



Yearly samples of Red-sided Garter Snakes (*Thamnophis sirtalis parietalis*) were large enough to detect significant differences in sex ratios. These differences may be related to the abundance of the snake's primary prey, the Plains Leopard Frog (*Lithobates blairi*).

Secondary sex ratios in samples of snakes must be interpreted with caution because they can be influenced by many factors that differentially affect the two sexes, and changes in actual population structure may be a minor factor. Sex ratios in samples have been shown to change rapidly when differential sexual behavior is affected. Shine et al. (2006) found significant daily variation in sex ratios of samples of Garter Snakes as they emerged from hibernation. These variations were related to time in season and daily maximum and minimum temperatures. In my study, greater activity by males in the spring and, in some species, in the autumn searching for mates and/or favorable habitat are probably the most important factors in the male-biased secondary sex ratios of these eight species of snakes.

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Salamander Sci-Art

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“Salamander” is the common name for amphibians with tails, and (with the exception of the Sirenidae) four legs of about equal size. They include all the members of the order Caudata, comprising nine families and over 500 species. The name “salamander” is derived from an old Arab/Persian word meaning “lives in fire,” stemming from the belief that the salamander was born in fire or could walk through fire without being harmed (Khanna and Yadav 1998). This myth might have originated from the bright skin colors that resemble flames in some salamanders, perhaps from the burning

taste one might feel while trying to eat such a creature, or observations of salamanders emerging from logs thrown onto a fire.

Salamanders of the northeastern United States and southeastern Canada are an ecologically interesting group. Their habitats include eastern mesophytic forests and periglacial features, such as woodland pool depressions, rocky wooded hillsides, outcrops, talus, and ravines (Petranka 1998). Included among northeastern species are enigmatic permanently aquatic forms that include Hellbenders (*Cryptobranchus alleganiensis*) and the mysic-

terious Mudpuppy (*Necturus maculosus*). Also, almost every pond is inhabited by Red-spotted Eastern Newts (*Notophthalmus viridescens*).

We have been monitoring high-diversity amphibian sites over the past three decades, focusing on two main issues: Declining amphibian populations and developmental deformities among wild stocks. We have scouted over a hundred amphibian breeding pools and habitats across New York, Pennsylvania, New England, and Quebec, sampling populations, documenting species, wetlands, and woodlands from March through November for well over a decade. We then selected a “top-ten list” to revisit repeatedly to monitor water levels and catch per unit time effort as recorded on data sheets, field notebooks, and spreadsheets using two basic surveying methods: Timed searches per person hour as well as area searches of a specific habitat type. The “good news” is that many of the remaining habitats we selected had relatively dense, healthy populations. The “bad news” is that many previously recorded salamander sites no longer exist or the habitat is degraded or severely changed. The bottom line is that fewer wild salamanders are around now than were historically and fewer habitats persist to sustain these great creatures.

A percentage of individuals from all populations showed signs of trauma such as injury, infection, or fungal growth. Occasional missing limbs and other injuries can be survivable and partial regeneration can create permanent deformities (Ballengée and Sessions 2009). Long-term surveys and further studies are still needed to understand the normal background rate of deformities, injuries, and disease (Sessions and Ballengée 2010). Our current biological research will continue as long as necessary.

In an effort to inspire people to become aware of these vulnerable creatures and to better appreciate their intrinsic value, we have been incorporat-



Supernumerary digits in a Northern Dusky Salamander (*Desmognathus fuscus*) collected in Allegheny County, New York in 2001.

ing art in our research. “Sci-Art” is the scientific pursuit of knowledge combined with the desire for the understanding inherent in art. Art and biology always have attempted to describe the world around us. From Neolithic cave renderings to Greek zoological accounts to E.O. Wilson’s modern concept of Biophilia, humankind’s desire to interpret the natural world has never ceased — and emerging technologies are expanding our ability to



Spotted Salamander (*Ambystoma maculatum*) at 72 hours.



Northern Slimy Salamander (*Plethodon glutinosus*).



Red efts are the intermediate terrestrial stage of development in Eastern Newts (*Notophthalmus viridescens*). Both larvae and adults are aquatic.



Northern Red Salamander (*Pseudotriton ruber ruber*).



Marbled Salamander (*Ambystoma opacum*).

comprehend the diversity of life on our planet, from the microscopic to the colossal. Art can be an effective tool to “frame” current ecological issues and bring them to public mind (Lippard 2007).

The accompanying images depict a variety of species and individual life history stages, including egg, larva, and adult. Each animal was gently examined for any scars or regeneration from injuries, fungi, ectoparasites, edema, and visible signs of infection. Most looked healthy and strong with good muscle tone and body weight. We also looked for asymmetries of the right and left eyes, mouthparts, limbs, digits, etc. Anuran larvae were staged according to Gosner’s stages of embryological development (Gosner 1960). The animals then were gently placed alive onto the glass bed of a scanner for digital recording at 1,200–8,000 dpi. This is approximately 25 times the output of a typical home or office scanner. The appeal of the process is the incredible detail that can be recorded into a digital file. These files can then be used to generate both scientific research images as well as fine art prints.

Salamanders are beautiful and intriguing animals that have persisted through millions of years of evolution, withstanding past extinction events. They are now being subjected to the “anthropocene” period of human-wrought habitat destruction resulting from bulldozing, paving roads, building dams across rivers, draining wetlands, introducing invasive species, and other afflictions. We are working to increase public awareness of salamanders and their habitats in the hopes of reducing detrimental human

impacts. We hope that these images will inspire people to appreciate not only the scientific and ecological significance of salamanders but also their aesthetic value in terms of beauty and form. Our main conceptual mission is to increase public awareness and understanding of biological phenomena and environmental concerns while challenging people both aesthetically and intellectually.

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