zoological institution with four separate zoos spread over Java and Bali, already actively supporting the conservation of a number of other threatened Indonesian species.

Additionally, it was now felt that to avoid the potential risk of further catastrophe (through theft or disease outbreak), we should move some of the birds out of the region. With the help of Taman Safari, who quarantined birds from Cikananga and helped with the complex transport arrangements, six pairs of Javan green magpies finally arrived in Chester Zoo in October 2015 after a nail-biting 38 hours in transit, which involved delays, last-minute negotiations with government agencies and missed connecting flights.

After quarantine at Chester, four pairs were moved to their new facilities at the zoo and pairs were sent to Jersey Zoo and Prague Zoo, both EAZA institutions with excellent songbird breeding experience.

An EEP was started in 2016, which was the first of its kind working with such a threatened bird both in Europe and in its range country.

### STEADY PROGRESS

Two years on and the albeit still small *ex situ* population is looking remarkably healthy, thanks to successful breeding taking place at Chester, Prague and Jersey. Both of the latter received second pairs of birds in 2018, as did two new EAZA songbird specialist institutions, Waddesdon Manor and Newquay Zoo, each of which received pairs in 2018. Taman Safari Prigen, TSI's park in East Java, took five pairs of Javan green magpies from TSI Bogor in early 2018 and have recently fledged their first chick.

With a 100 per cent known pedigree and an overall gene diversity of 94 per cent in the living population and an annual growth rate of 17 per cent (based on the past three years), this project makes other studbook keepers rather envious! We are learning a great deal about the biology, dietary and breeding requirements for this wonderful species and the first EAZA Best Practice Guidelines are currently in preparation.

The Javan green magpie EEP is the first such programme for a bird species to be officially approved under the new EEP structure.

This magpie is, of course, the flagship species for EAZA's Silent Forest campaign and one of the campaign's projects is ornithological surveys of west and central Java's most important mountain forests. This vital work has already started and is being carried out by local BirdLife partner Burung Indonesia, Manchester Metropolitan University and other local stakeholders. The data gathered will help to inform decision-makers and provide scientific evidence for the need for further forest protection as well as feed into a recovery plan for the species.

The conservation of the Javan green magpie is a perfect example of what we now call the One Plan approach.

Real progress has been made in a very short period of time. Birds have been recovered from the trade and a conservation-breeding programme has been initiated across two geographic regions. Husbandry methods are being perfected and shared between participating organisations. Education initiatives have begun with Chester Zoo's Discovery & Learning team, working with local communities around Cikananga, and Taman Safari's KASI foundation is doing the same around its zoological parks.

Of course there is no room for complacency, as the known global population is still tiny; with only 68 birds kept in eight institutions across two regions, the future of the species still hangs in the balance. Birds still occasionally turn up in bird markets, but numbers in the wild are believed to be extremely low.

The Indonesian government has recently added the Javan green magpie and other threatened songbirds to its protected list, and it is hoped that stronger law enforcement will help protect this species for future generations.

The next steps are for conservation practitioners from multiple disciplines (avian managers, field biologists, reintroduction specialists, veterinarians, educators, government authorities and NGOs) to work together to develop a conservation action plan for the species.

It is hoped that in the future, Java's verdant mountain forests will once again echo with the calls of this wonderful and mysterious bird.



# Reaching across the world

THE 73RD WAZA ANNUAL CONFERENCE APPROVED A RAFT OF GLOBAL INITIATIVES THAT WILL EXPAND AND STRENGTHEN ITS REACH AND INFLUENCE

Doug Cress, Chief Executive Officer, WAZA

At the 73rd WAZA Annual Conference, held on 21–25 October in Bangkok, Thailand, the World Association of Zoos and Aquariums (WAZA) stepped further into the international arena by voting to organise a high-level Global Species Congress that will align with major biodiversity summits.

WAZA delegates also committed to sustainable forestry guidelines, approved a WAZA Global Strategy that will bring more than 100 new institutions and associations into WAZA, and voted to close one of Thailand's most notorious zoos. More than 250 delegates from 46 countries heard keynote speakers such as United Nations Messenger of Peace Dr Jane Goodall (pictured), crane expert Dr George Archibald, Forest Stewardship Council director Kim Carstensen, and Thai conservationist Professor Pilai Poonswad.

The 73rd WAZA Annual Conference was the first-ever staged in Southeast Asia. WAZA delegates visited the Khao Kheow Open Zoo outside Bangkok midway through the conference, and the WAZA Secretariat worked closely with the Zoological Parks Organisation (ZPO) Thailand to ensure the conference ran smoothly.

WAZA honoured former Sedgwick County Zoo director Mark Reed with the WAZA Heini Hediger Award, an accolade given to leaders in the global zoo and aquarium community. Reed, who retired in 2016 after 37 years at the Kansas institution, also served eight years as a member of the WAZA Council.

The WAZA Conservation Award was given to Taronga Zoo in Australia, while the WAZA Environmental

Sustainability Award went to Wellington Zoo in New Zealand.

'WAZA is in an exciting position, poised to tackle critical global issues going forward,' said WAZA President Dr Jenny Gray. 'The annual conference really saw the global zoo, aquarium and conservation community coming together and taking decisive action on significant matters. WAZA and its members are becoming a global force for change.'

WAZA delegates embraced the WAZA Global Strategy, which calls for the rapid expansion of the membership into regions and countries in Asia, Africa and Latin America where WAZA had little or no impact to date, and an emphasis on recruiting more aquariums to better equip WAZA to address marine and freshwater issues. As many as 135 new members could be fast-tracked into WAZA in 2019.

WAZA also agreed to take the lead in organising a Global Species Congress in the coming years, based on a 2008 resolution by the International Union for the Conservation of Nature (IUCN) that called for an international summit 'to highlight the status of the planet's species, articulate and review the consequences of the threats that they face, and chart their future conservation'.

'WAZA is uniquely placed to play a leadership role in staging a Global Species Congress,' said WAZA Executive Director Doug Cress. 'An international forum that focuses squarely on species is long overdue, and will play an important role in aligning with major assemblies on environment, biodiversity and conservation in the years ahead.'

WAZA expanded its suite of sustainable development agreements in Bangkok, signing a Memorandum of Understanding with the Forest Stewardship Council (FSC) that called on 50 per cent of WAZA members to be committed to sourcing 70 per cent certified sustainable wood and paper products by 2023. FSC, meanwhile, agreed to increase its FSC-certified forests globally by 50 per cent by 2023, with an emphasis on natural forests in tropical regions.

One year ago, WAZA signed MoUs with United Nations Environment to eliminate single-use plastic among 50 per cent of the membership by 2023, while a similar MoU with the Roundtable on Sustainable Palm Oil (RSPO) committed at least 50 per cent of the members to using only certified sustainable palm oil.

WAZA delegates also took the bold step of resolving to close the Pata Zoo, a dilapidated institution atop the Pata shopping mall in downtown Bangkok, which includes endangered species such as gorilla, bonobo, rhinoceros hornbill, Komodo dragon, chimpanzee and orang-utan among the 300 animals in the two floors of exhibits. Numerous WAZA delegates visited the zoo during the conference – including Dr Goodall, who in her keynote address called on WAZA delegates to act – and WAZA passed a resolution to help improve welfare and husbandry standards at the Pata Zoo, as it works with Thai government officials to close the zoo as soon as possible.

The 74th WAZA Annual Conference will be held on 3–7 October 2019 in Buenos Aires, Argentina.

# Amphibians and EAZA: Updates from the Amphibian TAG and conservation partners



CLOCKWISE FROM ABOVE: BONY-HEADED TOAD © BENNY TRAPP; MONTSENY BROOK NEWT; PIPA FROG; ANDRIAS DAVIDIANUS ENCOUNTERED IN GUIZHOU PROVINCE © ZSL LONDON ZOO



# Action for amphibians

COLLABORATION AND CO-OPERATION ARE THE KEY TO SPECIES SURVIVAL

Candace Hansen-Hendrikx, Director of Operations, Amphibian Survival Alliance

A world that is unsafe for amphibians is unsafe for other species, including us, and saving amphibians has never been more important than it is now. The proportion of amphibian species threatened with extinction is now more than 40 per cent, making them the most globally threatened vertebrate group.

Although their contributions often go unnoticed, amphibians are an intrinsic part of our lives. Their skin secretions may offer hope in the battle against antibiotic-resistant bacteria, AIDS, Alzheimer's, cancer and numerous other diseases. Studies using amphibians as model organisms have facilitated many Nobel Prize-winning advances in science and medicine. Amphibians are an essential part of our living world, alerting us to adverse environmental change. Their loss will have profound repercussions for our world.

Home to over 7,900 species, our world is becoming increasingly unsafe for amphibians. Their loss is being driven by many familiar problems, including habitat destruction, climate change, disease, invasive species, pollution and unregulated use and trade. These problems are extremely pertinent to us, and to all species. And they require collaborative solutions.

The Amphibian Survival Alliance (ASA), established in 2011, is building an active and collaborative global partnership committed to creating a better world for amphibians through coordinated conservation action. Since 2016, ASA has progressed through a re-structuring period, including the development of a new strategic plan to guide our actions from 2017 to 2021. Using this new strategy, we have focused our efforts over the past year on strengthening both our governance and our partnership. We have now entered a new and revitalised period where we are more accountable to our Partners, and better designed to address the ongoing challenges of amphibian conservation.

Over the past year, we have focused on working more closely with two key coordinating bodies in global amphibian conservation, the IUCN SSC



Amphibian Specialist Group (ASG) and Amphibian Ark (AArk), to achieve our shared vision of 'Amphibians thriving in nature'. As part of our new governance structure, both of these bodies now act as ASA Advisors. This better reflects how our three networks relate to each other, and how we can support each other most effectively.

ASA is continuing to work towards a world where amphibians are valued for their beauty, variety and contributions to the planet. But it is our Partners who are at the forefront of this movement to secure a better future for amphibians. We wanted to share with readers some of the many highlights of the incredible work that our Partners have undertaken over the past year alone, which is already making a positive impact.

At the end of July 2017, the world lost a founding father of amphibian conservation, Dr George B. Rabb. Just a few weeks before George passed away, he agreed with Adam Sweidan – Founding Trustee and Chair of **Synchronicity Earth** (SE), an ASA

Partner – that an Amphibian Fund in his honour could be created. This will provide an annuity stream of strategic funding, thus easing the need for short-term fundraising to sustain the work of ASA. It also provides donors with a funding structure that not only grows their donation, but also puts it to work in the timeframe required for action.

SE has been funding and contributing staff time to complete the Second Global Amphibian Assessment. Led by the IUCN SSC Amphibian Red List Authority (ARLA), this initiative updates the conservation status of all amphibians on the IUCN Red List. This support has enabled 221 new and updated species assessments to be published for six priority regions of Chile, Colombia, Ecuador, Madagascar, Panama and West and Central Africa. A total of 1,051 amphibian species are under review with their support.

In 2016 the **Durrell Wildlife Conservation Trust**, ASA and ASG Madagascar began to implement The Critical Ecosystem Partnership Fund

(CEPF) project ‘Building a Future for the Amphibians of Madagascar’; its goal is to strengthen national co-ordination of amphibian conservation in Madagascar and help to implement the New Sahonagasy Action Plan. A network is now being developed for Malagasy organisations engaged in amphibian survey and monitoring to bring groups together to share knowledge and experiences; to help build capacity and offer advice; to identify grant and funding opportunities; and to provide a platform to share information. In addition, staff are identifying groups that can help to develop an amphibian education programme to build in-country awareness and knowledge of their unique amphibian fauna.

Using the Amphibian Conservation Action Plan (ACAP) as its guide, **Global Wildlife Conservation (GWC)** has put amphibian conservation among its highest priorities. GWC has been supporting projects and initiatives that feed into the IUCN Red List for numerous groups of species, including the Global Amphibian Assessment update, run by the ARLA. Its support ensures that current extinction risk assessments are available to the global conservation community.

In addition, GWC has raised over

\$44,000 to expand the Yal Yunin Yul Witz Amphibian Reserve in Guatemala in collaboration with **Fundaeco**, and, as part of their Search for Lost Species programme, protected more habitat for the recently re-discovered Jackson’s climbing salamander (*Bolitoglossa jacksoni*), whose status had been unknown since its discovery in 1975, as well as for two other rediscovered salamanders (*Bradytriton silus* and *Nyctanolis pernix*) and an entire community of rare and endemic Guatemalan wildlife.

**Zoological Society of London**

(ZSL), through a Darwin Initiative-funded project on Chinese giant salamanders, revealed that not only is the world’s largest amphibian extremely depleted or functionally extinct across large areas of its natural range, but also that it actually appears to comprise at least five distinct genetic lineages, some of which are now exceedingly rare and possibly extinct in the wild. Four EDGE Fellows were involved in the Chinese giant salamander project. In addition, five early career conservationists supported through EDGE Fellowships are currently working on the purple frog (*Nasikabatrachus sahyadrensis*), Madagascar frog (*Mantidactylus pauliani*), granular salamander (*Ambystoma*

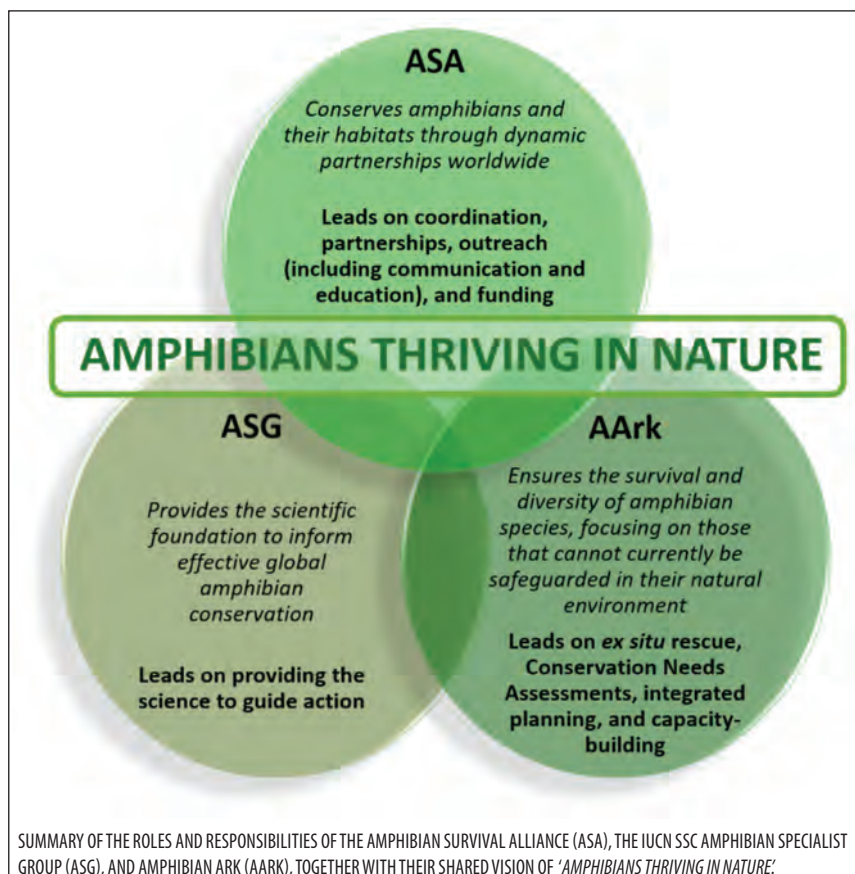
*granulosum*), El Rincón stream frog (*Pleurodema somuncureense*) and Botsford’s leaf-litter frog (*Leptotalax botsfordi*). ZSL staff members were also part of several key research publications including a long-term study published in *Science* identifying Asia as the hotspot for all chytrid fungi that infect amphibians, and the point of origin of the global pandemic *Batrachochytrium dendrobatidis* (Bd), and how variants are circulating in the global amphibian trade. They were also part of research on the open source method for isolating chytrid fungi while minimising impacts on wild amphibian populations.

Key amphibian areas saw increased protection thanks to the **Rainforest Trust (RT)** in 2017. Sites protected this past year include the Caloola Nature Refuge and Daintree National Park in Australia, Cerro Amay in Guatemala, Cerro Chucantí Private Nature Reserve in Panama, El Dorado Bird Reserve in Colombia, and Río Canandé and Tapichalaca Reserves in Ecuador. All are key to preventing the loss of critical habitat for threatened amphibians.

RT also provided funding to support the amphibian update on the IUCN Red List, in particular the assessment or reassessment of over 1,000 species in collaboration with ASA Partners GWC, SE, and IUCN. RT joined the **Key Biodiversity Areas (KBA)** Partnership alongside ASA in 2017, protecting places that include vital habitats for threatened species. Through this partnership, RT is contributing to conservation efforts for species that are often overlooked by other conservation campaigns, including amphibians.

Finding effective remedies to the global amphibian extinction crisis demands cooperative, focused and continuous attention from a wide variety of organisations and individuals. ASA Partners are making incredible progress in many directions to make this world a better and safer place for amphibians. But there’s still much more to be done.

While our goal is to further catalyse collaborations within the partnership, we are also looking to bring in new partners, groups whose expertise complements and enhances that of the existing partnership by bringing innovation and positive changes to amphibian conservation. If you would like to learn more, please contact me at [cmhansen@amphibians.org](mailto:cmhansen@amphibians.org).



# Fighting for their survival

A DECADE IN THE LIFE OF THE GLOBAL AMPHIBIAN CONSERVATION MOVEMENT

Dr. Ariadne Angulo, IUCN SSC Amphibian Specialist Group, Jennifer Luedtke Global Wildlife Conservation, Marcileida Dos Santos, IUCN SSC Amphibian Specialist Group, Phil Bishop, IUCN Amphibian Specialist Group

We are living in an unprecedented period of human history, as much for its technological developments as for the consequences of unabated human population growth and environmental resource use. The consequences are such that we are now considered by many to be in the midst of the Anthropocene, a geological era moulded and defined by human activity. Among the most notorious hallmarks of this era are increasing carbon dioxide emissions, loss of natural habitats, global-scale pollution and degradation of fresh water.

We are also undergoing a sixth mass extinction event, at the forefront of which are amphibians, the most imperiled vertebrate class on earth. Stories of mysterious recent declines from pristine areas across the world were shared anecdotally at the First World Congress of Herpetology in 1989, raising concerns that these losses could be a global phenomenon. The Declining Amphibian Populations Task Force (DAPTF) was subsequently established to determine the nature and causes of the declines. The DAPTF raised funds for seed grants to support amphibian decline research projects in key areas, resulting in nearly 200 publications over 15 years.

In the early 2000s a major multi-partner initiative, the Global Amphibian Assessment (GAA), used the IUCN Red List methodology to assess the extinction risk of all amphibians. At the time of its publication in 2004 the picture that emerged was alarming: at least one in every three amphibian species was threatened with extinction. Causes were varied, but habitat loss was the most ubiquitous, and emerging diseases the most immediately lethal for certain species.

This launched international efforts to address the declines and extinctions, starting with an Amphibian Conservation Summit (2005) and the subsequent publication of a global Amphibian Conservation Action Plan (ACAP). First published in 2007,

updated in 2015 and available online, ACAP is the global conservation roadmap for this class of animal. The IUCN SSC Amphibian Specialist Group (ASG) was established in 2005 from an amalgamation of the DAPTF and the Global Amphibian Specialist Group (GASG), initially focused on habitat protection and on the science needed to inform conservation action. The Amphibian Ark (AArk) was launched in 2006 to focus on *ex situ* conservation. In 2008 the zoo community led the Year of the Frog (YOTF) campaign, and this issue of *Zooquaria* marks its 10-year anniversary. Then the outcomes of the 2009 Amphibian Conservation Mini-Summit facilitated the formation of the Amphibian Survival Alliance (ASA) in 2011 to coordinate conservation action.

Today, these three global networks – ASG, AArk and ASA – work together to achieve a shared vision of ‘amphibians thriving in nature’.

## EXTINCTION RISK

While the YOTF campaign was underway, the GAA was updated to include more species. The full results of the initiative were published in the *Threatened Amphibians of the World* book and also made available on the IUCN Red List of Threatened Species (Red List). The GAA was instrumental in shaping the global amphibian conservation movement as we know it today. At present, the ASG’s externally funded Amphibian Red List Authority, established in 2009, continues this work of assessing extinction risk.

Red List assessments help inform scientists, conservation organisations, foundations, individual donors, governments and international agreements, and therefore underpin much of global amphibian conservation action. As of July 2018, the Red List contains 6,682 amphibian species. Of these, 32 are Extinct and two are Extinct in the Wild; for the latter, populations in human care are staving off total extinction. There are 2,100

(31%) species in a Threatened category (Critically Endangered, Endangered, Vulnerable) and of equal concern is the large proportion (22%) of Data Deficient (DD) species, of which it is estimated the same proportion of the total assessed species (31%) will also eventually be assessed as Threatened as new information becomes available.

The number of species has grown by 25 per cent in the last decade, from 5,915 in 2008 to more than 7,900 in 2018 (Amphibian Species of the World 6.0). Unfortunately, the proportions of Threatened and DD species in 2008 and 2018 are broadly similar, with 32 per cent at high risk of extinction and 23 per cent lacking sufficient information for a full assessment. However, these proportions are preliminary, as 55 per cent of the species assessed between 2004–2008 require updating. Furthermore, an additional 1,218 species need to be assessed for the first time for the Red List. This high rate of species descriptions and the need to update old assessments represent a challenge and a priority for the conservation community if the Red List is to continue guiding strategic actions.

In 2008, 63 per cent of all amphibian species were known to be affected by some form of habitat loss. Pollution ranked as the second most pervasive threat (19%), followed by fire (10%), disease and invasive species (8% each). Today, we still have the same proportion of species affected by habitat loss (63%), with a minor reduction in the proportion affected by pollution (17.5%), a small increase in the proportion affected by fires (11%), and marginally more species affected by disease and/or invasive species (18% combined). Again, these figures may change as amphibians are reassessed.

One of the most complex and perplexing threats highlighted during the GAA and YOTF was the role of emerging infectious diseases in amphibian declines. Since then, our





THE COVER OF THE IUCN SSC AMPHIBIAN CONSERVATION ACTION PLAN



THE GREEN-EYED BUSH FROG (*RAORCHESTES CHLOROSOMMA*), ONE OF THE SEVERAL HUNDRED CRITICALLY ENDANGERED AMPHIBIAN SPECIES

understanding of amphibian chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*) and how it operates has increased considerably, although there are still no widespread acceptable mechanisms to eradicate the fungus once it is present in an area. A second species of lethal chytrid fungus, *Batrachochytrium salamandrivorans* (*Bsal*), was identified in the last few years. *Bsal* originates from Asia and has travelled to Europe via the pet trade, where it has decimated native salamander populations. The interplay between trade and emerging infectious diseases could be deadly to naïve salamanders, so international efforts are being coordinated to prevent *Bsal* from entering North America, the world's salamander hotspot.

### YEAR OF THE FROG

The aim of the YOTF was to increase amphibian conservation efforts by raising public awareness, promoting amphibian conservation by zoos, aquariums and botanical gardens, and raising funds to address the amphibian crisis.

A questionnaire-based survey of 43 zoo curators from 14 countries evaluated the campaign's impact and how it influenced amphibian conservation at zoos. Results indicated

that the campaign met some of its aims, such as strengthening zoos as fundraisers and global promoters of conservation. YOTF contributed to the improvement of amphibian husbandry research in zoos and motivated zoos to support efforts towards conservation of amphibians outside their own institution. For those zoos that invested in external projects, the majority chose to do so for *in situ* conservation. Few zoos invested in both *in situ* and *ex situ* conservation, but those that did were in developed countries and invested up to four times more in *ex situ* and three times more in *in situ* conservation than their counterparts. However, important tools such as the Amphibian Ark Conservation Needs Assessments, which helps prioritise the conservation of individual species, has not been widely used within the zoo community, and many of those surveyed were not aware of this tool. A future amphibian campaign would benefit from supporting effective collaborations between the scientific community and practitioners in zoos, particularly those zoos based in developing countries and in need of more research capacity, as well as connecting zoos to existing global amphibian networks such as ASG, AArk and ASA.

### CONCLUSION

Looking at the growth of the amphibian conservation movement over the last decade, it is clear that the ACAP has assisted in guiding targeted action, stimulated research that provides greater insights and new understanding, and built bridges and effective collaborations, which have flourished among key stakeholders at both the local and global levels. However, this growth is not commensurate with the current needs, and we still have some daunting challenges ahead. Some of these include raising awareness and nurturing behavioural change, building capacity in research and action, ensuring efficient coordination at all levels, and finding much-needed resources. It is therefore critical that networks and partnerships continue to grow and commit to addressing top amphibian conservation priorities together. Key to this growth and the vision of 'amphibians thriving in nature' is the inclusion of all relevant communities, including the important contributions of the zoo and aquarium community.

Please consider joining us in our effort to save amphibians or tell us about what you have been working on by contacting ASG Co-Chair Ariadne Angulo at [aangulo@amphibians.org](mailto:aangulo@amphibians.org).

# The year of the frog

TEN YEARS AFTER THE LAUNCH OF EAZA'S 'YEAR OF THE FROG' CAMPAIGN, WE ASSESS ITS ACHIEVEMENTS

Gerardo Garcia, TAG Chair and Curator of Invertebrates and Lower Vertebrates, Chester Zoo, UK

Ten years ago, EAZA launched the Year of the Frog Campaign, the first joint campaign between Amphibian Ark (AArk), the World Conservation Union (IUCN) Conservation Breeding Specialist Group, the IUCN Amphibian Specialist Group and the World Association of Zoos and Aquariums (WAZA). It was a unique approach, to run a global campaign with all the regional zoo associations to address one of the most rapid major mass extinctions we have ever faced. So, 10 years on, how has this campaign affected global amphibian conservation?

EAZA's Year of the Frog campaign fully supported the global campaign but added further goals to support European *ex situ* activities. Its targets were:

- to generate public awareness and understanding of the amphibian extinction crisis;
- to raise funds for implementing the *ex situ* aspects of ACAP (Amphibian Conservation Action Plan);
- to encourage further EAZA Member participation in amphibian *ex situ* conservation, and
- to raise awareness and funds to support and supplement the activities of the EAZA AArk.

In addition, the ultimate goal of this campaign was to achieve a more active position in the IUCN and the zoo community as leaders in global conservation.

Fundraising for the campaign was a challenging strategy, as there weren't specific projects to support; instead there was a global grant system, where anyone in the world could apply for amphibian conservation support. It was totally new for EAZA, but provided opportunities for institutions, researchers and organisations to engage in amphibian conservation. The results were pretty successful; the campaign raised over €418,000, which was used to directly support grants for 29 projects related to a range of topics associated with amphibian conservation.

Meanwhile a small group from the Amphibian TAG (ATAG) has been

working hard, developing responses to the huge wave of challenges that this taxon is facing *in situ* and in our institutions. A great deal of time has been spent on raising the value of amphibians in our institutions, addressing animal welfare and the sustainability of populations in human care, developing applied research and connecting with *in situ* conservation. Putting amphibians on the agenda of EAZA institutions, particularly considering collection plans and exhibit planning, became an important objective. We wanted to move amphibians away from being just an 'accessory' to playing a key role.

To achieve these objectives, we developed multiple husbandry and conservation workshops and courses in different countries, supported by a wide range of professionals building capacity around the whole organisation. Amphibian animal and veterinary staff from EAZA institutions working in conjunction with field researchers and private breeders formed a core group with a single objective – to support amphibian conservation.

The difficulties of working with these species were increased by the threat of emerging diseases such as *Bd* and *Bsal*. These significantly constrain the moving of the taxa between institutions and potential translocations. To address the situation, we immediately implemented quarantine protocols and facilities, and we continue to progress.

At the beginning of the campaign, there were only a symbolic number of species in monitoring programmes (in fact, it was only the mountain chicken frog in 2008). It was very difficult to persuade our colleagues to lead on new species programmes, as they were wary of the technical challenges of using SPARKS to record tadpoles and clutches. Fortunately, ZIMS arrived just in time, and we now have six high-profile species programmes, and more are being developed.

Highlighting the efforts of institutions reinforces the need to increase the

diversity of *in situ* programmes and also builds bridges between institutions and amphibian *in situ* conservation. The initiatives that many of you have taken have encouraged other institutions to have amphibians in their collection and support conservation efforts.

Since 2008, diverse analysis and initiatives have been published by different organisations and researchers, identifying gaps in the conservation of amphibians. They also highlight the need for zoos and aquariums to be more effective in their species selection and conservation impact for this group. Many of them stress the importance of where to work and which species to work with, but unfortunately many of them fail to fundraise successfully for these strategies. Why do we not succeed at this, and what are we missing in the process? There are probably several reasons, as these problems are not unique to amphibians but occur with other taxa, too.

All of us in EAZA are facing new challenges and we must be pro-active. The Amphibian TAG has been invigorated by new participants (and we're still looking for more) and a new strategy is in progress. A new Regional Collection Plan is providing a more effective selection of species to focus on, and animal health and welfare topics are being discussed. The applied research approach has been expanded further, proving how complex amphibians are (whereas in the past it was thought that they were 'cheap and easy to breed'). Conservation *in situ* requires thorough analysis and a global approach of conserving ecosystems in conjunction with other groups. It is clear that joining forces with groups working with other taxonomic species such as mammals and birds (as for invertebrates or fish) rather than working in isolation is more likely to result in long-term success.

There are very exciting times ahead for this TAG, and we are delighted to be getting increased attention and support from EAZA Members, which will surely increase in the years to come.

# Immaculate conservation

AN UPDATE FROM AN ATAG EEP BEGINS WITH THE CURIOUS STORY OF SOME MEXICAN NUNS, A COUGH SYRUP AND A CRITICALLY ENDANGERED AMPHIBIAN

Gerardo Garcia, EEP Coordinator and Curator of Invertebrates and Lower Vertebrates, Chester Zoo, UK

In June 2018, a minor media storm was whipped up around a story about amphibian conservation in Mexico – more specifically, the discovery by the Western media that nuns at a convent on Lake Patzcuaro are playing an important part in the breeding of achoque (*Ambystoma dumerilii*). The revelation that the Sisters of Immaculate Health have been including an unspecified ingredient derived from the species in their patent cough syrup for 150 years, and that their breeding had preserved important genetic diversity, was irresistible to the press. For the first time, a religious community was being associated with amphibian conservation.

Behind the headlines, however, there's a lot more to the story. The species, which lives only in the lake and is classified as Critically Endangered on the IUCN Red List due to a combination of factors (pollution, introduction of invasive fish and over-exploitation), is in serious danger of extinction in the wild. In the past, the salamander and another endemic of the lake, the whitefish (*Chirostoma estor estor*) used to be a popular local dish, sourced from the lake. Mass extraction of animals for human consumption fell from 19 tonnes to 2 tonnes in the four years from 1987, and since the early 1990s, bycatch of the species from the local fishery has nearly wiped out the last few animals in the lake, removing them from the local gastronomy and culture.

These days the achoque is found only at a couple of locations in the lake, according to local fishermen: These also are affected by fish louse and anchor worm infection from invasive fish species, whose impact on the remaining population is still unknown. However, there are several well-established breeding facilities for the species, including not just the stocks kept by the Sisters, but also populations held at the University of Michoaca in San Nicolas de Hidalgo, and at the Regional Centre for Fishery Research



(CRIP). A three-day workshop for all the stakeholders for this species, including from the EEP, was held in November 2017, and produced an action plan that united the facilities and EAZA in a number of urgent actions.

Gerardo Garcia, Chair of ATAG and Coordinator of the EEP, and Adam Bland, lead amphibian keeper at Chester Zoo, UK, visited Patzcuaro in April 2018 and the project team started tagging animals, using visual implant elastomers (VIE) for young animals and larvae, and passive integrated transponders (PIT) for adults. Tissue samples have also been taken, and analysis is ongoing to check diversity of all the populations and to develop microsatellites. All the stakeholders, including the nuns at the convent, are involved in these measures, which will lead to the development of a studbook for the EAZA population. EAZA and the Mexican stakeholders are jointly developing Best Practice Guidelines for the species, to allow for its wider distribution across our network.

Over the next year or so, the EEP and Manchester Metropolitan University in the UK will work to develop microsatellites and use the genetic samples to complete an analysis of diversity within the existing EAZA population and in the lake; with the studbook complete later in the year, active management of the population

will then be possible. The EEP will also appoint a veterinary advisor and Chester Zoo is currently providing an internship for a Mexican veterinarian, Erika Servin, to develop her skills with the species for application *in situ*. At Lake Patzcuaro, local stakeholders are developing survey techniques to study the current distribution of the wild population; a recapture study of marked animals will start once the techniques for marking are seen to work; and a wider evaluation of the different *ex situ* populations and their genetic diversity will also begin.

Another important factor, as with most conservation projects, is the education of communities in the vicinity of the habitat. The principal challenges will be to prevent further filling in of the lake and pollution through use of chemical fertilizer and discarding of refuse, and to reduce pressure from the fisheries on the lake. It is currently unclear whether a widespread eradication of common carp (*Cyprinus carpio*) and other introduced fish will become necessary – the two species appear to have coexisted for decades, but perhaps the additional pressures of pollution and bycatch may have made the coexistence unsustainable. As a result, getting local populations on side with the wider project is essential.

At present, achoque are kept at ZSL London, Vienna, Cerza, Dusseldorf, Zagreb and Chester Zoos – all derived from founders at Vienna and Turtle Island in Graz, Austria. Additional animals are kept by private breeders in Europe and the United States. With a species committee now formed, and the work well under way, the EEP will be looking for new holders soon. This is a very visible and important conservation project in which EAZA Members can play an important role. If you might be interested in keeping achoque at your institution, please contact Gerardo Garcia, EEP Coordinator: [g.garcia@chesterzoo.org](mailto:g.garcia@chesterzoo.org).



# Saving the lemur leaf frog

AN ESB UPDATE ON BRISTOL ZOO'S CRITICALLY ENDANGERED LEMUR LEAF FROGS

Tim Skelton, Curator of Reptiles & Amphibians, Bristol Zoological Gardens, ESB Keeper

The lemur leaf frog (*Agalychnis lemur*), is one of the amphibian jewels of Central America: a stunningly beautiful but delicate tree frog that occurs in just three small sites within Costa Rica. Classed as Critically Endangered (Cr) in the IUCN Red List of Threatened Species, this frog historically had a much more extensive range in Costa Rica, but has suffered huge declines over recent years due to habitat loss and disease outbreaks such as chytrid fungus.

Its current range includes Panama and Colombia, but it is thought that these populations may actually be a different species or sub-species, and so further work needs to be done here to clarify this situation.

Bristol Zoo obtained its first groups of lemur leaf frogs from Andrew Gray at Manchester Museum – part of Manchester University – back in 2001. At first we had some limited success maintaining and breeding small groups of the frogs in a back room of the reptile house, where the temperature was not as warm as in the main display area. We succeeded where many other institutions did not, and as a result, we have continued the relationship with Andrew and the Manchester Museum to the present day.

Moving forward, and inspired by the EAZA Amphibian campaign of 2007/2008, we raised sufficient funds to enable us to develop a purpose-built climate controlled ‘amphipod’ at Bristol Zoo. This became a reality in 2009, and we are now able to maintain lemur leaf frogs in near ideal conditions under permanent quarantine, enabling us not only to safeguard these frogs, but also to protect from invasive diseases the native amphibian species that reside within the zoo’s grounds.

In the early days, we maintained the frogs in small groups of four to six individuals and allowed breeding within these groups without determining individual parentage. However, for the last 10 years or so, we have been managing them as individuals on ZIMS and using photographic records to identify them accurately and to enable more accurate breeding records to be kept.

In 2014, through an MSc. project at Salford University in the UK and in conjunction with the Manchester Museum, we participated in a genetic study to have all of our lemur leaf frogs swabbed and tested in order to determine relatedness and

improve our information for future breeding recommendations. Frogs at Manchester Museum were also tested, and we paired up frogs based on heterozygosity values within this limited population. This unfortunately yielded very limited success and eventually we went back to a group-managed system, which meant that we had to have a representative from each clutch of spawn found in enclosures tested at the lab at Salford University to decipher its parentage.

In 2016 this breeding programme was officially recognised by EAZA as an ESB, and we now have 10 institutions holding and breeding around 134 frogs. However, only Bristol Zoo and Manchester Museum in the UK and Norden’s Ark in Sweden currently hold animals from the core genetically managed group. Other institutions have obtained ‘surplus animals’ in order to hone their husbandry skills before becoming involved with the core managed group in the future. Amphibian Ark *ex situ* management guidelines were produced in 2011 and we hope to use these to formulate official EAZA guidelines shortly.

Bristol Zoological Society’s heavy involvement in the new lemur leaf frog ESB in turn spawned a field expedition in 2018, in which colleagues visited the previously recorded localities of lemur leaf frog habitation, as well as others recommended by local amphibian specialists. Despite finding all other leaf frog species at various locations in Costa Rica, the lemur frog was seen only in the two artificially managed sites to which it has been translocated within the last 15 years. A relatively large proportion of Costa Rica, and particularly higher elevation forests, is under protection. But many locations that once hosted lemur leaf frog populations are now near major road routes, and have probably changed a lot in the last 40 years, so it is perhaps not surprising that there were no sightings here. It is important now to investigate the species in its known area of occupation, particularly as amphibian infection by the chytrid fungus seems to benefit from the higher temperatures that are found at the frog’s increasingly scarce lower elevation habitat in Costa Rica.

Only by pushing further to understand the species in its natural habitat can we hope to align future conservation action with what will benefit the species most.

# Amphibian advice

EAZA DIRECTOR OF COMMUNICATIONS DAVID WILLIAMS-MITCHELL SPEAKS TO AMPHIBIAN TAG VETERINARY ADVISOR JAVIER LOPEZ OF CHESTER ZOO, UK

**DWM: Javier, you are one of the veterinary advisors for the Amphibian TAG. Can you tell us how and why you became interested in treating amphibians?**

**JL:** I have always been interested in reptile and amphibian medicine. From very early on in my career, I have been involved with all sorts of amphibian work in zoos, and more widely with conservation projects around the world, such as the mountain chicken frog in Montserrat and the common toad and agile frog in Jersey. My Master's project, for instance, focused on understanding ranavirus in UK frogs. *(Editor's note: Ranavirus is a highly infectious disease affecting fish and amphibians, and is seen as being one of the major contributory factors to the decline of amphibian populations worldwide.)*

**DWM: Could you tell us more about your involvement with the TAG? How did you become their vet advisor, and what level of involvement do you have with them?**

**JL:** The TAG was aware of my work with amphibians, and they approached me to see if I would be willing to become one of the veterinary advisors for the TAG, along with Sue Thornton. (Sue is a partner at veterinary group IZVG, and has previously worked as a veterinarian at ZSL London Zoo). I was delighted to be asked and had no hesitation in accepting.

The Amphibian TAG has always been very proactive in getting the participation of their vet advisors, especially contributing to annual meetings through talks and workshops. The TAG has further expanded its involvement with veterinary practice and advice over the years, the appointment of one more vet advisor (Melanie Berthet, Besancon Zoo) and with increased integration with the TAG group. The TAG aims to have a veterinary advisor present and providing input at all regular meetings and catch ups of the TAG.



JAVIER CARRYING OUT A HEALTH CHECK

**DWM: Our readers will almost certainly be aware of the chytrid fungus, but could you give us an idea of other medical issues that are threatening amphibians both in the wild and in captivity?**

**JL:** Chytrid fungus *Batrachochytrium dendrobatidis* and *B. salamandrorans* remain the most serious pathogens affecting *Anurans* (frogs and toads) and *Urodela* (salamanders) across the globe and are continuing to have a devastating impact on wild populations. However, these pathogens are by no means the only ones. Many other diseases are causing damage to local populations as well as more widely, and new diseases are being reported as our skills at surveillance and diagnosis increase: *Ranavirus*, which is killing populations of multiple frog species through apoptosis and necrosis, dermatitis caused by *Bufo* *herpesvirus 1*, and so on. Since amphibians are linked to both terrestrial and aquatic environments, they will be affected by pathogen introduction in either biotope. With the effect of

global warming and increasing human encroachment, the prevalence or effect of amphibian diseases is likely to increase. In zoos and breeding facilities, infectious diseases can often be controlled through quarantine or treatment; as a result, husbandry-based illness such as metabolic bone disease, can be more prevalent than infection in controlled environments.

**DWM: And could you give us a summary of where we are at the moment in the fight against chytrid and *B. Sal*? How are they impacting zoo and other *ex situ* populations right now?**

**JL:** *B. sal* is a very important threat to *Urodela* and has had an impact in some European populations, but there is still a lot that we don't know about it in terms of how quickly it can spread and what species will be affected. Treatments have been tested for *B. Sal*, so as long as amphibians are screened before movement between facilities and enclosures and the disease is detected early, it should be treatable and we

DEAD BD-INFECTED ATELOPUS LIMOSUS AT SIERRA LLORONA (POSED TO SHOW VENTRAL LESIONS AND CHYTRIDIOMYCOSIS SIGNS)



should be able to eradicate it from *ex situ* populations. There has been legislation passed at European community level that shows the importance of this disease, and I am hopeful that this should help stop the spread of *B. Sal*. Chytrid continues to affect wild populations and there's no pathway yet to eradicating it in the wild; having said this, we are making good progress in treatment and control in *ex situ* populations.

**DWM: We have seen the establishment of biosecure facilities at EAZA Member zoos. Is this still seen as an important measure, or are efforts being moved elsewhere?**

**JL:** Biosecure facilities are, in my view, the best way to keep amphibian populations outside their natural range, particularly if they are destined for a conservation programme that will result in re-introduction to the wild. There is still a lot that we do not know about amphibian infectious diseases, including diseases that we may not have discovered yet so cannot screen for. Amphibians in human care could acquire pathogens from contact from other *ex situ* species if not maintained under strict isolation. These pathogens could be introduced into the wild during a reintroduction with unforeseen consequences, as has happened before with the Midwife toad.

**DWM: Zooquaria has spoken in the past to the Conservation Genetics Specialist Group Chair, who sees genetic alteration as an important new way for species to adapt to changing conditions such as climate change. We have also seen that some amphibians have a natural resistance to chytrid. Should we prioritise breeding of resistant animals, or attempt to eradicate chytrid in another way? Is there any long-term benefit to be gained from continuing to breed non-resistant animals?**

**JL:** It is normally natural selection that does this job in the wild. When a new pathogen arrives in a naïve population, it can have a massive impact on the host, as has happened with chytrid fungus in some species of frog. However, eventually, with time, both host and parasite tend to adapt to each

other, the former becoming more resistant and the latter less pathogenic. I can see that for some species there may not be enough time for parasite and host to coexist together in order to adapt to each other, and this may lead to extinction of the host. In this case, a managed genetic component could be useful in speeding up the process. One obviously would need to be careful to ensure that such management would not modify other desirable characteristics that already exist.

Eradication of chytrid in the wild is a more complex option, which has not worked so far and might entail having to remove amphibian carriers from that environment, followed by some means to prevent chytrid gaining access to the area again. This would mean preventing access for other wild amphibians and some means of biosecurity for access to the area – a very complex scenario in a wild population situation.

**DWM: From a veterinary point of view, if a zoo is looking to get more involved with amphibians, could you advise a good starting species? Or should they just get stuck in with species that urgently need conservation help, such as the mountain chicken?**

**JL:** Conservation should be at the heart of decisions to keep species in zoos. However, keeping amphibians is not easy, as they are fully dependent on us to provide the correct environmental parameters. Being dependent on water and land and having a massive variety of biological adaptations, they are probably among the most difficult taxa to keep. For this reason, in my view, it is best to start with an easy, sturdy model species, similar to the one that has been targeted for conservation, to develop the skills and methods before moving onto the delicate species.

**DWM: Assuming you occasionally get a day off, what do you like to do that has nothing to do with veterinary medicine?**

**JL:** Anything family related I love; from watching a movie together to going for a walk. Otherwise, reading, DIY or having a barbecue with friends all help me to get my head completely away from work worries.

# Amphibian Conservation



Highlighted species



Golden poison dart frog (*Phylllobates terribilis*)  
Conservation education



Montseny brook newt (*Calotriton arnoldi*)  
Breeding and habitat restoration



Palmate newt (*Triturus helveticus*)  
Conservation research

## 2007-2017 Contributions



3.9 million Euros



+22000 staff hours



63 projects



41 amphibian species



## Focus Supported Projects



Research



Species and populations



Conservation education



Eradication of invasive species



Ecosystem restoration



Raising funds



Worldwide projects

Data Source: EAZA Conservation Database - 1 August 2018

General support of amphibian conservation organisations  
65% €  
13.5% hours

18% €  
80% hours

4.5% €  
0% hours

6% €  
7% hours

6.5% €  
13% hours



# Resisting the alien invaders

A BULLFROG ERADICATION PROGRAMME IN FRANCE COORDINATED A NUMBER OF DIFFERENT MEASURES TO BRING THIS INVASIVE SPECIES SWIFTLY UNDER CONTROL

Eric Bairrão Ruivo, Science, Collection and Conservation Director, Beauval Nature, France, and Gabriel Michelin, responsible for fauna studies, Departmental Committee for Nature and Environmental Protection

Considered to be one of the 100 worst alien invasive species in the world by IUCN, the bullfrog (*Lithobates catesbeianus*) was discovered in Sologne, France in 2002. In the middle of a Natura 2000 site, its presence directly affects the indigenous populations of amphibians, which represent 50 per cent of the bullfrog's diet. They also feed on other prey such as snakes, birds and fish, which has a considerable impact on the biodiversity of the environment and on the fishing activity.

As it doesn't have any natural predators in this region, and due to the thousands of hectares of stagnant water

in Sologne, the bullfrog could have increased its territory by about 5km per year if an eradication programme had not been implemented after its discovery.

Several organisations, including associations, environmental police, the French administration and volunteers work together on this programme, which is financed by the French government, the EU and private institutions, in order to avoid breeding, expansion and the dispersal of the species. A number of measures have been put in place, starting with the search and removal of bullfrog clutches.

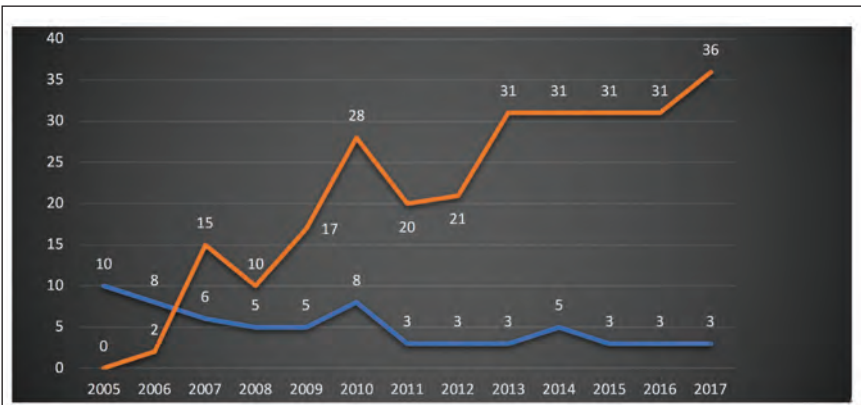


FIGURE 1: EVOLUTION OF THE NUMBER OF SITES WITH TADPOLES ACCORDING TO THE LEVEL OF SEARCH PRESSURE (SOURCE CDPNE). BLUE: NUMBER OF SITES WITH TADPOLES, ORANGE: NUMBER OF SEARCHES SOURCE CDPNE



TRAPPING BARRIERS

SHOOTING ACTION BY NIGHT



Twice a week, teams visit the colonised ponds to collect the eggs before they hatch. Originally, the removal of clutches was infrequent and uncertain, but at the time of writing, the most colonised sites are controlled twice a week (Figure 1).

Selective shooting, which is carried out with the same frequency as search and collection, makes it possible to collect breeding adults, for which the average weight and density has dropped since the programme was set up (see Figures 2 and 3). Estimates indicate that the breeding population of bullfrogs has dropped by more than 90 per cent since the programme began. Similarly, the individuals' weight has fallen by more than a half since the measures were put in place. All of these results are attributable to the selective shooting.

In addition, trapping barriers are placed around the ponds to stop the dispersal of all the metamorphosed juveniles, and tadpoles are removed from the pond.

The success of this programme lies in the synergy of the different measures that have been taken, starting with the early detection of the species in and around the colonised area. The use of environmental DNA (eDNA) makes it possible to locate the species quickly, even if it is present in low densities. This technique has been used since 2011, and the programme was





a pioneer in the eDNA use, allowing us not only to detect the presence of bullfrogs but also to confirm that it has been eradicated from some 20 formerly colonised ponds, demonstrating the effectiveness of the eradication programme.

Due to its success in Sologne, the programme has now become part of a national scheme funded by LIFE, called project CROAA (Strategic Control of Alien Invasive Amphibians), which harnesses new skills from academia and other sources. Coordinated by the Herpetological Society of France, the LIFE CROAA project aims to improve the conservation status of local populations of native amphibians, weakened by the presence of alien invasive species of amphibians such as bullfrog (*Lithobates catesbeianus*) and the smooth xenopus (*Xenopus laevis*). Its goals are as follows:

- **Identify and implement an optimal strategy** to control invasive alien amphibians.
- **Prevent the introduction** of new alien amphibian species by raising awareness among the various individuals and agencies involved,
- **Follow up** on invasive amphibian populations by developing a detection and early assessment system, based on the networking of local individuals with the required expertise (managers and scientists), and using all possible detection techniques including eDNA.
- **Communicate, inform and train** the public with regard to the problem of invasive alien species, in order to facilitate the acceptance of control operations, limit the risk of spread and create an alert network.

The best eradication programme for an invasive alien species is still, of course, the one that we do not need to perform. It is essential to raise public awareness of the dangers of introducing new species into a natural environment. Zoos and aquariums have an important role in raising this awareness, and the involvement of Beauval Nature with this programme is an example of what EAZA Members can do.

For more information on the participating organisations, go to:  
 LIFE CROAA: [www.life-croaa.eu](http://www.life-croaa.eu)  
 CDPNE: [www.cdpne.org](http://www.cdpne.org)  
 Beauval Nature:  
[www.beauvalnature.com](http://www.beauvalnature.com)

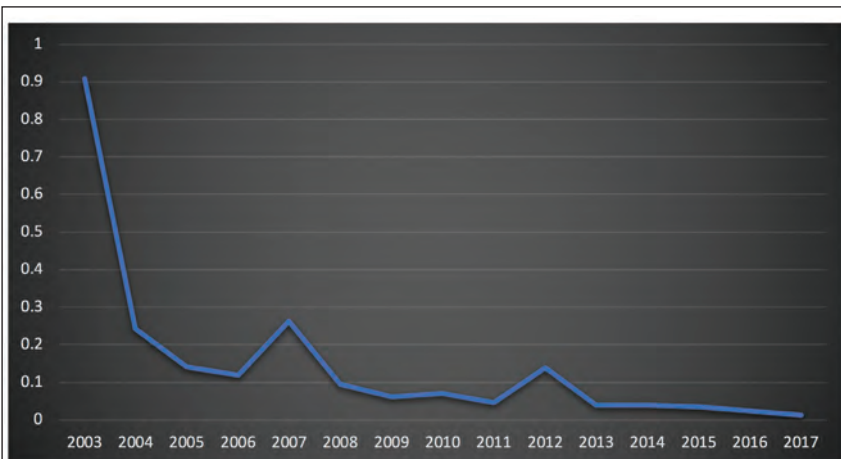


FIGURE 2 : ABUNDANCE INDEX OF INDIVIDUALS OVER 100GR (ADULTS) SOURCE CDPNE

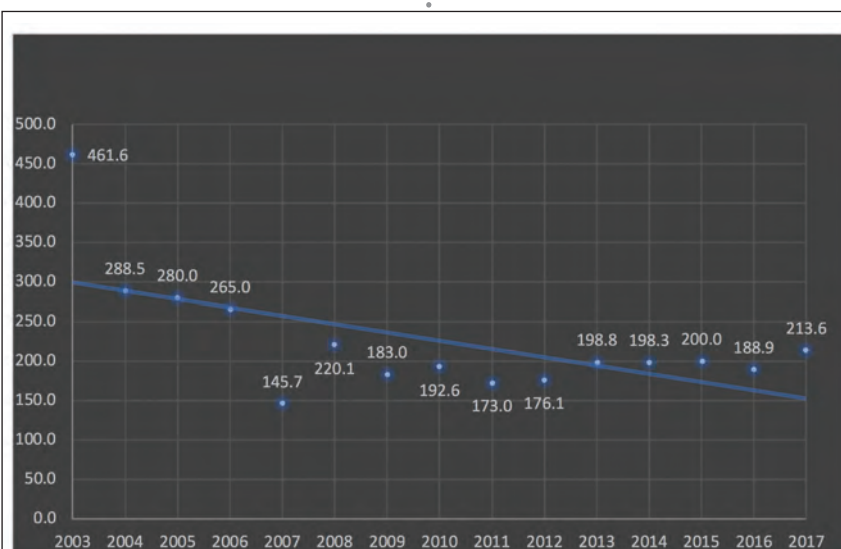


FIGURE 3 : AVERAGE WEIGHTS OF INDIVIDUALS OVER 100GR (ADULTS) SOURCE CDPNE



# Taking a leap

A DECADE OF DEDICATED EFFORT HAS ENSURED PROGRESS FOR DARWIN'S FROG CONSERVATION IN CHILE

Frank Oberwemmer, Conservation Officer, Zoo Leipzig, Germany

Inspired by the Year of the Frog Campaign in 2008, Zoo Leipzig became intensively engaged in amphibian conservation and decided to set up a breeding and research facility for Darwin's frogs (*Rhinoderma darwini*) in the city of Concepción (Chile), based in the grounds of the city's university. A five-year agreement between the zoo and the biological department of the university has secured the future of the project, which is now already in its second period. The IUCN Red List classifies this species as Vulnerable, but in 2013 it was suggested that the status be re-classified as Endangered, thanks to the alarming results of monitoring across the range area. One reason for this is undoubtedly the ongoing loss of temperate forest in central and south Chile, which is often turned into monoculture plantations. Whether the Chytrid fungus also plays a role is so far unproven, but cannot be excluded as a factor. The second species of this genus, *Rhinoderma rufum*, has not been recorded for over 35 years and seems to be extinct, the reason for which is not entirely clear.

At first, the breeding facility was co-funded through the EAZA Amphibian Conservation Fund in 2010 and 2011, and one year later, in 2012, a grant for monitoring and field work in the central Chilean private reserve Huilo-Huilo was allocated to the project. Since 2009, several hundred Darwin's frogs have been bred and many of them have survived to adulthood. This species, measuring around 2.5–3cm, has developed a special way of caring for the offspring, which can number up to 12: the male swallows the freshly hatched tadpoles into a vocal sac and keeps them there for around six weeks. They are released after their metamorphosis as 4–5 mm froglets and start to survive on their own.

Now that the project in its 10th year, what are the most recent developments?

First, Concepción University fulfilled its wish to expand the facility in order to keep a second threatened Chilean amphibian species. The Critically Endangered Vanzolini's Spiny-chest Frog (*Alsodes vanzolinii*) was chosen, which was

rediscovered in 2010 after decades of absence. Three new container rooms were added to the facility and four Vanzolini frogs were rescued from small patches of natural forest in the middle of plantations. Unfortunately no male has yet been found to start breeding attempts, but the search continues.

Another development concerns the Darwin's frog breeding: with no other holders in Chile available except the National Zoo in Santiago, after discussions in the EAZA Amphibian TAG, five zoos decided to import offspring to Europe to start a studbook. But the issuing of export permits by the Chilean authorities took a long time, and in the meantime a disease broke out at the end of 2016 which killed most of all *Rhinoderma* offspring, although the 20 founders were spared. Fortunately this disease came to an end in the summer of 2017, but the export to Europe has to be postponed for several years until new offspring have grown to a size of 2.5cm. It is suspected that this disease was caused by a bacteria or virus, but could not be detected in the labs of Concepción University and University Andres Bello in Santiago.

A third promising development is that public and scientific interest in the Darwin's frog has grown considerably thanks to the continuous media coverage. Professor Claudio Soto Azat from University Andres Bello Santiago, one of the main experts in this field, organised a public one-day symposium and a two-day workshop for all Chilean and Argentinean experts from universities, NGOs and state authorities to set up a conservation strategy at a national level. This took place in November 2017 and Zoo Leipzig was delighted to co-fund the meeting. A diverse strategy was developed, which is now being implemented by several stakeholders. Zoo Leipzig has signed an agreement with University Andres Bello to sponsor the measures needed to implement this strategy for the coming five years with a fixed annual grant.

Overall, we can say that the project has ensured a better understanding of the Darwin's frog's biology and inspired more activities for its conservation. But much more still has to be done to fight the extinction of this unique amphibian species.

# A giant challenge

HOW A TEAM FROM ZSL IS PLANNING A SUSTAINABLE FUTURE FOR THE CHINESE GIANT SALAMANDER

Benjamin Tapley, Shu Chen, Samuel T. Turvey and Andrew A. Cunningham, ZSL London Zoo, UK

The Chinese giant salamander (*Andrias davidianus*) belongs to an ancient group of salamanders (cryptobranchids) that diverged from their closest relatives during the Jurassic period. The species is considered a global conservation priority for maintaining evolutionary history and is assessed as Critically Endangered by the IUCN. The Chinese giant salamander (CGS) is protected by Chinese law, but wild populations are still in urgent need of protection. Population declines and local population extirpations have been attributed to overexploitation to supply a rapidly growing farming industry (Cunningham *et al.*, 2016) as well as habitat loss. Whilst millions of CGS are actively farmed in China, a proportion of farmed stock is released annually in local rivers as part of a government-endorsed conservation initiative. Unfortunately these releases occur without genetic or health screening and their impact is largely unknown. In 2010, ZSL and partners began a Darwin Initiative-funded project to develop the evidence base needed to determine future conservation action for this iconic species.

Despite its large size, the current CGS distribution is unknown. Historically the species was distributed across 17 Chinese provinces, but what little research has been undertaken has not been standardised and this has prevented comparison of results across study sites. We trialled and developed standardised techniques for ecological surveys (Tapley *et al.*, 2015; Tapley *et al.*, 2017) by incorporating methods that have been successfully used for other Cryptobranchid salamanders, including both active and passive survey techniques. We also trialled and developed standardised interview surveys (Pan *et al.*, 2016; Tapley *et al.*, 2017). Ten field teams received intensive training by experienced amphibian surveyors. Between 2013 and 2016 we conducted field surveys and interviews in 97 counties across 16 different provinces in what was possibly the largest wildlife survey conducted in China. These sites were selected from across the known

historical range of the species using a habitat suitability model, which we developed using open-source ecological data in combination with historical records (Chen *et al.*, 2018).

In the field we spent 7.20 cumulative person-weeks of active searching and 7.33 person-years of passive searching. During this time we detected 24 CGS at four sites representing a catch-per-unit-effort of 16.23 weeks per individual. At at least two sites where we detected CGS it is highly likely that the animals we detected had been recently released from a farm; if these data are excluded, catch-per-unit effort becomes 3.73 person-years per individual (Turvey *et al.* 2018). This effort is substantially greater than that reported for other cryptobranchid salamanders. There was evidence of CGS poaching at 24 sites, including within protected areas. Our ecological surveys were verified by the local ecological knowledge surveys, which were carried out at villages closest to each ecological survey site. We interviewed 2,872 respondents; 85.5 per cent of interviewees recognised the species, but the mean last sighting date was 18.96 years earlier (Turvey *et al.* 2018).

In collaboration with the Kunming Institute of Zoology we embarked on a study looking at CGS population genetics. We acquired samples from 70 wild-caught and 1,034 farm-bred salamanders and found that the CGS, previously thought to represent a single species, consists of at least five distinct genetic lineages (Yan *et al.* 2018). Individuals detected in our ecological surveys in the Pearl and Yangtze watersheds were of the Yellow River matriline, indicating that they were farm releases or escapes. Some of the lineages appear to be exceedingly rare and possibly extinct in the wild.

Our results provide evidence of catastrophic range-wide population declines of CGS. It is critical that legislation and enforcement is strengthened in China to ensure that any remaining wild populations are protected. Whilst we received EAZA funds to develop a conservation

breeding facility for CGS in China, the lack of founding stock precluded the establishment of such a facility. *Ex situ* conservation is still needed and it is imperative that dedicated breeding programmes are established in China for each distinct lineage of CGS.

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# Beyond the bullfrogs

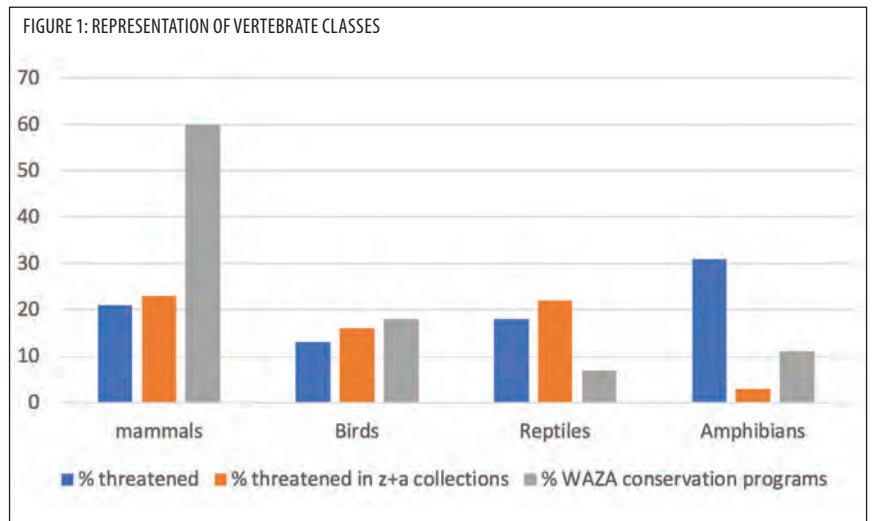
IN THE WORLD OF AMPHIBIAN CONSERVATION, HOW FAR HAVE WE COME IN 60 YEARS?

Anne Baker, Executive Director of the Amphibian Ark

Sixty years ago, William Conway issued a challenge to the zoo and aquarium community with his seminal paper 'How to Exhibit a Bullfrog: a bedtime story for zoo men'. In his story, a shadowy, red-cloaked man visits Conway (then a Curator at New York Zoological Society's Bronx Zoo) in a dream and asks why he is trying to buy a pygmy chimpanzee for \$5000 when he doesn't even have a proper exhibit of bullfrogs. Conway uses the question not just to explore the practices of species selection and exhibit design that were current at the time, but also to highlight issues of population management, animal behaviour and ecology, ecosystems, public education and conservation.

Were Conway's shadowy man to visit zoos and aquariums today, he would find exhibits that place species in an ecological context, allowing for expression of species-typical behaviours, sophisticated population management programmes that strive to maintain the genetic and demographic health of zoo animal populations, education programmes aimed at moving visitors from caring to knowledge to conservation actions, and extensive support for field conservation. But what about those bullfrogs and their frog, toad, salamander and caecilian relatives? How have they fared in the ensuing 60 years? Here again, zoo animal management has come a long way. Today amphibians are displayed in appropriate environments and many exhibits include visual and auditory displays of amphibian behaviour, explained to zoo visitors with engaging, often interactive, graphics and videos. Climate and lighting are carefully controlled, there are biosecurity protocols, and the Amphibian Ark website ([www.amphibianark.org](http://www.amphibianark.org)) offers more than 200 amphibian husbandry documents, many in Spanish. Available through the website, a PopFrog computer programme helps manage *ex situ* amphibian populations.

However, things don't look quite so rosy from the perspective of amphibian



conservation. In 1989, at the First World Congress of Herpetology held in Kent, England, participants discussed declines that they were seeing in the populations of amphibians they studied. Recognising that something unusual was occurring, Dr George Rabb, then Chair of the IUCN SSC, formed the Declining Amphibian Populations Task Force (DAPTF) in 1990. This resulted in the Global Amphibian Assessment (GAA), which was begun in 2001 and completed in 2004, and an Amphibian Conservation Summit in 2005. At that time there were approximately 6,000 known species of amphibian, and 32 per cent of them were identified as threatened with extinction. Realising that the chytrid fungus was rapidly advancing through Central America, the Amphibian Ark (AArk) was formed in 2006. Its charge was to identify those species for which continued existence in the wild was unlikely, and to establish *ex situ* rescue populations until such time as it was possible to deal with chytrid in the wild and reintroduce animals bred in human care to their native habitats. At the same time the IUCN/SSC/Amphibian Specialist Group (ASG) was formed, combining the talents of individuals within the DAPTF and the GAA, and the first Amphibian Conservation Action Plan (ACAP) was published in 2007 (Gascon *et al.*, 2007).

The 2008 Year of the Frog campaign

(YOTF), a joint effort by EAZA and the Amphibian Ark, led to heightened awareness of the challenges surrounding amphibians in the wild. Although it's impossible to say how many new *ex situ* amphibian rescue programmes resulted from the YOTF, AArk now monitors 107 amphibian *ex situ* rescue programmes, 66 *ex situ* research programmes and 10 head start or supplementation programmes in 32 countries. Interestingly, however, the majority of programmes are not in zoos or aquariums, which historically have not focused on amphibians.

## INCREASING POPULATIONS

The population management chapter of the ACAP provides direction to 'establish captive programmes as close to the indigenous range of a species as practically possible'. This presented challenges for some of the early *ex situ* programmes. The El Valle Amphibian Conservation Center (EVACC) had its beginnings on the grounds of a local hotel. Subsequently, the development of amphibian 'pods', modified shipping containers with self-contained HVAC and water treatment systems, provided a way to quickly install *ex situ* holding and breeding facilities in more remote areas. Today the Panamanian golden frogs, along with other threatened Panamanian species, are housed in a state-of-the-art facility at the Smithsonian Tropical Research

Institute's Gamboa Amphibian Conservation and Research Center. The centre boasts seven amphibian pods, which contain animal holding facilities, a dedicated laboratory, a quarantine facility, offices and a small exhibition niche. Similar pods can be found in other locations in Central and South America. A very successful programme at the Museo de La Plata in Argentina, led by Dr Federico Kacolicis, has bred and reintroduced the critically endangered Valcheta's frog (*Pleurodema somuncurensis*) and is now beginning work with the endangered Patagonia frog (*Atelognathus patagonicus*). We now have the potential to hold and breed amphibians in many parts of the world.

Sadly this potential is, to a great extent, unrealised. To be sure, there are some excellent amphibian conservation programmes supported by zoos, including one for the mountain chicken (*Leptodactylus fallax*), a joint effort of Durrell, ZSL, Chester Zoo and the governments of Montserrat and Dominica. In addition, Durrell has initiated the Save Amphibians from Extinction (SAFE) programme. However, were Conway's shadowy figure to visit our dreams today, he might be sceptical about the relatively small impact that zoos are having on amphibian conservation.

### A GROWING THREAT

As of 1 July, 2018, the IUCN Red List of Threatened Species identified 21 per cent of mammals, 13 per cent of birds, 18 per cent of reptiles, 31 per cent of amphibians, and 14 per cent of fish as Threatened (Critically Endangered, Endangered or Vulnerable). Neither the representation of amphibians in zoo collections, nor the representation of amphibian conservation programmes in the WAZA database, mirror the percentage of threatened amphibian species in the IUCN Red List. An analysis of Species360 data (Conde *et al.*, 2013) indicated that 23 per cent of threatened mammal species were represented in zoo collections, compared to 16 per cent of birds and 22 per cent of reptiles, but only 3 per cent of amphibians. Of the 221 conservation programmes currently listed in the WAZA database, 60 per cent (132) are for mammals, 18 per cent (38) are for birds, 7 per cent (17) are for reptiles, 11 per cent (25) are for amphibians (Figure

1), and the remaining 3 per cent are divided among invertebrates, corals and plants. If degree of threat were driving conservation programmes, amphibians would be at the top of the list.

### THE ROLE OF THE ZOO

While the chytrid fungus has caused dramatic amphibian declines, multiple factors impact the future of amphibian populations, including loss of quality habitat, invasive species, pollution and harvest for the pet and restaurant trades. Zoos have the potential to make a difference in a number of these areas.

Zoos in countries with low amphibian diversity could consider helping to set up *ex situ* breeding facilities in zoos in high-diversity range countries as (far) off-exhibit amphibian holding, receiving exhibit animals from these facilities once range-country populations produced surplus. For 11 years Denver Zoo has worked with Peruvian and Bolivian biologists to support *ex situ* and *in situ* work with the endangered Titicaca water frog (*Telmatobius coleus*). Three years ago, surplus Titicaca water frogs from the Peruvian *ex situ* population were sent to Denver Zoo for exhibition purposes. The frogs have bred and their progeny are now exhibited at several US zoos.

Zoos are able to influence public opinion with resulting changes in behaviour. Estimates are that 4,600 tons of frog legs (representing 90–230 million frogs) are imported into Europe each year for human consumption (Jensen and Camp, 2003; Altherr *et al.*, 2011). The vast majority of these come from a handful of Asian species, some of which are threatened, nearly all of which exhibit declining populations. Forty-seven amphibian species have been identified as primarily threatened by unsustainable collection for the international pet trade, with the majority of frog species coming from Latin America and Madagascar (Hoffmann *et al.*, 2008), and newt species from Southeast Asia (Rowley *et al.*, 2016). Focus on the impacts of these specific patterns of human use could provide zoo visitors with an opportunity to change behaviours that have a direct impact on amphibian conservation.

Over the past decade we've learned that there is no magic bullet for dealing with chytrid, with the recently identified salamander chytrid, or with

the host of other amphibian diseases. There are glimmers of hope that individuals of some species might have an inherent resistance to chytrid, as evidenced by recent discoveries of species thought to have been extinct for the past 20 years. Much more research is needed to understand whether there is a genetic basis for this resistance, and if so, how to manage *ex situ* conservation programmes to maximise its effect. Finally, with the number of identified and named amphibian species now above 7,500, we need to develop new multi-species planning tools.

Today Conway's red-cloaked man would probably agree that zoos are doing a better job of managing and exhibiting bullfrogs. But he might still be sceptical that zoos are meeting the conservation challenge of ensuring that the incredible diversity of amphibians will exist into the future. And he might just appear in your dream to ask, 'What is your zoo doing to save the bullfrogs?'

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# Frogs need friends

WHY EFFECTIVE PUBLICITY MANAGEMENT IS ESSENTIAL IF AMPHIBIANS ARE TO SURVIVE AND PROSPER

Björn Encke, Founder, Frogs & Friends

In 2016, Frogs & Friends made its public debut with permanent exhibits in zoos in Vienna, Zurich and Cologne. The mission of this Berlin-based initiative is to draw attention to the international amphibian crisis by telling compelling stories about these amazing animals. The scientists and media experts who founded the organisation want to go beyond local exhibits at individual zoos, instead creating a networked campaign that can serve as a communication resource – and amplifier – for zoological gardens and other institutions working to address the amphibian extinction crisis.

If it weren't for the Year of the Frog 2008, Frogs & Friends might not exist. It all started with a television segment about the lost Northern Darwin's frog in Chile. More than 3 million German public television viewers watched for almost four minutes as the film followed our travels looking for a hidden frog. All we had was a recording of its call. We found destroyed or polluted habitats, but no frogs. The viewers were glued to their screens. The key was the compelling, and relevant, story we told. We wondered if there were more compelling stories to tell about frogs.

Despite their acutely endangered status, amphibians still play only a minor role in most zoo collections. Too often they get little attention in discussions about strategic focus areas – and accompanying budgets. Frogs & Friends aims to address that deficit by gathering under its umbrella the communications, and in part the coordination, for all things amphibian. Similar exhibits can be set up at multiple zoos, combining site-specific texts with those from the wider Frogs & Friends portfolio. This enables zoos to offer their visitors high-quality, regularly updated amphibian exhibits for a very reasonable price.

One example is our series of web reports. These high-quality short films about five of our partners' projects are available both online and at all of our exhibit locations. The participating



zoos send an additional message: We are part of a larger network working together to protect biodiversity. Many zoo visitors don't know about this important aspect of modern zoos' work and mission. (All videos are available at [www.frogs-friends.org](http://www.frogs-friends.org) under the menu tab 'project-videos'.)

Another example is the Frogs & Friends web-based 'interactive trip'. The user can dive as deep as he or she wants into the fascinating variety of forms and evolutionary strategies that amphibians adopt, find information about current threats, and learn more about possible strategies to protect amphibians. This resource is freely available to partner zoos, which can also embed it into their own websites. Available in German and English, it can be found on the Frogs & Friends website, under the 'Fascinating Frogs' tab.

Frogs & Friends combines physical exhibits with digital media and a regularly updated online news service that reports on new developments from our partners, creating new connections between the participants. This approach has led to new types of project: for example, the Naturkundemuseum in Berlin and the Tiergarten Schönbrunn are working together on a new research and captive breeding project involving the Goliath

frog and its endangered relatives in Cameroon. We also want to shape the future closer to home. Together with the VdZ (Verband der Zoologischen Gärten) and DGHT (German Society for Herpetology), we are establishing a new, professionally organised breeding programme that involves both institutions and private keepers. The goal is to set an example for how *ex situ* breeding can develop even in the face of current challenges.

New insights prompt new ideas. In the spirit of the One Plan approach, we are convinced that *ex situ* population management must be an essential part of any strategy to preserve biodiversity. It is not part of the problem, as some accuse it of being, but is part of the solution. And it is the most effective way to organise the necessary public interest and political will to slow down the extinction crisis.

This gets to the core of why Frogs & Friends exists. We have to build bridges between scientific research and the general public. We attempt to do this with all the modern tools we have available, whether through new media opportunities or through organising participants in scientifically led breeding programmes. We're reminded of an old zoo saying: Nothing moves people like a living animal – even if it's as motionless as a salamander in winter.



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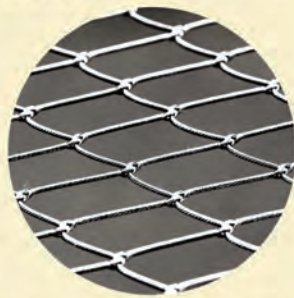
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