HERPETOCULTURE AND CONSERVATION

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These days, with conservation becoming more and more popular, herpetoculture is often associated with conservation. It's not uncommon to hear someone say, "we need animals in captivity so we can replenish wild populations when they become endangered." This reasoning is also used to fight against legislation prohibiting importation and/or collection of herps; "we need new blood lines to maintain genetically viable captive populations." Even professional herpetologists mention captive propagation as a conservation tool, but only when absolutely necessary and monitored by appropriate organizations (Dodd 1987; Dodd 1993). Since North American zoos only have room for about 16 snake species survival plans (Quinn and Quinn 1993; data for other amphibians and reptiles is not yet available), the possibility of letting herpetoculturists participate in conservation plans has been considered, and "studbooks" have been created for some species. Still other herpetoculturists have taken conservation into their own hands and claim to supplement their favorite herp population by releasing captive-bred offspring. All this effort seems to indicate most people believe this type of conservation will be successful. However, the only review of herpetological conservation plans (those including relocation, repatriation, and translocation in the plan) indicates that most conservation plans are unsuccessful (Dodd and Seigel 1991). All of the successful herpetological conservation programs (four crocodilians and one lizard species) have one thing in common; captive breeding programs are housed in or near the species range and in outdoor enclosures. The purpose of this paper is to examine if herpetoculture should play a roll in conservation.

Some may find it ironic that so many herpetoculturists claim to support conservation efforts when they also fight to be allowed to collect the very animals that need to be protected. Granted the wildlife agencies often do not have complete information on the amphibian and reptile species they are protecting, but they generally err on the side of conservation. Herpetoculturists, on the other hand, generally err on the side of habitat and species destruction.

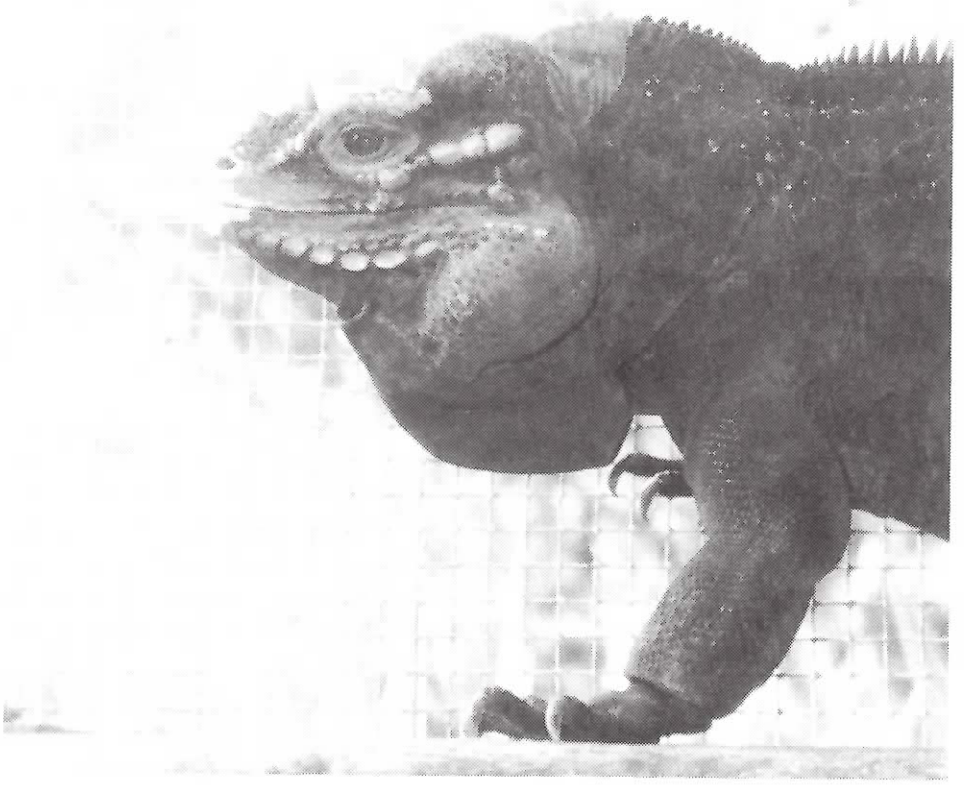
Casual collectors who pick the occasional snake up off the road probably impact the population very little because the habitat is not destroyed. However, when road cruising is done in excess it can have a major impact on the population. For example, areas such as River, Baghdad, and Ajo roads are littered with collectors during the "herpin' season." Nearly every desirable herp that crosses the road is either collected or killed on these roads. In time these herp populations are depleted, especially along the roads. This has already happened to desert tortoises (*Gopherus agassizii*) and it appears rosy boas (*Lichanura trivirgata*) are facing the same fate (Yozwiak 1993).

Field collecting can be much more devastating to populations and habitat than road cruising. Fender (1992) described an area with several herp species which was virtually destroyed by collectors using pinch or wrecking bars to move rocks. In less than one month the area went from sustaining an abundant herpetofauna to being deplete of nearly all herp species (Feldner 1992). Although Feldner's example may be extreme it is not entirely uncommon. Even in Utah, a state with relatively few herpers, there are areas where everything that can be lifted is turned and not replaced. This type of collecting impacts the entire ecosystem, not just the herps. Obviously, collecting is detrimental to wild populations, although there are instances when conservation may require collecting. In order for herpetoculturists to justify the claim of conservationism, the detrimental effects of collecting must be outweighed by the benefits of captive propagation and release programs.

For a captive propagation and release program to succeed, several biological constraints must be met. One of these biological constraints,

perhaps the most important, is often overlooked. Ecologists know this constraint as Shelford's "law" of tolerance. In terms of conservation Shelford's law states the survival of an organism depends upon the completeness of a complex of conditions. Failure of captive propagation and release of an organism can be controlled by the qualitative or quantitative deficiency or excess with respect to any one of several factors which may approach the limits of tolerance for that organism (Odum 1971). Basically, unless all the physiological, psychological, etc. needs of an organism are met the animal will not survive and reproduce. The limits of tolerance, to these factors, are set both by genetics (the extreme limits) and acclimation (the immediate values). To illustrate this imagine a species which ranges from high to low altitudes. Throughout its range this species maintains a preferred temperature of 27°C, but individuals at high elevations are often exposed to cold temperatures and never exposed to extreme high temperatures. These high elevation individuals become acclimated to lower temperatures than individuals from low elevations which are acclimated to higher temperatures. This may sound a bit confusing, yet the principle of Shelford's law is one that is intuitively obvious to most herpetoculturists.

Shelford's law explains why most wild caught animals die within a short time of capture. In the wild each individual is acclimated to a variety of factors within their genetic tolerance limits. When an animal is collected and placed in a human-controlled environment and some of these factors exceed what the animal is acclimated to (or the genetic limits) the animal becomes stressed and/or dies. In order for stressed animals to survive in captivity they must acclimate to their new environment and cope with all the symptoms of stress at the same time. One of the worst aspects of stress is a depressed immune system which makes the animal more susceptible to pathogens and parasites. The detrimental effects of the captive environment may not be immediately evident (see Oravecz 1993a-e for several examples of captive animals living months and years before dying because their physiological needs were not met).



The Rhinoceros iguana, *Cyclura cornuta*, a threatened species from Hispaniola sometimes bred in captivity.
Photograph: Ron Harrod

Animals that do survive in captivity are domesticated to some degree. Kohane and Parsons (1988) stated, "under normal circumstances, domestication would initially involve selection for behavioral traits such as docility and early breeding..." As herpetoculturists we see this in many species. The Burmese python (*Python bivittatus*) illustrates both docility and early breeding in captive born individuals. The process of domestication acts on the individual as well as the captive population (Kohane and Parsons 1988; Price 1984). Therefore, the captive breeding stock for conservation projects have been artificially selected for an unnatural environment. This selection process is repeated in a less forgiving environment when the animal is again released into the wild. Shelford's law can explain why Dodd and Seigel (1991) did not find any successful conservation programs which involved breeding animals outside their native environment. To examine the herpetoculture-conservation relationship further we must consider the genetics of the captive population.

Because of the selection process involved when animals are removed from the wild, we know the captive population does not adequately represent the genetic diversity of wild populations. This genetic difference alone warrants the exclusion of releasing captives except in extreme cases (i.e., imminent extinction). However, there are other reasons why captives are not genetically suitable for release. Philosophically and ethically we must decide whether we should destroy the evolutionary history of populations by introducing unnatural genes and gene frequencies. Since most captive herps lack accurate locality data, we cannot make evolutionarily intelligent decisions as to where the animal or its offspring should be released. Sure we could ignore evolutionary history and assume that all populations are identical or that species survival supersedes population genetics and evolutionary history (as most mammalian conservationists have). However there are good reasons not to ignore these things as Templeton (1986) illustrated by the following:

> "...when the Tatra Mountain ibex (*Capra ibex ibex*) in Czechoslovakia became extinct through overhunting, ibex were successfully transplanted from nearby Austria (Greig, 1979). However, some years later, bezoars (*C. ibex aegagrus*) from Turkey and the Nubian ibex (*C. ibex nubuana*) from Sinai were added to the Tatra herd. The resulting fertile hybrids rutted in early fall instead of the winter (as the native ibex did), and the kids of the hybrids were born in February—the coldest month of the year. As a consequence, the entire population went extinct (Greig, 1979)."

A herpetological example of mixing animals from different populations was described by Reinert (1991):

> "On 14 July 1980, I released a telemetrically tagged adult (110 cm total length) male timber rattlesnake (*Crotalus horridus*) 18 km from its point of capture. Because this is greater than known maximal dispersal distances for the species (Reinert and Zappalorti, 1988; Reinert, personal observation), it can be assumed that this snake was displaced from its normal population, established activity range, and social group. On 4 August, the snake was found in the company of a native adult (106 cm) male rattlesnake (also telemetrically tagged). The two snakes remained together for 20 days and traveled, in association, a distance of 404 m. On two occasions, the native male was observed attempting to copulate with the translocated male. The latter snake appeared to exhibit a passive, subordinate attitude during these attempts.
>
> Of the several thousand social encounters that I have observed among native *C. horridus* in this population, these were the only instances of attempted male to male copulation. Twenty days also represents the longest observed period of male to male association during the active season. However, it is not unusual for male to female relationships to last this long and for associated movement to occur (H. Reinert personal observation). From the stand point of the population, it is important to note that neither snake was observed to encounter or mate with females during their 20 day period of association. This represented a substantial portion of the July/August breeding season during which both animals were reproductively dysfunctional. However, in the 2 wk prior to encountering the translocated male, the native male exhibited normal reproductive behavior (i.e., mate searching behavior and copulation)."

These two examples indicate that animals of unknown origin should not be used for conservation programs and that populations should not be mixed, but what about supplementing a wild

population with captive bred animals from that same population?

At the level of herpetoculture, the release of captive produced animals into ancestral populations may sound fine, however from a genetic perspective this could prove devastating. Generally, the number of individuals collected from population is small compared to the total population size. Animals acclimated to their captive environment tend to put on weight faster after reproducing, thus they can reproduce again sooner. By releasing the captive born offspring the parents will be contributing an unusually high number of offspring to the population. In genetic terms the allelic frequencies will be weighted towards the captive population's allelic frequencies (which is not likely to adequately represent the wild population). The effect in the wild population is a higher rate of inbreeding, because of the proportionally high number of related (i.e., captive produced) individuals. In the long run, the population will suffer. In addition to the genetic effects, there are environmental effects. Burger (1990) found that incubation temperature effects the behavior of baby snakes. We can only speculate what the effect of captive incubation would be on animals released in the wild.

Inbreeding within the captive population is another reason why captive born animals are generally not suitable for release. Most herpetoculturists have bred siblings or know someone who has bred them. In fact it's not uncommon to purchase pairs or trios of siblings with the idea of breeding. The result of these breedings (e.g., inbreeding) is an increased probability of obtaining homozygous recessive alleles. These recessives are most notably seen as "cool" color patterns. Many of the morphs of corn snakes (*Elaphe guttata*), Burmese pythons (*Python bivittatus*), and California kingsnakes (*Lampropeltis getlula*) are a result of inbreeding. The release of these animals in the wild would probably result in the animals death, but if the animal survived, the genetics of the population would be artificially altered.

Finally, the risk of introducing pathogens and/or parasites into wild populations far exceeds the benefit of adding individuals to the population. Captive animals face the same stress because of acclimation to the natural environment that wild animals face when they become captives. As a result they are more likely to express pathogens that were hidden while in captivity. A good example of this is the desert tortoise (*G. agassizii*) which has been decimated by a disease purportedly introduced by released captives.

In their summary, Dodd and Seigel (1991) stated:"...our review casts doubt on the effectiveness of (relocation, repatriation, and translocation) programs as a conservation strategy, at least for most species of amphibians and reptiles." I would add that animals which are collected for private herpetoculture should not be used for conservation programs (excepting education). In addition, animals collected for conservation programs should be maintained within or very near their native environment, preferably in large outdoor enclosures.

It seems too many herpetoculturists use conservation to promote their own interests. As Dodd (1987) wrote: "Too many propagation programs are operated under the guise of 'conservation.' When this really means to supply individuals with a sufficient number of pets, it is not conservation but recreational use of wildlife." That doesn't mean herpetoculturists cannot be conservationists, but private herpetoculture is not (or should not be) a conservation tool. Herpetoculturists can promote conservation in many ways, including:

1. Stop collecting wild animals and purchase only captive born animals. By purchasing only captive born animals you will not be directly supporting the collection of wild animals. In addition, you'll generally get healthier animals. All in all, captive born animals are a much better buy.

2. Encourage others to buy captive born animals. As herpetoculturists we are often asked to talk to groups about amphibians and reptiles. Invariably someone is interested in getting a herp as a pet and asks where they can get one. We should tell the group that we only keep captive born animals. This may sound odd, but remember the people you're talking to probably can't tell if the animal you're holding is wild caught. If the person does get a captive born animal they are more likely to have a good experience and want to continue keeping herps.

3. Obey, local, state, and federal laws when both keeping (and collecting, if you must) herps. Unfortunately many of our headaches today are caused by a few money hungry herpers who think they are above the law. The result of their greedy actions are stricter laws which ultimately encourage more people to break the law (and the cycle continues).

4. If you must collect, do it in an environmentally safe manner. First of all you should question why you must collect these animals, are your reasons valid? When collecting, replace, to the best of your ability, everything you move.

5. Keep quiet about good herpin' sites. All too often herpetologists tell their friends about good herpin' sites, who tell their friends, who tell their friends... and eventually everyone knows about the area. Soon the area becomes a not-so-good herpin' area.

6. Do not release animals that have been in captivity, including newborns. The risk of introducing disease or detrimental genetic components is too high. This includes animals that were only kept for a couple of months. It would be better to donate the animal to a museum (with collection data) than release it. Only consider releasing an animal which has been kept for less than about two weeks *and* has been maintained in quarantine.

7. Finally, if you really want to contribute to conservation efforts, donate a proportion of your herpetoculture profits to an established conservation group which has herpetological projects. What better way to justify our hobby?

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IIS is considering participating in a reintroduction plan for the Rhinoceros iguana, *Cyclura cornuta* in Hispaniola. This paper describes and discusses the factors that need to be addressed before executing these plans.