

Portrait of a Herpetologist as a Middle-aged Man — Chapter 6 History of the Dallas Zoo Department of Herpetology (1965–2005) and Comments on the Shrinking Importance of Zoo Herpetology

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Some parts of this article have been presented elsewhere, but are included again here to produce continuity.

Dallas Zoo Department of Herpetology (1965–2005)

From 1966 to retirement 30 years later, I was in charge of the Department of Herpetology in the Pierre A. Fontaine reptile building at the Dallas Zoo and later the curator of the Art Deco Dallas Aquarium in Fair Park. After retirement, I moved to Washington, D.C., and became a Smithsonian Research Associate in the Department of Herpetology at the National Zoological Park (NZIP) for 15 years and Curator for five years until October 2015. Later, I moved to the Smithsonian Natural History Museum. I am proud that Lauren Augustine from NZIP is now herp curator at Philadelphia Zoo and is building a strong scientific presence.

In the beginning, the herpetological collection in Dallas was very uninteresting, being comprised of mostly common pet-shop taxa. Many of my friends came to the rescue and began to place extremely rare species on loan. At one time, there were 51 varieties of rattlesnakes and a large number of Neotropical pitvipers. Ken McCloud, a colleague at USFWS began sending Indo-Pacific confiscations of rare boids, pythonids, elapids, varanids, and so many others too numerous to mention. These were exciting days—so many choices contributing to a sensory overload! After one trip to Latin America, every single one of about 30 trash cans—used to hold animals when enclosures were being cleaned—was filled with specimens collected by two of my close friends, Barry Armstrong and Jonathan Campbell. As word circulated through the herp community that these creatures—some never photographed before—were in our collection, an increasing number of zoo workers, biologists and serious amateurs throughout the world came to see and photograph the animals.

When we opened the building in 1966, there were precious few who wanted to work there, but as our reputation grew, many started sending job applications. In one case, I was asked by the personnel department to stop advertising positions as over 400 persons, some with advanced degrees, had applied for a previous one. Those days will never happen again. Since there were potential breeding groups available, reproduction was often successful and in one year, over 400 individual reptiles were donated to other institutions.

Our department received American Zoo Association (AZA) Awards:

- Two Edward H. Bean awards for reproduction in Bismarck Ringed Python and Bushmaster;
- Four Significant Achievement awards for reproduction in Eastern Diamondback Rattlesnake, Tancitaran Rattlesnake, Coahuilan Box Turtle and our rattlesnake reproduction program;
- Twenty-one First Captive Breeding awards for a variety of reptilian species;

- Silver Propagator's Certificate for American Milksnake;
- Gold Propagator's Certificate for American Milksnake.

There is no question that the main key to our success was the skill and dedication of the staff. Fourteen employees have moved on to higher positions at other zoos. Examples include Don Boyer, curator of herpetology at Bronx and San Diego Zoos, Dave Blody and Clay Garrett, curators at Ft. Worth Zoo [Garrett and the late Dave Chiszar were co-editors of an issue of *Zoo Biology* on zoo herpetology.], Dave Barker at Gladys Porter Zoo and author of books on boid snakes, Fred Antonio at Santa Fe College Teaching Zoo and Central Florida Zoo, the late Jan Perry at Audubon Zoo, and Winston Card at Cincinnati Zoo.

We have collectively written or edited over a dozen books, some on captive management of herpetofauna, natural history of Mexican rattlesnakes, boid snakes, Komodo dragons and other varanids, chameleons, *Grzimek's Animal Life Encyclopedia*, and over 200 papers, book chapters and bulletins on topics such as the ethological and reproductive studies on a variety of amphibians and reptiles, ophiophobia, zoo history and philosophy, social behavior of herpetologists, and husbandry. A number of papers included keepers as sole and/or co-authors. In a future chapter, I will go into detail about our inclusion of the entire staff in these publications. Many of these books, papers and chapters were coauthored with academic herpetologists—Kraig Adler, J. T. Collins, Jon Campbell, Charles Carpenter, Gary Ferguson, Jim Gillingham, Jim Hanken, Gordon Burghardt, David Chiszar and Hobart Smith—resulting in far better final publications.

Over 20 years ago, Kraig Adler and editor Robert Hansen asked me to be section editor of a new column, called ZOO VIEW, in SSAR's *Herpetological Review* to stimulate zoo workers to join the society. When Bob Hansen retired as editor after 30 years in 2021, I decided to join him. My replacement is Robert Mendyk from the Audubon Zoo.

Part of this new endeavor was to solicit articles from zoo personnel; one important example was the description by NZIP pathologist Don Nichols on his search to identify the etiologic agent, later described as *Batrochochytrium dendrobatidis*, in a paper entitled "Tracking Down the Killer Chytrid of Amphibians" [2003, 34(2):101-104]. I was a board member of the IUCN/SSC Declining Amphibian Populations Task Force from its inception until it ceased operations 16 years later (see Heyer and Murphy, 2005) and continue as a member of the Captive Breeding Specialist Group of that organization.

My colleague Winston Card and I published two papers on zoo herpetologists. One of them (Murphy and Card, 1998) presented our analysis of the characteristics of our fellow work-

ers in zoos and aquariums and our perception of their unique personalities. It is striking that herpetologists have many similar interests; I received numerous comments from partners of these people stating that the comparisons were spot on.

The second contribution (Card and Murphy, 2000) was divided into two parts: 1) lists of persons in chronological order under their institutional affiliations in the United States; 2) biographies of deceased and retired staffers who have had an impact on our discipline. This circular, focusing on deceased zoo herpetologists, updates and expands upon earlier information presented in the first publication. In addition, the histories and accomplishments of deceased foreign professionals have been added to show how the profession is global in scope. Early on, I realized after talking to zoo workers that the rich herpetological history and contributions of our predecessors were in danger of being lost forever, so in 2007 I wrote my book entitled *Herpetological History of the Zoo and Aquarium World*, published by Krieger Publishing in cooperation with SSAR. This writing effort lasted over five years. One aspect was that all non-English literature citations were translated by volunteer translators available through the Smithsonian Institution. I sent drafts of chapters to many colleagues, for comments, additional information on initiatives and publications, and possible revisions; Roger Conant penned the foreword.

A list of publications by the Dallas Zoo and National Zoo staffs appears in the Appendix to this article.

Comments on the Shrinking Importance of Zoo Herpetology

"Reptile keeping has developed into a science during the past two decades, and the advancements, especially in the fields of medication and captive breeding, are little short of phenomenal. Compared with the sophisticated techniques that are now available, our efforts of half a century ago seem crude in the extreme. In those days we often considered ourselves lucky if a majority of our animals lived a year or two, and what little captive breeding occurred was fortuitous, not planned."

Roger Conant, 1980

"Thus captivity will result in intensive selection, molding the animal in a manner quite different from that followed in its natural environment. The final product will be an animal much better adapted to live in close association with humans, in the home or laboratory, but less well adapted for life under natural conditions."

Henry S. Fitch, 1980

There are enormous challenges and changes taking place in our profession. Unsettling and penetrating questions are being asked about the value of what we do as zoo and aquarium professionals, both inside and outside our institutions, as evident in the quotes above.

It is no longer possible to restrict one's zoo career to just keeping animals. During job interviews, some candidates have said that they prefer working with animals rather than humans --- their applications immediately go to the bottom of the pile. If one wishes to move up the food chain and compete for higher jobs, then familiarity with administration, fund-raising, supervision, public outreach, and other non-animal skill sets is critical. It is almost certain that the ability to read a budget spreadsheet is as important as knowing what current scientific name should be used for any taxon. One example here should suffice. I receive

job descriptions from many zoos soliciting applicants to apply for positions beyond the keeper level, virtually all of which require a minimum of at least one year's supervisory experience and broad familiarity with the needs of zoos and aquariums. The tragedy is that most zoos do not offer learning opportunities to keepers so that these minimal requirements can be met.

We are not preparing the younger generation to be successful as potential curators. This is obvious when a position description is circulated throughout our membership and applicants begin to send résumés. Academics from the research side often have virtually no experience with a variety of living captive animals, public outreach, or personnel management. Some zoo workers who came up through the ranks have little experience in setting up successful research programs, either in the zoo or in the field, which often includes collaborations with those outside the zoo setting. It is striking that many applicants are unfamiliar with the rich history of the zoo and aquarium world, so one fears that they may well repeat the mistakes made earlier by their predecessors. Curators with a blend of these critical skills are hard to find now; at least this is what I am told by those persons entrusted with finding suitable candidates.

Our profession is becoming increasingly bureaucratic, and much time is spent filling out surveys, answering an enormous number of e-mails, attending unproductive meetings, and preparing a plethora of memos in response to various issues such as visitor safety, personnel problems, and animal welfare. As a result, the time available to focus on biology is shrinking --- this is a chronic complaint by my fellow zoo workers and I understand their frustration. I suggest that institutions review all policies, jettison those which no longer apply, refine those that need improvement and keep only those that are proven to be effective and useful.

Zoo administrators now deal with the internet and any possible deficit that risks a zoo's reputation such as an animal escape, visitor injury, or untimely animal death, can be broadly and quickly spread --- worldwide. Some people dislike zoos and aquariums, accuse us of ignoring animal welfare, and do not understand the value of zoo programs to conservation in the broad sense. We may have inadvertently contributed to this perception by personalizing individual animals. Perhaps it seems safer and easier for us to focus on individual animals: we often use pet names for them, try to enrich their lives by interactive play and using manmade objects, and bond with them as surrogate humans without concern for imprinting or other side effects. When animals are near the end, they cannot send us a note saying "Do Not Resuscitate." But we employ dramatic medical interventions and costly procedures to ensure that they live to a ripe old age, and mourn and grieve over their deaths (In a few extreme cases, grief counselors have consoled the animal care staff for an animal death and quasi-memorial services have been held). In sum, we demonstrate that we care and we publicize to our audiences that we do.

Enrichment has become one of the newest trends in the zoo world but I am not certain how we measure whether our changes to an animal's living space and activities actually improves their lives or whether it just makes us feel better. I do know that if we were keeping animals successfully by fulfilling all of their needs, we might no longer need to resort to techniques like assisted reproduction, cryopreservation of gametes, and hand-rearing. We do not spend enough time trying to understand and convey the

need to protect an entire species or larger clade rather than individual animals. We need to confront and explain to our visitors thorny problems like the need for euthanasia to deal with limited space in zoos, the issues confronting wild populations, climate change, the sixth mass extinction event, and the advent of the Anthropocene. We need to figure out how our captive colonies can be managed more effectively to accomplish conservation goals.

Many of our zoos are experiencing severe financial shrinkage and the future for some may be problematic. Fund-raising, development, and public relations have become an integral part of the zoo scene. Some of my herpetological colleagues complain that their time is spent leading tours, giving public presentations and interacting with potential benefactors rather than working with the collections. These colleagues have an incredibly short-sighted view for, in fact, their existing or future programs will disappear if there are no monies to support these initiatives.

Obtaining animals has become much more difficult. Moving animals between zoos and aquariums for our captive management programs has become more time-consuming, due to risk of infectious diseases, lack of quarantine space, and increased paperwork. There are few animal dealers now, so zoos may be restricted to mounting their own collecting trips to range countries; these are limited, however, by travel and other expenses, increased paperwork for permits, and lack of reliable in-country associates. Even if such impediments are overcome, there are no guarantees that the animals will be found. While some zoos cooperate with hunting ranches for space to ensure genetic diversity for some large mammals, there is no such program for reptiles. Although this would have been inconceivable to me a short time ago, I can now envisage a day in the future where zoos could be forced to work more closely with hide dealers producing propagules to maintain large reptiles such as crocodylians, iguanids, varanids, boas, and pythons. Public outcry is certain to be deafening in the herp community and administrators may need to be ready to defend this practice. As a herpetologist, I find killing any herp abhorrent (unless it goes to a museum collection), especially when their skins are being used in the fashion industry, but we are running out of time and space ---and some protected wild populations are shrinking precipitously due to human exploitation. My sense is that convincing people to avoid purchasing animal products to drape on their bodies seems not to have been working effectively over the past decades --- I still see plenty of snakeskin belts, handbags, and wallets as well as shoes made from crocodile skins at the local department store and I suspect that most are collected from the wild. The IUCN Python Conservation Partnership is in favor of commercial python farming to combat the illegal trade for python skins (Natusch and Lyons, 2014). For nearly 80 years, the Reticulated Python (*Python reticulatus*) and the Burmese Python (*P. bivittatus*) have been harvested from the wild in Southeast Asia. An astounding nearly 500,000 skins are shipped on the black market every year for use in European fashion, worth an estimated one billion dollars US. This paper evaluates the economic feasibility and viability of captive breeding as a possible way to sustain and conserve them. One possible part of a future plan: do not harvest animals sent by zoos, but only their progeny not needed for sustaining captive populations.

The total of these onslaughts and new expectations is that our community has become defensive and tentative. For example, I have heard few discussions about management euthanasia for my entire career (45 years +) and the topic continues to be rarely discussed because there is great risk involved to those having the courage to act on the idea. In the past, zoo directors have lost their jobs over the controversy that erupted when they culled healthy animals that were not contributing to breeding programs. While the Copenhagen Zoo furor—after euthanasia of a giraffe and four lion cubs for management purposes—has spurred a useful discussion of the issues among many zoo workers, virtually all of my non-biologist friends have roundly condemned this action. When I try to explain the rationale for doing this, they are unconvinced.

What is the future of herpetology and specifically zoo herpetology? This latter discipline is becoming very different from our earlier experiences with zoo herpetologists and their buildings, animals and programs, accumulated over 50 years. While there are a few outstanding examples of new zoo herp buildings such as the Fort Worth Zoo's MOLA, Los Angeles Zoo's LAIR, and Zoo Atlanta's Scaly Slimy Spectacular, relatively few new facilities are being constructed exclusively for herps where new zoo employees may not be introduced to a herpetologically rich environment nor encouraged to become specialists. As new facilities are being designed in zoos throughout the world, it often seems that reptiles and amphibians are added as an afterthought, as a small part of a mixed species exhibit or a few small exhibits added in to a much larger exhibit complex. The sad reality is that many zoo herpetologists are concerned and traumatized by the enormity of the problem of disappearing biodiversity. They continue to struggle to find suitable niches, both within their institutions and in the broader conservation and academic communities.

Another worrisome trend that appears to be increasing is the decision by some zoos to move away from traditional taxonomically-defined departments. Over the last decade, several North American zoos which once had longstanding herpetology departments with dedicated herpetology staff and curators have been merged with other departments (e.g., birds, small mammals, aquatics, ambassador animals, invertebrates, etc.). Other zoos have done away with taxonomic groupings altogether and switched to biogeographically-defined departments (e.g., "Africa", "Asia") or even less-specialized zones in the zoo (i.e., "North Zone", "South Zone"). We are concerned that these changes will impact the herpetological conservation and research activities and productivity of zoos, the scope and diversity of their herp collections, staffing, and ultimately the level of expertise and care afforded to captive animals. These changes, including an increasing reliance on generalist keepers over specialists are also reducing the number of true herp keeper positions in zoos, leading to unprecedented levels of competition for jobs. As a recent example, NZP received more than 300 applications for a single herp keeper position. This reduction in specialized positions is also especially true for herp curator and manager positions, where the traditional pathways that zoo herpetologists once followed to advance in their careers may become a relic of the past. Much like many of the taxa we gravitate towards,

herpetology curators appear to be on the way to becoming an endangered species.

Countering these growing trends that could be disastrous for reptile and amphibian programs in zoos will require a multifaceted approach that clearly illustrates the importance of taxonomic specialization and expertise in herpetology to zoo administrators, board members, donors, patrons and oversight committees. Tangible results and deliverables demonstrating the productivity of herpetology departments such as scientific and popular publications, public and professional presentations, direct involvement and coordination of conservation projects, collaborative in-house research projects, and participation in documentaries that highlight specialized skill sets to wide audiences may serve as the best weaponry. For zoo herpetology departments to be productive in these endeavors, however, it is crucial that staff be provided with the opportunities and support to take on and excel in these endeavors.

Finally, there is a conundrum. Some administrators, educators, graphics designers, and marketing people insist that the zoo visit must be a pleasant experience, not depressing or disconcerting. Our messages need to be simple, positive, and uplifting. Others maintain that the experience should be unsettling, because the natural world is disappearing at an unprecedented rate and humans need to be aware that their lives will most certainly change by living in an increasingly homogenized natural world. Zoo people have struggled with this dichotomy for decades. My belief is that visitors are capable of connected thought so we need to address difficult concepts and challenges in a forthright way with our messages, but we should also speak to those who simply want to have a good day out.

So what is likely to happen to those older zoo workers who yearn for the good old days where life in a zoo or aquarium was far less complex? The answer is simple—the world is changing at a frantic pace, biodiversity is quickly leaving us, and those old days will never return. Get over it. Future challenges have been identified which must be addressed to ensure our survival, which in itself is a good thing.

Has Herpetological Science Shrunk in Zoos?

"It is still so near pioneer times that people over forty remember wilderness to spare. But talk big to your boy nowadays about your own boyhood in the woods and you suddenly realize that you're stirring him up with urges less likely to profit him than knowing how to shrink heads or to build himself a sound harem.

In Florida these days, you can still hear, under the mindless, glad din over industry coming in, the voices of the old ones -- or of the young ones who have listened to the old ones -- grieving over the passing of the wilderness. They are no longer watching landscapes wasting away. That happened long ago. What is going on now is just a lot of little cleanup operations, little scratchings-out of small tag-ends and patches of the past overlooked in the first waves of ruin."

Archie Carr, 1993

"The discovery and delimitation of species has changed dramatically over time. Species delimitation practices became more thorough and formal in the 1900s with the introduction of detailed studies of geographic variation, contact zones, and reproductive isolating mechanisms. In the 1960s, genetic methods for examining the allelic composition across many loci began to be used to test for gene flow and to delimit species boundaries. Methods for DNA sequencing were invented in the late 1970s, just as I started graduate school, when I set my sights on applying the vast stores of information in genomes to understanding biodiversity. In the late 1980s, a new method for rapid amplification of mitochondrial DNA led to "barcoding" of species and the subsequent splitting of species into mitochondrial haplotype groups. By the 1990s, widespread sequencing of nuclear genes led to the development of models that incorporated multispecies coalescent theory (MSC). Molecular-based methods provide new insights and opportunities for species delimitation, but many species delimitation studies do not adequately consider violations of underlying model assumptions before making taxonomic changes.

Inadequate sampling and a lack of attention to contact zones often leads to the over-splitting of species into geographical proximate groups of populations. I predict the future will bring a synthesis of many older practices (careful sampling, with attention to reproductive isolation, contact zone analysis, and geographic variation) with the new powerful analysis of genomic data sets, leading to a reevaluation and reversal of much of the recent overly enthusiastic splitting of geographically variable species."

David M. Hillis, 2019

In a recent issue of *Connect*, the newsletter of the American Zoo and Aquarium Association (AZA), it was said that zoos and aquariums supported conservation initiatives to the tune of over \$130 million dollars in 2011, an impressive sum indeed. These included both *in situ* and *ex situ* programs. Between 2007–2011, AZA's Conservation Endowment Fund awarded \$419,694 to 22 reptile and amphibian conservation projects. This was out of 71 projects funded overall during that time period. The herp projects are being done at the institution or in the field.

In 1983, since-retired curator Richard A. Sajdak from the Milwaukee County Zoo published an important article called "Herpetological research in zoos: A literature survey, 1977–1981" in the journal *Zoo Biology*. Of 1084 herp papers published in three major journals between 1977 and 1981, zoos were involved in fifty-three. A total of 16 zoos contributed and under three-fourths of these papers involved behavioral research.

Fifteen years later, Winston Card and David Roberts from Dallas Zoo and R. Andrew Odum from Toledo Zoo published a critical paper that was disturbing. They tried to survey 52 herp departments in the US to assess involvement with AZA-sponsored programs and formal research programs during the past decade. Problem # 1: less than half responded; Problem # 2:

nearly 80% of the 164 technical papers published were contributed by three institutions; Problem # 3: over 40% of the non-technical articles were published by one institution; Problem # 4: only four of the 20 plus departments having what they described as “in-house research projects” had clearly defined objectives.

If one takes this analysis further, it is clear that some zoo herpetologists devote many hours to AZA-related activities, i.e. preparing studbooks and Taxon Management Accounts (TMAs), administering Taxon Advisory Groups (TAGs) and so on, and believing that these activities are research. That is really not true.

For awhile, the U. S. Fish and Wildlife Service (USFWS) has prompted incorporation or support of field initiatives. In order to comply with some regulations protecting endangered or threatened species, we must demonstrate that our programs will enhance survivability in the wild by some direct involvement with wild populations. Sometimes, we are inexperienced or unprepared to do field projects in the field, especially in developing countries. Extensive habitat destruction, hopeless bureaucracies, and nightmares obtaining permits and indifference by issuing officials were identified by Jonathan Campbell and Darrel Frost nearly 20 years ago: “If the effect of our statements is to make others press for legal restrictions in the taking of these animals, without serious protection of their habitats, then we can only lament that these people have failed what is, in effect, a conservation biology IQ test. They will have put a new roof on a burning house” (Campbell and Frost, 1993). Can anyone argue that the situation has improved since that time of writing?

Because zoo keepers and biologists too often feel overwhelmed embarking on a project involving wild populations, I offer this solution to curators or other zoo staff for initiating a study in the field: 1) arrange to work with a biologist who already has a field project in place; 2) use the keeper staff as field assistants and rotate them; 3) minimally, keepers must prepare for the field beforehand by reading the two books below; 4) zoo staffers benefit by learning a new skill set. Although zoo herpetologists may have spent time in the field collecting herps, they rarely have formal training in conducting a field research project. I say this with certitude because I have reviewed hundreds of résumés, from keeper to curatorial jobs, during my career and this deficit is striking.

The task is easier now because these two books, one old and the other more recent, provide a comprehensive guide as to how to do an *in situ* study on amphibians and reptiles. The first is *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians* (Heyer et al., 1994). The newer companion volume covers reptiles: *Reptile Biodiversity: Standard Methods for Inventory and Monitoring* (McDiarmid et al., 2012). In the foreword, Rick Shine sums up the challenge in studying biodiversity: “This is the book that I desperately needed at the beginning of my scientific career. Like most other young herpetologists, I had a pretty simple set of ideas about how to gather data --- I’d just go out there, look for snakes, find some, catch them. and then write down anything that seemed useful (such as their sex or body size). And somehow or other, once I’d been doing that for long enough, I’d have a data set that could

then tell all kinds of interesting stories about the biology of the creatures in question . . . And after talking with those more experienced herpetologists, it dawned on me that I actually needed to think about what I was going to do, and how I might ultimately use the data, *before* I started my fieldwork.” Before any field study is planned, both books should be thoroughly read to ensure that proper methodology is incorporated; no bookshelf should be without them.

I know many biologists, and virtually all are pessimistic. Some are now calling themselves “Extinction Biologists,” a chilling appellation indeed.

Let me count the ways that some of my herpetological friends and colleagues are skeptical about the long-term success of our *ex situ* zoo conservation projects. Ecologists and evolutionary biologists tell me that extinction is part of the natural mosaic—I need to deal with it, get over the loss of biodiversity and give up intervening—I should just trim my fingernails indifferently and watch it happen. Academic and museum scientists tell me that successful reintroduction is unlikely since there are virtually no suitable places likely to be left after man has intruded into the habitats. Even if some relatively pristine protected areas can be found, the bureaucracy of getting permission to release captive-bred offspring is daunting. Besides that, some of our captive animals have been shaped in a negative way by becoming domesticated, as pointed out by the late Henry Fitch in 1980.

There are few careful studies that assess the competence of our propagules. My colleagues ask me that if our captive animals are competent, then why do we need to resort to procedures like assisted reproduction? The possibility of introducing infectious disease harbored by captive animals is always a concern. Some conservation biologists tell me that we should produce as many animals as possible, related and unrelated, dump them into a secure place and let natural selection weed out the unfit. They point out that genetic diversity is not the only measure of success for survival. Others say that we should not bother with captive assurance colonies at all but rather spend our money buying land focused on endemic hotspots and hiring armed guards to protect them.

A few say we should only set up breeding colonies in countries of origin. Some of my fellow zoo professionals say that many captive colonies have proven to be wasteful in terms of resources and unsustainable. They point out that some species coordinators take a long period of time to send recommendations to minimize inbreeding depression, that others do not send updated information or respond to the recommended pairings, that shipping costs are skyrocketing, paperwork to transfer animals between zoos is dramatically increasing, and there are not enough founders to sustain many populations over the long haul. Although we may try to deal with the founder issue, many countries are loathe to approve sending animals collected from the wild to zoos and so the requisite paperwork needed to do animal shipments is not issued. Registrars have witnessed a dramatic change in that fewer live animals are shipped now and requests for shipping biological materials have increased exponentially. Is it any wonder that zoo biologists are uncertain about their future role in conservation, especially when criticism and

suggestions for improvement — often contradictory — comes from many different directions?

Card et al. (1998) asked an important question: does zoo herpetology have a future? Do we want to be major players in conservation and, if so, where should we marshal our very limited resources of time, space, and money to protect animals at risk? At American Association of Zoos and Aquariums (AZA) meetings in the herp Taxon Advisory Group (TAG) sessions, the reality of putting breeding plans in place to cover amphibians and reptiles in danger of extinction is staggering — there are simply too many species in jeopardy and not enough space in captivity. When I talk with zoo people working with endangered mammals, birds, fishes and invertebrates, it is clear that their experiences parallel ours. We are fighting with each other for a bigger piece of the conservation pie (and that pie is shrinking). Which animal is more important to save — the Asian elephant or the Aruba Island rattlesnake? And most crucially, is there a realistic chance of success? Are our assurance colonies going to be nothing more than assisted living complexes? If assurance colonies are the end point, then why do we bother? Perhaps the programs and colonies exist only to have animals available for our institutions in the future without the slightest hope of reintroducing them? If this is our purpose, we should say so and not advance the notion that this is conservation. How about a middle ground where we do the assurance colonies with the best outcome being reintroduction and the worst being only in zoos and the middle being ‘should conditions in the wild merit it, animals would be available for reintroduction.’

I am confused by all the talk about reintroduction espoused by the zoo community. If a taxon is at risk in the wild, the prime reason seems to be that human activities have changed its living space in some fashion. There are many examples: strip-mining, mountaintop removal, introduction of invasive species, housing developments, oil exploration, clear-cutting forests, water pollution and others equally damaging. If those activities continue, then surely it is illogical to even consider putting captive animals at risk back in original habitat. As I see it, the only other option is reclamation after developers have had their way destroying the land. Studies are needed before the land is ravaged and thought as to what it takes to bring it back or can it even be brought back to its original state. So do we redirect funds to support reclaiming ravaged lands and make this our highest priority?

Scott Pfaff from Riverbanks Zoo told me that he contacted 40 zoos about a couple of decades ago to help develop a breeding program for King Cobras as a way of ensuring that these spectacular snakes would always be available in the future. To do this, a zoo would have to commit to maintaining breeding pairs,

incubating eggs, raising neonates, and distributing snakes to other institutions. Only two institutions were willing to participate and most of the others wanted only one large adult for display, expecting Scott to raise their snake until it was large enough for that purpose. Reminds me of the old folk tale: “Who will help me bake the cake?” asked the *Little Red Hen* “Not I, not I.”, said all the other animals in the barnyard. “Who will help me eat the cake?” “I will, I will.”

I quote William Conway (2011): “Successful specialized propagation programs for bats, beetles, snakes, and fish underscore the point: *Specialization is key to every successful threatened species propagation program.*” I here propose a plan for future captive populations in our zoos and aquariums using the Conway model as a guide. In a true Darwinian sense where species are selected against if unfit, we should ruthlessly evaluate all of our current programs, using the Aruba Island Rattlesnake (*Crotalus unicolor*) initiative (Odum and Goode, 1994; Odum, 2010) as a model which includes placement on the IUCN Red List of Threatened Species. For new ones, we should insist that an *in situ* component be required — this could include sending money to support scientific studies such as infectious disease, setting up rehabilitation and breeding centers for eventual release, training students and wildlife officials, rebuilding productive collaborations and interactions among the zoo, academic, and conservation biologists, actualizing a plan for public education, developing recommendations for protecting habitats and creating reserves, and a host of other challenges requiring our help. For those now existing without this element, we should consider requiring addition of an in-country plan and if this is not possible, letting them leave the collection through attrition. We must always ask the critical question: are our plans in place consistent with intended results and if not, are we willing to jettison them and try something different?

Conde et al. (2011) recommend a plan that is tangential to mine or even bolsters the idea that species should be ranked: “Because *ex situ* conservation programs can be challenged when called into action at the last possible moment with only a few remaining individuals of a species, captive breeding should not be simply seen as ‘emergency-room treatment.’ It is a tool that should be considered before the species has reached the point of no return.”

Now that I think of it, perhaps all the discussions taking place — of rewilding and de-extinction and forensic taxonomy — are a measure of just how desperate everyone is feeling. My friend Joe Mendelson sums it up succinctly (2011). Well, we certainly have much to discuss as captive managers and zoo/aquarium conservation biologists and we do not have much time to get it right!

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