A LARGE SCALE LIZARD BREEDING FACILITY IN ALABAMA

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As a small seven year old boy I kept my first lizard, which died within a month. That was forty years ago when I started as the only terrarium keeper in my native Dutch village. Since that time I have learned much about keeping lizards, and after all that time you even end up thinking like a lizard: during a rare thunderstorm on my wide favourite sandbeach in Spain, I dug myself in the sand, with just my nose and eyes sticking out to see people running and to breath, in the manner of *Phrynocephalus mystaceus* or *Phrymosoma* sp.

All my ancestors as far back as the 14th century were farmers and lived in the same region. I studied Physics and Mathematics at the University of Amsterdam, and spent 15 years teaching these subjects. The combination of long term observations on lizards, a farming background, and physics, is the basis of my success in breeding lizards.

About 1970, after my Physics studies, I started keeping lizards on a larger scale inside small greenhouses in the garden. This was at a time when lizard keeping was rare and if people kept them then it was almost always in a dry aquarium in the house. I discovered that lizards need enough space to avoid stress and that they need to thermo-regulate according their own desire instead of at a forced temperature in an evenly heated terrarium.

In the early seventies I made an important discovery, easily solved by my knowledge of physics; if lizards were kept behind glass the eggs never hatched, except eggs, or some of them, from the first clutch only. Lizards kept behind a mesh screen and profiting from full sun did better: almost all eggs hatched. I learned that glass filters the 300mm UV light and that no Vit. D3 can be made by the lizards. The calcium in the food, mainly in the stomach - contents of insects, cannot be absorbed. The first clutch of eggs may hatch, but after that the female will exhaust its store of calcium and the embryos tend to die just before hatching, incapable of opening the eggshell (a helping hand at the right moment could only save a very low percentage of the weak hatchlings). At that time (about 17 years ago) I believed that the whole problem was solved by replacing the 300mm UV light by vitamin D3 "aquosum" in the drinking water, this being by far the cheapest solution - Dutch people always look for the cheapest solution. Other options such as special "plexiglass" or artificial UV lamps were more expensive.

A problem is never as simple as it appears, however: in human beings we know that black people need more UV light in order to form sufficient Vit D3, and this is within one species. Roughly, I discovered that lizards which bask more and-or live further south need more Vit. D3. That is the reason why a lizard like *Eublepharis macularius* is so easy to breed for many people. Another problem is that even "water soluble" Vit. D3 is a kind of a fat and a lizard suffering stress or parasites such as flagelates cannot digest fat well (the base of the tail accumulates sticky faeces) and in addition the embryos will die.

Nobody yet knows the optimal amounts of Vit D3 required by a lizard of a particular species. Roughly I give 5,000-10,000 i.u. per litre of drinking water. I plan to begin a study of this problem by comparing next autumn the requirements of two completely different species, a Basilisk and a Lacerta.

Insects are poor in calcium as they don't need it to build up their own body. Therefore the only calcium to be expected in an insect will be in the food which passes through the stomach and intestines of the insect. The insect will never become richer in calcium content by feeding it a more expensive calcium-rich diet over a long period. It only makes sense to feed the insect a calcium rich diet immediately before it is fed to the lizards. This is what happens in nature, where no-one is "dusting" insects with calcium powder. Kale is a food which many insects like and is rich in calcium. So, my lizards are fed lots of insects at a time, so that the weaker individuals also get a chance, and these insects nibble at night from the waterdishes:

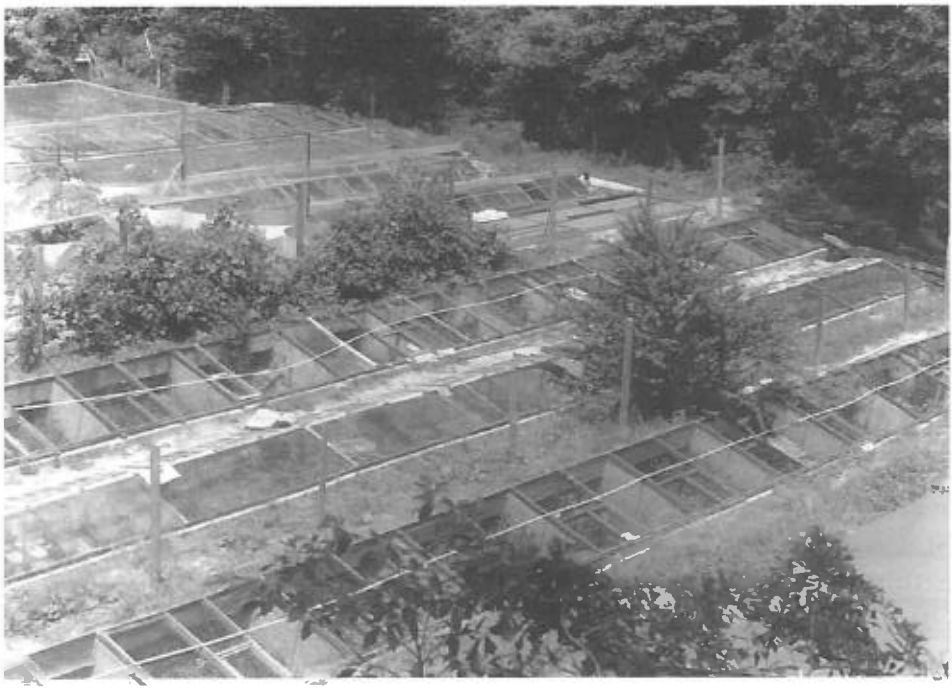

Plate 1: Overall view of some outdoor enclosures for breeding lizards at *Agama International.*

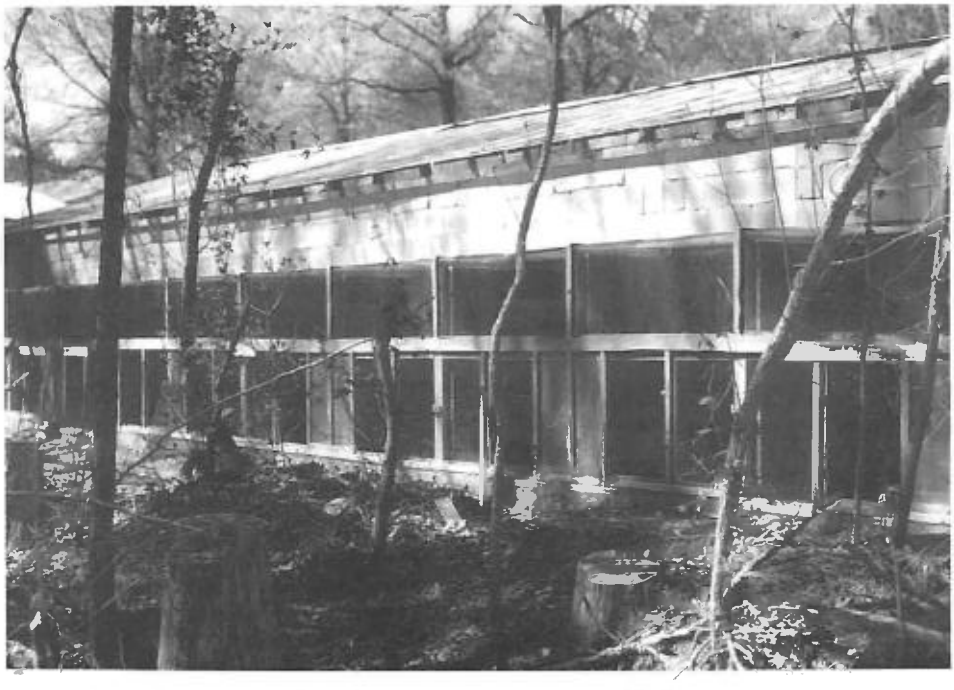

Plate 2: Cages for Basilisks and other large lizards at *Agama International.*

kale leaves. I never need to clean waterdishes, as I put in new kale leaves every second day with the young lizards. This is also faster than cleaning dishes. Now there are several good powders to dust the insects. The important thing is to use readily digestible calcium (as insects tend to contain enough Phosphorus) and Vit D3 (not D2). There is for example in the U.S.A., "Rep-Cal" of the Rep-Cal Research labs in Los Gatos, California, and there is "Formula C/P" of Mardel Laboratories Inc, Glendale Heights, Illinois. Probably there are more kinds of powders available. In the case of both mentioned powders it was hard for me to discover the precise Vitamin D3 content, in International Units. Add to this the fact that different lizards need different amounts of Vit D3 make me only more aware of the fact that we are still guessing and that here a lot of research is still needed.

Like most animals, lizards are also opportunistic. We need to understand what this means in order to reproduce optimal breeding conditions. In nature this means that when there is much space and food available the lizard will reproduce more rapidly and occupy the space before another competitor species takes the opportunity. To breed more lizards we roughly need more space and more food.

The space problem is not simply a matter of cubic metres. Space for lizards means spaces with different temperatures, different humidity, and enough basking spots for all. If we have less cubic metres available it is simply more difficult to create more of such useable space. If one has a nice large terrarium in which 1.2 Basilisks live and reproduce one should *not* expect to double the number of offspring by putting there 1.4 instead. It is even possible that this will produce less offspring and cost more in food. Also, the more places the young lizads have the faster they grow. This all means that lizard-breeding creates lots and lots of hard work in the beginning. One needs to build all these spacious terraria.

The other aspect is food. I discovered that more food will result in more eggs. The food of the insectivorous animals should be good. I worked mainly with crickets (*Gryllus*) and giant mealworms, but also locusts (*Schistocerca and Locusta*), common mealworms (*Tenebrio*), flies (*Musca*), etc. It appeared that it is important to give good food to the insects, especially just before feeding to the lizards. In the early 1980s, about five years before they arrived, with my help, in the U.S., I discovered that the "giant mealworm" was the best food insect to use, as it is easy to breed, the chitin content of the skin is relatively lower than in normal mealworms, and the lizards like them very much. Also it is easy to feed them to the lizards in a dish, unlike crickets (another good food) which jump away and hide. This "giant mealworm" (*Zophobas morio*) is now the bulkfood of my lizards and once such lizards as Basilisks, Lacertas, Sceloporus reach adult size, then it is their only food. Variety is provided only in the form of the varied stomach contents of the insects.

So far, at Agama International I have built about 200 terraria, mostly about 100 ft. sq. (or 10 m. sq.) each. As we have about 80 different species, I built various types of terraria, so as to be able to offer the lizards their most suitable microclimate. A terrarium is for me a room with enough space and enough possibilities for the lizards to chose favourable microclimatic conditions. One can do this indoors with computers etc., but this will be so expensive that the offspring would be impossible to sell. My basic idea is to start with local climatic conditions and adapt these, creating other microclimates according to the species kept. It would take too long to describe all the different types of terraria used.

My personal desire would be to just breed endangered species of lizards, maintaining large breeding groups (over 100 individuals) of such species inside the U.S., as long as their natural habitat abroad remains threatened. Experience has taught me that no one wants to spend a penny doing this, and I have no time to wait another twenty years for thinking to change.

So I choose the other option: we plan to breed non-endangered and mainly common species for the pet trade. If you only casually look around and listen, both in Europe and the U.S., at the way the trade in lizards works, it becomes clear that many lizards from the wild die between capture and sale to the terrarium keeper. So, breeding 1000 lizards for the pet trade will probably save up to 10,000 in the wild. In Europe there is so much public pressure against the trade in wild caught animals that new laws will be introduced very soon. These laws are very dramatic: dealers may no longer keep reptiles in stock; only member of reptile societies may still keep the animals. The result in fact will be that wildcaught animals are no longer

available and the future of terrarium keeping can only be assured by breeding enough animals in captivity - this public pressure, and hence the laws, are mainly caused by bad care of the animals in the countries of origin and also by some irresponsible dealers.

Although we have 80 species now, I believe we will end up with 30-40 speices, which breed most readily here. While I am building terraria I am at the same time expanding my populations. To mention one species as an example: in November 1989 I bought 12 *Basiliscus plumifrons.* Now I have about 150 *Basiliscus plumifrons* (bred from the original 12) (March 1991). By the middle of 1992 I expect to breed about 100 green *Basiliscus* each month.

I don't want to use this space to mention all the species I have, since this can be looked up in Slaven's books.

I want to breed about 500-1000 individuals of each species annually. Within a few years I expect to produce some 10,000 - 20,000 lizards each year. The genera *Basiliscus Eublepharis, Amphibolurus, Lacerta, Sceloporus* and *Physignathus* will make up the bulk of this number.

With the money provided by the sale of these offspring I can return to my first wish: breeding endangered species of the genera *Uromastix, Cordylus, Cyclura, Shinisaurus,* etc.

I hope my work will make it possible for other seven year old boys or girls in future to start their interest in nature by being able to keep a lizard from my captive breeding program. It is for this reason that I started breeding many cheap affordable lizards along with more expensive ones. Such lizards are *Lacerta strigata, Psammodromus algirus, Leiocephalus carinatus, Eublepharis macularius, Basiliscus basiliscus.*

Nature protection in future will be very much strenghthened by the fact that our youth is still able to have direct contact with nature. Either too strict laws, which will forbid the keeping of anything "wild", or the lack of availability of animals for terrarium keeping, will in the long run work against nature protection as a lack of concern arises from ignorance.