



2007

Loathsome Beasts: Images of Reptiles and Amphibians in Art and Science

Kay Etheridge
Gettysburg College

Follow this and additional works at: <https://cupola.gettysburg.edu/biofac>

 Part of the [Animal Sciences Commons](#), and the [Biology Commons](#)

Share feedback about the accessibility of this item.

Etheridge, K. "Loathsome beasts: Images of reptiles and amphibians in art and science." *Origins of Scientific Learning: Essays on Culture and Knowledge in Early Modern Europe*. Eds. S.L. French and K. Etheridge. (Lewiston NY: Edwin Mellen Press, 2007), 63-88.

This is the publisher's version of the work. This publication appears in Gettysburg College's institutional repository by permission of the copyright owner for personal use, not for redistribution. Cupola permanent link: <https://cupola.gettysburg.edu/biofac/27>

This open access article is brought to you by The Cupola: Scholarship at Gettysburg College. It has been accepted for inclusion by an authorized administrator of The Cupola. For more information, please contact cupola@gettysburg.edu.

Loathsome Beasts: Images of Reptiles and Amphibians in Art and Science

Abstract

The mythology and symbolism historically associated with reptiles and amphibians is unequalled by that of any other taxonomic group of animals. Even today, these creatures serve as icons - often indicating magic or evil - in a variety of media. Reptiles and amphibians also differ from other vertebrates (i.e. fish, mammals and birds) in that most have never been valued in Europe as food or for sport. Aside from some limited medicinal uses and the medical concerns related to venomous species, there was little utilitarian value in studying the natural history of reptiles and amphibians. Because of this history and other characteristics of these animals, the images of reptiles and amphibians played a unique role in the study of natural history from the Medieval through the Early Modern periods. The images I will discuss come from books that have been analyzed by other scholars, but in most cases there has been little or no scrutiny of the portrayal of the herpetofauna. Because much of my research as a biologist has focused on reptiles and amphibians, I will consider their differences from mammals and birds. In doing so, I will address image content from a somewhat different point of view than that of an art or science historian. My contention is that understanding the evolving portrayal of these “loathsome beasts” is particularly useful in tracing the development of the study of natural history. I also will address how changes in these images over time reflect a transformation in how nature was viewed and valued in western European culture. [*excerpt*]

Keywords

reptiles, amphibians

Disciplines

Animal Sciences | Biology

Comments

Dr. Kay Etheridge also co-edited this book with Sara L. French.

Loathsome Beasts: Images of Reptiles and Amphibians in Art and Science

Kay Etheridge

The mythology and symbolism historically associated with reptiles and amphibians is unequaled by that of any other taxonomic group of animals.¹ Even today, these creatures serve as icons - often indicating magic or evil - in a variety of media. Reptiles and amphibians also differ from other vertebrates (i.e. fish, mammals and birds) in that most have never been valued in Europe as food or for sport. Aside from some limited medicinal uses and the medical concerns related to venomous species, there was little utilitarian value in studying the natural history of reptiles and amphibians. Because of this history and other characteristics of these animals, the images of reptiles and amphibians played a unique role in the study of natural history from the Medieval through the Early Modern periods. The images I will discuss come from books that have been analyzed by other scholars, but in most cases there has been little or no scrutiny of the portrayal of the herpetofauna. Because much of my research as a biologist has focused on reptiles and amphibians, I will consider their differences from mammals and birds.² In doing so, I will address image content from a somewhat

¹ One of the first stories in Christian writings evokes a snake up to no good, and a plague of frogs was evoked as a curse in a later bible story. However, the use of these animals in mythology predates major religions by at least two millennia; an example is the constellation Hydra (a great serpent), recorded on a tablet as early as 2400 BC. Daniel Bell, "Herping the Night Sky: The Mythology of Snake and Lizard Constellations," *Sonoran Herpetologist* 18:6 (2005), 63-64. Some contemporary emblems also originate from myths involving reptiles or amphibians; for example, the rod entwined by snakes is used as an icon by the medical profession. The symbolic association of serpents with curative properties dates to Greek mythology. I. A. Ramoutsaki, S. Haniotakis, and A. M. Tsatsakis, "The Snake as the Symbol of Medicine, Toxicology and Toxinology," *Veterinary and Human Toxicology* 42:5 (2000), 306.

² Fish are more similar, as they also are "cold-blooded" animals and closer phylogenetically to herpetofauna than to the furred or feathered "warm-blooded" animals. For

different point of view than that of an art or science historian. My contention is that understanding the evolving portrayal of these “loathsome beasts” is particularly useful in tracing the development of the study of natural history. I also will address how changes in these images over time reflect a transformation in how nature was viewed and valued in western European culture.

Prior to the advent of photography, drawings and paintings of plants and animals were the primary means used to convey the appearance of an organism, short of a live or preserved specimen. In fact, images have some advantages over actual specimens. First, they can be replicated and disseminated with relative ease. In the case of animals that do not hold their form or color when preserved, the image is actually superior to the specimen in representing the organism as it appeared in life. The skins of amphibians (frogs and salamanders) and reptiles (snakes, lizards, turtles, amphisbeanids, and crocodilians) are particularly prone to losing color in preservatives like alcohol. In a sense, the image itself preserves the organism, and in the case of species now extinct, this form of preservation is particularly valuable to students of nature. Additionally, images hold other advantages over specimens; for example, they can depict life cycles, place the organism in its habitat, portray behaviors, and illustrate magnified details of structure.

The earliest natural history studies to be illustrated were manuscripts now known as herbals and bestiaries. Most of the known bestiaries were produced in England beginning in the twelfth century, and they typically contained a variety of animals that would be well-known in Europe, exotics (e.g. lions, elephants, and crocodiles), and mythical beasts such as the basilisk.³ Various “serpents”

example, fish, amphibians, and reptiles all have a very low metabolic rate relative to that of mammals and birds, and hence can survive much longer without food.

³ The earliest illustrated bestiaries dating from the ninth century draw much of their information on both real and mythical animals from the Greek *Physiologus*, adding quotations from scripture and moralizations based upon the character of the animals. The natural history of the animals takes on a more predominant role in the text by the fourteenth and fifteenth century.

(*serpentes*) usually were depicted, including some with wings, and the turtle (*testudo*) and frog (*rana*) also figured in some bestiaries. The salamander (*salamandra*) was often depicted as a serpent-like animal as in the Aberdeen Bestiary (Figure 1),⁴ although in some bestiaries the salamander does have four legs. The accompanying text in the Aberdeen Bestiary recounts the myth that salamanders can poison both fruit and water (hence the recumbent figure of a man sickened by the poison) and that they can survive fire and put it out. One suggested explanation for the origin of the fire myth is that salamanders often hibernate in logs, so that when wood is brought in and put on the fire, the animals suddenly appear, scuttling out of the log. *Salamandra salamandra*, the European or “fire” salamander discussed below can have bright yellow or orange patterns, perhaps reinforcing the connection with flames. Additionally, these salamanders do secrete a neurotoxin and can even spray this poison from pores along the back. Likewise some of the symbolism associated with snakes in bestiaries bears a relationship to aspects of their natural history. In many bestiaries a snake was pictured shedding its skin as it crawls through a crack in a rock or other narrow aperture. The image may show a characteristic snake behavior, but in the bestiaries this action was cast as an allegory of rejuvenation or salvation through shedding of the outer self.⁵

Bestiaries often served as pattern books for subsequent bestiaries, as well as models for the popular emblem books of the sixteenth century, and other works such as tapestries and carvings. Thus, these images were widely disseminated; copying was rampant and inaccuracies such as external ears on snakes and salamanders were perpetuated until some artists began to draw these animals from

Wilma B. George and Brunsdon Yapp, *The Naming of the Beasts: Natural History in the Medieval Bestiary* (London: Duckworth, 1991), 1-9.

⁴ The very well-preserved Aberdeen Bestiary (Aberdeen University Library MS 24) is believed to have been produced in the north of England around 1200.

⁵ *Ibid.*, folio 71r.

life. For reptiles and amphibians the trend toward more realistic representation appears to have been later than for birds and mammals, some of which appear as fairly accurate renditions as early as the sixth century.⁶ Until the advent of printing, however, few people had the opportunity to view these images. The Renaissance brought not only printing but the artistic use of shading and perspective as tools for rendering a naturalistic appearance. Perhaps the most pivotal influence on Renaissance natural history images however was the new-found impetus to work “from life.” Direct observation is particularly important when the item to be depicted is not well known; a skilled Renaissance artist could paint or draw the human animal without a model, but would have much more difficulty in producing a realistic image of a crocodile. Renaissance philosophers also moved toward observation and away from an exclusive dependence on classic texts for knowledge. In any case, exploration and expanding trade routes resulted in an influx of new and exotic creatures for which Aristotle, Pliny, and the bestiaries provided no context or imagery.

One of the earliest examples of an illustrated book that resulted from this confluence of circumstances was the travel account published by Pierre Belon (French, 1517-1564).⁷ The quality of Belon’s drawing can be seen in the woodcut of the chameleon (Figure 2). The chameleon is one of six reptiles illustrated in Belon’s account, which includes four snakes and a Nile crocodile. Belon also portrayed a “winged serpent.” The accompanying text states that the *serpents aellés* he observed in Egypt were embalmed specimens. Belon’s image of one of these serpents, which “has feet” and is said to “fly from Arabia to

⁶ The *Juliana Anica Codex* in Vienna is dated to 512 AD and contains detailed and identifiable images of a number of birds. Minta Collins, *Medieval Herbals: The Illustrative Traditions* (Toronto: University of Toronto Press, 2000), 39.

⁷ Pierre Belon, *Les Observations De Plusieurs Singularités Et Choses Mémorables, Trouvées En Grèce, Turquie, Judée, Egypte, Arabie & Autres Pays Étranges* (Paris: Guillaume Cauellat, 1554). This book was first published in 1553 and was issued in several editions in the sixteenth century. Belon made clear that his writings were based upon his own “ocular observations,” although like a good Frenchman he also included gustatory observations, and for at least one fish, a recipe.

Egypt,” is not very detailed.⁸ In contrast, although the image of the chameleon is not entirely accurate in every aspect, it is clearly identifiable to the level of genus in current taxonomy, and based upon the fact that he saw it in *Arabie*, possibly to the species, *Chamaeleo calyptratus*.⁹ While this level of specificity in the image may be of interest to the modern biologist, it is Belon’s careful observation of the living animal’s grip on the branch that separates it from depictions of a possum-like ground dwelling “chameleon” that precede it in emblem books such as those by Andrea Alciato.¹⁰ Belon’s rendition shows precisely how this very large arboreal animal can cling so securely to its perch; chameleons have five toes on each foot that function in opposition to each other in a distinctive mechanism. The front feet have two toes that grip the outside of the branch and three on the inside, and the back feet are arranged in opposite fashion. Belon must have studied his subject carefully, and he clearly thought it important to represent this unique arrangement of digits accurately even though he does not discuss it in the text. Evidently others must have thought this a remarkable image, for versions of it appear in animal encyclopedias and even in subsequent books on emblematic animals, such as later editions of Alciato.¹¹ Ironically, Belon’s image of the less-than-truthful winged dragon also appears in many of these books.

Belon’s near contemporary, Conrad Gesner (Swiss, 1516-1565), largely overshadowed Belon’s original contribution to natural history with his own prolific output in both botany and zoology. Gesner’s five-volume *Historia animalium* was the first animal encyclopedia with figures drawn “from life” and the inclusion of these images is generally seen as a major turning point in animal

⁸ Ibid., 133-134. Belon writes that he saw “*des corps embaumez tous entier de certains serpens aellés, qui ont pieds qu’on dit veller de la partie d’Arabie en Egypte,*” and that from this he made the “portrait.”

⁹ Ibid., 125.

¹⁰ William B. Ashworth Jr., “Marcus Gheeraerts and the Aesopic Connection in Seventeenth-Century Scientific Illustration,” *Art Journal* 44:2 (1984), 135.

¹¹ Ibid.

studies.¹² He produced many of these drawings himself, whereas others were copied from a variety of existing sources,¹³ or were sent to him by contemporaries interested in natural history. Gesner's woodcut images are surrounded by extensive descriptive text that delineates the animal's natural history from Aristotle and Pliny as well as the associated legends, symbolic meaning, and the beast's name in various languages. However, Gesner was a keen naturalist and often added his own observations as well as textual information from contemporary contributors.¹⁴

The "loathsome beasts" were given much more attention by Gesner than by any of his predecessors. The second volume of *Historia animalium* is devoted to what Gesner termed the *quadrupedibus ouiparis* (egg-laying quadrupeds); these include amphibians and reptiles, although the snakes (many of which do lay eggs) were treated in his volume on serpents. Volume II contains images and text on turtles, a crocodile (copied from Belon), and various lizards. Some of these animals were drawn with a high degree of realism and can be identified to the level of taxonomic family or genus in current classification. One lizard was drawn in such detail that the individual scales can be counted, and the animal is shown both from dorsal and ventral views, a pictorial device used in modern zoology texts. Another image shows a precisely rendered sea turtle with the

¹² Gesner's volumes were published over a period of years; images and references herein are from volume two on the egg-laying quadrupeds (Konrad Gesner, *Historia Animalium Liber II: De Quadrupedibus Oviparis* (Frankfurt: Roberti Cambieri, 1586)) and volume five on serpents, (Konrad Gesner, *Historia Animalium. Liber V: Qui Est De Serpentium Natura* (Zurich: Froschouiana 1587)). His place in the history of zoology has been noted by many scholars, see for example E.W. Gudger, "The Five Great Naturalists of the Sixteenth Century: Belon, Rondelet, Salviani, Gesner and Aldrovandi: A Chapter in the History of Ichthyology," *Isis* 22:1 (1934), 32-33 and Frank N. Egerton, "A History of the Ecological Sciences, Part 11: Emergence of Vertebrate Zoology During the 1500s," *Ecological Society of America Bulletin* 84 (2003), 207-208.

¹³ For example, Gesner's chameleon is an almost exact mirror image of Belon's down to the position of the knot of the tree; Gesner does credit Belon for information on many of the animals in his encyclopedia. Gesner, *Historia Animalium Liber II*, 3.

¹⁴ Volume four on the fish and other aquatic animals was particularly dependent upon a variety of sixteenth century naturalists for information and many of its 900 images. Unlike some encyclopedists who followed him, Gesner did credit his sources. Egerton, 207-09.

correct number of plates on its upper shell and a smattering of attached barnacles; this is clearly identifiable as *Eretmochelys imbricate*, the hawksbill sea turtle. This turtle was drawn from a dorsal view in order to depict the structure of the flippers and shell, but there is also a lateral view of the head showing the distinctive shape of the turtle's beak, a characteristic that separates it from all other sea turtles.

The amphibian images were equally innovative. Next to a mature frog that he termed *rana perfecta*, Gesner showed an incompletely metamorphosed froglet that had not yet lost its tail (*foetus rana caudatus*);¹⁵ this image may have been the earliest visual description of amphibian development to be published. He also included images of four distinct types of frogs (given different names) and differentiated between aquatic and terrestrial anurans. Relative to the amorphous frogs depicted in the earlier bestiaries and emblem books, Gesner's images are astoundingly specific and information-laden. Most importantly, the move towards naturalistic representation of these animals demonstrates that curiosity about their structure was increasingly important to Renaissance philosophers, and that an emblematic image was not considered sufficient on its own. Gesner went further by providing both a very exacting image of a common European salamander and a contrasting drawing of a mythical salamander (Figure 3).¹⁶ The former was clearly drawn from a live or fresh specimen of the previously mentioned *Salamandra salamandra* (this wide-ranging species occurs in Switzerland) and was rendered in great detail, giving it weight as an actual, observed animal. Gesner's salamander is equipped with the dorsal rows of pores

¹⁵Gesner, *Historia Animalium Liber II*, 81.

¹⁶ *Ibid.*, 81. Gesner's extensive accompanying text on the salamander is beyond the scope of this essay, but it is interesting to note that he reports his own experimental evidence that salamanders do not indeed survive fire.

that release poisons, just like the very similar image of the same species by Von Rosenhof, drawn over two-hundred years later (Figure 10).¹⁷

Gesner's fifth volume of *Historia Animalium* contains the serpents, both real and imagined. His images of snakes are strangely undefined and incorrect when compared to those of the frogs, lizards and turtles, and it may be that some of the snake woodcuts were based on drawings not by his hand.¹⁸ Both volumes were published posthumously, and the sources of many illustrations are not documented, so the differences in image quality remain a mystery. Another puzzle is the inclusion of so many mythical creatures by a man who prided himself on working "from life." Much has been written elsewhere about the hydras, dragons, and basilisks of Gesner and subsequent encyclopedists, and I will comment on just two such here. Gesner included the portrait of an undulating mythical basilisk sporting a crown, a human-like expression, and a tongue shaped like an arrow, but as with the salamander, he also depicted a realistic snake near the image of the mythical one.¹⁹ The latter is shown lying on the ground in a naturalistic pose, and although the head suggests a slightly crown-like shape, it still looks like a snake. Gesner also included a copy of Belon's winged serpent, and he quoted Belon's text on it and cited him.²⁰

The attention given to these images of reptiles and amphibians indicates that Gesner was interested in their truthful portrayal as much as that of the more familiar mammals and birds in volumes one and three of his encyclopedia. This

¹⁷ August Johann Rösel von Rosenhof, *Historia Naturalis Ranarum Nostratium: In Qua Omnes Earum Proprietates, Praesertim Quae Ad Generationem Ipsarum Pertinent, Fusius Enarrantur* (Nuremberg: Johann Joseph Fleischmann, 1758), frontispiece. The von Rosenhof salamander image was made from a copper-plate engraving and therefore can include more fine detail than a woodcut. The eighteenth century salamander image is complete with the characteristic pores on the parotid gland behind the eye, but other than this and the fact that it was hand-colored, it offers little information not found in Gesner's fine woodcut.

¹⁸ Gesner, *Historia Animalium. Liber II, passim*.

¹⁹ Gesner, *Historia Animalium. Liber V, 32*.

²⁰ *Ibid.*, 55.

emphasis on realism is a significant change from the countless inaccuracies and lack of specificity in images of reptiles and amphibians in the bestiaries and emblem books. By the time of Belon and Gesner, these animals were more than symbols; they were objects of curiosity and study for the purpose of generating new knowledge about nature. Although historical knowledge was conveyed along with contemporary natural history within the text, both Belon and Gesner relied primarily on first-hand knowledge for most of their imagery (with the curious exception of the mythical creatures).

Gesner's efforts were followed by those of the naturalist and prolific collector Ulisse Aldrovandi (Italian, 1522-1605). Aldrovandi published on many subjects, and like Gesner he produced encyclopedias of known and mythical animals.²¹ Aldrovandi did not draw but employed a variety of artists. Some images were made from animals in his own collection, but many were copied from Gesner, Belon, and others. For example, in his entry on chameleons he depicts four different types. One chameleon resembles that of Belon and Gesner, but is posed differently and is not on a branch. A more interesting addition is a drawing of a chameleon, based on an animal that was sent to him, in which he shows the lizard catching a fly with its tongue.²² This may be the earliest published image of a chameleon feeding, and it may have been meant to refute the

²¹ Ulisse Ambrosini Bartolommeo Aldrovandi, *Vlyssis Aldrovandi Patricii Bononiensis De Quadrupedibus Digitatis Viviparis Libri Tres, Et De Quadrupedibus Digitatis Oviparis Libri Duo*. Bologna: Nicolaum Tebaldinum, 1637) and Ulisse Aldrovandi and Ambrosini Bartolommeo, *Vlyssis Aldrovandi Patricii Bononiensis Serpentum, Et Draconum Historiae Libri Duo* (Bologna: Clementem Ferronium, 1640). Both of these books were published decades after his death, and as in his other natural history books these added tremendously to the published textual information on animals (largely history, symbolism and so on). Much ink has been expended comparing Aldrovandi to Gesner and other encyclopedists, but in fact, Aldrovandi added surprisingly little in the way of images of reptiles and amphibians considering the greatly increased number of specimens to which he had access. The opposite is true for his three volumes on birds in which he added images of tropical and new world species to what had been presented by Gesner.

²² *Ibid.*, 670-671.

longstanding myth that these animals exist on air.²³ Aldrovandi's separate volume on serpents and dragons is notable mostly for the fact that it contains images of mythical animals such as the hydra, basilisk and various dragons in numbers roughly equal to those of actual snakes. Many of the mythical animals and some of the snakes are copied from Gesner's woodcuts, but some specific snake images have been added. These are not very well drawn, and the accompanying illustrations of internal anatomy are even poorer; for instance, the snake "skeleton" looks like a serpentine piece of spiky ribbon and bears no resemblance to a vertebral column of any kind.²⁴ Another woodcut shows a viper accompanied by a lateral detail of its head with the mouth open to show its teeth; however, the teeth as depicted are not those of a viper or of any other snake.²⁵ Considering the care taken with the images in the books published before Aldrovandi's death (i.e., the beautifully illustrated volume on birds), I must conclude that the images in these later volumes would not have met his exacting standards.²⁶ Gesner and Aldrovandi were followed by other encyclopedists including Jan Jonston (Polish, 1603-1675) and Edward Topsell (English, 1572-1625),²⁷ both of whom copied most of their images from predecessors, including

²³ Ashworth Jr., "Marcus Gheeraerts and the Aesopic Connection in Seventeenth-Century Scientific Illustration," 134-37. Ashworth traces the image of Belon's chameleon through the encyclopedias, emblem books and even Aesopic tales of the 16th and 17th centuries.

²⁴ Aldrovandi and Bartolommeo, *Vlyssis Aldrovandi Patricii Bononiensis Serpentum, Et Draconum Historiae Libri Duo*, 273.

²⁵ *Ibid.*, 116

²⁶ Aldrovandi bequeathed his valuable natural history collection to the city of Bologna on the condition that his work was published after his death, which is the case for eight of the twelve natural history volumes published in his name. As keeper of the collection for twenty-five years beginning in 1632, Bartolomeo Ambrosini was charged with the task of seeing the books on reptiles into publication. Paula Findlen, *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy* (University of California Press, 1994), 25.

²⁷ Joannes Jonstonus, *Historiae Naturalis*, 6 pts. in 2 vols. (Amstelodami: Apud Ioannem Iacobi fil. Schipper, 1657) and Edward Topsell, *The History of Four-Footed Beasts and Serpents: Describing at Large Their True and Lively Figure, Their Several Names, Conditions, Kinds, Virtues (Both Natural and Medicinal), Countries of Their Breed, Their Love and Hatred to*

the mythical reptiles. Topsell's startling frontspiece to the volume on serpents (volume two) is his most original image, but the engraving of the giant arrow-tailed "boas" in the process of consuming an infant did little to advance the knowledge of reptiles.

By the end of the sixteenth century the tremendous expansion in trade and exploration provided a rich bounty of animals to be drawn "from life." Both exotic specimens and images of these strange organisms were avidly collected by a variety of people such as naturalists, apothecaries, and merchants. Many had their collections or "curiosity cabinets" documented in drawings, paintings and even published books. One such was the Italian apothecary, Ferrante Imperato (1550-1631), who maintained his collection in Naples not only as a place to conserve the raw ingredients for medicines,²⁸ but also as a place of study that was visited by many scholars of the day.²⁹ Imperato published a book describing his collection, and this volume was considered important enough to have been reprinted for over seventy years.³⁰ An often reproduced image from a fold-out page in the front of this volume shows visitors admiring Imperato's "cabinet" that was filled with specimens displayed in beautiful wall cabinetry and arrayed across the arched ceiling. The fact that a large crocodilian took pride of place in the center of the ceiling and several reptiles and amphibians were exhibited nearby

Mankind, and the Wonderful Work of God in Their Creation, Preservation, and Destruction (London: Printed by E. Cotes, for G. Sawbridge ..., T. Williams ..., and T. Johnson ... 1658).

²⁸ Guisepppe Olmi. "From the marvelous to the commonplace: notes on natural history museums," in Renato G. Mazzolini, ed. *Non-Verbal Communication in Science Prior to 1900* (Firenze: L.S. Olschki, 1993), 248.

²⁹ Frequent visitors included members of the Accademia dei Lincei of which Imperato was a member. The academy of the "Lynx-eyed" was determined to supplant classical knowledge with that gained by direct observation. Their influence on later natural history scholars was blunted by the dissolution of the group after the death of the founder, Frederico Cesi. Findlen, *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy*, 31-33.

³⁰ Ferrante Imperato, *Dell'istoria Naturale* (Napoli: C. Vitale, 1599) was the first edition of this book.

argues for the interest these animals held for scholars of the day.³¹ Images also played a key role in collections like those of Imperato, clarifying the appearance of the organism in life or at least when specimens were fresh.³² Specimens became degraded with time and handling, and an accompanying “paper museum” helped both to defray this loss and to facilitate information exchange with other naturalists through the duplication of images. Imperato’s book provides a good example of such documentation of a collection; most of the engravings appear to have been made with reference to living or fresh specimens and are not copies from other books. Three different animals are shown with their young: the “fire” salamander (*Salamandra salamandra*); a live-bearing skink, and a viper (Figure 4).³³ These early images of reptiles and amphibians with their offspring show an interest in the life cycle of the animals, and the viper illustration may have been meant to put to rest the myth that young vipers kill their mother at birth by eating their way out of the womb. The image depicts one young viper and its mother at the moment of birth, but it also shows the earlier step-by-step process that occurs as young vipers emerge from their individual amniotic birth sacs. This progression of events could have been seen only upon dissecting a pregnant viper (as with mammals the sac is broken open before the young enter the birth canal). It was essential that the original drawing of these animals be made from live or very fresh specimens, because the sacs would have become shriveled and clouded in preservative and information lost. The enlightening image of the vipers in

³¹ Ibid. At least a dozen reptiles and amphibians in addition to the crocodile can be seen, including a frog or toad and a salamander, along with several snakes and lizards. The crocodile must have been a particular favorite (or perhaps an early form of advertising logo) because it also adorns the title page of the first edition.

³² Guiseppe Olmi. “From the marvelous to the commonplace: notes on natural history museums.” In Mazzolini, ed., *Non-Verbal Communication in Science Prior to 1900*, 240-41.

³³ Imperato, *Dell’historia Naturale*, 785-90. The image of the salamander and young omits the egg and larval stages. The skinks and snakes are very well-drawn, but without any indication of size, color or geographic origin, it is not possible to identify them further. The same is true of the viper.

Figure 4 emphasizes both the importance of direct observation and the necessity of recording such observations from live animals.

Conversely, the engraving of native Floridians hunting and killing an alligator (Figure 5)³⁴ appears to be more drama than fact – at least regarding the representation of the animals - and points to the shortcomings of delayed or second-hand information turned into image. The original source for this volume from de Bry's series of "Great Voyages" was Jacques le Moyne de Morgue (French, 1533-1588), one of the few survivors of an ill-fated attempt to establish a Huguenot outpost in Florida.³⁵ Le Moyne was a fine artist whose surviving images of plants and animals are detailed and correct, but in escaping the settlement with his life, he may have left behind his notes and drawings, because all but one of the originals has been lost. It is impossible to know how much the distortion of the alligators' appearance is the result of Le Moyne being forced to produce these drawings from memory and how much is the result of liberties taken by de Bry's engravers.³⁶ Other images in the same volume show animals more correctly, so it is difficult to understand why the alligators have a head shape like those shown in Figure 5 (i.e., the bumpy snout, mammalian cranium and external ears). The alarming size of the foreground animal may be exaggerated, but alligators may have been larger and humans smaller 450 years

³⁴ Theodor de Bry, *Brevis Narratio Eorvm Qvæ in Florida Americæ Provincia Gallis Acciderunt, Secunda in Illam Nauigatione, Duce Renato De Laudoniere ... Anno Mdlxiii. Qvæ Est Secvnda Pars Americæ... Auctore Iacobo Le Moyne, Cui Cognomen De Morgues* (Frankfurt: I. Wecheli, 1591), plate 26. Le Moyne refers to the animals as crocodiles, but their size and setting indicate that they probably were what are now classified as alligators.

³⁵ Le Moyne accompanied the 1562 expedition as the recording artist. The Florida venture failed within two years due to internal strife among the Frenchmen. Paul Hulton, *The Work of Jacques Le Moyne De Morgues: A Huguenot Artist in France, Florida, and England*, 2 vols. (London: British Museum Publications, 1977), 4-10.

³⁶ Other images in publications by de Bry have similar exaggerations and errors in depictions of new world animals. For a discussion of this and examples of such images see Miguel Asuá and Roger French, *A New World of Animals: Early Modern Europeans on the Creatures of Iberian America* (Aldershot, England: Ashgate, 2005), 125-129.

ago.³⁷ Whatever the reason for the manner of depiction, the image of the alligator hunt and others within de Bry's "Voyages" served to introduce readers to an exotic and dangerous new world. Depictions of the fauna of the Americas and West Indies were critical to the process of documenting new organisms that had no history in Europe, and hence, no mythology or readily available images to be copied. One of the earliest volumes of the new world to catalog and portray a wide variety of organisms was the natural history of Brazil.³⁸ The simple but accurate woodcuts are presented with text describing the organism, and included are a tupinambis (lizard), a boa, and a toad, all of which are identifiable to family level from their images. Considering the abundant array of herpetofauna in Brazil (over 1300 species of reptiles and amphibians), the small selection included in *Historia Naturalis Brasiliae* is more notable for what omitted. However, these images were clearly the result of direct observation of the animals; even more of these visual observations were recorded as unpublished watercolors and sketches by artists posted to the Dutch settlement in Brazil.³⁹

With the exceptions of Gesner and Belon, most of the images of amphibians and reptiles discussed to this point were created by artists rather than naturalists. When the person making observations about an organism is not the same person representing it visually, critical information may be lost. On the

³⁷ Reptiles demonstrate indeterminate growth, and like trees, continue to increase in size as they age. The contemporary record for alligator length is nineteen feet, which occurred in a period with much more hunting pressure and habitat restriction than in the sixteenth century. The alligator in Figure 5 is four to five times as long as the height of a hunter; if the man was five foot five inches tall, the alligator would be twenty-two to twenty-seven feet long, which is not unimaginable for that time. Also in Le Moyne's defense, I can state from field experience that alligators do seem exaggerated in size when encountered up close.

³⁸ Willem Piso and Georg Marggraf, *Historia Naturalis Brasiliae* (Amsterdam: Franciscum Hackium, 1648). This book has 429 woodcuts and contains Piso's contribution on Brazilian medicine and Markgraf's natural history. Asuá and French, *A New World of Animals*, 116-17.

³⁹ In the second quarter of the seventeenth century hundreds of images of plants and animals were produced by the six or more artists working for the governor-general, Johan Maurits. Many of these were sold by Maurits when he returned to Holland and thus the images disseminated throughout Europe. *Ibid.*, 117.

other hand, a naturalist with poor artistic skills may produce an even less successful representation. The images in Oliger Jacobaeus's (Danish, 1650-1701) work on frogs and lizards exemplify this situation.⁴⁰ His illustrations of the internal anatomy of a frog and that of a lizard are fairly accurate if crude, but his simplified drawings of adult frogs in the plate on metamorphosis are strangely like the frogs of Medieval bestiaries, exhibiting disproportionately small heads, a definite "neck" and an incorrect number of toes. The tadpoles would be unrecognizable as frog larvae if seen out of context. However, Jacobaeus is of interest because he was one of the first to illustrate the stages of amphibian metamorphosis from egg to adult.

The quintessential artist-naturalist working at the end of the seventeenth century was Maria Sibylla Merian (German 1647-1717). The daughter and step-daughter of prominent engravers, Merian was trained as an artist from an early age. Her lifelong pursuits in natural history also began in childhood, and she wrote of raising silk worms to metamorphosis when she was thirteen.⁴¹ Merian established her reputation by publishing beautifully illustrated books both on flowers and on her work with the life cycles of European butterflies and moths. Her *magnum opus* resulted from two years of work done in Dutch Surinam, and when *Metamorphosis* was published in 1705 it set a new standard for natural history books.⁴² Aside from the magnificent quality of the artwork in this folio

⁴⁰ Oliger Jacobaeus, *De Ranis Et Lacertis Observationes* (Hafniae: Impensis Johannis M. Lieben, 1686). This volume was first published in 1676, but I had access to a later edition. Plate I shows thirteen stages of development of a frog, depicting three stages as an egg, six as a legless tadpoles, and four more stages as the legs appear and the tail is lost. These are little more than outlines with some cross-hatching, and four stages of the tadpoles are indistinguishable from each other except for increasing size.

⁴¹ Maria Sibylla Merian, *Schmetterlinge, Käfer Und Andere Insekten: Leningrader Studienbuch*, Wolf Beer, ed. (Luzern: Reich, 1976), 51. This facsimile publication of Merian's journal or "studienbuch" contains photos of many of her original studies of insects and other animals as well as the text of her accompanying notes.

⁴² Maria Sibylla Merian, *Metamorphosis Insectorum Surinamensium* (Amsterdam: Published by the author, 1705). The plates exhibit the fine detail made possible by copper-plate engraving, and in the first edition the information on the organisms was significantly enhanced by careful hand-coloring.

volume, it was the first book published by a European artist-naturalist who voyaged to the New World to study a specific aspect of nature. All or most of the organisms portrayed within were painted “from life,” and many were kept alive for several weeks by Merian as she studied them.⁴³ As she wrote to James Petiver, she was not interested in merely cataloguing exotic specimens, but in the “formation, propagation, and metamorphosis of creatures, how one emerges from the other, the nature of their diet.”⁴⁴ The emphasis on the life cycles and interactions of the species depicted makes *Metamorphosis* one of the first ecological studies (long before the word was coined). The focus of this volume and most subsequent research on it has been the detailed portrayal of the plants and insects of Surinam, while the fine images of reptiles and amphibians contained within have been largely overlooked. The first edition of *Metamorphosis* included two types each of lizards, snakes, and frogs, all painted precisely enough to be identifiable to species.⁴⁵ What is remarkable about Merian’s depictions is that the “loathsome beasts” are portrayed in a way that sparks kinship and curiosity. In the plates containing the frogs she shows the adult with its young; Figure 6 depicts an adult tree frog (*Phrynohyas venulosa*) and the stages of metamorphosis, showing the early eggs, an egg about to hatch, four stages of tadpole, and small froglet with a tail.⁴⁶ An older froglet (larger and

⁴³ *Ibid.*, *passim*.

⁴⁴ Maria Sibylla Merian, William T. Stearn, Vitor Osmar Becker, and Elisabeth Rücker, *Metamorphosis Insectorum Surinamensium*, 2 vols. (London: Pion, 1980), 73. This facsimile volume contains commentary and a collection of Merian’s letters. Merian wrote to Petiver on 27 April 1705 to tell him about the completion of her book and to ask him not to send her any more “small creatures,” as she was not interested in collecting animals about which she had no background.

⁴⁵ Although Merian’s purpose was not to catalog or classify, her images were so accurately rendered that they were used by others to do just this. Linnaeus named several species based upon Merian’s images. William T. Stearn, “Maria Sibylla Merian (1647-1717) as a Botanical Artist,” *Taxon* 31:3 (1982), 532.

⁴⁶ Images in Figures 6, 7, and 8 are photographs of original watercolors painted by Merian that may have served as models for the engravers working on *Metamorphosis*; these are

with a shorter tail) has met its fate as a meal for a predatory water bug.⁴⁷ The tableau is striking in its contrast between the beauty of the water plant and the birth-to-death struggle of the animals swimming around its base. As with Merian's other plates in *Metamorphosis* this microcosm of life shows a much more complete picture of "nature" than any illustrations of her predecessors. Merian also was the first to record the image of the remarkable *Pipa pipa* (the Surinam "toad"), an aquatic frog whose fertilized eggs become embedded in the dorsal integument where they develop until they hatch out as little froglets. She depicted this unusual phenomenon more clearly than can be achieved with a photograph, showing all of the stages in one image.⁴⁸ The Surinam "toad" was the first known example of an amphibian without a free-swimming larval stage. The biology of reproduction in amphibians restricts them to reproducing in water no matter how terrestrial the adult stage, and Merian's depictions of metamorphosis contributes to the understanding of this process.

The small lizard posed on a banana plant with its eggs and one of its hatchlings (Figure 7) likewise is typical of Merian's attention to aspects of animal reproduction,⁴⁹ as is the striking image of the caiman and the snake that appeared

from a complete set acquired by Hans Sloane that is now in the British Museum, but another set is housed at the Windsor Royal Library and a partial set is in St. Petersburg at the Russian Academy of Science.

⁴⁷ Merian did not know that this species is arboreal, because she found them in the water while they were breeding. She thought that the toe pads (characteristic of climbing tree frogs) were an aid to moving about in the marshy habitat, and she mistook the extended vocal sacs of the males for "ears." She did however document how long each stage lasted in the metamorphosis, as she frequently did for the caterpillars of moths and butterflies. Merian, *Metamorphosis Insectorum Surinamensium* text accompanying Plate 56.

⁴⁸ Ibid., plate 59 and text. Merian's text also describes the emergence of the young from the back of the adult. She relates preserving the adult and her young in brandy, probably in order to have a specimen to observe more closely as she painted it.

⁴⁹ The lizard is identifiable as the rainbow whiptail, *Cnemidophorus lemniscatus*. This image is reproduced in the 1705 volume of *Metamorphosis* as plate 23.

in a posthumous edition of *Metamorphosis* (Figure 8).⁵⁰ Like its much larger crocodylian cousins, the caiman will defend the eggs in its nest, and such a defense is shown here. As has been pointed out by others, the size of the false coral snake (*Anilius scyta*) seems exaggerated, but it may be that Merian used a juvenile spectacle caiman (*Caiman crocodilus*) as her model. The coloration of Merian's caiman is more similar to that of a juvenile than of an adult, and a subadult could be shorter than this species of snake, which can be a meter long. Dramatic license or no, crocodylians are unusual among reptiles in showing maternal behavior, and Merian has depicted this unexpected role of a fearsome creature succinctly. Several unpublished watercolors of other reptiles and amphibians by Merian exist in various collections, and she wrote that she hoped to publish another book on "such creatures" if the public and naturalists expressed an interest;⁵¹ unfortunately, the time in Surinam took a toll on her health and this project was never realized.

The influence of Merian may be seen in many important natural history studies that followed the publication of *Metamorphosis*, including those of Mark Catesby (English, 1683-1749) and of August Johan Roesel von Rosenhof (German, 1705-1759). Catesby was a naturalist and professional collector who traveled extensively in what was then known as "Carolina, Florida and the Bahama Islands."⁵² From 1729-1747 he worked on images and text for his two-

⁵⁰ Maria Sibylla Merian, *Metamorphosis Insectorum Surinamensium* (Amsterdam: Joannem Oosterwyk, 1719). In this edition twelve plates were added to the original sixty (all but two of the additions are thought to be by Merian). As with the original plates, multiple watercolor copies of some of these additional images were made. For example, I have seen the same image of the caiman and snake produced in watercolor and ink on vellum at the Morgan Pierpont Library, at the Royal Library at Windsor and at the British Museum. It is still unclear to scholars why multiple "originals" exist, but I suspect that Merian, known to be canny in business, produced them because wealthy collectors were willing to pay a premium for them.

⁵¹Merian, *Metamorphosis Insectorum Surinamensium*, text accompanying plate 4. This plate shows a striking lizard (a young tupinambis) on a cassava plant.

⁵² Catesby's travels were supported by a number of patrons for whom he collected plants and seeds. For more on Catesby and his *Natural History* see George Frick and Raymond Stearns, *Mark Catesby: The Colonial Audubon* (Urbana: University of Illinois Press, 1961).

volume *Natural History* on the flora and fauna of this region.⁵³ As seen in Figure 9 of the bullfrog (*Rana catesbeiana*, named for the naturalist) and the ladyslipper plant, most of the folio-sized Catesby plates featured one species of plant and one animal. Catesby's plants were not always associated with the animal depicted and may or may not have even been found in the same habitat.⁵⁴ He covered a much wider geographic area than Merian and his *Natural History* includes over two-hundred plates of birds, mammals, reptiles, amphibians and fish. The herpetofauna represented in Volume II of Catesby's *Natural History* include three sea turtles (one depicted with her eggs buried nearby), thirteen species of snakes, six species of lizards, four frogs and a young alligator. In most cases the animal is portrayed in a predominately dorsal view with a flattened appearance. Although Catesby does seem to intend a lifelike pose for most of the animals in his book, some of the snakes are arranged in what could only be described as a decorative manner, exhibiting rather unnatural configurations of bends and coils. Catesby conveys special attention to the rattlesnake by placing it on a page without an accompanying plant. The snake is coiled in a defensive posture, rattle raised. He also includes a detailed drawing of a dissected fang and two details of detached rattles.⁵⁵ It is not surprising that the details are included for this specific snake due to its reputation for danger to humans, but the illustrative nature of this image is in clear contrast to most of his plates. A few of Catesby's plates do show some

⁵³ Mark Catesby, *The Natural History of Carolina, Florida and the Bahama Islands: Containing the Figures of Birds, Beasts, Fishes, Serpents, Insects, and Plants; Particularly the Forest-Trees, Shrubs, and Other Plants, Not Hitherto Described, or Very Incorrectly Figured by Authors. Together with Their Descriptions in English and French. To Which, Are Added Observations on the Air, Soil, and Waters; with Remarks Upon Agriculture, Grain, Pulse, Roots, Etc. To the Whole, Is Prefixed a New and Correct Map of the Countries Treated of, 2 Volumes* (London: 1731-1743).

⁵⁴ It is unclear whether he was attempting to save on printing costs by combining these figures on a page. The original volume was self-published and sold by subscription; he learned engraving to produce these. David R. Brigham, "The Patronage of Natural History," in *Empire's Nature: Mark Catesby's New World Vision*, Amy Meyers and Margaret Pritchard, eds. (Chapel Hill: University of North Carolina Press, 1998), 114-115.

⁵⁵Catesby, plate 41.

interaction among organisms. His “brown viper” is about to prey upon a hapless salamander at the water’s edge,⁵⁶ and in another plate his tree frog has its mouth agape below a dangling spider.⁵⁷ Mark Catesby’s contribution was significant primarily because he presented a window on the diversity of reptiles and amphibians in the “new world;” his inventory certainly is not complete (for example, freshwater and land turtles are conspicuously absent), but he showed a greater variety of species than any predecessor. Additionally, the presentation of a bullfrog, snake or any creature arrayed across a folio-sized page, isolated from text and carefully hand-colored, imbues substance and significance to the animal. Such images assert that the organisms pictured are worthy of study and consideration.

While Catesby’s volumes presented an overview of the natural history of a region, von Rosenhof’s richly illustrated treatise on frogs was an exercise in detail and a bold new step in the imagery of amphibians that surely elevated their status as animals worthy of study.⁵⁸ In 1728 von Rosenhof was introduced to Merian’s *Metamorphosis*, and this event is credited with inspiring his book on the natural history of German insects.⁵⁹ He followed this volume with publication of the *Historia Naturalis Ranarum*. The magnificent frontispiece of this book (Figure 10) seems a tribute to Merian; the lizard twined around the rose stem regarding a butterfly, the details of the rose plant showing all stages from bud to fruit, and the evidence of insect damage on the plants’ leaves all show the hallmarks of Merian’s artistic style and observational skills.⁶⁰ *Historia Naturalis Ranarum* covers the small number of German anurans with great thoroughness in both text

⁵⁶ Ibid., plate 45.

⁵⁷ Ibid., plate 71.

⁵⁸ Rösel von Rosenhof, *Historia Naturalis Ranarum Nostratium*.

⁵⁹ August Johann Rösel von Rosenhof, *Der Monatlich-Herausgegebenen Insecten-Belustigung* (Nuremberg: Johann Joseph Fleischmann, 1746).

⁶⁰ Rösel von Rosenhof, *Historia Naturalis Ranarum Nostratium*.

and image. The book is subdivided into sections by species, and for each type of frog or toad von Rosenhof illustrated every step of their reproductive cycle from mating through metamorphosis as well as their external and internal anatomy. Aside from some small vignettes of the animals in their habitat and the full page frontispiece, the animals are simply arrayed on a white page. The forty-eight plates in the book are arranged in pairs of duplicates; the animals are first presented in color and unlabeled, and this is followed by a plate in black & white with figure labels that are referenced in the text. This arrangement was undoubtedly designed to satisfy both the artist and the naturalist in von Rosenhof. The result was a splendidly illustrated natural history study that is considered one of the finest of its type even today.

Natural history studies of the eighteenth century were capped by publications such as the 44-volume *Histoire Naturelle* by Georges-Louis LeClerc, Comte de Buffon (French, 1707-1788).⁶¹ Reptiles and amphibians were covered in volumes written by Bernard Germain Étienne de Lacépède, and the images in these books vary tremendously in quality. Some would be quite useless for identifying an animal beyond a broad grouping, and the plates are consistently lacking in any information about the animals' habits or habitat.⁶² LeClerc and Lacépède were concerned less with such details than with the ordering of nature by classification and cataloging as much of it as possible. However, by the middle of the nineteenth century exquisitely detailed and naturalistic images of every sort of plant and animal were made available by the process of lithography. Illustrated natural history books were the rage of the publishing world as an increasingly educated public became entranced by nature, and studies on reptiles

⁶¹ Georges Louis Leclerc comte de Buffon, *Histoire Naturelle, Générale Et Particulière Avec La Description Du Cabinet Du Roi*, 44 vols. (Paris: De l'Imprimerie royale, 1749-1804). Many editions of this were issued in an ever-expanding number of volumes.

⁶² Many of these illustrations seem almost cartoon-like when compared to those by Merian, Catesby, and Von Rosenhof. For example, "Le Scinque," depicts a stubby lizard vaguely resembling a skink, posed in a classical setting atop the ruin of a Greek statue. *Ibid.*, volume 37, 373.

and amphibians ranged from monographs to broad surveys.⁶³ By the time Charles Darwin returned from his famous voyage with specimens of three Galapagos tortoises, the study of reptiles and amphibians was an integral part of the beginnings of modern biology.⁶⁴

Conclusions

The above chronology of selected images is not meant to be comprehensive, or to imply that there was some orderly and linear evolution of increasingly representational portraits of these animals. Indeed, Gesner's salamander was much more accurately rendered in the sixteenth century than the same species pictured in the Buffon's encyclopedia over two-hundred years later. The manner in which animals were portrayed changed in response to many factors, but the purposes served by these images are the key to understanding their context. Likewise, understanding the intended function of the images gives us insight into how these animals were perceived at various points in history. That the salamander in an early bestiary resembled no living creature was not important to the symbolic function of the illustration. The earliest naturalistic portraits of nature were those of flora and fauna used for food or medicine, because reliable identification was essential.⁶⁵ Naturalistic representation of reptiles and amphibians came much later with the work of Belon and Gesner, when the purpose of the image was to show the animal as it was observed, and to

⁶³ For a pictorial overview see Sally Haines, *Slithy Toves: Illustrated Classic Herpetological Books at the University of Kansas in Pictures and Conversations* (Ithaca: Society for the Study of Amphibians and Reptiles 2000), 68-98.

⁶⁴ Charles Darwin, *Journal of Researches into the Geology and Natural History of the Various Countries Visited by H. M. S. Beagle, under the Command of Captain Fitz Roy, R. N., from 1832-1836* (London: Henry Colburn, 1839), 394. The fact that tortoise populations isolated on different islands varied enough to be distinguished from each other was one of the observations that helped Darwin to formulate his ideas on natural selection.

⁶⁵ Manuscript herbals with images of identifiable plants are known from as early as the fifth century, and by the seventh century birds were depicted realistically. Collins, *Medieval Herbals*, 37-40.

place it in the growing catalog of nature. While the text of Gesner and Aldrovandi included information on the symbolism of the animals, with the exception of the mythical creatures pictured, the images are straightforward and naturalistic. William Ashworth has argued that Aldrovandi brought “the emblematic view of nature to fruition,” but he also goes on to say that within a half century of Aldrovandi’s death this view had dissipated.⁶⁶ When exotic animals from the Americas and elsewhere came to be viewed in Europe, there was no historical context or established symbolism. By the middle of the seventeenth century the purpose behind animal images shifted to cataloging and describing the natural world, and reptiles and amphibians were included in this process, albeit not as comprehensively as other fauna. Images of large or venomous reptiles did play a role in showing how alien and dangerous these new lands could be, and possibly, how exciting.⁶⁷

Maria Sibylla Merian was among the first to make images with a purpose that was clearly separate from that of cataloging and classifying. Before Merian, reptiles and amphibians were typically pictured as specimens on a page with no external context. A few images illustrated an animal feeding or some aspect of reproduction, but little more. Merian’s reptiles and amphibians (and of course her insects) are shown as existing in nature with plants and with other animals. Her animals are portrayed with their natural coloration; they exhibit behaviors, reproduce, and serve as both prey and predators. This quantity of visual information demystifies the beasts, and showcasing these images on a folio-sized page validates their significance. Mark Catesby greatly expanded the number of reptiles and amphibians given this star treatment, although the purpose of his images seems to have been aligned somewhat more with those who wished to

⁶⁶ William B. Ashworth, “Emblematic natural history of the Renaissance” in Nicholas Jardine, James A. Secord, and E. C. Spary, *Cultures of Natural History* (Cambridge: Cambridge University Press, 1996), 30-36.

⁶⁷ This seems to be the purpose behind the image in Figure 5.

inventory nature. However, like Merian and Von Rosenhof, Catesby granted a certain aesthetic quality to the herpetofauna he drew and painted, and it is interesting to note that he usually reserved the more sinister poses (coiled body, open mouth) for venomous species of snakes such as the rattlesnake and brown viper. Non-poisonous snakes like the green tree snake often are draped around flowering plants like baroque ornaments.⁶⁸ It may be that his purpose in this presentational style was to emphasize their harmless character as well as their physical beauty.

Lastly, I would like to discuss the importance of the images of amphibian metamorphosis that began in a simple way with Gesner and reached their apogee with von Rosenhof. Depictions of this gradual process of development from egg to adult body form were important for several reasons. Perhaps most obviously, these images show the process of embryonic development, which is not so visible in most animals. Metamorphosis also emphasizes that animals are not immutable, but can change as they grow. Unique to amphibian metamorphosis is the transformation from a creature that breathes in water to one that can respire in air. Finally, images of the spawning of eggs and their development helped to dispel long-held beliefs in spontaneous generation. All of these aspects of the study of metamorphosis in amphibians made an important contribution to what is now modern biology.

In observing nature directly and recording these observations in text and images, natural philosophers took the first steps to establish scientific inquiry, pushing aside the role of myth and magic in understanding the world. Curiosity about the “loathsome beasts” and increasing attention to their natural history reflect this sometimes circuitous path very well. Even though some naturalists in the Early Modern period treated these animals with the same objective attention as the other vertebrates, others such as naturalists John Ray and Thomas Pennant

⁶⁸ Catesby, Plate 47.

expressed a deep aversion to them.⁶⁹ Such repugnance and fear may actually be explainable to a degree by twenty-first century science. Psychologists working with photographs of snakes found that humans and other primates learn fear of snakes more quickly than fear of almost any other stimulus, and they have postulated that there may be an evolutionary reason for this.⁷⁰ It appears that images of the loathsome creatures may teach us about ourselves as well as about the nature of the beasts.

Kay Etheridge (Gettysburg College) is Associate Professor of Biology at Gettysburg College. Her publications include work on foraging in tropical bats, food consumption by manatees, and the role of thyroid hormones in the regulation of metabolism in reptiles and amphibians. She currently is studying the evolution of images in natural history studies from the medieval through the early modern periods.

⁶⁹ Keith Thomas, *Man and the Natural World: Changing Attitudes in England, 1500-1800* (New York: Oxford University Press, 1996), 57. Ray, an eminent seventeenth century English naturalist, stated that he had such an abhorrence of snakes that he was “not very inquisitive after them.” Pennant, an eighteenth century Welsh naturalist who published on the quadrupeds, admitted a dislike of frogs that prohibited his examination of them.

⁷⁰ Arne Öhman and Susan Mineka, “The Malicious Serpent: Snakes as a Prototypical Stimulus for an Evolved Module of Fear,” *Current Directions in Psychological Science* 12:1 (2003), 1-5. It can be argued that an innate fear of a potential danger is a protective adaptation that would be selected for in offspring.

Figure 1. Salamander. From the Aberdeen Bestiary, English 1200. Aberdeen University Library MS 24, folio 70r. Used with permission of Aberdeen University. Copyright University of Aberdeen.



Figure 2. Chameleon. From Belon, Pierre. *Les Observations De Plusieurs Singularités Et Choses Mémorables, Trouvées En Grèce, Turquie, Judée, Egypte, Arabie & Autres Pays Étranges*. Paris: Chez Guillaume Cauellat, 1554. Image courtesy of the Department of Library Services, American Museum of Natural History.



Figure 3. Mythical and real salamanders. From Gesner, Konrad. *Historia Animalium Liber II : De Quadrupedibus Oviparis* Frankfurt: Roberti Cambieri, 1586. Used with permission of the Smithsonian Institution Libraries, Washington, DC.



Figure 4. Viper giving birth. From Imperato, Ferrante. *Dell'istoria Naturale*. Napoli: C. Vitale, 1599. Image courtesy of the Department of Library Services, American Museum of Natural History.



Figure 5. “Their way of killing crocodiles” by Jacques Le Moyne de Morgue. From de Bry, Theodor. *Brevis Narratio Eorum Quae in Florida Americae Provincia Gallis Acciderunt, Secunda in Illam Navigatione, Duce Renato De Laudoniere ... Anno Mdlxiii. Quae Est Secvnda Pars Americae... Auctore Iacobo Le Moyne, Cui Cognomen De Morgues.* Frankfurt: I. Wecheli, 1591. Image courtesy of the Department of Library Services, American Museum of Natural History.

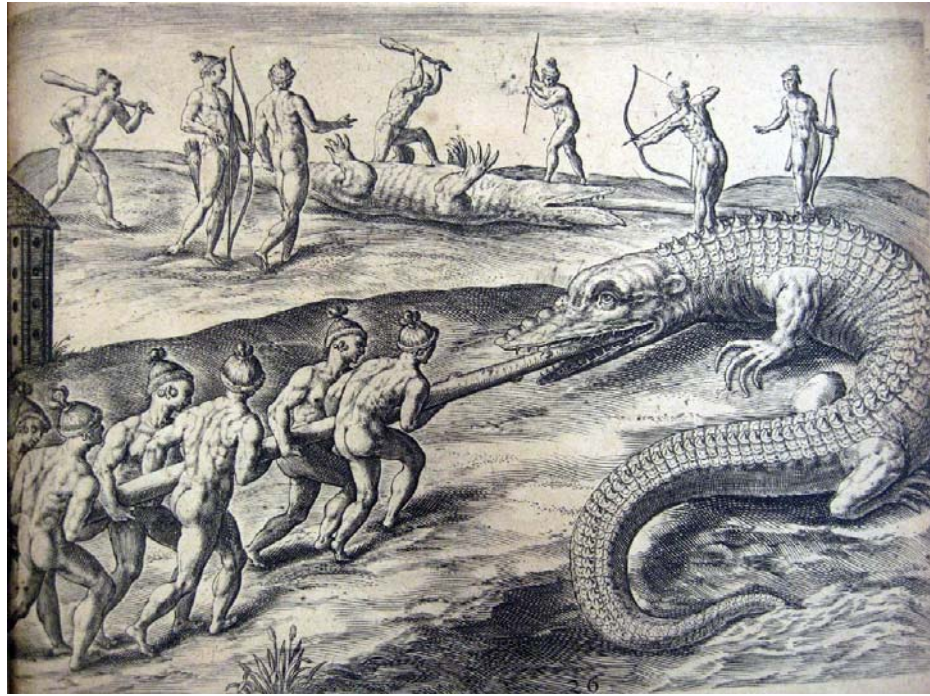


Figure 6. Frog with tadpoles and eggs, hyacinth and insects. Maria Sibylla Merian. Pen and ink with watercolor and bodycolor on vellum. Photograph © The Trustees of the British Museum.



Figure 7. Lizard with eggs and hatchling, butterflies and banana plant. Maria Sibylla Merian. Pen and ink with watercolor and bodycolor on vellum. Photograph © The Trustees of the British Museum.



Figure 8. Caiman defending young and egg against a false coral snake. Maria Sibylla Merian. Pen and ink with watercolor and bodycolor on vellum. Photograph © The Trustees of the British Museum.

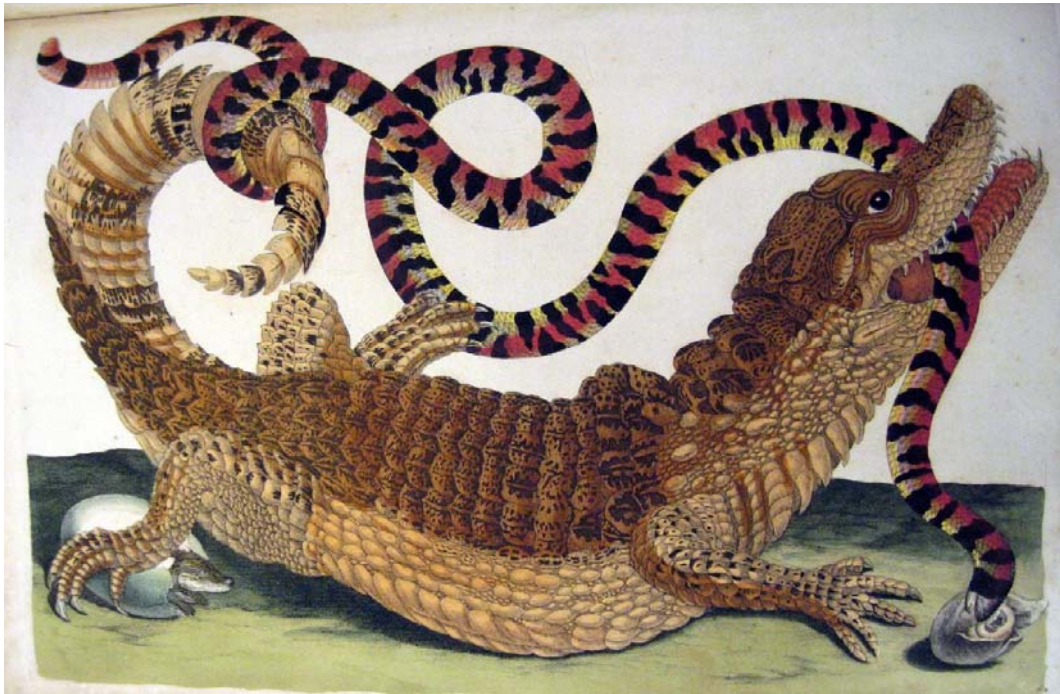


Figure 9. Bullfrog and ladyslipper. Mark Catesby. *The Natural History of Carolina, Florida and the Bahama Islands*: London, Printed at the expense of the author, 1731-1743. Used with permission of the Smithsonian Institution Libraries, Washington, DC.



Figure 10. Frontispiece from Rösel von Rosenhof, August Johann. *Historia Naturalis Ranarum Nostratium*. Nuremberg: Johann Joseph Fleischmann, 1758. Image courtesy of the Department of Library Services, American Museum of Natural History.

