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ERPETOLOGY AND HERPETOCULTURE: THE BRIDGE BETWEEN



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The field of herpetology focuses on the study of reptiles and amphibians, including their general biology, morphology, physiology, behavior, ecology, evolution and, increasingly, their conservation. As new methods of investigation emerge, herpetological studies become more and more integrated, being part of interdisciplinary research that applies molecular, genetic, genomic and

proteomic methods, geoinformation modeling, etc... At the same time, some classic methods (e. g. demographic monitoring, morphometry) are still relevant and can solve tasks that cannot be achieved by any modern high-tech approaches. On the other hand, herpetoculture refers to the practice of keeping and breeding amphibians and reptiles in captivity, either as a personal



Figure 1. One of the natural biotopes inhabited by various amphibians and reptiles (photo by O. Marushchak & O. Nekrasova, Rivne region, Ukraine).



Figure 2. Checking different stages of the embryo's development (photo by O. Marushchak).

interest, part of a commercial breeding venture, or for conservation purposes. Herpetoculture attracts individuals from various backgrounds and ages, ranging from dedicated herpetologists and professional breeders to casual enthusiasts. Once initiated as a hobby and discipline, herpetoculture has united hundreds of thousands of individuals who share a passion for having amphibians and reptiles in their homes, yards, and farms. Together, they possess unparalleled knowledge and understanding of the requirements for the captive husbandry and propagation of a wide range of amphibian and reptile species. Thus, both herpetology and herpetoculture have been closely interconnected for hundreds of years. It would be quite fair to say that every herpetologist is (or at least once had been) a herpetoculturist.

One of the features of herpetoculture is the unique opportunity to constantly observe the animal, the peculiarities of its biology and behaviors. In nature, such observations are often almost impossible due to unpredictable intrinsic field conditions, the commonly cryptic morphology and behavior

of the herpetofauna representatives, and the high costs of equipment for such field observations and monitoring. As a result, observations in the wild are fragmentary and often do not provide the opportunity to fully assess the spectrum of physiological, behavioral and ecological features of most species. In contrast, under the conditions of herpetoculture, the possibility of observations is almost unlimited. Because the conditions can be standardized, the collected information for further herpetological research can be much more complete, comprehensive, and broad.

It should be emphasized that different aspects of breeding can only be studied in conditions provided by herpetoculture:

- 1) key stimuli of mating behavior, copulation, courtship, access to reproduction;
- 2) generation time and associated factors
- 3) behavior of gravid females;
- 4) aspects of choices of nesting places;
- 5) peculiarities of egg incubation and embryonic development;
- 6) possible sex determination through controlled temperatures/humidity;

- 7) role of different factors for successful incubation (humidity, substrate, steadiness of temperatures or need of temperature drop during the day or year (diapause));
- 8) techniques for starting and raising juveniles;
- 9) different aspects of fertility of females (number of eggs, clutches, changes in fertility of eggs);
- 10) kinship assessment;
- 11) heredity of different morphs, their genetics and role for surviving of particular individuals;
- 12) influence of environmental conditions on development until sexual maturity and beyond, including wintering studies.

Such information can help fill crucial knowledge gaps about captive breeding techniques and the effects of captivity on development, physiology, and behavior, with the potential for developing increasingly needed reintroduction programs. This list can be greatly expanded, but these spheres of study strongly benefit from

herpetoculture. The main reason for this is that herpetoculture can produce a great range of information, offering conditions that can be controlled and even standardized, yielding data that can be reliably statistically processed. Collecting this kind of information in such conditions is very limited in the wild. As an example, we can see the latest scientific works produced by the experts of BION Terrarium Center dedicated to study of different aspects of reproduction in leaf-tailed geckos. The articles are entitled as "The data on the reproductive biology of the satanic leaf-tailed gecko, *Uroplatus phantasticus* (Squamata, Gekkonidae), at the BION Terrarium Center as a contribution to *ex situ* offspring programs" and "Data on the reproductive biology and temperature-dependent patterns of Henkel's leaf-tailed gecko, *Uroplatus henkeli*, at the BION Terrarium Center" can be found via the following links: <https://ojs.akademperiodyka.org.ua/index.php/Zoodiversity/article/view/304> & <https://ssarherps.org/herpetological-review-pdfs/>. These studies and their results have become



Figure 3. European pond turtles (*Emys orbicularis* (Linnaeus, 1758)) bred in captivity to be released in one of the local ponds (photo by O. Marushchak).



Figure 4. European pond turtle before releasing into the wild by J.-Y. Georges (photo by O. Nekrasova).

excellent examples of how beneficial is it to collect data in conditions of herpetoculture for further scientific analysis. Now they are helping hundreds of *Uroplatus* breeders worldwide to maintain their own collection and contribute to global *ex situ* conservation of this group of arboreal geckos. Such an interesting cases as sperm storage or parthenogenesis in for some species became known only thanks to accidental observation in terms of herpetoculture (e. g. parthenogenesis in *Varanus salvator* (Laurenti, 1768); <https://reptilesmagazine.com/project-varanus-salvatorii/>).

On the other hand, classic herpetology provides essential information for keepers and breeders for developing protocols for captive husbandry. It provides a scientific methodology for species identification (sometimes close species are really difficult to identify without handling and close inspection), collection data, and field notes that allow herpetoculturists to address husbandry in the most appropriate manner for species-specific needs. As a result hundreds of thousands of articles provide basic knowledge for hobbyists for starting new breeding projects with



Figure 6. Release of young turtles in the wild in terms of Life-HerpetoLatvia conservation project (photo by M. Pupins).

interesting species be it giant geckos from New Caledonia in "Thermal ecology and habitat utilization of *Rhacodactylus leachianus* from New Caledonia (Squamata: Diplodactylidae)" (<https://archive.org/details/salamandra-54-117-122>) or rare frogs from Latin America in "Breeding biology, territoriality, and reproductive site use by *Phyllomedusa iheringii* (Anura: Phyllomedusidae) from the South American Pampa in Brazil" (<https://archive.org/details/salamandra-53-257-266>).

In the present context of biodiversity erosion, it becomes more and more obvious that operational conservation initiatives in favor of preserving endangered species, such as amphibians and reptiles, can only be achieved with the contribution of herpetoculture. Herpetoculture can produce large numbers of healthy, genetically appropriate, captive-bred individuals for rewilding programs through population

reinforcements or reintroductions. In numerous cases, such initiatives are conducted using the last few surviving individuals or populations, with major genetic issues that only knowledge collected in herpetoculture for decades can deal with. Of course, such initiatives can only be effective if suitable habitats and biotopes are preserved and properly managed. Another important role of herpetoculture in promoting conservation and preventing biodiversity loss is through educational initiatives that involve both professionals and enthusiasts. By sharing their knowledge through workshops, seminars, and online resources, herpetologists and herpetoculturists can promote responsible pet ownership and conservation awareness. This also will help to develop guidelines and standards for responsible herpetoculture practices (e. g. standards of animal keeping, providing

veterinarian services, etc.). This includes ensuring the humane treatment of captive animals, minimizing the negative impacts of the pet trade, and advocating practices that can prevent the possible introduction of alien invasive species or diseases. One of the examples is the project "Conservation of rare reptiles and amphibians in Latvia" which had captive breeding of reptiles and amphibians as a significant component. The main aim of the Life-HerpetoLatvia project was to facilitate the enlargement of populations of *E. orbicularis*, smooth snake *Coronella austriaca* Laurenti, 1768 and fire-bellied toad *Bombina bombina* (Linnaeus, 1761), and to ensure their long-time survival in Latvia, by implementing a combination of *in situ* and *ex situ* actions and by improving their legal protection. Specific project objectives included the creation of a suitable habitat-corridor network to sustain key populations of the target species;

the establishment of a new Natura 2000 network site in south-eastern Latvia (the Daugavpils district) for the main *B. bombina* population in Latvia; and the preparation and approval of a species protection plan for *C. austriaca* (<https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE09-NAT-LV-000239/conservation-of-rare-reptiles-and-amphibians-in-latvia>). More than 100 captive bred *E. orbicularis* were released in Latvia in terms of the project. Its results are highlighted in numerous scientific works, like "Projects on *Emys orbicularis* (Reptilia: Testudines: Emydidae) in Latvia for thirty years (1984 – 2014): biological aspects, results and effect on population and ecosystems" (https://www.researchgate.net/publication/272173511_Projects_on_Emys_orbicularis_Reptilia_Testudines_Emydidae_in_Latvia_for_thirty_years_1984_-_2014_biological_aspects_results_and_effect_on_population_and_ecosystems).



Figure 6. Release of young turtles in the wild in terms of Life-HerpetoLatvia conservation project (photo by M. Pupins).

The application of carefully designed and controlled herpetoculture for the restoration of indigenous populations of amphibians and reptiles has already been implemented in different European countries. By collaborating with colleagues from different countries, herpetoculturists and herpetologists can cooperate in breeding and monitoring animals and, most importantly, in restoring and protecting populations of rare, if not endangered, species. This direction where so called "herpetolog-culturists" gather and merge their energy and skills for spreading them beyond borders offers great prospects for nature conservation in the context of current global crises, such as climate change, biological invasions and habitat degradation, the latest being global the effects of increasing military aggressions on natural habitats, including their fauna and flora (considering the aggressors have little regard for nature and for life).

Last but not least, herpetoculture provides rich resources for cultural expression of reptiles and amphibians in human society. Historically, snakes, lizards, frogs and other herps appeared to be not the most favorite animals in our society. Usually, they tend to be associated with some negative things, such as venoms, warts, slime, bites, dark magic etc. Herpetoculture helps us to understand the herps' world better, showing their beauty, explaining interesting and mostly hidden aspects of their life through some sorts of art. Replicas, drawings, souvenirs, photo-shots, videos and other ways of expressing of nature of these creatures sometimes appear to be true masterpieces. Such people as Tell Hicks (<https://tellhicks.com/>), René Villanueva

Maldonado (<https://www.historianatvrae.com/>) or Adeline Robinson (<https://www.adelinerobinsonart.com/>) and many others create herp-related things that sometimes worth hundreds and thousands of dollars.

To sum up, these two disciplines, herpetology and herpetoculture are complementary, providing mutual benefits and contributing to the evolution of their objects, subjects, and the people who are passionate about amphibians and reptiles, and actively working for their survival. Herpetology provides basic tools, approaches and methods for data processing and finding valuable correlations or solutions to certain problems, as well as fundamental knowledge about the biology of amphibians and reptiles. On the other hand, herpetoculture offers unique opportunities for experimental studies and gathering a wealth of information collected in controlled conditions, that can be used by herpetologists for true and correct scientific studies. The symbiotic relationship of herpetology and herpetoculture has broad practical applications: fundamental, conservational and ethnoherpetological (economic, aesthetic, social and cultural).

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