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PUBLICATION TRENDS OF NATURAL HISTORY AND FIELD STUDIES IN HERPETOLOGY

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***Abstract.*—Although natural history studies provide important information on the life histories of amphibians and reptiles, their publication has gradually declined over recent decades. We compared publication of natural history and total articles in *Herpetologica* and *Journal of Herpetology* over the lives of these two journals. We analyzed data using trends analysis and the individual trends with regression techniques to describe changes in publication frequency. In *Herpetologica*, the number of natural history articles increased from 1936 through the 1960s, but these manuscripts were often short notes and isolated observations. The number of total publications and of natural history publications remained stable through the late 1960s. Although the total number of articles published in *Herpetologica* has declined in more recent times, the relative number of life history publications has dropped much faster than the total production. Both the numbers of natural history articles and all articles increased since the founding of *Journal of Herpetology*, but natural history articles have dropped substantially since the mid-1990s. When combining publishing trends for both journals, there was an obvious decrease in the proportion of natural history articles. Explanations for these reductions are complex but may include less grant funding, editorial decisions, additional competition from other journals, and the rise of molecular biology and genetic studies. Many of the 'natural history' papers may have migrated to regional journals, foreign outlets, or one of many new specialized journals.**

Key Words.— conservation, *Herpetologica*, herpetology, *Journal of Herpetology*, natural history, publishing

Defining the biodiversity of our planet goes beyond describing structure and phylogeny. Biodiversity is also defined by how the environment molds life history characteristics (a.k.a., natural history) within and among species. Therefore, the basic biology of an organism provides critical information for developing models and testing questions of importance to evolution (Mayr 1963), environmental issues (Anderson 1985; Clemmons and Bucholz 1997; Schneider and Root 2002) and clinical topics (Mayer 2004). Natural history traits are the result of natural selection on the individual which drives the makeup of a population (Stebbins and Cohen 1995) and it forms the foundation upon which advanced biological research and conservation strategies are built (Greene 2005). Meaningful question-driven research requires in-depth data collection of natural history information. Further, we derive the information necessary to implement conservation strategies from the organism's basic biology or natural history (e.g., see Bury 2006).

Natural history data are key elements of biodiversity studies and must be statistically robust, of sufficient sample sizes, and temporally and geographically representative (Greene 1993). These considerations require a firm understanding of study design (e.g., danger of pseudoreplication; see Hurlbert 1984) and the biological levels of organization. Also, they should be focused on natural history and not embedded in other kinds of research.

The volume of natural history articles being published may be declining fast (Lunney 1998). Others suggest that natural history is thriving and dominating outlets outside the herpetological community (Arnold 2003) or being embedded in other studies. Here, we examine publishing in two herpetology journals to determine how natural history publishing has varied over their lives and discuss the implications of these patterns.

MATERIALS AND METHODS

Because the *Journal of Herpetology* and *Herpetologica* are the two major North American journals focused strictly on herpetology, we chose these as the focus of this study. We reviewed 62 volumes of *Herpetologica* published from 1936–2003 (Volume 4, 19, 38-39, 49, and 52–54 were not available for examination and were excluded from this study) and 37 volumes of the *Journal of Herpetology* published from 1972–2003. We assembled a list of research areas that we used for categorizing manuscripts (Table 1). Often this information was embedded in manuscripts focused on questions of phylogeny or ultimate function ('why' something happens [Tinbergen 1963]) making the data difficult to identify. Any confirmatory (tests a hypothesis) or exploratory (proposes a hypothesis) article (for a discussion of these two approaches see Jaeger and Halliday 1998) containing new, original life history information was tabulated as a natural history article. Any attempt to document natural history articles will have a degree of subjectivity involved, and this study is no different. Still, we made every effort to accurately portray and represent what is and what is not a natural history article and to take the most inclusionary and liberal approach possible to classify manuscripts. Articles that focused on phylogeny, systematics, genetics or molecular biology, ultimate function, or other areas without contributing new life history data were generally not classified as natural history articles.

We subjected tabulated data to linear trends analysis and linear regression using Minitab 14.0 (Minitab, Inc.). We analyzed the publication patterns of both journals combined and each journal

TABLE 1. An abbreviated list of areas for life history and ecology studies with amphibians and reptiles.

Reproduction and Development	**Species Relationships**	**Gastroenterology and feeding**
Hybridization	Parasitism	Bioenergetics of feeding
Karyotypes	Commensalism	Selectivity and diet composition
Inheritance	Symbiosis	Foraging economics
Induced spawning	Mimicry	Factors influencing food eaten
Fertilization	Predation	Biomechanics of feeding
Developmental period	Predator evasion	Feeding behaviors
Hatching	Competition	Periodicity of feeding
Intersexual variation	**Biogeography**	Daily food requirements
Geographical variation	Original and current distribution	Nutrition
Environmental affects	Influencing factors	Food conversion rates
Embryonic development	Local distributions	Seasonal diet variation
Early life history	**Habitats and Associations**	Temperature association
Periodicity	Stress tolerance	Seasonal anatomical changes
Courtship	Thermal	**Populations**
Parental care/mate guarding	Salinity	Mortality rates
Spawning site	Daily, seasonal, etc., habitats use	survivorship/recruitment
Spawning period	Community associations	Relative/absolute abundance
Gamete viability	**Morphology/anatomy**	Demographics
Fate of breeders	Coloration/patterns/morphs	Disease
Spermatic/ovulatory cycles	Sexual dimorphisms	Conservation/management
Fecundity	Life history stage characterization	Seasonal, geographic
Fitness	Organ weights	Yearly patterns
Post-breeding behavior	Teratology	
Factors influencing growth	Length & weight associations	
Relation of sexes and kin selection		
Longevity (average/maximum)		

separately to reveal the patterns (N papers/yr) of total, natural history, and non-natural history publishing which have occurred over the life of these journals.

RESULTS

Herpetologica.—Number of papers was erratic early in its history, but stabilized to about 10–20 articles per issue by the 1970's (Fig. 1). From 1936–1964 *Herpetologica* published a mean of 14.7 (SD = 8.2) articles and 7.6 (SD =5.6) natural history articles per issue. There was little difference (2.2%) between total and natural history publishing in the journal during this period. Natural history articles increased from 1936–1964 (Fig. 2; r^2 = 0.317, P < 0.001) despite an obvious shift from publications characterized as short "natural history note" type manuscripts, to larger research manuscripts with extensive datasets. Then the total volume of articles stabilized in *Herpetologica*, but the number of natural history articles declined in 1970-2003 (r^2 = -0.630, P = 0.001) 13.8% faster than total publishing (r^2 = -0.506, P = 0.001). Non-natural history publishing remained stable during this same period (r^2 =0.040, P = 0.327). The proportion of published articles that focused on natural history also declined (r^2 = -0.242, P = 0.011).

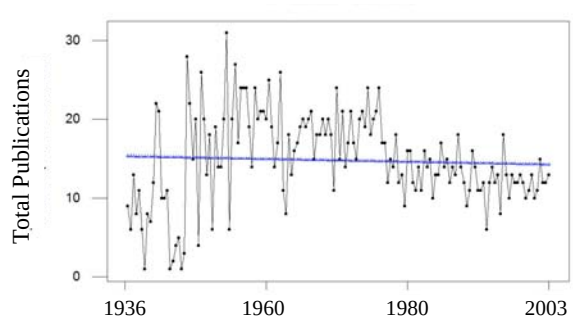

FIGURE 1. Total publishing in *Herpetologica* 1936–2003. Points are observed values and the line represents the trend.

Journal of Herpetology.—The total number of articles published increased since its first issue (Fig. 3). Publication of natural history articles increased dramatically (Fig. 4; r^2 = 0.597, P = 0.001) since its founding, but rose 10.5% slower than total publishing and dropped since 1993. Currently, *Journal of Herpetology* publishes a mean of 14 (SD = 3.5) natural history articles and 24 (SD = 5.0) total articles per issue. Publication of non-natural history articles remained stable throughout this same period (r^2 = 0.099, P = 0.117).

Combined publishing.—Total combined publishing increased since 1973 (Fig. 5a; r^2 = 0.161, P = 0.042). The number of natural history articles did not increase (Fig. 5b; r^2 = 0.010, P = 0.634), although publication of non-natural history articles increased (r^2 = 0.141, P = 0.059).

DISCUSSION

Our results suggest that the number of papers on natural history and species ecology data in herpetology journals is stable or declining relative to other types of articles. This is occurring when we need increases of such work for conservation and biodiversity management professionals (see Bury 2006). Of particular concern is the nearly 20% overall reduction in articles containing natural history.

Possible Reasons for the Decline.—There are many reasons that could reduce production or acceptance of natural history studies in herpetology journals. Editorial decisions played a critical role for *Herpetologica* (Robert Jaeger, pers. comm.) as this journal gradually altered its focus to "question driven" research while shying away from all but exceptional descriptive studies.

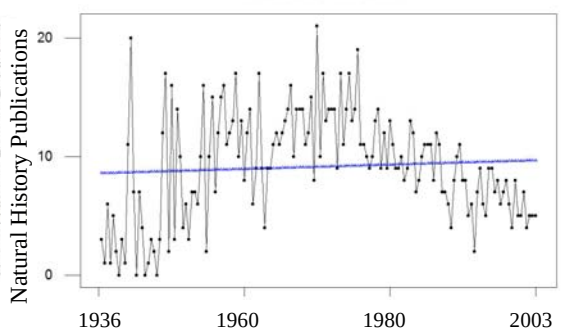

FIGURE 2. Publication of natural history articles and articles containing natural history information in *Herpetologica* 1936–2003. Points are observed values and the line represents the trend.

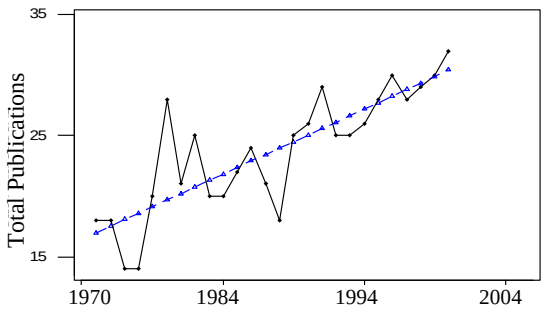

FIGURE 3. Total publications in the *Journal of Herpetology* 1973–2004. Points are observed values and the line represents the trend.

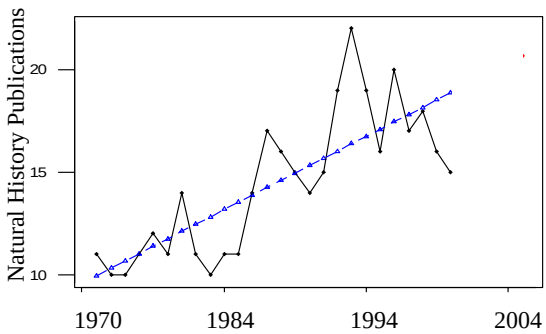

FIGURE 4. Publication of natural history articles and articles containing natural history information in *Journal of Herpetology* 1973–2003. Points are observed values and the line represents the trend.

Although *Herpetologica* regularly rejected natural history manuscripts during this period, the *Journal of Herpetology* continued to publish these kinds of submissions. The number of herpetologists has proliferated dramatically since these decisions were made (Altig 1989) and competition for page space within the primary herpetology outlets increased. This trend may have squeezed out natural history and field ecology studies. These studies are now often found in other outlets with more regional foci (e.g., *Southwestern Naturalist*).

The need for expansion of natural history research follows that which transpired in the systematics community after a steep decline in systematics research. The United States National Science Foundation (NSF) established a grant program dedicated to increasing systematics training opportunities. This action led to increased publication in this important field. By 1989, the growth of modern molecular and mathematical techniques was accompanied by the loss of funding in systematists (NSF 2005). One of us (Malcolm McCallum) recalls hearing faculty say, "Systematics is dead" when he was an undergraduate during the 1980s. Recently, some university professors are declaring the same of natural history (see Bury 2006). This seems to run counter to declarations that it is alive and thriving (Arnold 2003). In response to a recognized accelerating loss of biological diversity, the U.S. National Science Board inspired the U.S. National Science Foundation to develop programs to circumvent declining numbers of systematists (NSF 2005). The goal was to "increase the number of systematists so that we could accurately document the biodiversity present on the planet." This was needed because of the "Retirement of taxonomic specialists, shifts in academic recruitment and staffing, and reductions in graduate training opportunities." These situations were declared to "impede biodiversity research and conservation, particularly of poorly known groups of organisms" (NSF 2005). Today, we have a much more secure and technologically advanced systematics infrastructure; whereas, natural history continues to disappear from the research scene.

The introduction of genetics and molecular biology into the

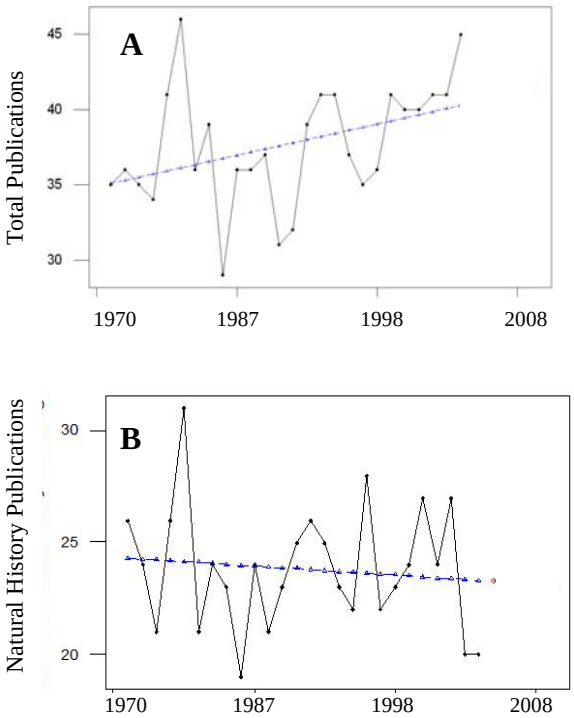

FIGURE 5. Combined publication patterns between *Journal of Herpetology* and *Herpetologica*. Points are observed values and the line represents the trend. A) Total number of manuscripts published by both journals combined has increased since 1973. B) Publication of natural history publications and articles containing natural history information has decreased since 1973.

research arena undoubtedly created significant competition for financial, human, and technical resources. Natural history research surely continues to suffer as these other growing fields expand (but see Arnold 2003). An examination of the herpetological literature will reveal considerable inroads by molecular biology into systematics, conservation and evolutionary ecology. Molecular approaches now dominate modern systematics, but technologically advanced approaches (e.g., radio isotope diet studies, genetic fingerprinting) are expensive to justify for natural history work unless the focal species has conservation status. Geographic information systems and their associated extensions are probably the only new technology that became widely adopted by natural historians. Although most natural history investigations do not require technologically advanced and novel approaches, incorporation of these techniques can improve the odds that a natural history article will be published. In fact, most natural history publications in highly rated journals involve some form of advanced technology or species of conservation concern (our anecdotal observation).

Consolidation and closure of many university museums (a key resource used in status reviews, see Bury 2006) probably also contributed to the reduction in natural history work as well. Natural history studies frequently use museum deposited specimens for investigation. The researcher lacking travel funds and access to museum collections cannot obtain enough specimens to adequately describe life history characteristics leading to abandonment of this line of work in favor of more fundable research areas. This situation creates negative feedback because for natural history studies to be useful they must be permanently archived (Greene 1993). As more researchers cease natural history work and field biologists retire, there remain fewer opportunities to properly train candidates in this important area of biodiversity studies. Consequently, the climate for natural historians studying the Earth's biodiversity mirrors that which was present in systematics when NSF implemented programs to reduce the shortfall of experts.

The current academic climate does not foster natural history research, especially long-term studies (Fitch 2006). Many universities require specific grant numbers and dollar values for superior faculty evaluations. The moderate number of government biologists studying natural history is also declining as administrative tasks continue to grow and increasingly dominate their time and responsibilities. No grant-funded programs currently support training natural historians and none are dedicated strictly to natural history research (NSF, pers. comm.). Natural history research on common species must be attached to larger questions or embedded within other areas of research (NSF, pers. comm.). Essentially it is an after thought to "fundable research." By placing low priority on life history investigations our society has unintentionally placed conservation needs for common species on the backburner. If a species declines enough, reactive measures will make funding available. However, many logistical problems exist and proactive approaches to funding natural history research are needed to avoid or prepare for imminent declines.

What Does This Mean to Science and Conservation Efforts in Herpetology?— Natural history studies are generally focused on the organism and its response to its environment (Greene 1986, 2005). The immediate aim is to "describe fully and accurately everything that is seen" (Green 1993) and to develop hypotheses for future study (Jaeger and Halliday 1998). This requires substantial dedication and skill, despite the general belief that it is chiefly anecdotal, requiring no forethought, perspective, or special training (Greene 1986). In fact, natural history study requires a voluminous knowledge of biodiversity. Because of the skill required (Table 1), there are several detailed outlines of important areas for natural history studies (Anonymous 1933; Fitch 1949; Cagle 1953, 1956). Despite this, the ability of the scientific community to conduct solid natural history and field ecology studies continues to decline (Greene 1993; Lunney 1998).

Operationally, the natural historian is more of a hypothesis generator while most ecologists are hypothesis testers (Jaeger and Halliday 1998). Few biologists play both roles, but this is feasible. With a demonstrated reduction in the publication of natural history articles, we should be concerned with how this may impair our conservation efforts in the face of looming biodiversity declines.

Biodiversity conservation requires description of critical natural history parameters (Table 1; Schultz et al. 1999). These parameters are poorly known for most herpetofauna (Stuart et al. 2004; IUCN [International Union for the Conservation of Nature], Conservation International, and NatureServe. 2006. Global Amphibian Assessment. http://www.globalamphibians.org. Downloaded on 9 August 2006.). Early life history, which is an active area of research in ichthyology, is infrequently studied for most species of amphibians and reptiles. Until life history information is acquired, we must hypothesize or speculate on this information needed for modeling population responses to environmental problems. This is inadequate.

Conservation of amphibians and reptiles necessitates life history inquiries while the species are common and their populations are ecologically functioning. Environmental stressors frequently influence life history characteristics early in the stress response (Newman and Unger 2002). Consequently, waiting until a species is on the brink of extinction is too late to accurately estimate life history parameters consistent with a "healthy" environment. We sometimes base our conservation decisions on extrapolations from somewhat well known species or surrogates (Newman and Unger 2002). Most of our decisions for herpetofauna are based on organisms that are distantly related both systematically and ecologically. The natural history of an organism defines its place in the ecosystem and reveals its conservation needs (Greene 2005). Without attention placed in this vital area of biodiversity study, any attempt to significantly improve the conservation status of amphibians and reptiles will be compromised.

We recommend that granting agencies (e.g., NSF) follow on the rationale used to implement the NSF program for systematists and initiate funding and training programs that targets the heart of the amphibian decline question: the lack of life history information. We further encourage those training graduate students to ensure that these young investigators develop the skills necessary for both inquiry and descriptive studies. Finally, we challenge scientists, especially those who are no longer seeking tenure or promotion, to dedicate at least part of their efforts to natural history study and to encourage young researchers to pursue research in this important area of herpetology. By doing these things we can ensure that our study of biodiversity reveals information critical to the conservation needs of herpetofauna. Without these efforts, the opportunity to observe these intriguing animals and their unique position in the biosphere will be lost.

We hope that this new international journal published in concert with Partners in Amphibian and Reptile Conservation and the World Congress of Herpetology will provide an important outlet for studies

ranging from descriptive natural history to theoretical approaches in conservation and ecology. A publication of this kind is important to facilitate dissemination and exchange of information within the scientific and conservation communities. We desire for this journal to stimulate research activity in these areas. Although the launch of *Herpetological Conservation and Biology* appears to be counter to the declining publication trend of natural history and many field studies, there remains a growing critical need for information on the basic biology, conservation, ecology and management of amphibians and reptiles.

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LITERATURE CITED

Altig, R. 1989. Academic lineages of doctoral degrees in herpetology. Pp. 179-202 *In* Adler, K. (Ed.). Contributions to the History of Herpetology, No. 5. Society for the Study of Amphibians and Reptiles, St. Louis, Missouri, USA.

Anderson, S.H. 1985. Managing our Wildlife Resources. Merrill Publishing Company, Columbus, Ohio, USA.

Anonymous. 1933. Opportunity for Investigation in Natural History by High School Teachers. University of Michigan Press, Ann Arbor, Michigan, USA.

Arnold, S.J. 2003. Too much natural history, or too little? Animal Behaviour 665:1065-1068.

Bury, R.B. 2006. Natural history, field ecology, conservation biology and wildlife management: Time to connect the dots. Herpetological Conservation and Biology 1:56-61.

Cagle, F.R. 1953. An outline for the study of a reptile life history. Tulane Studies in Zoology and Botany 1:31-52.

_____. 1956. An outline for the study of an amphibian life history. Tulane Studies in Zoology and Botany 4:79-110.

Clemmons, J.R. and R. Bucholz. 1997. Behavioral Approaches to Conservation in the Wild. Cambridge University Press, Cambridge, UK.

Fitch, H. S. 1949. Outline for ecological life history studies of reptiles. Ecology 30:520-532.

_____. 2006. Ecological succession on a natural area in northeastern Kansas from 1948 to 2006. Herpetological Conservation and Biology 1:1-5.

Greene, H.W. 1986. Natural history and evolutionary biology. Pp. 99-108 *In* Predator-Prey Relationships: Perspectives and Approaches from the Study of Lower Vertebrates. Feder, M.E. and G.V. Lauder (Eds). University of Chicago Press. Chicago, Illinois, USA.

_____. 1993. What's good about good natural history? Herpetological Natural History 1:3.

_____. 2005. Organisms in nature as a central focus for biology. Trends in Ecology and Evolution 20:23-27.

Hurlbert, S.H. 1984. Pseudoreplication and the design of ecological field experiments. Ecological Monographs 54:187-211.

Jaeger, R.G. and T.R. Halliday. 1998. On confirmatory versus exploratory research. Herpetologica 54(Suppl.):S64-S66.

Lunney, D. 1998. Lack of awareness and knowledge about biodiversity. Australian Zoologist 30:381-382.

Mayer, J. 2004. The importance of understanding the natural history of novel species used in research. Lab Animal 33:32-34

Mayr, E. 1963. Animal Species and Evolution. Harvard University Press. Cambridge, Massachusetts, USA.

NSF (National Science Foundation). 2005. Partnerships for Enhancing Expertise in Taxonomy (PEET). Program Solicitation NSF 04-140.

Newman, M.C. and M.A. Unger. 2002. Fundamentals of Ecotoxicology, 2nd edition. CRC/Lewis Publishers, Boca Raton, Florida, USA.

Schneider, S.H. and T.L. Root. 2002. Wildlife Responses to Climate Change. Island Press, Washington, D.C., USA.

Schultz, S.M., A.E. Dunham, K.V. Root, S.L. Soucy, S.D. Carroll, and L.R. Ginzburg. 1999. Conservation Biology with RAMAS Ecolab. Sinauer Associates, Inc., Sunderland, Massachusetts, USA.

Stebbins, R.C. and N.W. Cohen. 1995. A Natural History of Amphibians. Princeton University Press, Princeton, New Jersey, USA.

Stuart, S.N., J.S. Chanson, N.A Cox, B.E. Young, A.S.L. Rodrigues, D.L. Fischman, and R.W. Waller. 2004. Status and trends of amphibian declines and extinctions worldwide. Science 306:1783-1786.

Tinbergen, N. 1963. On aims and methods in ethology. Zeitschrift fur Tierpsychologie 20:410-433.

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