

## A

BRIEF LOOK ON VIETNAMESE  
WILDERNESS AND HERPETOFAUNA

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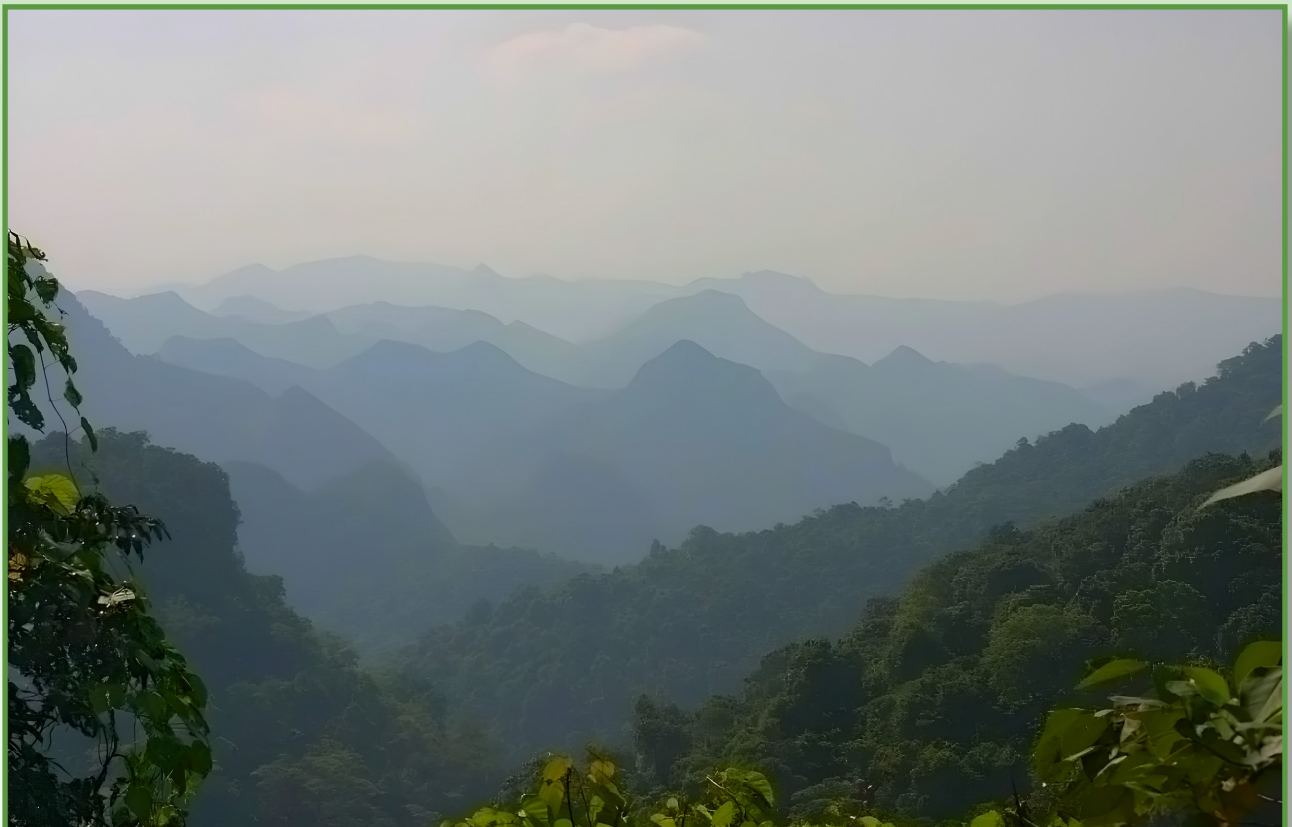
\*All photos are provided by author.

### Introduction

Vietnam is amazing. In addition to an expansive area of around 331,690 km<sup>2</sup>, the country is also characterized by a high level of ecosystem diversity and biodiversity. Different regions and a variety of landscapes, ranging from tropical rainforests to coastal ecosystems are home to many different creatures whose existence is increasingly threatened. These include many reptile and amphibian species.

Vietnam alone harbors around 850 known species of reptiles and amphibians, many of

which have remained poorly studied. Time is running out, as the species are facing many direct threats. Researchers and nature conservation organizations have recognized the problem and are making efforts to combat it. Now, the measures are gradually bearing fruit. At the latest after the EAZA conservation campaign "Vietnamazing", the protection of various Vietnamese species, many of which are endemic, will receive a great deal of more attention. We first presented the campaign in issue



**Figure 1.** A breathtaking view of Phong Nha - Ke Bang National Park, by Thomas Ziegler.

13 of the RHJ. The interview with Prof. Dr. Thomas Ziegler, who gave an insight behind the scenes of Cologne Zoo and its projects (including “Vietnamazing”), made quite a splash at the time when it was distributed by various organizations, such as Reverse the Red, and was included in the global WAZA (World Association of Zoos and Aquariums) newsletter.

But there is a lot more to Vietnam. In the following article, we present modern molecular approaches, making it possible to precisely identify the ancestry and status of single individuals and thus avoid hybrids coming into conservation breeding programs or different conservation units being mixed together.

### Species-rich Vietnam

Vietnam has a wide variety of habitat types, including lowland evergreen forests, semi-evergreen forests, deciduous dipterocarp

forests, savanna forests, montane forests, limestone karst forests, mangrove forests, freshwater swamp forests, seasonally flooded savannas and grasslands, other freshwater habitats, secondary vegetation and plantations, and marine habitats (for more details see Sterling et al. 2006, Vietnam: A Natural History, Yale University Press). There are currently 34 national parks, 60 nature reserves and 22 species and habitat conservation areas in Vietnam.

Over the course of the region’s geological history, numerous species have evolved. Vietnam is home to roughly 280 amphibian species: 267 species of frogs, 10 species of salamanders, and 3 species of caecilians. As for the reptiles, ca. 540 species of reptiles are reported so far from Vietnam: 271 snake species, 232 lizard species, and 37 turtle species. In the past, two species of crocodiles had been abundant across the country.



**Figure 2.** *Rhacophorus kio* Ohler & Delorme, 2006, is one of the many frog species in Vietnam with decreasing population, by Thomas Ziegler.



However, while the saltwater crocodile is extinct in the wild, the Siamese crocodile has been successfully reintroduced to Cat Tien National Park in southern Vietnam in the beginning of this century.

Nonetheless, many of these species are endangered. Habitat loss, over exploitation, invasive species, pollution, and the consequences of climate change, play a tragic role. Research to protect this biodiversity is therefore of great importance.

### Most threatened species

Among reptiles, turtles (such as *Rafetus swinhoei* (Gray, 1873), *Mauremys annamensis* (Siebenrock, 1903)), geckos, monitor lizards, Vietnamese crocodile lizards (*Shinisaurus crocodilurus subsp. vietnamensis* Schingen et al., 2016) and large snakes are the most endangered species. Among amphibians, certain frogs like some *Leptobranchella* species (*Leptobranchella botsfordi* (Rowley, Dau & Nguyen, 2013), *Leptobranchella rowleyae*, *Leptobranchella bidoupensis bidoupensis* (Rowley, Le, Tran & Hoang, 2011)) and salamanders and newts are particularly threatened.

### Protective measures

In Vietnam, several measures have recently been introduced to actively protect amphibians and reptiles, as well as biotopes. This involves both in-situ measures, i.e., measures on site, and ex-situ measures,



**Figure 3.** One of two crocodile species previously recorded from Vietnam. Here *Crocodylus siamensis* Schneider, 1801, by Thomas Ziegler.



**Figure 4.** *M. annamensis*, by Thomas Ziegler.



**Figure 5.** *Tylostotriton ngoclinhensis* Phung, Pham, Nguyen, Ninh, Nguyen, Bernardes, Le, Ziegler & Nguyen, 2023, by Thomas Ziegler.





**Figure 6.** *Gonyosoma boulengeri* (Mocquard, 1897),  
by Thomas Ziegler.



**Figure 7.** *Goniurosaurus catbaensis* (Mocquard, 1897), by Thomas Ziegler.



**Figure 8.** *Bombina microdeladigitata* Liu, Hu & Yang, 1960,  
by Cuong The Pham.

such as conservation breeding in human care.

In order to take a significant step towards biodiversity conservation, protected areas have been established. These currently include various national parks, nature reserves, species and habitat conservation areas and the like. Furthermore, several animal species have been placed under official protection. For example, 44 reptile and amphibian species, which make up around 5% of the total, are already officially protected by law and are listed in various government regulations.

Vietnam is working hard to develop effective conservation strategies for endangered species. For example, there have already been national action plans for sea turtles and freshwater turtles and tortoises. A national action plan for primates has also been initiated and a national action plan for the biodiversity strategy has been enacted by the government.

In addition, various areas have now been assigned to different ministries for protection. Natural resources and biodiversity are now managed by the Ministry of Environment and Natural Resources. Forest resources, including wild animals and plants, on the other hand, are managed by the Ministry of Agriculture and Rural Development.

As poaching and especially illegal trade have constantly been imperiling animal populations, it has been decided to improve law enforcement to combat



the illegal trade in wild animals. As consumers have played a key role in promoting the trade, changing consumer behavior towards the use of wildlife products has been a focus of different education and awareness campaigns. In addition, law enforcement officers have continuously been trained in species identification and other wildlife handling skills.

Citizens are also better educated in local areas where endangered species occur. Here, educational programmes on the respective species are used to minimize the risk of reckless actions in nature.

In addition to the in-situ measures just mentioned, ex-situ measures are also being actively implemented and have been successful to date. Assurance populations have constantly been built up so that individuals can be released back into the wild in the event of imminent extinction. In particular, the conservation breeding

of endangered species in zoos (such as Cologne Zoo) and rescue centers in the country is already bearing fruit. Even animals confiscated and rescued by the authorities are already included in species conservation programs. Nonetheless, this process needs to be carried out carefully and correctly to avoid negative impacts on populations of native species and entire ecosystems in the long run. To this end, held individuals are first tested to ensure that they are genetically pure. New advancements in genetic techniques are being used to make sure this approach is applied correctly.

In recent years, molecular techniques have been successfully employed to assist conservation measures of highly threatened reptiles and amphibians. Specifically, molecular data have been incorporated into an integrative taxonomic framework to discover many new cryptic species in Vietnam, which were previously neglected



**Figure 9.** The team of Cologne Zoo at one of Vietnam's conservation stations, namely the Melinh Station for Biodiversity, here with an upgraded conservation breeding terrarium for endangered tiger geckos, by Thomas Ziegler.





**Figure 10.** A view on the impressive Melinh Station for Biodiversity, by Thomas Ziegler.

due to their similar morphologies. As a result of taxonomic splitting, some species turn out to be restricted to very small ranges and are much more threatened than formerly thought. Examples include two species of the hyper-diverse bent-toed geckos, the Gia Lai

(*Cyrtodactylus gialaiensis* Luu, Dung, Nguyen, Le & Ziegler, 2017) and the Ota's (*Cyrtodactylus ota'i* Nguyen, Le, Van Pham, Ngo, Hoang, The Pham & Ziegler, 2015) bent-toed geckos, with the former classified as Critically Endangered and the latter as Endangered in the IUCN Red List.



Another application of the tool involves genetic screening of purebred individuals and genetically distinct lineages from held colonies in various facilities around the world. Such measures help maintain genetic integrity of the populations and avoid mixing different locally adapted stocks. Genetic mixture can compromise fitness of held individuals. In addition, determining geographic provenance of trade confiscated animals with unknown origin through genetic screening and phylogeographic analysis assures that the individuals will be released back to their native habitat. Reintroduction of reptiles and amphibians to nonnative habitat can lead to genetic pollution, which exerts a long-term adverse impact on the local fauna. Finally, environmental DNA (eDNA), i.e., DNA extracted from environmental samples such as water and soil, has been used to survey threatened and elusive species to determine their presence. Traditional survey methods failed to detect aquatic or semi-aquatic

reptiles, including the Swinhoe's giant softshell turtle (*R. swinhoei*), the Vietnamese pond turtle (*M. annamensis*), and the crocodile lizard (*Shinisaurus crocodilurus* Ahl, 1930), but eDNA analyses of water samples collected from different sites within the species distribution ranges has helped to discover their previously unknown localities. The data has been included in conservation plans developed for the species and effective conservation measures based on the results will help recover their populations in the future.

### Conservation organizations

There are various nature conservation organizations in Vietnam. These can be government agencies on the one hand and NGOs on the other. Government agencies include research institutes, universities, national parks, nature reserves, provincial authorities for forestry and fisheries.

Understandably, there are also a number of active conservation NGOs. These



**Figure 11.** A look on amazing Ha Long Bay - Cat Ba Archipelago UNESCO world heritage, by Thomas Ziegler.





**Figure 12.** Gecko conservation in work with Cologne Zoo, here newly established gecko conservation breeding facilities at the Cat Ba National Park, by Cat Ba National Park.

include quite prominent organizations such as WWF, FFI, WCS, TRAFFIC, ATP, IUCN as well as many local NGOs, e.g. Save Vietnam's Wildlife, GreenViet, VietNature, WildAct, PanNature.

### Current species conservation projects

There are many projects currently being carried out in Vietnam and their number is increasing; some projects are briefly listed below.





**Figure 13.** Conservation breeding terraria at Melinh Station for Biodiversity, by Thomas Ziegler.

turtle. Data is also collected for this Critically Endangered turtle species and reintroduction programs are developed.

Cologne Zoo in particular is an important partner for Vietnam. In the case of reptiles, the Vietnamese crocodile lizard is part of the program. Data is being collected and attempts are being made to improve habitat management. This program is also carried out jointly with the Institute of Ecology and Biological Resources.

The recently described Cat Ba tiger gecko is also receiving its own conservation projects. As Thomas Ziegler announced at a press conference in the frame of the launch of the Zoo Species of the Year 2024 campaign – The Gecko: ‘You can only protect what you know’. That is why data is currently being collected that will be used to implement

conservation measures.

The last species to be included in the program is the psychedelic rock gecko. Here, surveys are being carried out and conservation measures, such as conservation breeding, are being implemented. These programs are also run jointly with the Institute of Ecology and Biological Resources, Wildlife at Risk and Cologne Zoo.

### Vietnamazing

The EAZA conservation campaign “Vietnamazing” aims to save Vietnam’s unique biodiversity with special focus on several endangered flagship species, for example the Northern White-cheeked Gibbon, Vietnamese Pheasant, Vietnam Pond Turtle, Crocodile Lizard, Crocodile newts, Mossy frogs, Tiger Hillstream Loach,

The first project is biodiversity conservation. It consists of several large projects funded by the Vietnamese government and by USAID, GEF, UNDP, and other organizations.

There are also projects to protect endangered species. One example is the Saola project. The aim of this project is to identify and survey the Saola population in Vietnam for conservation measures through WWF-Vietnam as well as Saola Foundation and working group.

There are now also fruitful projects for other species. With the support of Leipzig Zoo, the Cat Ba langur project is being carried out to improve species protection.

Several campaigns are also being carried out with the Asian Turtle Program (ATP). For example, for the Swinhoe’s giant softshell turtle, data is collected here in order to be able to develop effective conservation measures. The same applies to the Vietnamese pond

Vietnam Giant Magnolia Snail and Nui Chua Stick Insect. Research and conservation activities will be conducted by EAZA members and Vietnamese partners in order to protect the natural habitat and populations of endangered species in the wild. In addition, conservation breeding programs and public awareness will be implemented to improve conservation efforts in Vietnam. Another topical conservation campaign, The Zoo Species of the Year 2024 adds to “Vietnamazing”, as threatened Vietnamese geckos are in the focus of this additional conservation campaign.

### Education

Information and education must also be well organized and structured so that wildlife populations can be conserved in the

long term. A reduction in the demand for wild animals in Vietnam is essential. The protection of habitats and populations of endangered wildlife should be prioritized and addressed in schools, for example. It will be up to the new generation to continue the projects that have been initiated in order to safeguard the remaining populations. Accordingly, educational programs for children in areas where endangered species occur are very important. “You only protect what you know”.

### Conservation zoos

Conservation zoos also play a crucial role in Vietnam. They offer conservation breeding programs for endangered or endemic species. They can successfully help to establish reserve populations, whose offspring can be released into the wild.



**Figure 14.** Thomas Ziegler and Trung Quang Nguyen at Saigon zoo conference, introducing the “VIETNAMAZING” conservation campaign to the Vietnamese audience, by Dao A. T. Tran.





**Figure 15.** Group photo of “VIETNAMAZING” team members in Ho Chi Minh City, Vietnam - left to right: Truong Q. Nguyen, Khoi V. Nguyen, Thomas Ziegler and Minh D. Le, by WAR.

They can also provide technical support for conservation breeding facilities and stations in Vietnam and support programs aimed at releasing animals from sanctuaries and breeding stations back into their natural habitat. As Thomas Ziegler says, the modern zoo is no longer a prison for animals, but rather the contrary - a kind of hotel where anyone who needs help is welcome, but is also allowed to leave when the situation allows.

Education and awareness programs play a very important role in generating interest from the general public in environmental protection and biodiversity conservation. A good example is IEBC's Melinh Station for Biodiversity, located at the forest edge, where school children and visitors can get in touch with nature, biodiversity value and conservation needs. There, a special environmental education exhibition was developed together with Friedrich Ebert Foundation Hanoi and Cologne Zoo, to raise interest in nature conservation in particular for the

young generations. Many school classes visit the station every day and they are informed through special guided tours, also covering a new forest trail.

### Funding

Understandably, such projects and programs also require a lot of work and therefore cost a lot of money. Money that is invested wisely. In order to cover the costs, there are various partners who help with the financing. First and foremost, it is the government of Vietnam that provides funding. But there is also funding from international partners (zoos, aquariums, nature conservation authorities, universities, research institutes, foreign governments, etc.) who have recognized the importance of such projects. NGOs also contribute to the costs and foundations provide grants. In addition, there are numerous investments in development by the DAAD and other main sponsors.





**Figure 16.** Latest trip to Vietnam - Meeting with Cologne Zoo team, that helped to upgrade existing conservation breeding facilities, in front of the Melinh Station for Biodiversity, by Melinh Station.

### Future steps to counteract the extinction of species in the best possible way

The suitable answer here is IUCN's One Plan Approach to Conservation: Use all tools, all facilities, all sources and all available experts together, i.e., combining different expertise as well as *in situ* and *ex situ* conservation measures, where required. Education and awareness programs in urban and remote areas are needed to reduce demand on wildlife products and

raising people's awareness of issues related to biodiversity conservation.

Building capacity for law enforcement officers across the country to control poaching, wildlife trade, and wildlife consumption. Involving local people and improving law enforcement effectiveness in protected areas across Vietnam and new initiatives including payment for ecosystem service/ecotourism/nature-based tourism to generate fundings for conservation.