HAMADRYAD

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Front cover: Portrait of Patrick Russell in profile (1794), after his return from India and shortly before the publication of *An Account of Indian Serpents* (1796), the first of his two volumes on the snakes of India. Image courtesy of the Bibliothèque Nationale, Paris. See the articles by Kraig Adler and Indraneil Das in this issue for detailed information about Russell and his books.

Back cover: Plate VII from Patrick Russell's *An Account of Indian Serpents* (1796) illustrating the Ketuka Rekula Poda [= *Daboia russelii* (Shaw & Nodder, 1797)]. The specimen illustrated is the paralectotype of the species. Although this animal has been lost, the lectortpe, BMNH II.1.1a, is still extant. Russell described only one snake species himself, but his illustrations and text served as the basis for the descriptions of more than 100 nominal taxa by many authors through the mid-19th century (see paper by Aaron Bauer in this issue).

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Patrick Russell (1727–1805), surgeon and polymath naturalist

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ABSTRACT.– The life and times of Patrick Russell (1727–1805), a Scottish medical practitioner and natural historian from Edinburgh, are traced, with emphasis on his work in the Ottoman town of Aleppo (currently, Halab, in north-western Syria), with that of his half-brother, Alexander Russell (1715–1768), and along the Coromandel Coast (in eastern India). Russell is best known amongst zoologists for the discovery of his namesake, the venomous serpent referred to as Russell's Viper, *Daboia russelii*. His two folio volumes, centred around his time in the Coromandel coast of south-eastern India, was lavish in its illustrations of Indian snakes, and executed by an unknown Indian artist. Vernacular, rather than English or scientific names were used in this compendium, arguably the first text exclusively on a herpetological topic published on the Indian fauna. Apart from snakes commonly occurring in the south-eastern India, the work also describes a few species sent to Russell by colleagues from other parts of Asia. He also experimented on the venom of the local snakes, and documented their effects on dogs, rabbits and chickens, these being the first attempts to classify the venomous snakes from the harmless ones in the country.

KEYWORDS.– Patrick Russell, Alexander Russell, biography, medicine, herpetology, natural history, Aleppo, Syria, Coromandel Coast, India.

> "*After all that has been already done, India still presents a wide field for research; and the progress made, of late years, in other branches of knowledge, affords room to expect material improvement in Natural History...*"
>
> Patrick Russell (1795) Preface in *Plants of the coast of Coromandel, selected from drawings and descriptions presented to the Hon. Court of Directors of the East India Company* by William Roxburgh.

Introduction

The Age of Enlightenment reached Scotland's shores before the glorious Victorian Age in England, in the 18th Century. Witness the Act of Union passed by the Parliament of Scotland (1707); the establishment of Britain's first circulating library as well as medical school (1726) and of the Royal Bank of Scotland (1727); game of golf played on Bruntsfield Links (1735); the first series of public lectures by political economist Adam Smith (1748); publication of the first edition of *Encyclopædia Britannica* (1768–71); creation of the Royal Society of Edinburgh for "the advancement of learning and useful knowledge" (1783); and the birth of Scotland's famous sons (David Hume, philosopher, 1711; James Hutton, geologist, 1726; Alexander Monro, discoverer of the lymphatic and nervous systems, 1733; James Boswell, biographer, 1740 and Sir Walter Scott, poet, 1771). In the field of medicine, in particular, that of surgery, Edinburgh was the world centre (Fillmore, 2009), attracting attention of scholars and students, including, most famously, the Darwin family, several of its

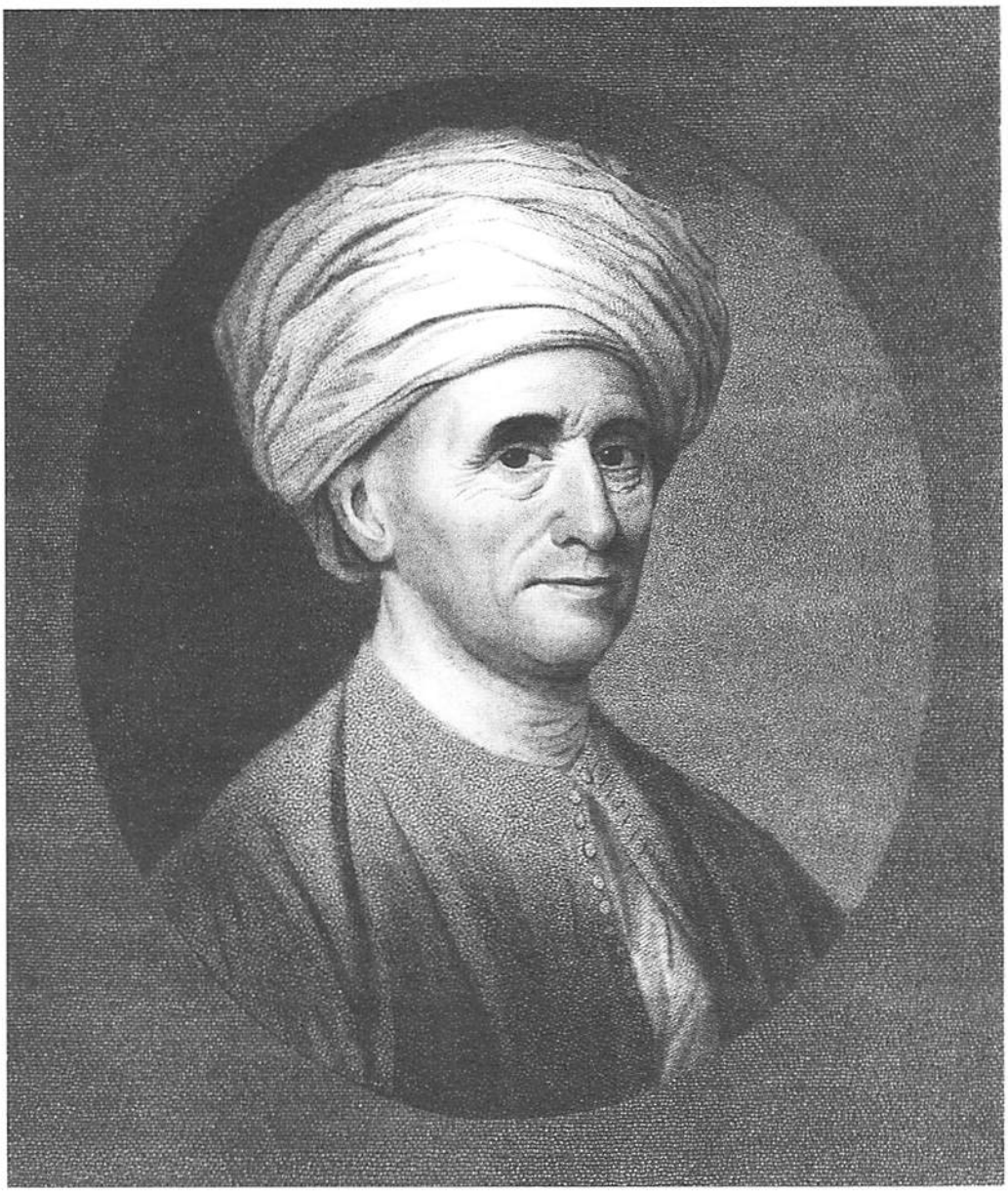


Figure 1. Patrick Russell (1726–1805). Frontispiece portrait from Patrick Russell's (1802) *A Continuation of an Account of Indian Serpents.* Although Western sources mention that he was permitted to wear a turban, a privilege seldom given to Europeans in Aleppo (Anon, 1811), it is more likely that a turban was presented to him as a symbolic gesture of recognition rarely given to a European at the time, presumably for his medical services to the Pasha and others in Aleppo.

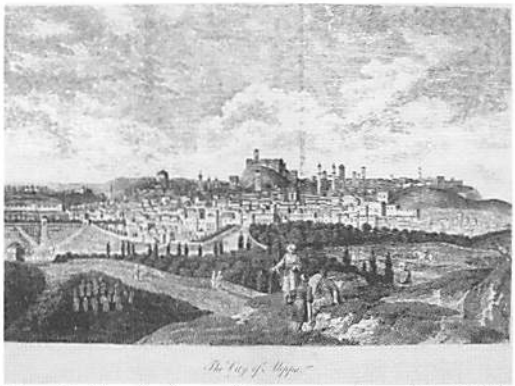
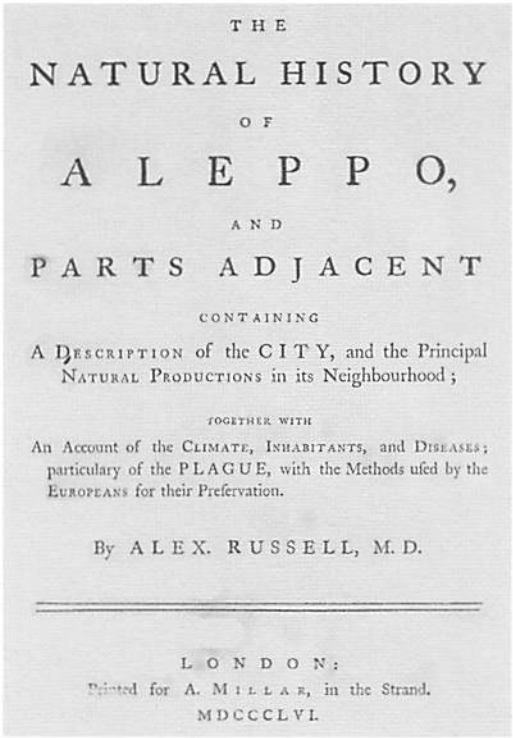


Figure 2. Frontispiece of Alexander Russell's (1794) *The Natural History of Aleppo and Parts Adjacent*, showing the city of Aleppo, in modern-day Syria, described as "..opulent and orderly" at the time of residence by the Russell brothers, Alexander and Patrick, in the late 18th century (Starkey, 2002).

members taking courses at Edinburgh (Antolin 2011).

This essay centres around the contributions of two remarkable individuals, Alexander Russell (1715–1768) and especially his younger half-brother, Patrick Russell (1727–1805; Fig. 1) to the natural history of the Near East, and of India.



THE
NATURAL HISTORY
OF
ALEPPO,
AND
PARTS ADJACENT
CONTAINING
A DESCRIPTION of the CITY, and the Principal NATURAL PRODUCTIONS in its Neighbourhood;
TOGETHER WITH
An Account of the CLIMATE, INHABITANTS, and DISEASES; particulary of the PLAGUE, with the Methods uſed by the EUROPEANS for their Preſervation.
By ALEX. RUSSELL, M. D.
LONDON:
Printed for A. MILLAR, in the Strand.
MDCCCLVI.

Figure 3. Title page of Alexander Russell's (1756) first edition of *The Natural History of Aleppo and Parts Adjacent*.

The Brothers Russell in Aleppo

The sons of the eminent Edinburgh solicitor, John Russell (1710–1796), who was also a founding member of the Royal Society of Edinburgh, Alexander (born 8 September 1715) and Patrick (born 6 February 1727) studied classical subjects (Greek and Roman) in high school, and as was possible at the time, took up medicine, graduating as Doctors of Medicine. The elder sibling took up a position as a physician in the Levant Company's factory, in charge of quarantine and disease control in Aleppo (Arabic name, Halab), a major Ottoman city dating back to the 14th century, in north-western Syria (Fig. 2). The Levant (or the Company of Turkey Merchants) Company, an English chartered company established in 1581, regulated trade with these countries, and welcomed Scots, unlike the English East India Company at the time (Starkey 2013). Factories (in reality, trading centres or commercial bases) were established at a number of commercial centres, and were provided with chaplains as well as physicians (Epstein 1908). Alexander attended to both staff of the Levant Company as well as the local populace, regardless of religion, race or rank, and his knowledge of the local customs and language apparently attracted the notice of Mehmet Raghib Pasha (1699–1763), the Governor-General of Aleppo (between 1755–1756), propelling him to the post of chief medical practitioner in Aleppo; perhaps more importantly, he was permitted to dissect corpses (Starkey 2013). One of his major medical contributions was the first description in English of *cutaneous leishmaniasis* (Hawgood 2001), a common skin infection caused by parasites transmitted by sandfly bites. Despite what must have been a trying time (including the outbreak of plague), he retained a strong interest in natural history.

The younger sibling, Patrick, followed shortly (in 1750), replacing Alexander who resigned (in 1753) to return to London in 1755, and Alexander was elected to the Royal Society the following year. The two brothers shared residence and workspace at Khan-al-Jumruk, near the Great Umayyad mosque, in the centre of the bazaar, a structure that dates back to 1574.

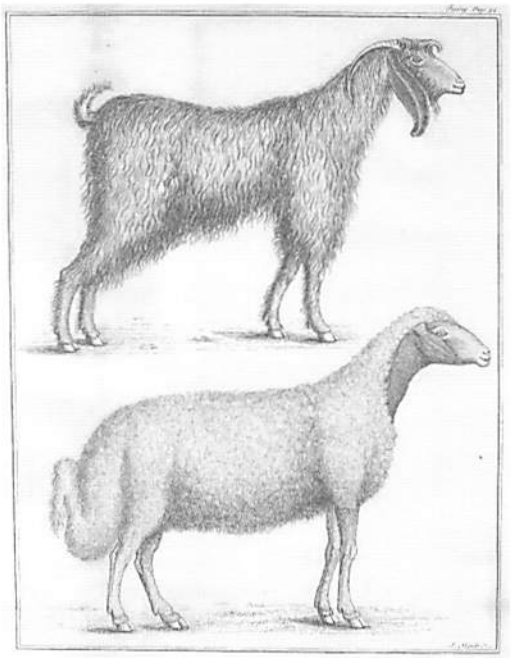


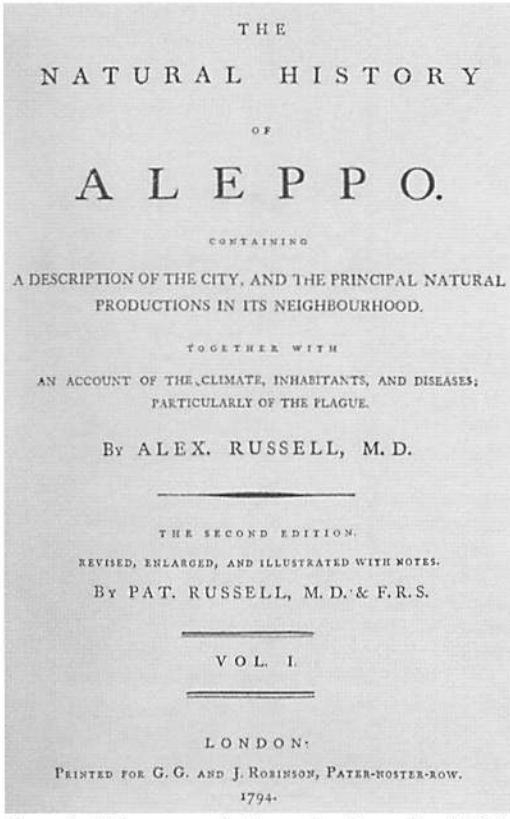
Figure 4. Plate opposite page 52 of Alexander Russell's (1756) *The Natural History of Aleppo and Parts Adjacent,* the text reporting "..two sorts of sheep in the neighbourhood of Aleppo", the extraordinary one illustrated below, with its broad tail that terminates in an appendix.

Patrick returned to London a good 16 years later, in 1771. Like his half-brother, Patrick was similarly held in esteem by the Pasha (Anon 1811). Back home in 1772, the younger Russell was feted by his peers and elected Fellow of the Royal Society. Alexander published what was to become an important work on the natural history of the Near East in the broadest sense, entitled "The Natural History of Aleppo and Parts Adjacent" (A. Russell 1756; Fig. 3), published in quarto, bearing multiple illustrations, and including accounts of the city of Aleppo, its inhabitants and natural products, as well as diseases and their treatment (Figs. 4–5). Noteworthy in the volume is the extensive use of Arabic sources in the footnotes, especially medical texts (Starkey 2004). Patrick edited a second edition of the work (A. Russell 1794; A. Russell & P. Russell 1794; Fig. 6), in two volumes (the second also coauthored by him), the first one on the city itself, its seasons and fruits and vegetables, as well as ethnic groups and local government, the second on Europeans and other foreigners residing in the city, medical observations, natural history (Fig. 7) and a detailed section on the plague epidemic whose waxing and waning was the subject of a special study. There are substantial details (in the form of a complete chapter) on the local flora and fauna, using the then recent Linnaean (but not always binomial) nomenclature for botanical specimens. These works were published after the passing of Alexander in 1768, and include new material both collected by Patrick and those sent to him by former colleagues at Aleppo (Starkey 2002).

Patrick Russell in the Coromandel Coast

After his return to London, Patrick Russell was convinced by family to follow to India an ailing younger brother, Claude Russell (1733–1820), originally a "writer" (junior clerical staff), and subsequently, an officer with the English East India Company, based at Vizagapatam (currently, the city of Visakhapatnam, in Andhra Pradesh). Towards the end of 1781, Patrick arrived at this southern Indian coastal town, to tend to his brother, and significantly, devoted his energy to the exploration of the flora and fauna of this part of the Indian Subcontinent, that had remained virtually unexplored. He was 55 years at the time. Following the death of the botanist, Johann Gerhard Koenig (1728–1785), Russell received an offer to serve as either Botanist or Naturalist with the British East India Company, which he accepted, at the insistence of his brother Claude. The following several years were spent in organising the delivery of "every information...(on)...useful plants" from "residents of different (medical) stations" of the Madras Presidency (Anon 1811), and Patrick Russell went

Figure 5. Plate XV of Alexander Russell's (1756) *The Natural History of Aleppo and Parts Adjacent.* "The people of Aleppo lead in general a sedentary life. They do not consider exercises as necessary to the preservation of health".



THE

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TOGETHER WITH

AN ACCOUNT OF THE CLIMATE, INHABITANTS, AND DISEASES; PARTICULARLY OF THE PLAGUE.

By ALEX. RUSSELL, M. D.

THE SECOND EDITION,

REVISED, ENLARGED, AND ILLUSTRATED WITH NOTES.

By PAT. RUSSELL, M. D. & F. R. S.

VOL. I.

LONDON:

Printed for G. G. and J. Robinson, Pater-noster-row.

1794.

Figure 6. Title page of Alexander Russell's (1794), Volume 1 of the second edition of *The Natural History of Aleppo*.

on to collect some 900 herbarium specimens. These and other collections were published in a three folio volumes, between 1795–1819, by William Roxburgh (1751–1815), Russell's successor, and Russell provided a generous preface to the work that include hundreds of watercolours (Fig. 8). The text also capture knowledge of botany of ethnic groups speaking Telinga and Tamil, south of the Godavari River, and Patrick himself was reported to have learnt Telugu. Patrick Russell continued to stay at Vishakhapatnam with Claude, an area in the Northern Circars, even though his work for the Company was further south, in the Plains of the Carnatic.

At the same time, Patrick Russell made detailed studies of the dentition of snakes, particularly as observed in bites, and thus could generalise differences between life-threatening venomous species from the harmless ones. Descriptions and figures of these observations were published in the form of pamphlets and were widely disseminated. Russell also revisited the remedial procedure then widely used for treating snake envenomation, as well as bites from rabid animals, via the use of the *Tanjore Pill*, an arsenic and mercury-containing drug, concluding that efficacy "was a matter of difficult discussion" and concluded optimistically that further evidence may "confirm its good character" (Raman *et al.* 2014).

In 1799, the outbreak of the plague in the Middle East alarmed the Privy Council of Great Britain, and a committee was duly appointed to draw up quarantine regulations. The task naturally fell on Patrick Russell. During his time in India, he also collected marine as well as freshwater fishes assiduously, a large collection that, before his departure, were deposited in the Company's Museum at Fort Saint-George, Madras. Notes on the collection and specially commissioned paintings by an unnamed Indian painter (who apparently also worked on his snake folios, see Raman 2010) were brought back to Britain, and provided material for his future work on ichthyology.

To return to Russell's herpetological contributions, his masterpiece, a two volume folio on snakes was published after his return to Britain, in 1796 (Vol. 1) and between 1801 and 1809 or 1810 (Vol. 2). The complex issues surrounding dates on publication of the text and plates for these volumes have been dealt with by Adler (1989; this issue), and it is evident that three of five fascicles of the second volume were published posthumously. While the Aleppo volumes do not reveal a special interest in snakes or treatment for envenomation, an oft mentioned

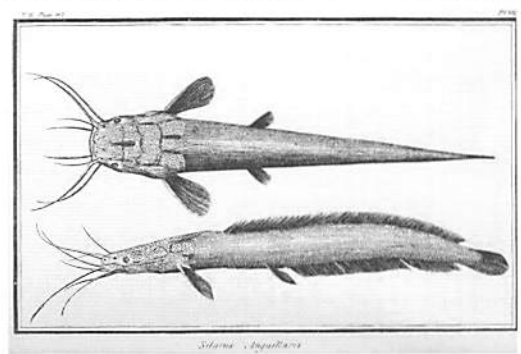

Figure 7. Plate VII from Alexander and Patrick Russell's (1794), Volume 2 of the second edition of *The Natural History of Aleppo*. The Russells wrote "Though the Turks seldom eat fish, the Kowick (river) does not afford a sufficient quantity for the Aleppo market".

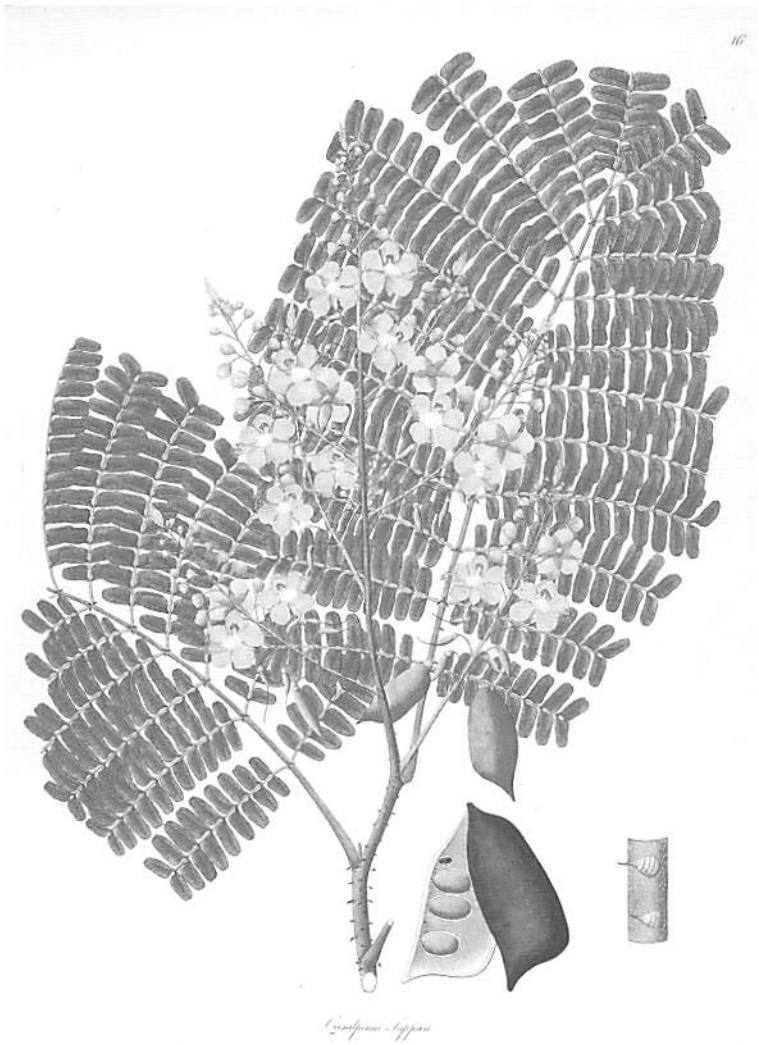

Figure 8. Plate 18 from Roxburgh's (1795) *Plants of the Coast of Coromandel. Vol 1.*, a work for which Patrick Russell prepared the preface and collected much botanical material.

passage from Russell (1796) may throw light on his new-found interest in the field: "The terror occasioned by those numerous reptiles, is immoderately aggravated by the indiscriminate apprehension of all being poisonous. To distinguish, therefore, those that are really so, from such (by far the greater number) as are harmless, becomes a matter next in importance to the discovery of a remedy against their poison". Yet, the English East India Company was "not a liberal patron of science" (see Bhaumik 2012), the rationale behind their support of such expensive undertakings as an inventory of a complex tropical fauna considered utilitarian to the Company, in terms of saving life and limb of its civil servants, rather than generation of knowledge or attending to an age old problem encountered by the human inhabitants of the Carnatic.

Contemporary workers will find the usage of local (Telugu, the state language of the Indian State of Andhra Pradesh, and of Dravidian roots) vernacular names, rather than their English or scientific names odd. However, it must be borne in mind that Linnaeus' 10th edition of *Systema Naturae* was merely three decades old, and transmission of paper and ideas between continents and across languages must have been slow two-and-half centuries ago. Additionally, snakes encountered by Russell along the east coast of India (barring a few sea snakes and *Naja naja*, Russell's "cobra de Capello") were undescribed at the time. Nonetheless, the Russells had earlier used Linnaean names for botanical material from Aleppo, and Linnaeus himself named a plant after the elder Russell (Starkey 2004; 2013). Patrick Russell (1801) provided a valid description of *Boa Johnii* (currently, *Eryx johnii*), the types of which were not designated, on the basis of material from "Tranquebar" (= Tarangambadi, Mayavaram Taluk, Tanjore District, Tamil Nadu State). The species name honours Reverend Christoph Samuel John (1747–1813), a Danish missionary who sent specimens from Tranquebar to Germany. Several others were found in his study after Patrick Russell's untimely death (Anon 1811).

Museum-based zoologists in Europe, including Britain, France and Germany, were quick in

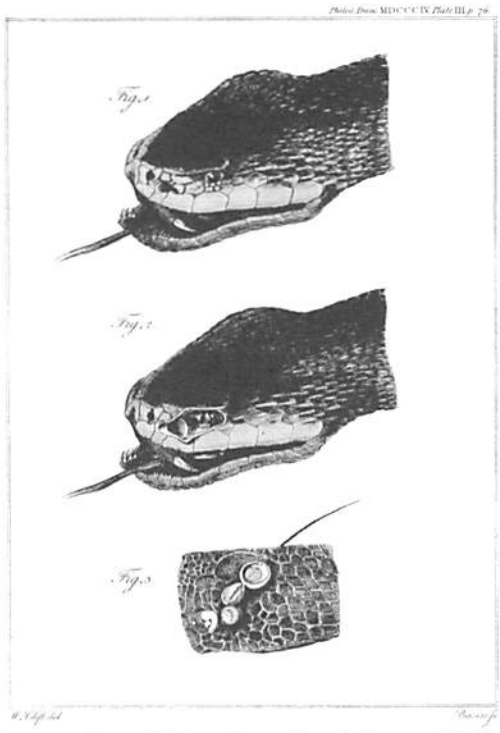

Figure 9. Plate III from Russell and Home (1804b), showing lateral view of head and neck of a "Ferde-lance" or "yellow snake of Martinico" (*Bothrops lanceolatus*), and the position of the loreal pit and a dissected view of the structure.

taking notice of Russell's paintings, and starting with Shaw and Nodder (1797), a number of snakes depicted in the two volumes were given names. Two species originate from "Java", *Dipsas multomaculata* Boie, 1827 and *Lycodon capucinus* Boie (1827), and a few from the Sunderbans further north and one was from Bombay, exceptional for the coverage in Russell's volumes, these specimens being received as a donation from members of the civil service. However, the bulk of the specimens were collected from the Coromandel region. Apart from snakes, the volumes also illustrate a limbless lizard that Schneider (1801) described as *Anguis melanostictus* (see Das 2000). Several species names honour Patrick Russell, including *Coluber russelii* Shaw and Nodder (1797), currently referred to as *Daboia russelii* (Shaw and Nodder, 1797), *Coluber russelius* Daudin, 1803, a junior synonym of *Oligodon arnensis* (Shaw and Nodder, 1802), *Cerberus russelli* Cuvier, 1837, a junior synonym of *Cerberus rynchops* (Schneider, 1799), *Dryinus russelianus* Bell,

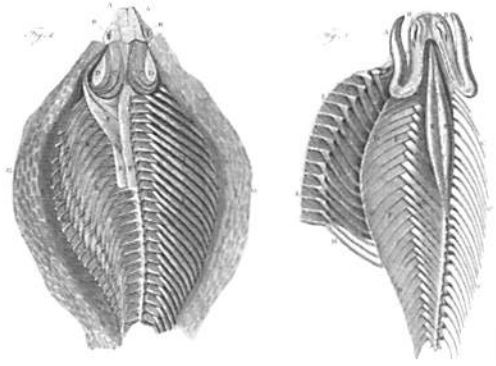

Figure 10. Plate VIII from Russell and Home (1804a), comprising dissected views of the neck of "Cobra de Capello" (*Naja naja*), showing ribs and muscles involved in the "hooding" of cobras.

1825, a junior synonym of *Ahaetulla nasuta* (Bonnaterre, 1790) and *Tortrix russelli* Merrem, 1820, a junior synonym of *Ramphotyphlops braminus* (Daudin, 1803).

The snake folio volumes also record experiments Russell conducted to discover differences between venomous and harmless snakes, through an examination of dentition as well as observations on the effect of their bite on various small animals (dogs, rabbits and chickens), reporting, in particular, both neurotoxic and haemorrhagic effects of viper envenomation. To undertake these experiments, he learnt to milk venomous snakes, presumably after mastering their safe capture and restraint. Patrick Russell's other herpetological contributions include observations on the loreal pits of crotaline snakes from both the Old and New Worlds. In a paper coauthored with the anatomist and fellow member of the Royal Society, Sir Everard Home (1756–1832), the First Baronet of Well Manor, Southampton, Patrick Russell described and illustrated these loreal pits (Russell & Home 1804a; see Fig. 9). Russell was to work with Home one last time to solve the problem of "hooding" by cobras, in this case, making dissections on specimens he brought back from India to study the osteological and myological adaptations in these species that permit the spreading of the hood (Russell & Home 1804b; see Fig. 10).

The Legacy of Patrick Russell

Early European scientific contacts with the Subcontinent were various, those prior to the second

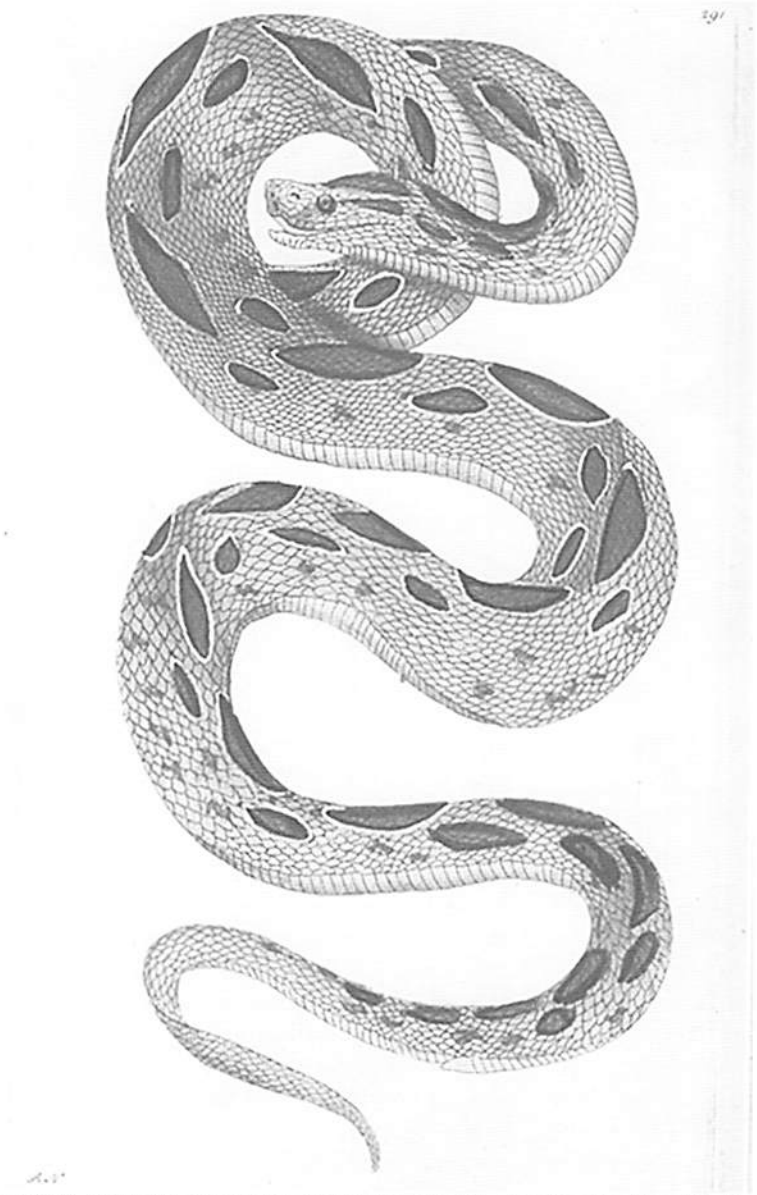

Figure 11. Plate 291 from Shaw and Nodder (1797), showing the Russell's Viper, *Daboia russelii*, thought to be derived from the British Museum holotype (BMNH II.I.Ia).

half of the 18th century being described as couriers, rather than collaborators, in making specimens available to European cabinets (Kochhar 2013). Larwood (1962) was less generous to these early contributors, writing that "Amateurism and motivation by practical needs are the keynotes" of their contribution, albeit admitting to the small European population in the Indian Subcontinent prior to the middle of the 19th century, as well as shortage of professionals in scientific disciplines and of local scientific bodies and journals.

Thomas Hardwicke (1756–1835) and Patrick Russell were arguably the first European zoologists in India (Smith, 1952), arriving in the Subcontinent in 1778 and 1781, respectively. Rising to the position of Major-General in the Bengal Artillery of the East India Company, like Russell, Hardwicke collected natural history specimens and coloured sketches of plants and animals. Hardwicke's collection of the latter run into some 32 folio volumes, that included over 2,000 drawings (366 being of amphibians and reptiles). Hardwick's most important work, prepared in collaboration with John Gray (1800–1875) of the British Museum, London, was entitled 'Illustrations of Indian Zoology' (Gray 1830–1832). The text was not published, owing to Hardwicke's premature death (biographical accounts in Adler 1989; Leviton & Aldrich 2000; Das 2004). Russell's "Serpents", in comparison, carries 92 plates (on 87 leaves), and is near exclusively on snakes. The aesthetic appeal of these illustrations to this day is evident in their continued discussion and reproduction in works of both art and science (see for instance, Magee 2013). Described as one of the most impressive book in the field for its weight alone (eight kilos) by Adler (1989), copies of 'Serpents' are highly

sought after- Christie's Sale 7576 lists one that realised $8,588 USD (against an estimate of $2,978–3,970 USD) in 2008.

Patrick Russell's contributions did not stop with the aforementioned works. He had earlier published a short account on the earthquakes in Syria (P. Russell 1760), wrote on indigenous inoculation practiced by the Bedouin Arabs (P. Russell 1768), wrote a definitive treatise on the plague as witnessed at Aleppo (P. Russell 1791), made observations on smallpox (P. Russell 1800), and finally, prepared two folio volumes on the fishes of the Coromandel Coast (P. Russell 1803).

As mentioned earlier, Patrick Russell is immortalised through the name for the Russell's Viper, *Daboia russelii*, given by Shaw and Nodder (1797) as *Coluber russelii* and based on a specimen in their colour plate (Fig. 11). It is derived from a specimen in The Natural History Museum, London (BMNH 11.1.1a) that is generally considered the lectotype of this species (see Bauer, this issue). The type locality was unfortunately not specified in the original description, although most workers (e.g., David & Ineich 1999: 312) have inferred that Russell's (1796) specimen that served as the type of *Coluber Russelii* Shaw and Nodder, 1797, originated from the Coromandel Coast. On the other hand, Hawgood (1994) opined that the species was sketched by an artist in Russell's pay from a specimen that originated from Bombay. This is a medically important species associated with mortality and morbidity of a large number of human victims across the subcontinent. The town of Rasulkonda (19.55N, 84.34E), in Ganjam District, Odisha State, in eastern India is named for Patrick Russell; more recently, the town was renamed Bhanjanagar. Nonetheless, for these scientific contributions, as well as for his important contributions to the development of herpetology in the early 19th century, Russell's name will not be forgotten.

Patrick Russell was, by all accounts, a modest man, and never married. He provided specific instructions for his funeral: "It is my request to be interred in the nearest burial ground, in the most private manner that custom will permit, but not be deposited within the walls of any place dedicated to public worship". Upon his death on 2 July 1805, he was laid to rest in the Marylebone burial ground, an event witnessed only by a few of his closest acquaintances (Anon 1811).

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The planning and publication history of Patrick Russell's classic book, "Indian Serpents"

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ABSTRACT.– The life of Patrick Russell is briefly reviewed. The publication history of Russell's "Indian Serpents" is recounted. Part I of the work, including 46 plates on 45 leaves, was published in its entirety in 1796. Part II, however, was issued in a series of five fascicles between 1801 and 1809 (more probably 1810) with a total of 45 plates on 41 leaves. Only the first three of these (1801, 1802 and 1804) appeared during Russell's lifetime. The sources of prior confusion regarding the number of fascicles and their dating are discussed as is the evidence supporting the interpretation presented here.

KEYWORDS.– Patrick Russell, Everard Home, publication history, bibliography, Serpentes, India.

Introduction

Patrick Russell (1727–1805), a Scottish physician and naturalist, was the pioneer specialist on the snakes of British India. His publication on this subject—"An Account of Indian Serpents . . ." (1796–1809 [1810]), a book published in imperial folio format that measures 55 cm tall and contains 91 mostly hand-colored plates—is one of the most imposing and best-known classics on Asian natural history, yet its publication details are complicated and not widely understood.

The Author

Russell[1] was born in Edinburgh, Scotland, on 6 February 1727[2]. In 1750, he joined his older half-brother, Alexander Russell, in Aleppo, an ancient Syrian city in the Ottoman Empire, where Alexander was a physician at an English factory. Alexander also studied the local fauna and flora, which he published in book form in 1756. Patrick assisted his brother who also mentored him in natural history, but when Alexander returned to Great Britain in 1753 he succeeded to his brother's position at the factory and continued to study the local plants and animals. He also treated the local Turks and gained such respect for his work that the local pasha granted him the rare privilege, for a European, to wear a turban (see Fig. 1A). Russell returned home in 1772 and settled in London where, because of his nascent scientific accomplishments, he was elected to the Royal Society in 1777.

Early in 1782, Russell accompanied his younger brother, Claud Russell, to India where the latter had been appointed by the English East India Company to be the administrator of the company's settlement in Vizagapatam (now spelled Visakhapatnam), the only natural harbor on India's eastern coast. At that time, British interests in India were managed by the Company, which had its own army and civil service. (Only after the revolt in 1857–1858 did the British government take direct control, an era called the Raj.) The Company had trading stations and settlements throughout most of the Indian Peninsula and in 1785 Patrick

1. His surname is sometimes misspelled "Russel," apparently based on the Latinized version of his name that was correctly written without the final l due to the rules of Classical Latin (see Adler et al., 2000). Russell signed his name with two ls and it was also printed this way in his own publications.

2. Russell's year of birth is sometimes given as 1726. This is due to the fact that the calendar year in Scotland was moved to 1 January in 1600, but in England this did not occur until 1752. Thus, he was born in Edinburgh on 6 February 1727 and this corresponded to 6 February 1726 (Old Style) in London publications. This difference in year is sometimes indicated in contemporary publications as "1726/27," but is correctly rendered according to the calendar style in use where a person was born.

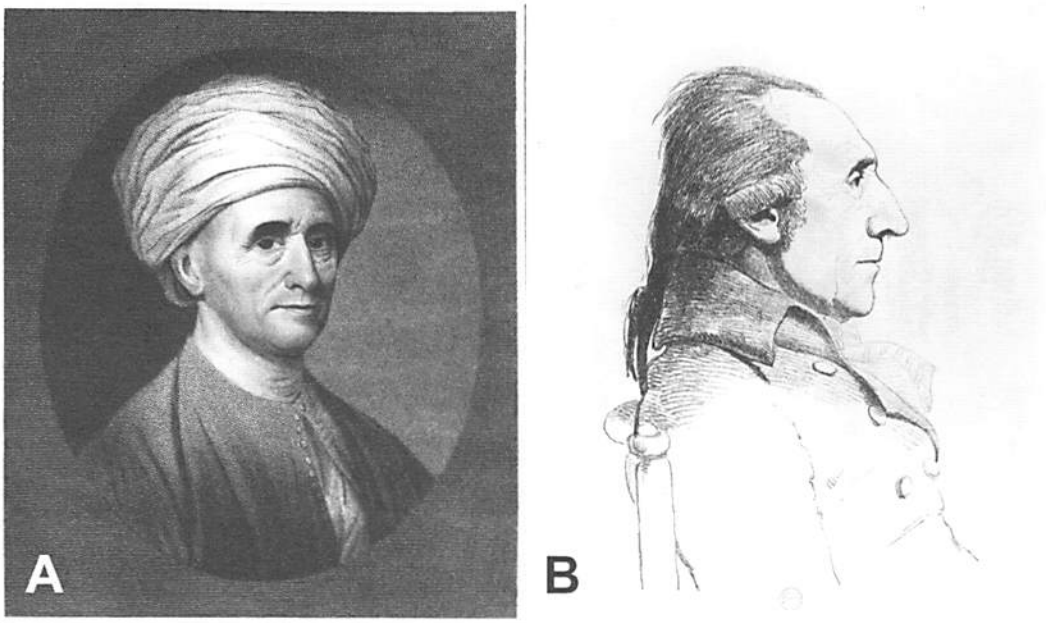


Figure 1. A. Portrait of Patrick Russell, with turban, as published in Part II of his snake book. **B.** Portrait of Russell in profile (from Adler 2014, courtesy Bibliothèque Nationale, Paris).

Russell became the Company's official naturalist. He made extensive collections of plants, fishes, and reptiles, especially of snakes. In 1787, he authored an illustrated memoir on the poisonous snakes of the Coromandel Coast south of Vizagapatnam; this was published in Madras by the Company and sent to all of their settlements in the region to help them identify the venomous snakes, but also to encourage them to send specimens to Russell. As a physician, he was particularly interested in distinguishing the venomous from the harmless species. While in India, he made collections of alcoholic specimens and dried skins, and he had colored drawings made, primarily by his Hindu assistants, which were later copied and engraved by English artists for publication purposes.

Russell returned to London in 1789 and began his personal studies on the collections of snakes and fishes that he had amassed and started to write his books about them. His book on snakes was initiated first and appeared in sections from 1796 through 1809 or more probably 1810 (see below), but he did not live to see the project finished. Russell, who never married, died in London on 2 July 1805 after a 3-day illness. His literary executors finished publication of his snake book based on the manuscript that Russell left behind. Russell's collection of specimens, skins, and drawings are today in the Natural History Museum, the Wellcome Institute, the Royal College of Surgeons, and at India House, all in London.

Biographies of Patrick Russell have been published by Anonymous (1809 [1810], on which several obituaries and most subsequent biographies have been based), Boulger (1921), Hawgood (1994, 2001), Desmond (1992), Raman (2010), and Adler (2014).

Plans for the Book

Russell's plan was to illustrate and describe all of the snakes of India and to determine which of them were venomous. The book was not intended to be a scientific treatise and, in fact, he did not give his species Latin binomial names, preferring instead to use the local vernacular ones. He applied to the Court of Directors of the East India Company to financially support publication of his book, which given its elaborate size and the numerous hand-colored plates, was an expensive proposition. The book was printed in its entirety by William Bulmer and Co., in London, a celebrated printer of Shakespeare and one of the East India

Company's principal printers. It was published by George Nicol, a prominent London bookseller with appointment to King George III, who often cooperated with Bulmer in publishing his elaborate volumes of Shakespeare.

Russell's plan for the entire book, including the anatomical appendices by Everard Home on the mechanism of expansion of the cobra's hood, was laid out in detail in his preface published in 1796.

Simultaneously, however, he was preparing an even larger illustrated work on the fishes of the Coromandel Coast containing 198 plates that was published in 1803. The second half of "Indian Serpents" was actually issued in parts, of which only the first three were published during Russell's lifetime (see below).

The Book, "Indian Serpents"

According to Russell's plan, the book was to be issued in two "Parts," which are generally referred to bibliographically as volumes. This is clear from Russell's own signature mark ("Part II") at the foot of page 1 of what is today called volume 2; this point is confirmed in the book's index. Russell's exact terminology becomes important in understanding the content and publication of fascicles of "volume 2."

The two parts (or "volumes") of Russell's snake book can be described as follows:

Part I (= "volume 1"). An Account of Indian Serpents, Collected on the Coast of Coromandel; Containing Descriptions and Drawings of Each Species; Together with Experiments and Remarks on Their Several Poisons.– Pages [i]–viii + [1]–91, plates I–XLVI (46 plates on 45 leaves, with plates 42 and 43 together on one leaf), 1796. Note: page 50 is blank.

All of these plates (except for three: 39, 45, and 46) are hand-colored. The double plate causes some bibliographic confusion, and this method was used more often in Part II. By comparison to Part II, Part I is bibliographically simple because it was published as a single unit. The first half of this part consists of descriptions of snake species; pages 51–88 describe case studies of a large number of humans bitten by snakes and Russell's experiments on poisons and remedies for bites, and pages 89–91 (with plates 45 and 46) compare the palates of the venomous and non-venomous species and detail the mechanism by which the fangs are erected.

Russell's dedication and preface are dated 2 April 1796. An anonymous review was published in *The British Critic* in March 1797.

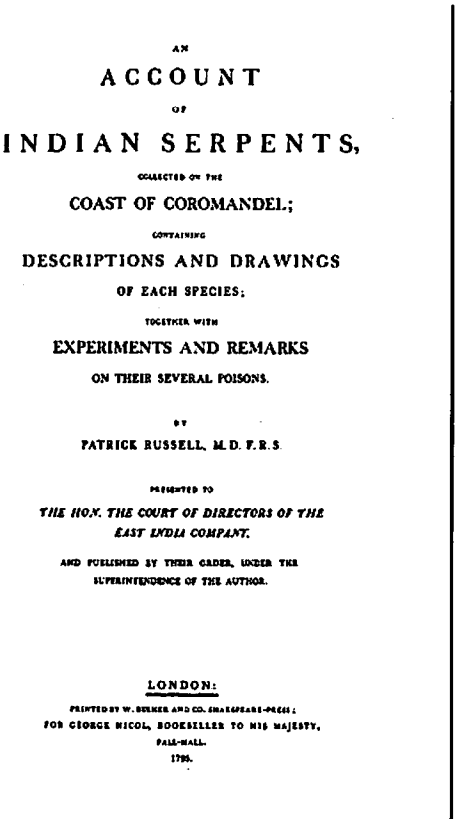
Part II (= "volume 2"). A Continuation of an Account of Indian Serpents; Containing Descriptions and Figures, from Specimens and Drawings, Transmitted from Various Parts of India, to the Hon. The Court of Directors of the East India Company.– Pages [i]–xv + [1]–53 + [1–4], portrait of author, 45 plates on 41 leaves, published in five fascicles (see details below), 1801–1809 (–1810).

All of these plates (except for the last three) are hand-colored. The fact that Part II was published in five separate fascicles, two of them after Russell's death, and the fact that there are four double plates have led to some bibliographic confusion. The first attempt to give a detailed description of Russell's "Indian Serpents," that by Klauber (1945: 165–166), is incomplete because his copy lacked fascicle 5. Nissen (1969: 355) incorrectly states that Part II contains only four fascicles and 41 plates (which is the number of leaves, not plates). As noted earlier, Russell's habit of combining plates on the same leaf of paper has been a source of considerable confusion in correctly citing this book and in knowing whether copies listed for sale by booksellers are, in fact, complete.

The first complete bibliographic description of Russell's two-part book appears to be that of Zhao and Adler (1993: 396–397). They analyzed a complete copy, determined that Part II was published in five fascicles and not in four, stated that the correct number of plates in Part II is 45 (on 41 leaves), and established the year of publication for each of the five fascicles. These data are summarized as follows:

Fascicle number:

1. Pages [i]–v + [1]–11, plates I–X (10 plates on 9 leaves, with plates 3 and 4 together on one leaf), 1801. *Note*: pages vi–viii and 12 are blank.
2. Pages 13–20, plates XI–XVIII (8 plates on 7 leaves, with plates 17 and 18 on one leaf), 1802.
3. Pages 21–28, plates XIX–XXIV, 1804.



AN

ACCOUNT

OF

INDIAN SERPENTS,

COLLECTED ON THE

COAST OF COROMANDEL;

CONTAINING

DESCRIPTIONS AND DRAWINGS

OF EACH SPECIES;

TOGETHER WITH

EXPERIMENTS AND REMARKS

ON THEIR SEVERAL POISONS.

BY

PATRICK RUSSELL, M.D. F.R.S.

PRESENTED TO

THE HON. THE COURT OF DIRECTORS OF THE EAST INDIA COMPANY.

AND PUBLISHED BY THEIR ORDER, UNDER THE SUPERINTENDENCE OF THE AUTHOR.

LONDON:

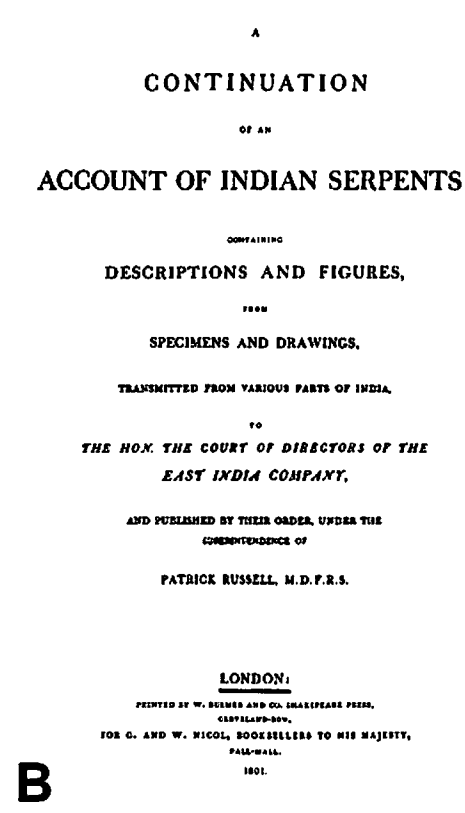
PRINTED BY W. BULMER AND CO. SHAKESPEARE-PRESS;

FOR GEORGE NICOL, BOOKSELLER TO HIS MAJESTY,

PALL-MALL.

1796.

A



A

CONTINUATION

OF AN

ACCOUNT OF INDIAN SERPENTS;

CONTAINING

DESCRIPTIONS AND FIGURES,

FROM

SPECIMENS AND DRAWINGS,

TRANSMITTED FROM VARIOUS PARTS OF INDIA,

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1801.

B

Figure 2. A. Title page of Part I of Russell's book (1796). **B.** Title page of Part II of Russell's book (1801–1809 [1810]).

4. Pages 29–38, plates XXV–XXXII (8 plates on 7 leaves, with plates 28 and 29 on one leaf), 1807.
5. Pages ix–xv, 39–53, [1–4, the index], portrait of author, plates XXXIII–[45](13 plates on 12 leaves, with plates [43] and [44] on one leaf), "1809" (most likely early 1810; see below). Note: page 46 is blank.

Most bibliographic citations and book dealers' catalogues give the number of preliminary pages in Part II as "xv," yet the collation above indicates that pages vi–viii are blank. To indicate that the collation given above is correct, consider the following points. An imperial folio book is produced by folding very large sheets of paper once, thus creating a signature of four pages from each sheet. To produce pages i–v means folding two sheets, thus creating a signature of eight pages. In checking with a half dozen private collectors who own copies of Russell's complete book, all of them report that the leaf corresponding to pages vii–viii is missing; it was probably discarded by the bookbinders. In one instance a blank leaf is bound in place. At first it was thought that the portrait in Part II might have been printed on page vii (but moved by bookbinders to the front of the volume), but the portrait was printed on a different stock of paper than were the preliminary pages. To confirm the collation given here would require examination of an unbound copy of Part II in its original wrappers, but no such copy is known to exist.

Dating of Part II

The Preface in fascicle I is dated 20 August 1801. The biography of Russell in fascicle 5, beginning on page ix, is dated November 1809.

In assigning dates to each fascicle of Part II, the "Continuation," it appears that Russell's literary executors erred in labeling the two fascicles that they issued. The collation given above is based on watermarks in the paper,

the changes in artists from fascicle to fascicle, and on dated or datable citations made in various parts of the text. It should be recalled that Russell used the term "Part" to designate the two *volumes* of his book. All three fascicles of Part II, the only ones issued during Russell's lifetime, have "Part II" at the foot of several pages. Fascicles 4 and 5, issued by his executors, are called by them "Part III" (or "Fascicle 3") and "Fascicle 4," respectively; they were apparently unaware that the author had issued three, rather than two fascicles of Part II and that he intended "Part" to correspond to volume. That Russell did, in fact, issue three fascicles of Part II is confirmed by his biographer, G. S. Boulger (1921).

Dating and paginating the fascicles are more complicated. Russell's own title page and preface, issued with fascicle 1, are dated 1801, the date often given in error for Part II in its entirety. Nowhere in this fascicle is George Shaw's "General Zoology" cited; Shaw's book was issued in January 1802 (*fide* the "Editor's Note" in the SSAR reprint of Shaw's book, published in 1999). Beginning on page 14, however, there are regular citations to specific pages in Shaw. The introduction to Russell's "Continuation" (page xiv) and Boulger (1921) confirm that the first two fascicles were issued in 1801 and 1802. The collation of fascicle 3 is more difficult, but based on watermarks, artists, and other features it begins on page 21. On page 24 (which is ligated to page 21 through the fold in the book's spine) there is a footnote reference to a monograph published in 1804; Boulger (1921: 470) confirmed that Russell himself issued the third fascicle of Part II in 1804.

Fascicles 4 and 5 can be segregated by the signature marks ("Part III" and "Fasc. 4" at the foot of the plates). These two fascicles were dated by the executors in their introduction (page xv) as 1807 and 1809, respectively (confirmed by Boulger). However, on page 52 of fascicle 5, there is a reference to a paper as having been read at the meeting of the Royal Society on 21 December 1809. It thus seems unlikely that the final fascicle of Part II could have been issued before the end of 1809 and actually was published sometime early in 1810 (see below). It is assumed that all plates were issued together with the text fascicles in which they were cited. That this assumption likely is true is supported by the description of a copy of fascicle 1 in Wheldon & Wesley Ltd. book catalogue 24 (item 596, page 26, 1931) consisting of pages vi, 11, and 10 plates.

Pages [47] to 53 constitute the Appendix, with two uncolored plates. This represents reprints of two papers by Russell and Everard Home (1756–1832), a noted English anatomist, which were originally published in the *Philosophical Transactions of the Royal Society* in London in 1804. The first (read before the Royal Society on 14 June 1804, and published on pp. 346–352 in volume 94) discusses the expansion mechanism and structure of the cobra's hood. This included two plates (VII and VIII), which were reproduced in Russell's book from the same printing plates used for the journal version. In the former version these are on separate leaves, but in the book version, because of its larger format, they were printed on a single sheet (generally accorded as book plates 43 and 44). The second paper (read before the Royal Society on 2 February 1804, and published on pp. 70–76, also in volume 94) discusses the pit orifice in certain vipers and its anatomical connection to the eye. This included one plate (III), which was reprinted in Russell's book from the same printing plate (regarded as book plate 45, the final plate in Part II). The *Philosophical Transactions* at that time were printed by the same firm as was Russell's snake book—William Bulmer & Co.— thus facilitating the incorporation of the three plates from the former into the latter.

Finally, on pages 52–53 of Russell's Appendix is an abstracted version of Home's account of a man bitten by a rattlesnake. This is based on a paper read before the Royal Society on 21 December 1809. Home's paper was published in Volume 100, Part I of the *Philosophical Transactions* for 1810, an issue consisting of six papers read at dated meetings of the Royal Society. The last of these was read at a meeting on 22 February 1810. Thus, it appears that Home's paper (and, consequently, the fifth fascicule of Part II of Russell's snake book) probably appeared sometime after February 1810.

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Patrick Russell's snakes and their role as type specimens

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ABSTRACT.- The British medical doctor Patrick Russell had a tremendous impact on Indian systematic herpetology through his *An Account of Indian Serpents* (1796), and its companion volume, issued 1801–1809 [1810]. Although Russell himself described only one species of snake using a Linnaean binominal name, his descriptions and plates formed the whole or partial basis of more than 100 subsequent species descriptions by authors in the following decades. Russell's snake specimens, which were depicted in his illustrations, are thus the type specimens of these many nominal taxa. The subjects of each of Russell's plates are reviewed, any names based on each figured animal are identified, and the type status and locality associated with these specimens are given. If extant, the museum registration numbers of these specimens are provided. More than 20 spirit preserved specimens, most of them types, originating from Russell's collection are present in the Natural History Museum, London. Others may exist in the collection of the Royal College of Surgeons of England. The significance of Russell to early 19th century herpetology cannot be emphasized enough. J. G. Schneider, G. Shaw and F. M. Daudin, amongst others, relied exclusively of Russell's words and images for many descriptions.

KEYWORDS.- Patrick Russell, type specimens, Serpentes, history, nomenclature.

Introduction

The impact of Patrick Russell's *An Account of Indian Serpents* (1796), and its continuation (Russell 1801–1809[1810]) on the herpetology of the time was both immediate and great. Workers at the turn of the 18th century who discussed snakes quoted Russell's works extensively. Little was known of Indian snakes at the time and Russell's books were authoritative and well illustrated. They also included valuable information about the medical significance of most species, usually verified by Russell himself. As it happened, Russell's initial volume appeared just a few years in advance of some of the most important global reviews of herpetology, and so his was the latest word. Russell's plates in particular, allowed subsequent authors to be able to refer unambiguously to a particular image. Further, since Russell refrained from applying Linnean names in most cases, favouring the vernacular of the Coromandel Coast and other parts of India, the specimens he described and illustrated were ideal subjects to be named by those who were more taxonomically inclined. At this point in time, indications to previously published works or plates therein were common and thus, many types were known to even their describers only through such published sources. Most of Russell's illustrations were unambiguously based on single individuals and many of these then became types, whether or not the specimens had been preserved. As a consequence, Russell's material was fodder for the descriptions of all who followed, but particularly those who followed him closely in time. In temporal order, these were J. G. Schneider (1799, 1801; Schneider in Bechstein 1802), Shaw (1802), and Daudin (1803a, b, c). Others of the period, like Sonnini & Latreille (1801), also cited Russell's plates, but generally used the names applied by Schneider (1799). Russell's snakes continued to be used as the basis (or usually partial basis)

for new descriptions until the middle of the 19th century (e.g., Schlegel 1837a, b; Gray 1849; Duméril *et al.* 1854).

Several related topics intersect in this paper. These are: 1) the identity of the snakes figured and described by Russell (1796, 1801–1809 [1810]), 2) the role of Russell's snakes as type material for taxa described by himself (one species, *Boa johnii* [= *Eryx johnii*]) and others, and 3) the whereabouts of the figured snakes. The first topic was most recently comprehensively treated by Smith (1943), who presented a section in the *Fauna of British India* entitled "Notes on Russell's 'Indian Serpents'" in which he provided his identifications of Russell's plates, building on the earlier identifications of Boulenger (1890, 1896), Günther (1858, 1864) and Gray (1842a, 1842b, 1842c, 1842d, 1845, 1849). Smith identified the subjects of 77 (plates 15A and B counted as one) of 86 plates in Russell's works. The sea snakes were earlier identified by Smith (1926). I here provide a modern summary and update to Smith's listing.

The second topic forms the bulk of this contribution and a list of all names known to have used Patrick Russell's specimens, either directly or indirectly, as the basis for valid descriptions is presented. To the best of my knowledge, no such evaluation of Russell's snakes has been previously undertaken. This is incredible when one realises how much early systematic herpetology owes to Russell.

The third topic is not critical to the second (see Art. 73.1.4. [ICZN 1999] below), but it is certainly of interest to know which specimens are still extant. This is a story in and of itself, part of which is outlined by Patrick Campbell and Bauer *et al.* (both this issue). This story remains incomplete, however, as a lack of documentation clouds the source of some supposed Patrick Russell snakes. Those fluid preserved specimens donated by Russell during his lifetime or upon his death to the British Museum, or that were donated elsewhere and ultimately transferred to the British Museum are generally reliably identifiable (although several Russell specimens may have been confused with others of great age), and do include some types. However, two collections of dried snake skins donated, presumably by the Russell family in 1837 and 1904, are more problematic (Campbell, this issue; Bauer *et al.*, this issue). Although these have been believed by some researchers (e.g., Vogel & David 2012) to include type specimens, the match of most to Russell's illustrated specimens is poor and at least some may have been collected long after Patrick Russell's death.

Material and Methods

I used the synonymies provided in Wallach *et al.* (2014) as the basis for identifying potential nominal taxa that might be based, in whole or in part, on material collected by Russell and/or illustrated by Russell (1796, 1801–1809 [1810]). Original descriptions were verified to determine if Russell was cited, if a name was validly described, if that name represented a new description or a replacement name, and to determine if other type specimens were designated and what the type localities were. In the case of older literature, predating modern nomenclatural standards, it is often difficult to determine, for example, if a name was proposed as a new species that incorporated the concepts of the named taxa of several previous authors, or if it was intended as a *nomen substitutum*. This has been particularly confounding in cases in which newly proposed names are both synonyms and homonyms of previous names (Smith & David 1999). In some cases, I have differed in my interpretation from other authors.

The accounts that follow are organised by the subjects of Russell's books. His subject numbers (No.), which always correspond to the plate of the same number, are neither strictly references to a species (as several species as recognised by him were treated in more than one account), nor a reference to a particular specimen (as the text of many accounts refers to multiple individuals in addition to the one figured). On the first line of each entry appear the subject number, genus (as applied by Russell), text pages, and plate number.

The second line lists the ventral (V) and subcaudal (SC) scale counts as given by Russell. Those counts in bold are those presented at the beginning of the account, presumably those associated with the illustrated specimen and other specimens described in detail. Any additional specimen scale counts mentioned later in the text or in other accounts — but attributable to the same species — are indicated in normal

font. These counts are the clearest evidence of the number of specimens examined in detail by Russell (or for which he was provided explicit data, as in some cases he received only drawings and/or descriptions from others). Although in many cases he indicated that he had seen other specimens, or used other specimens in his experminets on envenomation, these do not all appear to have contributed to the descriptions *per se*. In most cases, subsequent authors referred explicitly to the illustrated specimen in any case.

The third line gives the names applied to the snake as reported by Russell. He typically used the local vernacular name(s) and these take the place of scientific names as the main identifiers of the species discussed. At least in the first volume many of these names are from the Telugu language, which is the dominant local language of the modern Indian state of Andhra Pradesh, where Russell was primarily based. However, other names given are derived from Bengali, Marathi and Tamil. The main vernacular name (or in some cases, names) are printed in bold, whereas any other names reported in the species account, including any Linnaean names and vernacular English or Latin names believed by Russell to apply to his snakes are reported in regular font.

The fourth line lists any specific localities noted for specimens associated with the account and, if given, the collector (if not Russell or his assistants) and/or date of collection or receipt of the specimen by Russell. A listing of Russell's localities and their current names is provided in Table 1 (see also Das 2004). Finally a citation to the current name applicable to each snake (based chiefly on reference to the corresponding plate) is provided. I have typically followed Wallach *et al.* (2014) for names in current use, with updates from the literature. The specific identity of Russell's specimens as established by earlier authors is also noted. Gray (1845, 1849), Günther (1858, 1864), Boulenger (1890, 1893, 1894, 1896) and Smith (1926, 1943) explicitly noted Russell's preserved specimens in the BMNH collection and through their synonymies provided their identifications of the specimens illustrated in Russell's plates. Although many other authors have commented on the identity of Russell's snakes, only these sources have been uniformly noted herein. When these authors differ in their identification only in the generic allocation, but use the same specific epithet, only the most recent combination is mentioned. However, when the specimens were associated with other names, whether in synonymy of the currently applied name or not, these are also noted. Smith (1943) provided a short list of his identifications of many of Russell's plates, which constitutes the most complete set of published identifications to date. In the present contribution the identity of all but one snake of the 86 (plus one lizard) pictured by Russell has been established (Table 2). In some cases, additional remarks are also provided.

Following these initial lines relating to the plates and their subjects, indented text provides information about the nominal taxa that have type material that includes Russell's snakes (and lizard). Accounts are arranged chronologically and each such account first lists the name of the taxon as originally described, using the original orthography of the describer, along with author(s) name(s), date of description, abbreviated title of the work (full citations appear in the Literature Cited section), page number on which the description appears and any associated plates or figures. Taxon names in bold are currently regarded as valid, those in regular font are considered synonyms (based largely on Wallach *et al.* 2014).

In the vast majority of cases, the types are the specimens that were figured and or discussed in Russell's accounts and thus serve as "iconotypes". In most cases the specimens themselves were not seen by the describer, although George Shaw, based at the British Museum (Adler 1989) had access to Russell's material in that institution and in the Museum of the Royal College of Surgeons. A number of later authors (e.g., Wall 1909; Vogel & David 2012) believed that they had identified original Russell material that had been overlooked.

For each nominal taxon listed a section labeled "Type status" is provided. I here discuss the composition of the type series, the type status of Russell's snake(s), the type locality and whether any of the types are still extant (summarised in Table 2). In each case, I began with the original description and with Russell's works (1796, 1801–1809 [1810]), and in many cases, dis-

Table 1. Localities mentioned by Russell (1796, 1801–1809 [1810]) and their modern equivalents. An asterisk (*) indicates that the locality also extends into adjacent districts. Accounts are cited as volume: account number (lower case Roman numeral: uppercase Roman numeral).

Locality	Current Locality Name	Accounts Cited
Arnee	Arni, Tiruvannamalai District, Tamil Nadu	i:XXXVIII
Arni	Arni, Yavatmal District, Maharashtra	i:II
Bengal	= area approximating modern Bangladesh and West Bengal, India	i:XI
Bimilipatam	Bheemunipatnam, Visakhapatnam District, Andhra Pradesh	i:I
Bombay	Mumbai, Mumbai City District*, Maharashtra	i:I, ii:XIV, XVA–B, XXV, XXXII
Boni	Boni, Visakhapatnam District, Andhra Pradesh	i:I
Buchier	Bushehr, Bushehr Province, Iran	ii:XXX
Calcutta	Kolkota, Hooghly District*,West Bengal	i:III, XXXIX, ii:XIV, XVA
Carnatic	= region in southeastern peninsular India between the Krishna and Kaveri rivers in modern Tamil Nadu and Anhra Pradesh	i:XII
Casem Cottah/ Casemcottah	not identified	i:I, XXIX
Circars	= Northern Circars (Sarkars), coastal strip of Andhra Pradesh and Odisha from 15°40' to 17° N	i:XII
Coromandel Coast	= Region between the Eastern Ghats and Bay of Bengal in Andhra Pradesh and Tamil Nadu	
Ganjam	Ganjam, Ganjam District, Odisha	i:IV, X, XIV, XVII, XXIII, XXV, XXVII–XXVIII, XXXV
Guzerat	= Gujarat	ii:XXV
Hyderabad	Hyderabad, Hyderabad District, Telangana	i:XXVI, XXXI, XL
India		ii:XII, XXIX, XXXIX–XL
Java	Java, Indonesia	i:IX, ii:XIX–XXI, XXIV, XXVII, XXXIII–XXXVIII, XLI–XLII
Lake of Ankapilly	Ankapalli Lake, Visakhapatnam District, Andhra Pradesh	i:XXX
Madepolam	Madapollam, West Godavari District, Andhra Pradesh	i:XVIII
Madras	Chennai, Chennai Distirct*, Tamil Nadu [although the term was also broadly appliued to the entire Madras Presidency]	i:IV, XXIV
Mahratta/ Mahratta country	= Maratha Empire, including Mahrashtra	ii:XXV, XXX
Mansoor Cottah	Gopalpur-on-Sea, Ganjam District, Odisha (*fide* David & Ineich 1999)	i:III
Masulapatam	Machilipatnam, Krishna district, Andhra Pradesh	i:I, XXXV
Nerva	Gudla Nerva, Guntur District, Andhra Pradesh (see Russell 1796, No. VIII below)	i:VIII
Raja Mundrah	Rajahmundry, East Godavari District, Andhra Pradesh	i:X
Samul Cottah	near Gopalapuram, West Godavari District, Andhra Pradesh	i:XI
Sunderbunds	Sundarbans, West Bengal, India and Bangladesh	ii:VI–X
Tranquebar	Tharangambadi, Nagapattinam District, Tamil Nadu	i:XVII, ii:IV, XI–XIII, XVA–B, XVI, XVIII , XXVI, XXVIII, XXXI
Vellore	Vellore, Tamil Nadu	i:XXXVI
Vizagapatam	Visakhapatnam, Visakhapatnam District, Andhra Pradesh	i:I, IX, XII, XV–XVI, XIX, XXIV, XXXII, XXXIV–XXXV, XLI, XLIII–XLIV, ii:XX

Table 2. List of Russell's (1796, 1801–1809 [1810]) snakes by current identification. The nominal taxa for which Russell's figured and described specimens are types are indicated, followed by the nature of the type status of each (H = holotype, L = lectotype, N = neotype, PL = paralectotype, S = syntype). Bold names represent currently valid taxa. The specimen numbers of these type specimens is also provided, or if lost, this is so indicated. See individual text accounts, organised by plate number, for detailed discussions. Note that the type and specimen status apply only to Russell's figured specimens, i.e., not to the taxon as a whole, or to other members of a type series based on non-Russell specimens.

Current Name	Vol.: Plate	Year	Nominal taxon of which type (Type Status)	Spec. Status
Ahaetulla nasuta	i:XII	1796	*Dryinus oxyrhynchus* Bell, 1825 (S)	lost
Ahaetulla nasuta	i:XIII	1796	*Dryinus russellianus* Bell, 1825 (S) *Dryophis passericki* Schinz, 1833 (H)	lost
Ahaetulla prasina	ii:XXIV	1804	*Dryophis prasina* F. Boie, 1827 (S)	lost
Amphiesma stolatum	i:X	1796	—	—
Amphiesma stolatum	i:XI	1796	—	—
Amphiesma stolatum	ii:XV B	1802	—	—
Argyrogena fasciolata	i:XXI	1796	***Coluber fasciolatus*** Shaw, 1802 (H) *Coluber hebe* Daudin, 1803 (H)	lost
Argyrogena fasciolata	i:XXIX	1796	—	—
Atretium schistosum	ii:IV	1801	***Coluber schistosus***. Daudin, 1803 (H)	BMNH III.22.1.e
Barkudia melanostictus	i:XLII	1796	***Anguis melanostictus*** Schneider, 1801 (H)	lost
Boiga multomaculata	ii:XXIII	1804	***Dipsas multomaculata*** F. Boie, 1827 (S)	lost
Boiga trigonata	i:XV	1796	***Coluber trigonatus*** Schneider *in* Bechstein, 1802 (S/L) *Coluber sagittatus* Shaw, 1802 (S) *Coluber catenularis* Daudin, 1803 (S)	lost
Bungarus caeruleus	i:I	1796	***Pseudoboa caerulea*** Schneider, 1801 (S) *Boa lineata* Shaw, 1802 (H)	lost
Bungarus caeruleus	ii:XXXI	1807	—	—
Bungarus fasciatus	i:III	1796	***Pseudoboa fasciata*** Schneider, 1801 (S) *Boa fasciata* Shaw, 1802 (H) *Bungarus annularis* Daudin, 1803 (S)	lost
Calliophis intestinalis	ii:XIX	1804	—	—
Calliophis melanurus	i:VIII	1796	***Coluber melanurus*** Shaw, 1802 (H) *Vipera trimaculata* Daudin, 1803 (H)	BMNH 1946.1.17.86
Calloselasma rhodostoma	ii:XXI	1804	—	—
Ceratophallus vittatus	ii:XXXV	1809	—	—
Cerberus rynchops	i:XVII	1796	***Hydrus rynchops*** Schneider, 1799 (H) *Hydrus cinereus* Shaw, 1802 (H) *Coluber cerberus* Daudin, 1803	lost
Cerberus rynchops	i:XL	1796	*Hurria bilineata* Daudin, 1803 (H) *Homalopsis molurus* H. Boie, 1826 (S)	lost
Cerberus rynchops	ii:XL	1809	—	—
Hydrophis mamillaris	i:XLIV	1796	*Hydrus fasciatus* Schneider, 1799 (S) ***Anguis mamillaris*** Daudin, 1803 (H)	lost
Chrysopelea ornata	ii:II	1801	*Coluber ibiboboca* Daudin, 1803 (S)	lost
Coelognathus helena	i:XXXII	1796	***Coluber helena*** Daudin, 1803 (H)	lost
Coelognathus radiatus	ii:XLII	1809	***Coluber radiatus*** F. Boie, 1827 (S)	lost
Cylindrophis maculatus	ii:XXIX	1807	—	—

Cylindrophis ruffus	ii:XXVII	1807	—	—
Cylindrophis ruffus	ii:XVIII	1807	—	—
Daboia russelii	i:VII	1796	***Coluber Russelii*** Shaw & Nodder, 1797 (S/PL) *Coluber trinoculus* Schneider *in* Bechstein, 1802 (S) *Vipera elegans* Daudin, 1803 (S)	lost
Daboia russelii	ii:XXXII	1807	—	—
Dendrelaphis chairecacos	ii:XXVI	1807	***Dendrophis chairecacos*** F. Boie, 1827 (H)	lost
Dendrelaphis tristis	i:XXXI	1796	***Coluber tristis*** Daudin, 1803 (H/N) *Coluber scandens* Bechstein, 1802 (H)	lost
Dendrelaphis tristis	ii:XXV	1807	*Leptophis mancas* Bell, 1825 (H) *Dendrophis maniar* F. Boie, 1827 (H)	lost
Hydrophis nigrocinctus	ii:VI	1801	***Hydrophis nigrocinctus*** Daudin, 1803 (H)	BMNH 1946.1.10.13
Dryocalamus nympha	i:XXXVI	1796	***Coluber nympha*** Daudin, 1803 (S/L)	BMNH 1946.1.13.69
Dryocalamus nympha	i:XXXVII	1796	***Coluber nympha*** Daudin, 1803 (PL)	lost
Echis carinatus	i:II	1796	***Pseudoboa carinata*** Schneider, 1801 (S/L) *Boa horatta* Shaw, 1802 (S) *Scytale bizonatus* Daudin, 1803 (S)	lost
Hydrophis schistosus	ii:X	1801	***Hydrophis schistosus*** Daudin, 1803 (H) *Hydrophis cyanura* and *Hydrophis hoglin* Rafinesque-Schmaltz, 1817 (H) *Disteira russelii* Fitzinger, 1827 (S)	BMNH 1946.1.10.7 [?]
Hydrophis schistosus	ii:XI	1802	*Hydrus valakadyn* F. Boie, 1827	BMNH 1946.1.10.7 [?]
Enhydris enhydris	i:XXX	1796	***Hydrus enhydris*** Schneider, 1799 (H) *Enhydris caerulea* Latreille *in* Sonnini & Latreille, 1801 (H) *Hydrus atrocaeruleus* Shaw, 1802 (H) *Coluber pythonissa* Daudin, 1803 (H)	lost
Eryx conicus	i:IV	1796	***Boa conica*** Schneider, 1801 (S) *Boa viperina* Shaw, 1802 (H) *Boa ornata* Daudin, 1803 *nom. sub.* (S)	lost
Eryx johnii	ii:XVI	1802	***Boa johnii*** Russell, 1802 (H) *Tortrix eryx* Schlegel, 1837 (S)	lost
Eryx johnii	ii:XVII	1802	*Tortrix eryx* Schlegel, 1837 (S)	lost
Homalopsis buccata	ii:XXXIII	1809	—	—
Hydrophis obscurus	ii:VII	1801	*Hydrophis cloris* Daudin, 1803 (H) *Pelamis marginatus* and *Hydrophis shootur* Rafinesque-Schmaltz, 1817 (H)	BMNH 1946.1.3.80
Hydrophis obscurus	ii:VIII	1801	***Hydrophis obscurus*** Daudin, 1803 (H) *Pelamis marginatus* and *Hydrophis shootur* Rafinesque-Schmaltz, 1817 (H)	BMNH 1946.1.9.27
Hypnale hypnale	ii:XXII	1804	—	—
Indotyphlops braminus	i:XLIII	1796	***Eryx braminus*** Daudin, 1803 (H) *Tortrix russelii* Merrem, 1820 (H)	lost
Hydrophis jerdoni	ii:XII	1802	—	—
Hydrophis cyanocinctus	ii:IX	1801	***Hydrophis cyanocinctus*** Daudin, 1803 (H) *Hydrophis chittul* Rafinesque-Schmaltz, 1817 (H)	BMNH 1946.1.9.23
Lycodon aulicus	ii:XXXIX	1809	*Lycodon unicolor* F. Boie, 1827 (S)	lost
Lycodon capucinus	ii:XXXVII	1809	***Lycodon capucinus*** H. Boie *in* F. Boie, 1827(S/L)	lost
Lycodon jara	i:XIV	1796	***Coluber jara*** Shaw, 1802 (H)	lost

Lycodon striatus	i:XVI	1796	***Coluber striatus*** Shaw, 1802 (H) *Coluber malignus* Daudin, 1803 (H)	lost
Lycodon striatus	i:XXVI	1796	*Coluber galathea* Daudin, 1803 (H)	lost
Lycodon subcinctus	ii:XLI	1809	***Lycodon subcinctus*** F. Boie, 1827 (S/L)	lost
Hydrophis gracilis	ii:XIII	1802	—	—
Naja naja	i:V	1796	—	—
Naja naja	i:VI	1796	—	—
Naja naja	ii:I	1801	—	—
Naja sputratrix	ii:XXXVI	1809	***Naja sputatrix*** F. Boie, 1827 (S)	lost
Oligodon arnensis	i:XXXV	1796	*Coluber russelius* Daudin, 1803 (S)	lost
Oligodon arnensis	i:XXXVIII	1796	***Coluber arnensis*** Shaw, 1802 (H) *Coluber russelius* Daudin, 1803 (S)	lost
Oligodon bitorquatus	ii:XXXIV	1809	—	—
Oligodon octolineatus	ii:XXXVIII	1809	—	—
Oligodon taeniolatus	i:XIX	1796	*Coluber taeniolatus* Daudin, 1803 *nom. oblitum* (H) ***Coronella taeniolata*** Jerdon, 1853 (S/L)	lost
Hydrophis platurus	i:XLI	1796	*Hydrus bicolor* Schneider, 1799 (S) *Hydrophis pelamis* Schlegel, 1837 (S) *Pelamis bicolor variegata* Duméril, Bibron & Duméril, 1854 (S)	lost
Ptyas korros	i:XXV	1796	—	—
Ptyas mucosa	i:XXXIV	1796	*Coluber blumenbachii* Merrem, 1820 (H)	lost
Ptyas mucosa	ii:XVIII	1802	—	—
Python molurus	i:XXII	1796	*Boa cinerea* Schneider, 1801 (H) *Coluber boaeformis* Shaw, 1802 (H) *Python tigris* Daudin, 1803 (H)	lost
Python molurus	i:XXIII	1796	*Boa castanea* Schneider, 1801 (H)	lost
Python molurus	i:XXIV	1796	*Boa albicans* Schneider, 1801 (H)	lost
Python molurus	i:XXXIX	1796	*Boa orbiculata* Schneider, 1801 (H) *Python bora* Daudin, 1803 (H)	lost
Spalerosophis diadema	ii:XXX	1807	***Coluber diadema*** Schlegel, 1837 (S/L)	lost
Taphrometopon condanarum	i:XXVII	1796	***Coluber condanarus*** Merrem, 1820 (H)	lost
Trimeresurus gramineus	i:IX	1796	***Coluber gramineus*** Shaw, 1802 (H) *Coluber viridis* Bechstein, 1802 (H) *Vipera viridis* Daudin, 1803 (H)	lost
Trimeresurus popeiorum	ii:XX	1804	—	—
Xenochrophis piscator	i:XX	1796	*Hydrus palustris* Schneider, 1799 (H/N) *Coluber braminus* Daudin, 1803 (S) *Tropidonotus quincunciatus* Schlegel. 1837 (S/L)	BMNH 1904.7.27.32
Xenochrophis piscator	i:XVIII	1796	*Coluber mortuarius* Daudin, 1803 (H)	lost
Xenochrophis piscator	i:XXXIII	1796	***Hydrus piscator*** Schneider, 1799 (H) *Coluber anostomosatus* Daudin, 1803(H) *Tropidonotus quincunciatus* Schlegel. 1837 (PL)	BMNH 1904.7.27.32
Xenochrophis piscator	ii:III	1801	*Coluber umbratus* Daudin, 1803 (H)	lost
Xenochrophis piscator	ii:V	1801	*Coluber dora* Daudin, 1803 (H)	lost
Xenochrophis piscator	ii:XIV	1802	*Tropidonotus quincunciatus* Schlegel. 1837 (PL)	lost
Xenochrophis piscator	ii:XV A	1802	*Tropidonotus quincunciatus* Schlegel. 1837 (PL)	lost

covered that earlier authors had not correctly identified the number and/or source of the relevant type specimens. Although brief statements about types and type localities of many of the species are provided elsewhere (e.g., Stimson 1969; Cogger *et al.* 1983; Golay *et al.* 1993; David & Ineich 1999; McDiarmid *et al.* 1999; Iskandar & Colijn 2001; Leviton *et al.* 2003; Wallach *et al.* 2014), only a few types have been discussed in any detail (e.g., Smith & David 1999; Bauer 2003; Vogel & David 2012), and I here take the opportunity to provide a narrative that more fully explains the often confusing situation surrounding these specimens.

The following collection codes are used in this paper: BMNH (British Museum of Natural History, now The Natural History Museum, London), MNHN (Muséum National d'Histoire Naturelle, Paris), RCSM (Royal College of Surgeons Museum, London = Hunterian Museum of the Royal College of Surgeons of England), RMNH (Naturalis–Nationaal Natuurhistorisch Museum, Leiden), SMF (Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt am Main), ZMB (Museum für Naturkunde, Berlin) and ZSI (Zoological Survey of India, Kolkata). In addition, the acronym ICZN and the term "the Commission" are used for the International Commission on Zoological Nomenclature and the term "the *Code*" is used to refer to the *International Code of Zoological Nomenclature* (ICZN 1999).

Several articles of the *Code* are particularly relevant for this paper. The nomenclatural actions and interpretations of authors in the late 18th and early 19th centuries did not follow any set of strict rules or regulations and neither the significance of typification nor the concepts of priority and stability, so critical to modern nomenclature, were yet engrained in systematic practice. This results in significant ambiguity which still causes confusion today and requires careful reading of the original descriptions and an understanding of the provisions of the *Code* relevant to type material. In order to facilitate readers understanding of the interpretations I have made, I list several of the most pertinent articles here:

Art. 12.1. To be available, every new name published before 1931 must satisfy the provisions of Article 11 and must be accompanied by a description or a definition of the taxon that it denotes, or by an *indication*. [italics mine]

Art. 12.2. For the purpose of this Article the word "indication" denotes only the following:

12.2.1. a bibliographic reference to a previously published description or definition even if the description or definition is contained in a work published before 1758, or that is not consistently binominal, or that has been suppressed by the Commission (unless the Commission has ruled that the work is to be treated as not having been published [Art. 8.7]);

Art. 72.4.1. The type series of a nominal species-group taxon consists of all the specimens included by the author in the new nominal taxon (whether directly or by bibliographic reference), except any that the author expressly excludes from the type series [Art. 72.4.6], or refers to as distinct variants (e.g. by name, letter or number), or doubtfully attributes to the taxon.

Art. 72.5.6. In the case of a nominal species-group taxon based on an illustration or description, or on a bibliographic reference to an illustration or a description, the name-bearing type is the specimen or specimens illustrated or described (and not the illustration or description itself).

Art. 73.1.4. Designation of an illustration of a single specimen as a holotype is to be treated as designation of the specimen illustrated; the fact that the specimen no longer exists or cannot be traced does not of itself invalidate the designation.

Art. 73.2.1. Syntypes may include specimens labelled "cotype" or "type" (both used in the meaning of syntype), specimens with no identifying label, and specimens not seen by the author but which form the bases of previously published descriptions or illustrations upon which the author founded the new nominal species-group taxon in whole or in part [Art. 72.5.5].

Art. 74.4. Designation of an illustration or description of a syntype as a lectotype is to be treated as designation of the specimen illustrated or described; the fact that the specimen no longer exists or cannot be traced does not of itself invalidate the designation.

Art. 74.5. In a lectotype designation made before 2000, either the term "lectotype", or an exact translation or equivalent expression (e.g. "the type"), must have been used or the author must have unambiguously selected a particular syntype to act as the unique name-bearing type of the taxon. When the original work reveals that the taxon had been based on more than one specimen, a subsequent use of the term "holotype" does not constitute a valid lectotype designation unless the author, when wrongly using that term, explicitly indicated that he or she was selecting from the type series that particular specimen to serve as the name-bearing type.

Results

Accounts, as outlined in Material and Methods above, are listed below in numerical order. In the case of Russell's second volume, the accounts are also subordinated under the year of publication. A simple listing of the anatomical images on plates XLV and XLVI in Russell (1796) is provided, but without comment, as these are unrelated to goals of this paper. I have not listed the anatomical plates reprinted from other sources that are part of Russell (1801–1809 [1810]). These are noted by Adler (this issue).

Russell (1796). An Account of Indian serpents, Collected on the Coast of Coromandel; Containing Descriptions and Drawings of Each Species; Together with Experiments and Remarks on Their Several Poisons.

No. I. *Boa*, pp. 1-2, pl. 1.

Scale counts: (209 V + 47 SC), (220V + 50 SC), (221 V + 52 SC) [see Russell 1807: 36].

Name(s): **Gedi Paragoodoo**, **Pakta Poola**, Cobra Monil [sic], Karu Walalay [see Russell 1807: 36].

Localities: Vizagapatam, Boni, Masulapatam, Bimlipatam, Casem Cottah, Bombay [see Russell 1807].

Current name: *Bungarus caeruleus* (Schneider, 1801: 284). Identified by Günther (1858, 1864), Boulenger (1890, 1896), and Smith (1943).

Pseudoboa Caerulea Schneider, 1801.
Hist. Amph. 2: 284.

Type status: Schneider's (1801) description explicitly mentioned a dry specimen of the species (250 V + 40 SC), which was referred to as "primo exemplo meo sicco", suggesting that this was in his own possession. The whereabouts of this specimen is unknown, although it is possible that it was eventually added to the university collection at Frankfurt-an-der-Oder, where Schneider worked, or Breslau (now Wroclaw, Poland), where his institution moved in 1811 (Adler 1989), although it was not mentioned by Gravenhorst (1832). A second specimen examined by Schneider was from the Museum Blochianum, which became the foundational herpetological collection of the Zoological Museum of Berlin. Bauer (1998) reported that this specimen, ZMB 2787, is still extant. The third specimen noted is that illustrated by Russell in plate I. This specimen is lost. Wallach *et al.* (2014) considered that Klemmer (1963: 279) had designated the specimen described and illustrated by Russell as the lectotype. Presumably this interpretation was based on Klemmer's listing of the terra typica as "Vizagapatam (Indien)", the locality presumably associated with Russell's specimen. However, Klemmer's action does not satisfy Art. 74.5 of the *Code* and all three specimens should be considered as syntypes. The type locality is thus "India orientali[s]", the published locality of Bloch's specimen (ZMB 2787) and "Vizagapatam" the probable locality of Russell's figured specimen. Russell also noted Boni and Masulapatam as localities where the species was known, but it is probable that Vizagapatam, where Russell himself was based, was the site of collection of the syntype. Wallach *et al.* (2014) stated that the MNHN catalogue lists MNHN 3952 and MNHN 7686–88 as syntypes, however, these are almost certainly types of *Bungarus arcuatus* Duméril, Bibron & Duméril, 1854, a junior subjective synonym of *Pseudoboa caerulea*.

Boa Lineata Shaw, 1802.
Gen. Zool., Amph. 3(2): 356.

Type status: Shaw's description is based exclusively on Russell (1796: 1–2, pl. 1), thus the specimen he depicted, now lost, is the holotype

and "Vizagapatam" is the type locality of this nominal taxon.

No. II. *Boa*, pp. 2-3, pl. II.

Scale counts: (150 V + 25 SC).

Name(s): **Horatta Pam**, Viryen Pamboo.

Locality: Arni (from Major Bonniveaux, 1778).

Current name: *Echis carinatus* (Schneider, 1801: 285). Identified by Gray (1849), Boulenger (1890, 1896), and Smith (1943).

Pseudoboa Carinata Schneider, 1801.
Hist. Amph. 2: 285.

Type status: Schneider had not seen this species himself and based the description entirely upon the "bestiam descripsit et in tabula II. pinxit" by Russell (1796). Russell's original description was, in turn, based chiefly on a spirit preserved specimen, received from Major Bonniveaux in 1778. Although he cited only one set of scale counts and measurements, Russell did mention variation in the species and that specimens (plural) had been received from Bonniveaux. Wallach *et al.* (2014) interpreted this to mean that there were an unknown number of syntypes and designated as lectotype the "specimen described and illustrated by P. Russell (1796: 2–3, pl. 2)". Two specimens from "India" presented by Russell, BMNH II.4.2.a, b, which were reported by Gray (1849) and Boulenger (1896), are still extant, but their scale counts exclude them from being the lectotype, which is considered lost. The type locality is "Arni" by implication from Schneider's (1801) indication of Russell (1796), who explicitly gave this locality. David & Ineich (1999) gave the original type locality as "Arni, Madras", now "Arni, State of Tamil Nadu, India", presuming it to refer to the same locality reported as "Arnee" by Russell in account XXXVIII.

Boa Horatta Shaw, 1802.
Gen. Zool., Amph. 3(2): 359.

Type status: Shaw's (1802) description is derived from Russell's account (1796: 2–3, pl. II), thus the syntypes and type locality of *Pseudoboa carinata* are the same for *Boa horatta*.

Scytale bizonatus Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 5: 339, pl. LX, fig. 27, LXX, figs. 1,2b.

Type status: Daudin's (1803) synonymy cites both the Horatta Pam (Russell 1796: 2–3, pl. II), and the description of *Pseudoboa carinata* by Schneider (1801), itself based exclusively on Russell's description and illustration.The syntypes and type locality are, thus, identical to those of the two preceeding nominal taxa.

No. III. *Boa*, pp. 3-5, pl. III.

Scale counts: (233 V + 36 SC).

Name(s): **Bungarum Pamah**, **Sackeenee**, Holadola, Ransa Pam.

Localities: Mansoor Cottah (from Mr. Gordon, November 1788); Calcutta (description of Mr. Alexander Russell).

Current name: *Bungarus fasciatus* (Schneider, 1801: 283). Identified by Günther (1864), Boulenger (1890, 1896) and Smith (1943).

Pseudoboa Fasciata Schneider, 1801.
Hist. Amph. 2: 283.

Type status: Schneider's (1801) description mentions two specimens from the Bloch collection, one in the Linck collection (not noted by Wallach *et al.* 2014) and the specimen figured by Russell (1796, pp. 3–5, pl. III), all of which are syntypes. The Bloch specimens have been identified as ZMB 2771, 2772 (*fide* Bauer 1998) and are extant in Berlin. The Linck collection specimen, now lost, was cited in Linck (1783) as "*Boa hortulana* Lin., Eine mit braunen Bändern" and originally bore the number 488 in the Linck collection. It was illustrated by Scheuchzer (1735: pl. 655, fig. 8) and Linck & Linck (2014, plate XXII). (see Bauer & Wahlgren 2013). Iskandar & Colijn (2001) stated of the type "Kopenhagen from Bengal, India", but without further comment. Wallach *et al.* (2014) noted "(P. Russell & natives, 1781–1791)" in association with the ZMB types, but these specimens are unrelated to Russell. The ZMB specimens are associated only with the locality "Indien" (*fide* ZMB catalogue). The locality of the snake figured by Russell (1796) is "Mansoor Cottah, Bengal, India". Together these constitute the type locality of this nominal taxon; the Linck specimen was from an unknown locality. Leviton *et al.* (2003) gave the type locality as "Mansoor, Cottah, Bengal, India" ("cottah", an Anglicized version of "katha", is a unit of land land still used in eastern India, Nepal and Bangladesh).

Boa Fasciata Shaw, 1802.
Gen. Zool., Amph. 3(2): 353, pl. 99.

Type status: Shaw's description is derived exclusively from Russell (1796) and is independent of that of Schneider, despite being both a junior synonym and homonym (see Smith & David 1999). The animal illustrated by Russell is the holotype and its type locality is "Bengal", although this is restricted to "Mansoor Cootah" on the basis of Russell's original text.

Bungarus annularis Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 5: 265,
pl. LX, fig. 24, pl. LXV, figs. 1,3.

Type status: Daudin (1803) cites in his synonymy Russell (1796, pp. 3–5, pl. III), Schneider's description of *Pseudoboa fasciata* (1801), and the Bloch, Linck, and Scheuchzer references cited therin. The syntypes and type locality of *Pseudoboa fasciata* and *Bungarus annularis* are thus identical.

No. IV. *Boa*, pp. 5-6, pl. 4.

Scale counts: (209 V + 19 SC).

Names: Padain Cootoo, Manooli Pampoo, Mondi Poda, Manooli Pamboo.

Localities: Madras (Mr. Anderson), Ganjam.

Current name: *Eryx conicus* (Schneider, 1801: 268). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1893) and Smith (1943).

Boa conica Schneider, 1801.
Hist. Amph. 2: 268.

Schneider's (1801) description is based upon three specimens: one from the Bloch Museum, one from the Museum Barbyensis, and the specimen figured by Russell (1796: 5–6, pl. IV). The Bloch specimen corresponds to ZMB 1470, sent from C.S. John to M.E. Bloch, and is still extant (Bauer 1998; Bauer *et al.* 2002). The Barby specimen remains unlocated and the fate of this collection as a whole has never been documented. A fluid preserved specimen from "India" obtained from Russell (BMNH IV.20.1.a) was reported by Gray (1849) and is present in the collection today, but is not the specimen figured by Russell. The published locality of the Bloch specimen is "India orientali[s]" (Schneider 1801: 268), however, the jar label of ZMB 1470 reads "Tronquebar" [= Tharangambadi, Tamil Nadu, India] (Bauer *et al.* 2002). Russell's figured specimen was from "Madras" [= Chennai, Tamil Nadu, India, although it was also used as a shorthand for the Madras Presidency, which included much of southeastern India]. As noted by McDiarmid *et al.* (1999), Russell's description actually refers to three specimens, two from Mr. Anderson in Madras, and one received from Ganjam in December 1788, although only the figured specimen was explicitly noted by Schneider (1801). The two localities "Tronquebar" and "Madras" together constitute the type locality; no locality was given for the Museum Barbyensis specimen. Stimson (1969) gave the terra typica as "Tronquebar" only, having considered the syntypes to include only the Berlin specimen and another (presumably the Barby specimen), untraced. Kluge (1993) likewise listed the type locality as "Tranquebar, Tanjore District, SE Madras".

Boa viperina Shaw, 1802.
Gen. Zool., Amph. 3(2): 355, pl.100.

Type status: Shaw's description is derived exclusively from Russell (1796) and the animal illustrated by Russell (1796: 5–6, pl. IV) is the holotype and its type locality is "Madras" [= Chennai, Tamil Nadu, India, but see comment above regarding ther Madras Presidency].

Boa ornata Daudin, 1803.
Hist. Nat. Gén. Part. Rept. vol. 5: 210
(*nomen substitutum*).

Type status: Daudin (1803a) listed Russell's snake (1796: 5–6, pl. IV) and Schneider's (1801) description in his synonymy. As a replacement name, this nominal taxon has as its syntypes and type locality those of Schneider's (1801) *Boa conica*.

No. V. VI. *Coluber*, pp. 7-10, pls. V-VI.

Scale counts: (185 V + 57 SC).

Names: Chinta Nagoo, *Coluber Naja*. Linn. Syst. Nat. p. 382; Cobra de Capello, Seb. Mus. 2.

Localities: none noted.

Current name: *Naja naja* (Linnaeus, 1758). Identified by Günther (1858, 1864) and Boulenger (1890) as *Naja tripudians*, and by Boulenger (1896) and Smith (1943) as *N. naja*.

Remarks: Russell's (1796) basic account for Nos.

V and VI referred to the "Tamarind Cobra de Capello" but he recognised ten additional varieties of cobra by their local vernacular names:

Arege Nagoo (189 V + 60 SC), p. 8, pl. VI. Figs. 1–2.

Coodum Nagoo (187 V + 57 SC), p. 8–9, pl. VI. Fig. 3.

Sankoo Nagoo (183 V + 56 SC), p. 9, pl. VI. Fig 4.

Mogla Nagoo (192 V + 65 SC), p. 9.

Malle Nagoo (191 V + 62 SC), p. 9.

Cumboo Nagoo (186 V + 60 SC), p. 9.

Jonna Nagoo (189 V + 57 SC), p. 9.

Nella Tas Pam (186 V + 62 SC), p. 10.

Kistna Nagoo (186 V + 63 SC), p. 10.

Korie Nagoo (184 V + 57 SC), p. 10.

No. VII. *Coluber*, pp. 10-11, pl. VII.

Scale counts: (168 V + 59 SC), (??? V + 56 SC).

Name: Katuka Rekula Poda.

Localities: none noted.

Current name: *Daboia russelii* (Shaw & Nodder, 1797). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1896) and Smith (1943).

Coluber Russelii Shaw & Nodder, 1797.
Nat. Misc. 8: pl. 291, 2 pp. [unnumbered].

Type status: The original syntypes included the specimen illustrated by Russell in plate VII, and a specimen presented by Patrick Russell, and figured by Shaw & Nodder (1797). The latter specimen was cited as BMNH II.1.1a by Gray (1849) and Boulenger (1896) and was designated by Golay *et al.* (1993) as the lectotype. It is still extant in the collection of the BMNH. The specimen figured by Russell, which is untraced, is therefore the paralectotype (see McDiarmid *et al.* 1999 for a discussion). Based on the lectotype data, the type locality is "India". The paralectotype was not associated with any specific locality, but presumably originated from the Coromandel Coast based by implication from Russell (1796).

Coluber trinoculus Schneider
in Bechstein, 1802.
Lacépèdes Naturges. Amph. 4: 245,
pl. XXXVIII, fig. 1.

Type status: Schneider (1802) cited Russell's plate VII and Shaw & Nodder's (1797) *Coluber russelii*. It is thus based on the same two specimens as the latter species, which should be considered as syntypes with the published type locality of "Ostindien", which may be restricted to "India" and "the Coromandel Coast" [by implication] based on the data associated with these specimens.

Vipera elegans Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 6: 124,
pl. LXXIII.

Type status: Russell's (1796) account and plate VII are cited and scale counts are given for the illustrated specimen and a second mentioned by Russell (1796) (although Daudin reported 168 ventrals for the second specimen, Russell, in fact, mentioned only its subcaudal count). These two specimens, both lost, are thus the syntypes of this nominal species and the type locality is "la côte de Coromandel" [India], based on Daudin's statement that Russell's vernacular name was in the language of the people of this region.

No. VIII. *Coluber*, pp. 12-13, pl. VIII.

Scale counts: (241 V + 32 SC).

Names: none given.

Localities: near Nerva.

Current name: *Calliophis melanurus* (Shaw, 1802). Identified by Günther (1864), Boulenger (1890, 1896) and Smith (1943) as *Callophis trimaculatus*.

Coluber Melanurus Shaw, 1802.
Gen. Zool., Amph. 3(2): 552.

Type status: Shaw's description is based on Russell's description and figure. Russell (1796: 13) noted that he deposited a single specimen in the British Museum corresponding to this specimen, which he himself obtained in June 1788. This specimen is still extant as BMNH 1946.1.17.86 and is the holotype of this nominal taxon (see Boulenger 1896). Its type locality is "near Nerva" by implication from Shaw's (1802) citation of Russell (1796). The location of Nerva is uncertain. It is often stated to be in Bengal (e.g., David & Ineich 1999), but this appears to be based on Daudin (1803b), who used the term "Bengale" for much of India, Wallach *et al.* (2014) place it in Uttar Pradesh and Cantor

(1847) listed it as being in the Coromandel. I regard it most likely that the locality is the modern Gudla Nerva in the Guntur District of Andhra Pradesh. It is unknown when most of Russell's other spirit-preserved specimens entered the collection of the British Museum, although most were after his death. This is the only specimen that is known with certainty to have been deposited in London prior to the publication of Russell's first volume.

Vipera trimaculata Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 6: 25.

Type status: Daudin based his description solely on Russell (1796, pp. 12–13, pl. VIII), thus BMNH 1946.1.17.86 is also its holotype.

No. IX. *Coluber*, pp. 13-14, pl. IX.

Scale counts: (170 V + 58 SC).

Name: Bodroo Pam.

Localities: hills in the vicinity of Vizagapatam (October, 1788), Java [see Russell 1804: 24].

Current name: *Trimeresurus gramineus* (Shaw, 1802). Identified by Gray (1849; as *Trimeresurus viridis*), Günther (1864), Boulenger (1890, 1896) and Smith (1943).

Coluber Gramineus Shaw, 1802.
Gen. Zool., Amph. 3(2): 420.

Type status: Shaw's description was derived entirely from Russell (1796), whose description and illustration was based on a single holotype specimen, the whereabouts of which are unknown. Shaw mentions no locality, but by implication from Russell's original account the terra typica is "hills in the vicinity of Vizagapatam". Hoge & Romano-Hoge ([1978–1979] 1981), considered this locality in error and suggested that it should be "Java, Indonesia", although the species associated with this name does not occur in Indonesia.

Coluber viridis Bechstein, 1802.
Lacépèdes Naturges. Amph. 4: 252,
pl. XXXIX, fig. 1.

Type status: Bechstein's account is based entirely on that of Russell (1796), and the specimen described and figured therein is the holotype of this nominal taxon. The state type locality is "von den Hügeln in der Vizagapatam", the German translation of Russell's stated locality.

Vipera viridis Daudin, 1803,
Hist. Nat. Gén. Part. Rept. 6: 112.

Type status: Daudin (1803) based his description chiefly on Russell (1796, pp. 13–14, pl. IX) and thus this specimen is the holotype. Daudin also questionably referred the animal illustrated by Seba (1735: pl. LIV, fig. 2) to this taxon, but as per Art. 72.4.1. This doubtful attribution excludes this specimen from inclusion in a syntype series. As explained by McDiarmid *et al.* (1999), the use of the epithet *viridis* by Daudin is independent of that of Bechstein, and the names are both synonyms and homonyms.

No. X. *Coluber*, pp. 14-15, pl. X.

Scale counts: (143 V + 70 SC), (146 V + 77 SC), (147 V + 71 SC).

Names: Wanna Pam, *Coluber Stolatus*, Linn. Syst. Nat. p. 379, Neerogady, Neergady.

Localities: Raja Mundrah (from Dr. Roxburgh, 1788), Ganjam (Mr. Snodgrass).

Current name: *Amphiesma stolatum* (Linnaeus, 1758). Remarks: Identified by Günther (1858, 1864), Boulenger (1890, 1893) and Smith (1943).

No. XI. *Coluber*, pp. 15-16, pl. 11.

Scale counts: **(145 V + 66 SC)**, (144 V + 77 SC).

Names: Wanna Cogli, Wanna Pam, *Coluber Stolatus*, Linn. Syst. Nat. p. 379), Kurharria.

Current name: *Amphiesma stolatum* (Linnaeus, 1758). Identified by Boulenger (1890) and Smith (1943).

Localities: Samul Cottah (from Dr. Roxburgh, July, 1788), Bengal.

Remarks: Russell explicitly stated that the Wanna Pam and Wanna Cogli were conspecific.

No. XII. *Coluber*, pp. 16-17, pl. XII.

Scale counts: (178 V + 166 SC).

Names: Passeriki Pam, Pastiletti, *Coluber Mycterizans*, Linn. Syst. Nat. p. 389.

Localities: Vizagapatam (in the Circars, as well as in the Carnatic).

Current name: *Ahaetulla nasuta* (Bonnaterre, 1790). Identified by Smith (1943). Previously identified as *Passerita mycterizans* by Günther (1858, 1864) and *Dryophis mycterizans* by Boulenger (1890, 1896).

Remarks: Russell (1796: 19) noted "Whether it is

to be considered distinct from the Passeriki Pam, I shall not take upon me to determine; but on a comparison of the two descriptions, circumstances sufficient may be collected to constitute at least a variety".

Dryinus oxyrhynchus Bell, 1825.
Zool. J. 2: 326.

Type status: Bell provided scalation data (179 V + 130–166 SC) different from Russell, but also cited Russell (1796 p. 16, pl. XII), Shaw's (1802) *Coluber mycterizans* var., Merrem's (1820) *Dryinus nasutus* and questionably Daudin's (1803c) *Coluber mycterizans*, Daudin's account was in turn based on Russell (1796 p. 16–17, pl. XII, p. 18–19, pl. XIII), La nasique of Lacépède (1789: pl. IV, fig. 2), and La couleuvre nasique (*Coluber myxterizans*) of Latreille (Sonnini & Latreille 1801: 122). Lacépède's description and presumably his illustration was based on a specimen in the Cabinet du Roi, and that of Latreille was based on a specimen in the Paris Museum, quite possibly the same individual. Shaw's (1802) variety cites only the two plates (XII and XIII) of Russell (1796). Merrem (1820) also cites the two Russell plates, XII and XII, Lacépède (1789), Shaw (1802), and Daudin (1803c), as well as Gronovius' (1763) "Coluber scut. abdom. CLXXX, squam. caud. par. CXXXIVet ultra". However, Bell (1825) further clarified that Merrem (1820) was incorrect in synonymizing Russell's Passeriki Pam (pl. XII) and Botla Pam (Pl. XIII) and so excluded the latter from his concept of *Dryinus oxyrhynchus*. This presumably also holds true for Shaw's (1802) and Daudin's (1803) use of this name under their respective usages of *Coluber mycterizans*. Assuming that the doubtful attribution of Daudin's *Coluber mycterizans*, was associated with his inclusion of the Paris specimen(s), Bell's name has as its syntypes the specimen illustrated by Russell in plate XII and the specimen cited by Gronovius, both of which are unlocated. Bell (1825) provided the statement "Habitat in Indiâ orientali". However, by implication from Russell (1796) the locality of the animal figured in Russell's plate XII is "Vizagapatam". The other sources mention no specific localities for the specimens cited or illustrated.

No. XIII. *Coluber*, pp. 18-19, pl. XIII.

Scale counts: (174 V + 148 SC).

Name: Botla Passeriki.

Localities: none noted.

Current name: *Ahaetulla nasuta* (Bonnaterre, 1790). Identified by Smith (1943). Previously identified as *Passerita mycterizans* by Günther (1858, 1864) and *Dryophis mycterizans* by Boulenger (1890, 1896).

Remarks: Russell (1796: 19) noted "Whether it is to be considered distinct from the Passeriki Pam, I shall not take upon me to determine; but on a comparison of the two descriptions, circumstances sufficient may be collected to constitute at least a variety".

Dryinus Russellianus Bell, 1825.
Zool. J. 2: 327.

Type status: Bell provided scalation data (174 V + 148 SC) matching that of the specimen in Russell's description and plate XIII, which he cited. He also included in his synonyms *Coluber mycterizans* var. of Shaw (1802) and *Dryinus nasutus* var. of Merrem (1820). Shaw's variety is based exclusively on Russell's specimen. Merrem (1820) did not explicitly mention a variety, but presumably Bell (1825) was referring to the specimen figured in Russell's plate XIII, which he excluded from *Dryinus oxyrhynchus* (see above). Gronovius' specimen cited in Merrem has a scale count incompatible with that reported by Bell for *D. russellianus*, but consistent with that of *D. oxyrhynchus*, so it is here considered part of the type series of the latter nominal taxon only. It remains ambiguous if Bell considered the other secondary and tertiary citations of Merrem (1820) (i.e., Lacépède 1789; and Latreille [Sonnini & Latreille] 1801) to be assignable to this nominal taxon, but as Daudin's (1803c) *Coluber mycterizans*, which is based largely on the specimen(s) in these works, is not placed in Bell's synonymy, I presume that the associated individuals are not part of the type series. Thus, it appears that Bell's description is based on a holotype specimen corresponding to the animal illustrated in Russell's plate XIII. Bell (1825) gave "Habitat in Indiâ orientali rarior".

Dryophis Passericki Schinz, 1833, *Naturges. Abbild. Rept.*: 142.

Type status: This description is merely the notation of this name and the indication to Russell's plate XIII, making the specimen illustrated the holotype. No type locality was mentioned, and nothing more precise than "India" can be implied through the reference to Russell (1796).

No. XIV. *Coluber*, pp. 19-20, pl. XIV.

Scale counts: (175 V + 56 SC).

Names: Jara Potoo, Candee Poda.

Locality: Ganjam (from Mr. Snodgrass).

Current name: *Lycodon jara* (Shaw, 1802). Identified by Günther (1858, 1864), Boulenger (1890, 1893) and Smith (1943).

Coluber Jara Shaw, 1802. *Gen. Zool., Amph.* 3(2): 525.

Type status: Shaw's short description is based entirely on the single specimen described and illustrated by Russell in plate 14. Thus, this specimen, which has not been located, is the holotype and the lectotype designation by Wallach *et al.* (2014) is superfluous. The type locality given by Shaw (1802) is simply "India", but this was restricted to "Ganjam, India", "[= Ganjam, Orissa State, E India, 19°23'N, 85°03'E, elevation 5 m]" by implication from Russell (1796) by Wallach *et al.* (2014).

Remarks: Shaw (1802) erroneously cited Russell's plate as "44", rather than 14.

No. XV. *Coluber*, pp. 20-21, pl. XV.

Scale counts: (229 V + 87 SC), (235 V + 85 SC), (237 V + 97 SC).

Name: Tar Tutta.

Localities: Vizagapatam.

Current name: *Boiga trigonata* (Schneider *in* Bechstein, 1802). Identified by Günther (1858, 1864), Boulenger (1890, 1896) and Smith (1943).

Coluber Sagittatus Shaw, 1802. *Gen. Zool., Amph.* 3(2): 526 (*nomen oblitum*).

Type status: Shaw cites only Russell's (1796) account of the Tar Tutta. He provides only one set of scale counts (229 V + 87 SC), but the account is based on the overall account of Russell, thus the type series includes three original syntypes (see above). The type locality is given only as "India" by Shaw, but may be restricted to "Vizagapatam" by implication from Russell (1796).

Remarks: As noted by Smith & David (1999), Shaw's *Coluber Sagittatus* was actually published before *C. trigonatus*, but the former is treated as a *nomen oblitum* and the latter should be considered a *nomen protectum* under Article 23.9 of the *Code*.

Coluber trigonatus Schneider *in* Bechstein, 1802. *Lacépède's Naturg. Amph.* 4: 256, pl. 40, fig. 1 (*nomen protectum*).

Type status: Schneider's (1802) description is taken directly from Russell (1796: 20–21, pl. 15) and provides the same three sets of scale counts. Wallach *et al.* (2014) designated as the lectotype the specimen illustrated by Russell (1796) in plate XIV. The other two specimens are thus paralectotypes. Russell's text provides no correspondence that allows identification of the illustrated specimen with a particular set of scale counts, and all three specimens are unlocated. One discoloured adult specimen presented by Patrick Russell from Vizagapatam was noted by Günther (1858) and Boulenger (1896) and is still present in the The Natural History Museum collection as an unregistered specimen (P. Campbell, in litt. 9 June 2015), but its scale counts preclude it from being one of those mentioned by Russell (1796). The type locality is "Vizagapatam".

Coluber catenularis Daudin, 1803. *Hist. Nat. Gén. Part. Rept.* 6: 253, pl. LXXV, fig. 2.

Type status: Daudin's (1803b) description was based solely on Russell's plate XV and all three sets of scale counts from Russell (1796) were given. The syntypes are thus the same as for *Coluber sagittatus*. Duadin noted the locality as "Bengale" [sic], but by implication from Russell it is "Vizagapatam". Daudin typically used the term Bengale to refer to a much wider area of India than is implied today, or even than was used by his contempories.

No. XVI. *Coluber*, p. 22, pl. XVI.

Scale counts: (174 V + 40 SC).

Name: Gajoo Tutta.

Localities: Vizagapatam.

Current name: *Lycodon striatus* (Shaw, 1802). Identified by Günther (1864), Boulenger (1890, 1893) and questioningly by Smith (1943). Previously identified by Günther (1858) as *Lycodon aulicus* Var. C.

Coluber Striatus Shaw, 1802.
Gen. Zool., Amph. 3(2): 527.

Type status: Shaw's brief description is based exclusively on Russell's account and illustration, which refer to a single holotype, now lost, thus the lectotype designation of Wallach *et al.* (2014) is superfluous. Shaw (1802) noted only "India" as a locality, however, by indication to Russell (1796) the locality may be restricted to "Vizagapatam".

Coluber malignus Daudin, 1803.
*Hist. Nat. Gén. Part. Rept.*7: 46.

Type status: Based entirely on the description and illustration of Russell (1796: 22, pl. XVI), although the plate is incorrectly cited as CLXI, and it thus shares the same holotype as *C. striatus*. "Vizagapatam" is mentioned explicitly as the type locality.

No. XVII. *Coluber*, p. 23, pl. XVII.

Scale counts: (144 V + 59 SC).

Names: Karoo Bokadam, Neer Pamboo [sic].

Localities: Ganjam (from Mr. Snodgrass, July, 1788), Tranquebar [see Russell 1802: 17].

Current name: *Cerberus rynchops* (Schneider, 1799). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1896) and Smith (1943), although indicated by a question mark by the last author.

Hydrus Rynchops Schneider, 1799.
Hist. Amph. 1: 246.

Type status: The original description of Schneider is based upon a single holotype specimen sent from Mr. Snodgrass and figured by Russell (1796: 23, pl. XVII), thus Wallach *et al.*'s (2014) designation of a lectotype is superfluous. Schneider (1799) mentioned no locality, but by implication from Russell (1796) the locality is "Ganjam". Murphy *et al.* (2012) formally restricted the locality to "Ganjam, India (~19°22'N, 85°03'E)" to distinguish this locality from other similarly named places in eastern India. Gray (1849) noted a single spirit-preserved specimen of this species, BMNH III.16.1.k from "India" presented by Russell, and this specimen is still extant (in litt. P. Campbell, 9 June 2015). This specimens was incorrectly listed as BMNH III.16.1.h by Boulenger (1896). It is not the holotype, which is presumed lost.

Hydrus Cinereus Shaw, 1802.
Gen. Zool., Amph. 3(2): 567.

Type status: Shaw (1802) cited both Russell's Karoo Bokadam (plate XVII) and Schneider's (1799) *Hydrus rhynchops*. As these are one and the same, this nominal taxon shares the same holotype and type locality (mentioned explicitly by Shaw 1802) with *Hydrus rynchops*. Murphy *et al.* (2012) stated that the types also include BMNH 1966.1.21.55–57, although the justification for this is unclear.

Coluber cerberus Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 7: 167.

Daudin's (1803c) description was based on Russell's (1796) plate XVII, Schneider's (1799) *Hydrus rhynchops* and the Enhdyre muselière (*Enhydris rynchops*) of Latreille [Sonnini & Latreille] (1801), all referencing the same specimen of Russell (1796). This nominal species is thus associated with the same holotype and type locality (mentioned explicitly by Daudin 1803c) as *Hydrus rynchops*.

No. XVIII. *Coluber*, p. 24, pl. XVIII.

Scale counts: (198 V + 84 SC).

Names: none noted.

Localities: Madepolam (from Mr. Rowley, September, 1783).

Current name: The species pictured in Russell's plate XVIII has not been previously identified. The specimen was approximately one metre in length with smooth scales, limiting the possible species. Russell stated that the natural colour had probably been affected by preservation.

Remarks: Russell's account is based on a single specimen received in spirits from Madepolam.

No. XIX. *Coluber*, pp. 24-25, pl. XIX.

Scale counts: (182 V + 38 SC).

Name: Wanapa Pam.

Locality: Vizagapatam.

Current name: *Oligodon taeniolatus* (Jerdon, 1853). Identified by Smith (1943) as *Oligodon subgriseus*, although this name was included in his synonymy of *O. taeniolatus*.

Remarks: The date of description of *Oligodon taeniolatus* is often incorrectly given as 1854, see Bauer (2003) for a discussion of the date of publication.

Coluber taeniolatus Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 6: 428
(*nomen oblitum*).

Type status: Daudin's description is based entirely upon Russell's plate XIX and the associated text. The specimen figured is thus the holotype, which is unlocated. The type locality is "Vizagapatam". As noted by Bauer (2003), this nominal taxon is a senior subjective synonym of Jerdon's (1853) *Coronella taeniolata,* but is considered a *nomen oblitum* as it meets the criterion of Article 23.9 of the ICZN (1999) as a forgotten name. This interpretation is dependent on the assumption that Jerdon's usage constitutes a description and not merely a generic reallocation of Daudin's *Coluber taeniolatus* (see Bauer 2003 for a justification of this interpretation).

Coronella taeniolata Jerdon, 1853. *J. Asiat. Soc. Bengal* 22(6): 528 (*nomen protectum*).

Type status: Jerdon's description was based on a specimen described and figured by Russell in plate. XIX), and an unlocated specimen (Das *et al.* 1998), presumably once in the collection of the Asiatic Society of Bengal, with 185 V + 41 SC. Bauer (2003) designated the specimen illustrated by Russell as the lectotype of Jerdon's species.The paralectotype was suggested by Wallach *et al.* (2014) to be the holotype. These specimens are respectively associated with the localities "Vizagapatam" and "Madras", the latter based on Jerdon's statement that the species was common at Madras. Jerdon listed Russell's plate 19 in his description with a question mark, although his text suggests that he considered it conspecific with his own material.

No. XX. *Coluber*, pp. 25-26, pl. XX.

Scale counts: (140 V + 49 SC).

Name: Paragoodoo.

Localities: Common, but no specific localities noted.

Current name: *Xenochrophis piscator* (Schneider, 1799). Remarks: Identified by Boulenger (1890, 1893) and Smith (1943). Previously identified as *Tropidonotus quincunciatus* by Günther (1858, 1864).

Hydrus Palustris Schneider, 1799.
*Hist. Amph.*1: 249.

Type status: Based on Paragudu of Russell, pl. XX. "ab incolis Indiae orientalis". Vogel & David (2012) designated BMNH 1904.7.27.32 as the neotype of this taxon. This is the same specimen that they recognised as the holotype of *Hydrus piscator* Schneider (1799) (see Russell 1796, No. XXXIII). It is a dried specimen accessioned into the British Museum collection in 1904 along with other specimens from the Russell family (see Campbell, this issue). Vogel & David (2012) restricted the type locality to "the coastal areas of northern Andhra Pradesh State, eastern India".

Coluber braminus Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 7: 176.

Type status: Daudin's species was based on Russell's plate XX, as well as the specimen figured by Seba (1735) in plate LIII, fig. 1, *Hydrus palustris* of Schneider (1799), and the Enhydre des Marais (*Enhydris palustris*) of Latreille [Sonnini & Latreille] (1801). Ultimately these are based on just two specimens, that of Russell and that of Seba. The type locality is "Coromandel" by implication to the region treated by Russell (1796), Seba's specimen is not associated with a specific locality. *Coluber braminus* was considered by Smith (1943) and Vogel & David (2012) as a replacement name for *Hydrus palustris.*

Tropidonotus quincunciatus Schlegel. 1837.
Essai Physion. Serp. 1: 307,
pl. XII, figs. 4–5.

Type status: Schlegel's (1837a) description mentioned the size of one specimen from "Bengale" and gave scale counts for two individuals, neither of which match those of any of Russell's snakes. He included in the material discussed specimens in Paris from "Malabar", "Pondichery", "Bengale", "Cochinchine" and the "Philip-

pines", specimens from Leiden from "Bengale", "Java" (the specimen illustrated in Schlegel 1837b), the "iles Mariannes", and "Chine". He also made specific reference to Russell's (1801) plates XX and XXXIII and (1802) plates XIV and XVA, and to *Coluber melanozostus* Gravenhorst , 1807, *Coluber funebris* et *sinuatus* (Oppel & Reinwardt, unpublished, *nomina nuda*, see Vogel & David 2012), *Coluber rectangulus* Gray, 1834, *Hydrus palustris* Schneider, 1799, *Coluber anastomosatus* Daudin, 1803, *Coluber braminus* Daudin, 1803 and *Coluber lippus* Reuss, 1834. As argued by Vogel & David (2012), *T. quincunciatus* is not a replacement name, but rather represents Schlegel's concept of a taxon that subsumed a variety of previously proposed nomina. Vogel & David (2012) designated BMNH 1904.7.27.32, the presumed holotype of *Hydrus piscator* (see Russell 1796, No. XXXIII) as the lectotype, thus restricting the type locality to "northern coastal areas of Andhra Pradesh State, estern India". The specimen figured on Russell's (1801) plate XX is thus a paralectotype. Its whereabouts are unknown.

No. XXI. *Coluber*, pp. 26-27, pl. XXI.

Scale counts: (192 V + 62 SC).

Name: Nooni Paragoodoo.

Localities: None mentioned.

Current name: *Argyrogena fasciolata* (Shaw, 1802). Identified by Günther (1858, 1864), Boulenger (1890, 1893) and Smith (1943).

Coluber Fasciolatus Shaw, 1802.
Gen. Zool., Amph. 3(2): 528.

Type status: Shaw's (1802) name was based solely on the account in Russell (1796: 26–27) and the specimen illustrated on plate XXI should be considered the holotype. Therefore, the lectotype designation of the figured specimen by Wallach *et al.* (2014) is superfluous. Shaw (1802) noted only "India", but by implication from Russell (1796) the type locality is "Coromandel coast of India" (based on the book as a whole, as Russell provides no stated locality). Wallach *et al.* (2014) gave the type locality as "Vizagapatam" "[= Vishakhapatnam, Andhra Pradesh State, SE India, 17°41'N, 83°13'E, elevation 25 m]" based on their lectotype designation. Günther (1858), noted an adult specimen from "East Indies" as the "original specimen of Dr. Russell", however, this specimen (BMNH 37a), which is still present in the collection, is apparently unrelated to the illustrated specimen (P. Campbell, in litt. 9 June 2015).

Coluber hebe Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 6: 385.

Type status: Daudin's (1803) name was based solely on the account in Russell (1796: 26–27, pl. XXI) and the specimen illustrated on plate XXI should be considered the holotype. Daudin mentioned only the locality "Coromandel" [India], which should be considered the type locality.

No. XXII. *Coluber*, pp. 27-28, pl. XXII.

Scale counts: (252 V + 62 SC).

Name(s): Pedda Poda, Rock Snake

Localities: no localities noted.

Current name: *Python molurus* (Linnaeus, 1758). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1893) and Smith (1943).

Boa Cinerea Schneider, 1801.
*Hist. Amph.*1: 270.

Type status: Schneider's (1799) *Boa Cinerea* was based solely on the Pedda Poda, (Russell, 1796, p. 27, pl. XX, [sic, pl. XXII]).The holotype is thus the specimen, which is unlocated, illustrated in plate XX. The state type locality is "Coromandel" by implication to Schneider's reference to the name being "Pedda Poda" in the "ora Coromandelica" [Coromandel language].

Coluber Boaeformis Shaw, 1802.
Gen. Zool., Amph. 3(2): 511.

Type status: Shaw (1802) included in his synonymy of this nominal taxon Russell's (1796) Bora (pl. XXXIX) and Pedda Poda (pls. XXII, XXIII and XXIV), however, those specimens figured on pls. XXXIX and XXIII and XXIV were referred to separate putative varieties ("var.?"). As such the specimen figured on plate XXII is here regarded as the holotype, as the others are excluded from the type series under Art. 72.4.1. of the *International Code of Zoological Nomenclature* (1999), although all are referable to *Python molurus*. Shaw (1802) gives only "India" as the locality, which is consistent with Russell (1796), who did not mention any locality associated with this specimen.

Python tigris Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 5: 241,
pl. LIX, fig. 4, pl. LXIV, fig. 1,2.

Type status: Daudin included in his synonymy the specimens figured in plates XXII, XXIII and XXIV of Russell (1796), Schneider's (1801) *Boa cinerea*, and *Boa castanea* and the Céraste de Siam of Seba (1735, pl. XIX, fig. 1). Daudin's figure 2, plate LXIV is cited for this species in Daudin's account, but it actually depicts the ventral scutellation of *Python bora* (Russell 1796: pl. XXXIX). Within *P. tigris* Daudin recognised the typical form, based on Russell's (1796) description and pl. XXII. The associated specimen, unlocated, is here regarded as the holotype as it is the only specimen referred to the typical form, excluding the others from the type series under Art. 72.4.1. of the *International Code of Zoological Nomenclature* (1999). Daudin recognised two varities that had been described by Schneider: *Python tigris castaneus* Daudin (1803a) based on Russell's (1796) plate XXIII and Seba's figured specimen and *Python tigris albicans* Daudin (1803a,) based on Russell's (1796) plate XXIV. Daudin's type locality is "Inde" [= India].

No. XXIII. *Coluber*, pp. 28-29, pl. XXIII.

Scale counts: (252 V + 64 SC).

Name: Pedda Poda.

Locality: Ganjam (from Captain Gent, February, 1788).

Current name: *Python molurus* (Linnaeus, 1758).

Remarks: Synonymy *fide* Smith (1943). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1893) and Smith (1943).

Boa Castanea Schneider, 1801.
Hist. Amph. 1: 272.

Type status: Schneider's *B. castanea* was based exclusively on Russell's pl. XXIII, and the specimen figured is its holotype. The stated locality by Schneider is "in India orientali", although by implication from Russell (1796) this may be restricted to Ganjam. The specimen is lost.

No. XXIV. *Coluber*, pp. 30-31, pl. XXIV.

Scale counts: (256 V + 69 SC).

Name(s): Pedda Poda, Rock Snake, Dussery Pamboo?

Localities: Vizagapatam (1787), Madras ? (associated with Dussery Pamboo *fide* Physician General, Madras, 1788).

Current name: *Python molurus* (Linnaeus, 1758). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1893) and Smith (1943).

Boa Albicans Schneider, 1801.
Hist. Amph. 1: 274.

Type status: Schneider's nominal taxon is based solely on Russell's pl. XXIV, thus the specimen figured is the holotype, which is unlocated. Schneider gave the type locality as "in India orientali", however, by implication from Russell (1796) the locality may be restricted to "Vizagapatam".

No. XXV. *Coluber*, pp. 31-32, pl. XXV.

Scale counts: (??? V + 120 SC) [only the head and tail were preserved in spirits, precluding ventral counts]

Name(s): Dameen.

Localities: Ganjam (Mr. Snodgrass, February, 1788).

Current name: *Ptyas korros* (Schlegel, 1837). Identified by Smith (1943).

No. XXVI. *Coluber*, p. 32, pl. XXVI.

Scale counts: (171 V + 41 SC).

Name: Karetta.

Locality: Hyderabad.

Current name: *Lycodon striatus* (Shaw, 1802). Identified by Boulenger (1893) and Smith (1943), although not in his "Note on Russell's 'Indian Serpents'", pp. 531–532).

Coluber galathea Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 7: 55,
pl. LXXXII, fig. 2.

Daudin's *Coluber galathea* was based exclusively on Russell's plate XXVI and the specimen represented there, already lost before 1796, is the holotype. Russell (1796) noted that the description of this snake was lost, so only the drawing is provided in his account. Daudin gave the type locality as "Coromandel", but by implication from Russell (1796), this may be restricted to "Hyderabad".

No. XXVII. *Coluber*, pp. 32-33, pl. XXVII.

Scale counts: (176 V + 88 SC).

Names: Condanarouse, *Coluber lineatus*, Linn.

Syst. Nat. p. 982 [sic].

Localities: Ganjam (from Mr. Snodgrass, October, 1788).

Current name: *Taphrometopon condanarum* (Merrem, 1820). Identified by Günther (1864), Boulenger (1890, 1896) and Smith (1943).

Coluber condanarus Merrem, 1820.
Versuch Syst. Amph.: 107.

Type status: Merrem noted only the specimen described and illustrated by Russell (1796: pp. 32–33, pl. 27), as such that specimen, now lost, is the holotype. Wallach *et al.*'s (2014) designation of a lectotype was superfluous as there was only a single type. The type locality is "Ganjam".

No. XXVIII. *Coluber*, p. 33, pl. XXVIII.

Scale counts: (138 V) [The specimen figured was received by Russell in a poor state of preservation and a reliable subcaudal count was not possible].

Name: Naugealled Keaka.

Locality: Ganjam (March, 1788).

Current name: *Xenochrophis piscator* (Schneider, 1799). Identified by Boulenger (1890, 1893) and Smith (1943). Previously identified as *Tropidonotus quincunciatus* by Günther (1864). See discussion in Vogel & David (2012).

Coluber mortuarius Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 7: 187.

Type status: Based exclusively on Russell's plate XXVIII and the associated text. Daudin gave the type locality as "aux environs de Ganjam".

No. XXIX. *Coluber*, pp. 34-35, pl. XXIX.

Scale counts: (202 V + 91 SC).

Name: Patza Tutta.

Locality: Casemcottah (from Captain Gowdie, July, 1788; Lieutenant Whyte).

Current name: *Argyrogena fasciolata* (Shaw, 1802). Identified by Smith (1943).

No. XXX. *Coluber*, p. 35, pl. XXX.

Scale counts: (159 V + 52 SC).

Names: Mutta Pam, Ally Pam.

Localities: Lake of Ankapilly.

Current name: *Enhydris enhydris* (Schneider, 1799). Identified by Günther (1864), Boulenger (1890, 1896), and Smith (1943).

Hydrus Enhydris Schneider, 1799.
Hist. Amph. 1: 245.

Type status: Based exclusively on the specimen described and illustrated by Russell (1796: p. 35, pl. 30), which is therefore the holotype, unlocated. Wallach *et al.* (2014) designated Russell's specimen as the lectotype, but this was unnecessary as Schneider based his description on this animal alone. Schneider (1799) did not explicitly mention a locality, but by implication from Russell (1796), the locality is "lake of Ankapilly"[= Ankapalle, Andhra Pradesh, India].

Enhydris caerulea Latreille
in Sonnini & Latreille, 1801.
Hist. Nat. Rept. 4: 202.

Type status: Latreille referred exclusively to the specimen described and illustrated by Russell (1796: p. 35, pl. 30), thus it shares the same holotype with *Hydrus enhydrus*. Latreille (1801) only mentioned "côte de Coromandel" in his description, but by implication from Russell (1796), the locality is "lake of Ankapilly"[= Ankapalle, Andhra Pradesh, India].

Hydrus Atrocaeruleus Shaw, 1802.
Gen. Zool., Amph. 3(2): 567.

Type status: Shaw included in his concept of this species Russell's (1796: p. 35, pl. 30) Mutta Pam & Schneider's (1799) *Hydrus enhydris*, itself based on the same specimen. Thus *H. atrocaeruleus* shares the same holotype with *Hydrus enhydrus*. Shaw stated the type locality as "an Indian lake called *Ankapilly*".

Coluber pythonissa Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 7: 107.

Type status: Specimen described and illustrated by Russell (1796: 35, pl. 30). Daudin cited in his synonymy Russell's (1796) Mutta Pam, Ally Pam (plate XXX) and Schneider's (1799) *Hydrus enhydris*as well as Latreille's (1801) *Enhydris caerulea*, all based on the same specimen. The published type locality is "le lac de Aukapilly" [sic, Ankapalle, Andhra Pradesh, India].

No. XXXI. *Coluber*, p. 36, pl. XXXI.

Scale counts: (181 V + 130 SC).

Name: Goobra.
Locality: Hyderabad (from Alexander Russell, summer of 1788).
Current name: *Dendrelaphis tristis* (Daudin, 1803). Identified by Boulenger (1894) and Smith (1943). Previously identified by Günther (1858) as *Chrysolpelea rhodopleuron*.

Coluber tristis Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 6: 430.
Type status: Daudin's description was based entirely on the specimen described and figured by Russell (1796, p. 36, pl. XXXI), which itself was based on a skin and sketch of head received from Alexander Russell. However, the holotype is unlocated and the revised taxonomy of the group to which this species belongs necessitated the stabilization of the name *tristis*. Rooijen & Vogel (2008) designated SMF 58442, a 665 mm male, collected by H. Schetty, as the neotype. The original type locality was "Hyderabad" [Telangana, India]. The neotype locality is "Calcutta, India" [= Kolkata, West Bengal, India].

Coluber scandens Bechstein, 1802.
Lacépède's Naturg. Amph. 4: 276, pl. XLV, fig. 2.
Type status: The description is based entirely on the specimen described and figured by Russell (1796, p. 36, pl. XXXI), which, although unlocated, is the holotype. The type locality is "Hyderabad" [Telangana, India].
Remarks: Rooijen & Vogel (2008) attributed the specific epithet *scandens* to Boie (1827).

No. XXXII. *Coluber*, pp.37-38, pl. XXXII.
Scale counts: (222 V + 93 SC).
Name: Mega Rekula Poda.
Localities: Vizagapatam.
Current name: *Coelognathus helena* (Daudin, 1803). Identified by Günther (1858, 1864), Boulenger (1890, 1894) and Smith (1943).

Coluber helena Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 6: 277, pl. LXXVI, fig. 1.
Type status: The holotype is the sole specimen described and illustrated by Russell (1796: 37–38, pl. XXXII). Wallach *et al.* (2014) designated a lectotype, but as the description is based on a single individual, the action was not necessary. The type locality is "Vizagapatam"[= Vishakhapatnam, Andhra Pradesh, India].

No. XXXIII. *Coluber*, pp 38-39, pl. XXXIII.
Scale counts: (152 V + 80 SC).
Name: Neeli Koea.
Localities: none noted.
Current name: *Xenochrophis piscator* (Schneider, 1799). Identified by Boulenger (1890, 1893) and Smith (1943). Previously identified as *Tropidonotus quinciunciatus* by Günther (1858, 1864).

Hydrus Piscator Schneider, 1799.
Hist. Amph. 1: 247.
Type status: Schneider's description was based solely on the specimen described and illustrated on Russell's plate XXXIII, which was presumed to have been lost (e.g., Iskandar & Colijn 2001). Kramer (1977) noted that a neotype was needed but did not designate one himself. Vogel & David (2012) identified and figured (their fig. 1) BMNH 1904.7.24.32, a dried skin of a female specimen, as the holotype based on the belief that the collection of 97 skins they examined was from Russell's original collection. These specimens were donated to the museum nearly 100 years after Russell's death (see Campbell, this issue). Schneider gave as the locality "ab Indiae orientalis". Vogel & David (2012 restricted the type locality to "the coastal areas of northern Andhra Pradesh State, eastern India" based on Russell's primary area of activity during his stay in India.

Coluber anostomosatus Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 7: 140.
Type status: This description was based on Russell's plate XXXIII, Schneider's *Hydrus piscator*, and the Enhydre pêcheur (*Enhydris piscator*) of Latreille in Sonnini & Latreille (1801). All of these names rest on the single holotype specimen initially figured and described by Russell (1796). If Vogel & David (2012) are correct, this specimen (BMNH 1904.7.24.32) is extant as a dried skin (but see Discussion below). These authors considered this to be a replacement name. The locality "Coromandel" is given by Daudin in the context of the area covered by Russell's first volume (1796).

Tropidonotus quincunciatus Schlegel. 1837. *Essai Physion. Serp.* 1: 307, pl. XII, figs. 4–5.

Type status: Schlegel's (1837a) description mentioned the size of one specimen from "Bengale" and gave scale counts for two individuals, neither of which match those of any of Russell's snakes. He included in the material discussed specimens in Paris from "Malabar", "Pondichery", "Bengale", "Cochinchine" and the "Philippines", specimens from Leiden from "Bengale", "Java" (the specimen illustrated in Schlegel 1837b), the "iles Mariannes", and "Chine". He also made specific reference to Russell's (1801) plates XX and XXXIII and (1802) plates XIV and XVA, and to *Coluber melanozostus* Gravenhorst, 1807, *Coluber funebris* et *sinuatus* (Oppel & Reinwardt, unpublished, *nomina nuda*, see Vogel & David 2012), *Coluber rectangulus* Gray, 1834, *Hydrus palustris* Schneider, 1799, *Coluber anastomosatus* Daudin, 1803, *Coluber braminus* Daudin, 1803 and *Coluber lippus* Reuss, 1834. As argued by Vogel & David (2012), *T. quincunciatus* is not a replacement name, but rather represents Schlegel's concept of a taxon that subsumed a variety of previously proposed nomina. Vogel & David (2012) designated BMNH 1904.7.27.32, the presumed holotype of *Hydrus piscator* as the lectotype, thus restricting the type locality to "northern coastal areas of Andhra Pradesh State, estern India".

No. XXXIV. *Coluber*, pp. 40-41, pl. XXXIV.

Scale counts: (199 V + 121 SC).

Names: **Jeri Potoo**, ***Coluber Mucosus*** Linn. Syst. Nat. p. 388?; Laur. Amph. p. 77. N. 156.

Locality: Vizagapatam.

Current name: *Ptyas mucosa* (Linnaeus, 1758). Identified by Günther (1864), Boulenger (1890, 1893) and Smith (1943). Previously identified as *Coryphodon blumenbachii* by Günther (1858).

Coluber blumenbachii Merrem, 1820. *Versuch Syst. Amph.*: 119.

Type status: Merrem (1820) cites only the specimen figured and described by Russell (1796: pp. 40–41, pl. XXXIV), which is the holotype and is currently untraced. Merrem gave the locality "Bengala" [= India], but by implication from Russell (1796), the restricted type locality is "Vizagapatam".

No. XXXV. *Coluber*, p. 412, pl. XXXV.

Scale counts: (188 V + 55 SC).

Name: **Katla Tutta.**

Localities: Vizagapatam (April, 1788), Ganjam, Masulipatam.

Current name: *Oligodon arnensis* (Shaw, 1802). Identified by Boulenger (1890, 1894) and Smith (1943). Previously identified as *Simotes russellii* by Günther (1858, 1864).

Coluber russelius Daudin, 1803. *Hist. Nat. Gén. Part. Rept.* 6: 395, pl. LXXVI, fig. 2.

Type status: Daudin's species was based on Russell's plates XXXV and XXXVIII (which also see), each of which he considered a different variety. It is unclear if in this instance Daudin used the term "variété" to imply a taxonomic difference or merely to distinguish the two colour patterns illustrated by Russell. Assuming the latter interpretation, the specimens associated with both plates would be syntypes of *C. russelius*. Both specimens are unlocated. Daudin noted the localities "Vizagapatam" and "Mazulipatam", both of which are mentioned in Russell's account for snake No. XXXV, although only the former locality is associated with the figured specimen. Daudin did not mention "Arnee", the locality of the specimen figured on Russell's plate XXXVIII.

No. XXXVI. *Coluber*, p. 42, pl. XXXVI.

Scale counts: (234 V + 87 SC).

Names: **Katla Vyrien**, Cobra Monil [sic].

Locality: Vellore (from Mr. Duffin).

Current name: *Dryocalamus nympha* (Daudin, 1803). Identified by Günther (1858, 1864), Boulenger (1890, 1893) and Smith (1943).

Coluber nympha Daudin, 1803. *Hist. Nat. Gén. Part. Rept.* 6: 244–245, pl. LXXV, fig. 1.

Type status: Description based on Russell (1796: 42–43, pls. XXXVI–XXXVII). Thus there were originally two syntypes. Daudin (1803b) described and illustrated this specimen (BMNH 1946.1.13.69) received by Patrick Russell from Mr. Duffin and corresponding to the specimen

described and illustrated Russell in plate XXXVI. This is one of two adult specimens from "India" from Russell that were reported in the BMNH collection by Günther (1858), both of which (BMNH 1946.1.13.69–70) are still present. Russell (1796) gave the locality of the lectotype specimen as "Vellore", which was clarified by Kucharzewsli & Tillack (2008) to be ""Vellore" [Vellore, Vellore District, Tamil Nadu State of India]". Wallach *et al.* (2014) incorrectly listed the type locality as "Nellore, Andhra Pradesh State, SE India, 14°27'N, 79°59'E, elevation 15 m"], a different city all together.

No. XXXVII. *Coluber*, pp. 42-43, pl. XXXVII.

Scale counts: (243 V + 82 SC).

Names: **Katla Vyrien**, Cobra Monil [sic].

Localities: none mentioned.

Current name: *Dryocalamus nympha* (Daudin, 1803). Identified by Günther (1858, 1864), Boulenger (1890, 1893) and Smith (1943).

Coluber nympha Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 6: 244–245, pl. LXXV, fig. 1.

Type status: Russell considered this species a variety of XXXVI, or perhaps only a different aged or sized individual. The specimen illustrated by Russell on plate XXXVII is the paralectotype of *Coluber nympha* Daudin (see above). This specimen had previously been supposed to have corresponded to BMNH 1946.1.13.70, which was regarded as a syntype by Boulenger (1893). Kucharzewski & Tillack (2008) demonstrated that this specimen was not that figured by Russell and considered the whererabouts of the paralectotype to be unknown.

No. XXXVIII. *Coluber*, pp. 43-44, pl. XXXVIII.

Scale counts: (169 V + 50 SC).

Names: none given.

Localities: Arnee (from Major Bonniveaux, October, 1788).

Current name: *Oligodon arnensis* (Shaw, 1802). Identified by Boulenger (1890, 1894) and Smith (1943). Previously identified as *Simotes russellii* by Günther (1858, 1864).

Remarks: Russell considered this species to possibly be the same as XXXV.

Coluber arnensis Shaw, 1802.
Gen. Zool., Amph. 3(2): 526.

Type status: Shaw's original description was based on the specimen described and figured by Russell (1796: 43–44, pl. XXXVIII), which had been received by Russell from Bonniveaux in October 1788. The designation of a lectotype by Wallach *et al.* (2014) was not required, as the illustrated animal, unlocated, is the holotype. Shaw gave the type locality as "the country of Arnee in the East Indies" [= Arni, Tamil Nadu, India].

Coluber russelius Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 6: 395, pl. LXXVI, fig. 2.

Type status: Daudin's species was based on Russell's plates XXXV (which also see) and XXXVIII, each of which he considered a different variety. It is unclear if in this instance Daudin used the term "variété" to imply a taxonomic difference or merely to distinguish the two colour patterns illustrated by Russell. Assuming the latter interpretation, the specimens associated with both plates would be syntypes of *C. russelius*. Both specimens are unlocated. Daudin noted the localities "Vizagapatam" and "Mazulipatam", both of which are mentioned in Russell's account for snake No. XXXV, although only the former locality is associated with the figured specimen. Daudin did not mention "Arnee", the locality of the specimen figured on Russell's plate XXXVIII.

No. XXXIX. *Coluber*, pp. 44-45, pl. XXXIX.

Scale counts: (265 V + 67 SC [36 scales + 28 scutes + 3 scales]).

Name: **Bora**.

Locality: Calcutta (from description and sketch of head and tail from Mr. Alexander Russell, June, 1788).

Current name: *Python molurus* (Linnaeus, 1758). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1893) and Smith (1943).

Remarks: Russell (1796) noted the strong resemblance between this form and the Pedda Poda (snakes Nos. XXII, XXIII, XXIV), but was uncertain if they were conspecific.

Boa Orbiculata Schneider, 1801.
Hist. Amph. 2: 276.

Type status: Schneider's *Boa Orbiculata* is based solely on Russell's pl. XXXIX, the Bora, thus the individual figured is the holotype, the whereabouts of which are unknown. The type locality from Schneider is "Coromandel" by implication from Schneider's reference to the vernacular name being "Bora" in the "ora Coromandelica" [language of the Coromandel]. However, by implication from Russell (1796) the correct locality associated with this specimen is "Calcutta".

Python bora Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 5: 236.

Type status: Daudin's name was based on Russell's plate XXXIX, and the *Boa orbiculata* of Schneider (1801), which was also based on this same specimen, which is thus the holotype of this nominal species and is unlocated. The type locality is "Calcutta".

Remarks: Daudin's figure 2, plate LXIV is cited under *Python tigris* (based on Russell's plate XXII) but it actually depicts the ventral scutellation of *Python bora*.

No. XL. *Coluber*, pp. 45-46, pl. XL.

Scale counts: (145 V + 49 SC [21 scutes + 28 scales]).

Name: Hurriah.

Localities: Hyderabad (from description and sketch of the head, neck and tail of Mr. Alexander Russell).

Current name: *Cerberus rynchops* (Schneider, 1799). This snake was not identified by Gray (1849) Boulenger (1896) or Smith (1943), but the connection of Russell's plate XL with *C. rynchops* was made by Murphy (2007), Murphy *et al.* (2012) and Wallach *et al.* (2014).

Hurria bilineata Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 5: 284,
pl. LIX, fig. 7, pl. LXVI, figs. 2, 4.

Type status: Name based entirely on the specimen described and depicted in Russell's (1796) account on pp. 45–46 and plate XL, which were based on a description and drawings from Patrick Russell's brother, Alexander. The type locality is "Hyderabad" [Telangana, India]. The whereabouts of the holotype are unknown.

Homalopsis molurus H. Boie, 1826,
Isis von Oken 19: column 213.

Type status: Boie's description was based on Russell's (1796) plate XL and Seba's (1735) plate 15, figure 3, as well as the *Python molurus* of Merrem (1820), *Coluber moluroides* of Schneider (1801), *Coluber Schneideranus* of Daudin, *Col. Decipiens* Oppel (Mus. Paris) [an unpublished name], and *Col. Obtutasus* Reinwardt (Mus. Bat. [= Leiden]) [an unpublished name]. There are thus multiple syntypes, of which the specimen figured by Russell is one. Boie (1826) mentioned "Japan ... von Indien auf den Sundainseln und auf den Molucken" explicitly in the description, but the complete list of terrae typicae includes additional localities, including Hyderabad by implication from Russell (1796).

No. XLI. *Anguis*, p. 47, pl. XLI.

Scale counts: [Abdominal and subcaudal scales uncountable].

Name: Nall Wahlagillee.

Localities: beach at Vizagapatam (January, 1788; May, 1788).

Current name: *Hydrophis platurus* (Linnaeus, 1766). Identified by Gray (1849), Boulenger (1890, 1896), Wall (1909) and Smith (1943). Referred to *Pelamis bicolor* by Günther (1864).

Hydrus bicolor Schneider, 1799.
Hist. Amph. 1: 242.

Type status: Schneider's (1799) *Hydrus Bicolor* was based on a specimen figured by Seba (1735) on plate 77, figure 1, a specimen figured by Vosmaer (1774) in his *Regnum Animale* (see Bauer & Bell 2014 for a reprint, translation and discussion), Gmelin's (1788) *Coluber platuros*, a specimen in the Bloch collection, and the Nalla Wahlagillih Pam figured by Russell (1796) on plate 41. Although Russell mentioned a second specimen, his description appears to be based on the specimen that washed up at Vizagapatam in January 1788. This specimen is thus one of several syntypes associated with this nominal taxon. The whereabouts of Russell's specimen are unknown.

Hydrophis pelamis Schlegel, 1837,
Essai Physion. Serp. II. Part. Descr.: 508,
pl. XVIII, figs. 13, 14, 15.

Type status: Schlegel's description of *Hydrophis pelamis* was based on Russell's plate XLI, Seba's (1735) plate 77, figure 2, specimens collected by Bélanger from "des côtes de Pondichery", by Dussumier "à la côte de Malabar et à l'embouchure du Gange", by van Raalten "à la côte occidentale de Java", by Reinwardt from "la mer de Java prés de Samarang", von Siebold (who saw many "lors de son trajet de Java au Japon, depuis l'équateur jusqu'au 27me degré latitude boréale"; Schlegel 1838) "prés de la côte occidentale de Borneo", and by Lesson "à la côte de la Nouvelle Guinée et dans la mer des Moluques". He also cited specimens in the Paris Museum from Quoy and Gaimard from "prés de Menado à Célèbes, et prés de Port Jackson" and repeats Forster's report in Schneider (1799) from "l'Archipel des îles de la Société". Schlegel also included in his concept of *H. pelamis* the previously published nominal taxa *Anguis platura* Linnaeus, 1758 *Hydrophis platura* Latreille in Sonnini & Latreille, 1801, *Hydrus bicolor* Schneider, 1799, and *Pelamis bicolor* Daudin 1803. A specimen from the collection of M. Klinkenberg in Utrecht is also mentioned. Russell's specimen figured on plate XLI is, thus, part oof the syntype series of *Hydrophis pelamis*. Its whereabouts are unknown.

Pelamis bicolor variegata Duméril, Bibron & Duméril, 1854.
Erpétol. Gén. 7(2): 1337.

Type status: This taxon is based on the specimen figured by Russell (1796), pl. XLI, a specimen figured by Schlegel (1838) and a specimen in the Paris Museum, all of which are syntypes. The whereabouts of Russell's specimen is unknown. The type localities are "Tranquebar sur la côte de Coromandel" "Japon" and "îles Célèbes ... près de Macassar".

No. XLII. *Anguis*, p. 48, pl. XLII.

Scale counts: (151 abdominal scales + 120 subcaudal scales).

Names: RondooTalooloo Pam, double headed snake.

Localities: none noted.

Current name: *Barkudia melanostictus* (Schneider, 1801). Identified by Das ([1999]2000). Shaw (1802) considered this specimen to be s variety of *Anguis Meleagris* [= *Acontias meleagris*].

Remarks: This is the only lizard described and figured by Russell in either volume of his Indian snake researches. Russell (1796) and Schneider (1801), whose account follows Russell for all its content, compared this species to *Anguis Meleagris* (= *Acontias meleagris*) of Linnaeus. Schneider (1801) provided the name Rondu Talulu Pam as a phonetic spelling of Russell's name. These are corruptions of the Tegulu 'renda talu pam' (Das [1999] 2000).

Anguis Melanostictus Schneider, 1801.
Hist. Amph. 1: 323.

Type status: The holotype, which is unlocated, was the specimen illustrated by Russell (1796) on plate XLII. Das ([1999] 2000), who did not expressly state that the holotype was lost but did imply that a neotype would facilitate comparisons with this species' only congener, *B. insularis* Annandale 1917, designated as a neotype ZSI 20627, an adult female from "Visakhapatnam (17° 42'N; 83° 18'E), Andhra Pradesh State, Southeastern India, 47.8 m above mean sea level, collected by P. N. Ganapati, 17 August 1954".

No. XLIII. *Anguis*, pp. 48-49, pl. XLIII.

Scale counts: [abdominal scales "not to be counted on the belly"].

Names: RondooTalooloo Pam, double headed snake.

Locality: Vizagapatam.

Current name: *Indotyphlops braminus* (Daudin, 1803). Identified by Günther (1864), Boulenger (1890, 1893) and Smith (1943).

Eryx braminus Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 7: 279.

Type status: Daudin's description was based exclusively on the specimen described by Russell and figured on his plate XLIII. This specimen, the whereabouts of which are unknown, is the holotype, therefore the lectotype designation of Wallach *et al.* (2014) is unnecessary. The type locality is "Vizagapatam" [= Vishakhapatnam, Andhra Pradesh, India].

Tortrix Russelii Merrem, 1820.
Versuch Syst. Amph.: 84.

Type status: Merrem included in his concept of this species Russell's (1796) pl. LXIII, Daudin's *Eryx braminus*, and the "Punctulated slow-worm" of Shaw (1802), but all of these names ultimately refer to the same single specimen, which is therefore the holotype. Merrem's stated locality is "in India orientali", but by implication from Russel (1796), the restricted type locality is "Vizagapatam" [= Vishakhapatnam, Andhra Pradesh, India].

No. XLIV. *Anguis*, p. 49, pl. XLIV.

Scale counts: [no scalation counts provided].

Names: Tatta Pam, *Anguis Scytale*, Linn. Syst. Nat. p. 392?

Locality: sea-beach at Vizagapatam (August, 1788).

Current name: *Hydrophis mamillaris* (Daudin, 1803d). Identified by Boulenger (1890, 1896) and Smith (1926, 1943). Considered a "doubtful species" by Gray (1849) and questioningly considered a synonym of *Distira gracilis* by Wall (1909).

Hydrus fasciatus Schneider, 1799.
Hist. Amph. 1: 240.

Type status: Schneider's description was based on specimen number 4 in the Bloch collection (now ZMB 2836; see Bauer 1998), another in the University of Jena, a specimen illustrated and described by Vosmaer (1774) (see Bauer & Bell 2014 for a reprint, translation and discussion), a specimen described by Linnaeus (1754), many specimens in the Museum Barbyensis, and the specimen illustrated in Russell's (1796) plate XLIV. As such, Russell's specimen, which has not been located, is one of the original syntypes of this species. The extant Berlin specimen has been considered a lectotype by Wallach *et al.* (2014) based on its listing by Iskandar & Colijn (2001) as the type, but this action does not meet requirements of the *Code* (1999). This specimen does not appear to be identical with BMNH III.6.3.c, an extant Russell specimen noted by Gray (1849) as "In spirits. Young. Indian Ocean. From Mr. Russell's collection; named by Dr. Shaw" Shaw's (1802: 563) usage of the name *Hydrus fasciatus* has been assumed by all other authors to simply reflect his use of Schneider's (1799) name for this species, and indeed Gray (1849) lists Schneider in the synonymy of the species, despite his implication that this specimen was a Shaw type.

The current name of this species is *Hydrophis fasciatus* (Schneider, 1799). The original type locality was "litore maris Indici", but based on the data accpmanyng the lectotype, the type locality is "Ostindien".

Anguis mamillaris Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 7: 340.

Type status: Daudin's original description is based entirely on the specimen described and figured by Russell (1796: p. 490, pl. XLIV). The identity of this specimen has a convoluted history (see Smith 1926), but was established by Boulenger (1890). Smith (1926) stated that the holotype was lost. McCarthy in Golay *et al.* (1993) referred to BMNH 61.12.30.38 as the type and Wallach *et al.* (2014) considered the same specimen as the neotype, designated by Smith (1926). In reality BMNH 61.12.30. was collected by R.H. Beddome decades after Russell's death and neither this specimen or any other was proposed as a neotype by Smith (1926). Daudin gave the type locality as "sur le rivage de la mer au Vizagapatam", a translation of Russell's "sea beach at Vizagapatam".

Anatomical Plates
XLV.

Fig. 1. Tar Tutta (No. XV) [palate and upper jaws]
Fig. 2. Katuka Rekula Poda (No. VII) [palate and upper jaws]
Fig. 3. Cobra de Capello (No. V) [palate and upper jaws]
Fig. 4. Bungarum Pamah (No. III) [palate and upper jaws]
Fig. 5. Tar Tutta (No. XV) [skull]
Fig. 6. Katuka Rekula Poda (No. VII) [skull]
Fig. 7. Katuka Rekula Poda (No. VII) [lateral view of upper jaw, fang erect]
Fig. 8. Katuka Rekula Poda (No. VII) [lateral view of upper jaw, fang recumbent]
Fig. 9. Katuka Rekula Poda (No. VII) [fang]
Fig. 10. Cobra de Capello (No. V) [lateral view of upper jaw]

Fig. 11. Bungarum Pamah (No. III) [lateral view of upper jaw]
Fig. 12. Bungarum Pamah (No. III) [dorsal surface of upper jaw]

XLVI.

Fig. 1. Cobra de Capello (No. V) [venom gland and associated structures]
Fig. 2. Cobra de Capello (No. V) [venom gland and associated structures]
Fig. 3. Cobra de Capello (No. V) [venom gland and associated structures]
Fig. 4. Cobra de Capello (No. V) [venom gland and associated structures]
Fig. 5. Katuka Rekula Poda (No. VII) [venom gland and associated structures]
Fig. 6. Katuka Rekula Poda (No. VII) [venom gland and associated structures]
Fig. 7. Katuka Rekula Poda (No. VII) [venom gland and associated structures]

Russell (1801–1809[1810]). A Continuation of an Account of Indian Serpents; Containing Descriptions and Figures, from Specimens and Drawings, Transmitted from Various Parts of India, to the Hon. the Court of Directors of the East India Company.

Part 1 (1801) [pp. i–v, 1–12, pls. I–X]

Remarks: All snakes in Part 1 1801 were obtained by Patrick Russell from Alexander Russell.

No. I. *Coluber*, pp. 1-3, pl. I.

Scale counts: (185 V + 59 SC).
Names: *Coluber Naja*, Linn. Syst. Nat. p. 382, Cobra de Capello.
Current name: *Naja naja* (Linnaeus, 1758). Identified by Boulenger (1896) and Smith (1943). Earlier identified as *N. tripudians* by Günther (1864) and Boulenger (1890).

No. II. *Coluber*, p. 4, pl. II.

Scale counts: (209 V + 129 SC).
Name: Kalla Jin.
Localities: none noted.
Current name: *Chrysopelea ornata* (Shaw, 1802). Identified by Günther (1858, 1864), Boulenger (1890, 1896) and Smith (1943).
Remarks: The specimen illustrated by Russell (1801) was in spirits. Although Russell (1796) considered this snake to be in the synonymy of Seba's (1735) "Serpens Ceilanica pomposâ veste ornata", one of the three syntype specimens of Shaw (1802), Shaw did not cite the Kalla Jin in his synonymy, probably because the first part of Russell's second book appeared too late for him to incorporate details from it in his own manuscript.

Coluber ibiboboca Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 6: 327.

Type status: This description was based chiefly on Russell's (1801) plate II, as well as the "Ibiboboca" and "Serpens Ceilanica pomposâ veste ornata" of Seba (1735), plates VII and LXI, respectively (on the basis of Russell's inclusion of these in his own synonymy). None of the three syntypes are known to be extant. The type locality is "Coromandel", based on Daudin's citation of the general region covered by Russell's works.

No. III. *Coluber*, p. 5, pl. III.

Scale counts: (151 V + 93 SC).
Name: Dooblee.
Localities: none noted.
Current name: *Xenochrophis piscator* (Schneider, 1799). Identified by Boulenger (1890, 1893) and Smith (1943), although indicated with a question mark in the latter's "Note on Russell's 'Indian Serpents'". Previously identified as *Tropidonotus quincunciatus* Var. E. by Günther (1858, 1864).

Coluber umbratus Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 7: 144.

Type status: The description of this nominal taxon is based solely upon Russell's (1801) plate III, figure 1. The type locality is "Coromandel", based on Daudin's citation of the general region covered by Russell's works. The holotype is presumably lost.

No. IV. *Coluber*, pp. 5–6, pl. IV.

Scale counts: (154 V + 67 SC).
Names: Chittee, Neer Pamboo [sic].
Localities: Tranquebar (see Russell 1802: 17).
Current name: *Atretium schistosum* (Daudin, 1803). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1893) and Smith (1943).

Coluber schistosus. Daudin, 1803.
Hist. Nat. Gén. Part. Rept. 7: 132.

Type status: Daudin's description was based entirely on the specimen described and illustrated by Russell (1801) in plate IV. This specimen presumably corresponds to BMNH III.22.1.e., an extant fluid-preserved specimen, which was designated as the lectotype by Wallach *et al.* (2014), although no such designation is required, given that the specimen is a holotype. The type locality is "Bengale" and Russell (1801) provided no more specific locality.

No. V. *Coluber*, p. 6, pl. V.

Scale counts: (135 V + 73 SC).

Name: Dora.

Localities: none noted.

Current name: *Xenochrophis piscator* (Schneider, 1799). Identified by Boulenger (1893) and Smith (1943). Previously identified as *Tropidonotus quincunciatus* Var. E. by Günther (1858). See discussion in Vogel & David (2012).

Coluber dora Daudin, 1803
Hist. Nat. Gén. Part. Rept., 7: 191.

Type status: Based exclusively on Russell's (1801), plate V, thus, the corresponding specimen, presumed lost, is the holotype. Only "Bengale" is mentioned in the description and Russell (1801) provided no more specific locality.

No. VI. *Anguis*, pp. 6-7, pl. VI.

Scale counts: (323 abdominal scales + 46 SC).

Name: Kerril pattee.

Locality: "from the salt water rivers which intersect that part of Bengal called the Sunderbunds".

Current name: *Hydrophis nigrocinctus* Daudin, 1803. Identified by Gray (1849), Günther (1864), Boulenger (1890, 1896) and Smith (1926, 1943).

Hydrophis nigrocinctus Daudin, 1803.
Hist. Nat. Gén. Part. Rept., 7: 380.

Type status: Original description based upon the specimen depicted in Russell (1801) in plate VI. This holotype has been identified as BMNH 1946.1.10.13 (formerly BMNH 1896.3.25.5, cited by Smith 1926), donated by Patrick Russell, who noted that the specimen was well-preserved in spirits and accompanied by colour drawings when he received it. Daudin's type locality is "dans les eaux salées d'une rivière près de Calcutta, qui partage en deux la contrée du Bengale, nommée en anglais *le Sunderbunds*".

No. VII. *Anguis*, p. 8, pl. VII.

Scale counts: (323 abdominal scales + 46 SC).

Name: Shootur Sun.

Locality: "from the salt water rivers which intersect that part of Bengal called the Sunderbunds".

Current name: *Hydrophis obscurus* Daudin, 1803. Identified by Boulenger (1890, 1896), Wall (1909) and Smith (1926, 1943). Gray (1849) placed the specimen figured in *Hydrophis Lindsayii* (syn. *Hydrophis fasciatus*) and Günther refered it to *H. cloris*.

Hydrophis cloris Daudin, 1803.
Hist. Nat. Gén. Part. Rept.,7: 377, pl. XC.

Type status: The description is based entirely on Russell's (1801) pl. VII. Russell described the specimen as well-preserved in spirits and accompanied by colour drawings. It was identified as the holotype by Smith (1926) as BMNH 96.3.25.3 (cuurent number of this extant specimen BMNH 1946.1.3.80). Daudin's type locality is "dans les eaux salées d'une rivière près de Calcutta, qui partage en deux la contrée du Bengale, nommée en anglais *le Sunderbunds*".

Remarks: Wall (1909) incorrectly stated that Daudin based this name on Russell's (1801) plate VIII.

Pelamis marginatus and *Hydrophis shootur* Rafinesque-Schmaltz, 1817.
Amer. Month. Mag. Crit. Rev. 1: 432.

Type status: Rafinesque-Schmaltz used the following format in referring to this species: "4. Sp. *Pelamis marginatus* Raf. (*Hydrophis Shootur* Latr.)". The second name, attributed to Latreille, cannot be found in the works of that author. The description was presumably based on one or the other of Russell's plates VII or VIII. The stated type locality "in the swamps of India" was apparently a reference to the Sundarbans.

No. VIII. *Anguis*, p 9, pl. VIII.

Scale counts: (338 abdominal scales + 48 SC).

Name: Kalla Shootur Sun.

Locality: "from the salt water rivers which intersect that part of Bengal called the Sunderbunds".

Current name: *Hydrophis obscurus* Daudin, 1803. Identified by Boulenger (1890, 1896), Wall (1909) and Smith (1926, 1943). Günther (1864) earlier refered Russell's plate to *Hydrophis gracilis.*

Hydrophis obscurus Daudin, 1803.
Hist. Nat. Gén. Part. Rept.,7: 375.

Type status: The original description was based on the specimen figured by Russell (1801) on plate VIII. This holotype specimen corresponds to BMNH 1946.1.9.27 (formerly BMNH 1896.3.25.4 cited by Smith 1926), still present in the Natural History Museum, London today. Russell described the specimen as well-preserved in spirits but without accompanying drawings. Daudin's type locality is "dans les eaux salées d'une rivière près de Calcutta, qui partage en deux la contrée du Bengale, nommée en anglais *le Sunderbunds*".

Remarks: Wall (1909) incorrectly stated that Daudin based this name on Russell's (1801) plate VII.

Pelamis marginatus and *Hydrophis shootur* Rafinesque-Schmaltz, 1817.
Amer. Month. Mag. Crit. Rev. 1: 432.

Type status: Rafinesque-Schmaltz used the following format in referring to this species: "4. Sp. *Pelamis marginatus* Raf. (*Hydrophis Shootur* Latr.)". The second name, attributed to Latreille, cannot be found in the works of that author. The description was presumably based on one or the other of Russell's plates VII or VIII. The stated type locality "in the swamps of India" was apparently a reference to the Sundarbans.

No. IX. *Anguis*, p. 10, pl. IX.

Scale counts: (308 abdominal scales + 48 SC).

Name: Chittul.

Locality: "from the salt water rivers which intersect that part of Bengal called the Sunderbunds".

Current name: *Hydrophis cyanocinctus* Daudin, 1803. Identified by Gray (1849), Günther (1864), Boulenger (1890, 1896), Wall (1909) and Smith (1926, 1943).

Hydrophis cyanocinctus Daudin, 1803.
Hist. Nat. Gén. Part. Rept., 7: 383.

Type status: The description is based exclusively on the specimen depicted in Russell's (1801) plate IX. This corresponds to the extant holotype, BMNH 1946.1.9.23 (formerly BMNH 1896.3.25.6 cited by Smith 1926). This specimen had been stated to be lost by Iskandar & Colijn (2001). Russell described the specimen as well-preserved in spirits and accompanied by colour drawings. Daudin's type locality is "dans les eaux salées d'une rivière près de Calcutta, qui partage en deux la contrée du Bengale, nommée en anglais *le Sunderbunds*".

Hydrophis chittul Rafinesque-Schmaltz, 1817.
Amer. Month. Mag. Crit. Rev. 1: 432.

Type status: Rafinesque-Schmaltz attributed this name to Latreille, cannot be found in the works of that author. The description was based on Russell's (1801) plate IX. The stated type locality is "India" but according to Russell (1801) the origin of the specimen is "the salt water rivers which intersect that part of Bengal called the Sunderbunds".

No. X. *Anguis*, p. 11, pl. X.

Scale counts: (306 abdominal scales + 52 SC).

Names: Hoogli pattee.

Locality: "from the salt water rivers which intersect that part of Bengal called the Sunderbunds".

Current name: *Hydrophis schistosus* Daudin, 1803. Identified by Boulenger (1890, 1896) and Smith (1926, 1943). It was previously identified as *Chitulia fasciata* by Gray (1849).

Hydrophis schistosus Daudin, 1803.
Hist. Nat. Gén. Part. Rept.,7: 386.

Type status: The original description was based on Russell's (1801) plate X. Russell described the specimen as well-preserved in spirits and accompanied by colour drawings. Wall (1909) discovered this specimen in the collection of the Royal College of Surgeons (RCSM 523) and it was subsequently transferred to the British Museum. According to Smith (1926, 1943) the holotype corresponds to BMNH 1946.1.10.7 (formerly BMNH 1921.7.28.1). Wall (1909), however, had associated the specimen with

Russell's plate XI (see Remarks below), calling into question whether the extant specimen in London is the holotype of *Hydrophis schistosus* or that of *Hydrus Valakadyn*. Daudin's type locality is "dans les eaux salées d'une rivière près de Calcutta, qui partage en deux la contrée du Bengale, nommée en anglais *le Sunderbunds*", as stated by Russell (1801). However, according to both [Royal College of Surgeons] (1859) and Smith (1926) the specimen is associated with the locality "Tranquebar".

Hydrophis cyanura and *Hydrophis hoglin* Rafinesque-Schmaltz, 1817.
Amer. Month. Mag. Crit. Rev. 1: 432.

Type status: Rafinesque-Schmaltz used the following format in referring to this species: "2. Sp. *Hydrophis cyanura* Raf. (*H. hoglin* Latr.)". The second name, attributed to Latreille, cannot be found in the works of that author. The description was presumably based on Russell's plate X. Wallach *et al.* (2014) gave this name as *Hydrophis cianura*, but this spelling does not occur in the paper. Rafinesque-Schmaltz gave the locality "East Indies", but based on Russell (1801) this can be restricted to "the salt water rivers which intersect that part of Bengal called the Sunderbunds" [= Sundarbans, Ganges River Delta].

Disteira Russelii Fitzinger, 1827.
Isis von Oken 20: column 733.

Type status: This description cites Russell's (1801) plate X in its synonymy but also includes a specimen with the scale counts: 318 V + 45 SC. This other syntype has not been listed in any of the published catalogues of types in the Naturhistorisches Muaeum Wien and is here considered as unlocated. The published type locality is "Asien, indisches Meer".

Part 2 (1802) [pp. 13–20, pls. XI–XVIII]

No. XI. *Anguis*, pp. 13-14, pl. XI.

Scale counts: (318 abdominal scales + 45 SC).
Name: Valakadyen.
Locality: Tranquebar.
Current name: *Hydrophis schistosus* Daudin, 1803. Identified by Smith (1926, 1943). It was previously identified as *Enhydrina Valakadyen* by Gray (1849), *E. bengalensis* by Günther (1864) and *E. valakadien* by Boulenger (1890, 1896).
Remarks: Gray (1849) cited III.5.2.a as a specimen of *Enhydrina Valaladyen* presented by Russell. Wallach *et al.* (2014) cited *Enhydris valakadin* Rafinesque-Schmaltz, 1817 in the synonymy of this species, but no mention of this name is found in that paper.

Hydrus Valakadyn F. Boie, 1827.
Isis von Oken 19: column 554.

Type status: Based on Russell's pl. XI, the subject of which is, thus, the holotype of this taxon. Boie (1827) noted that specimens of this species were in Paris and Leiden, but these did not constitute part of the description. Russell's specimen was from "Tranquebar" and was noted as lost by Smith (1926). However, Wall (1909) identified RCSM 523 (now BMNH 1946.1.10.7) as the specimen associated with Russell's plate XI. It is unclear if Smith (1926, 1943) found an error in Wall's work and correctly associated the extant specimen with Russell's plate X (see above), or if he was in error and Wall's (1909) original link to plate XI was correct. If the locality "Tranquebar" associated with the specimen is correct, it would be consistent with Russell's locality for the Valakadyen, and would account for the inconsistency noted for the Hoogli pattee (see above).

Remarks: Wallach *et al.* (2014) considered this name as a *nomen incorrectum*, based on the assumption that it was an incorrect subsequent spelling of *valakadin*, as used by Rafinesque-Schmaltz (1817). However, as this is not the case (see Remarks above), Boie's (1827) use of *valakadyn* appears to be the first use of a variant of this epithet (as listed by Gray 1849, Boulenger 1896, Smith 1926, 1943). Rafinesque's name is not mentioned by Sherborn (1931) in the *Index Animalium*, although other names appearing in this paper are indeed indexed. Wall (1909) recognised that *Enhydrina schistosa* and *E. valakadyn* were synonyms and suggested that the former name be given prescedence, although he himself placed the species account under the latter name.

No. XII. *Anguis*, p. 14, pl. XII.

Scale counts: (228 abdominal scales + 38 SC).

Name: Shiddil.

Locality: Tranquebar (from Rev. Mr. John).

Current name: *Hydrophis jerdonii* Gray, 1849. Identified by Boulenger (1890, 1896), Wall (1909) and Smith (1943). Previously identified by Gray (1849) and Günther (1864) as *Hydrophis spiralis* (Shaw).

Remarks: Wall (1909) stated "I believe Mr. Boulenger is in error in supposing Jerdon's specimen in the British Museum the type (*vide* Catalogue, 1896, vol. iii, p. 299). A specimen of this species (No. 528) in the Royal College of Surgeons' Museum, London, collected by Russell, on comparison with Russell's plate xii (Ind. Serp., vol. ii, 1801 [sic, 1802]) leaves little doubt in my mind is the original of the figure, and if my conviction is correct should be acknowledged the type". While Wall (1909) may have been correct that the specimen was that figured by Russell (1802), it is manifestly not the type of *H. jerdonii*, as Gray (1849) in his description lists a single specimen, collected by Jerdon, not Russell, and Russell's pl. XII is referred by Gray (1849) to *Hydrophis spiralis*.

Gray (1849) noted that BMNH III.6.10.a from "Indian Ocean?" in spirits, but dried, had been presented by Russell and had been "described and figured by Dr. Shaw" as the type of *H. spiralis*. Shaw himself (1802) stated that the "specimen was in the British Museum, but that its particular history was unknown". Smith (1926) noted that the type of *H. spiralis* was listed as III.6.10.c contradicting Gray (1849), but described the specimen as a shriveled juvenile, which is consistent with Gray's statement of the state of the specimen. Thus the identity of the type specimen of *H. spiralis* is not in doubt, but its association to Russell is. Smith (1943) linked the Shiddil to *H. jerdonii*, however, his account of this species does not include Russell's plate XII in its synonymy.

No. XIII. *Anguis*, p. 15, pl. XIII.

Scale counts: (244 abdominal scales + 34 SC).

Name: Kadell Nagam.

Locality: Tranquebar (from Rev. Mr. John).

Current name: *Hydrophis gracilis* (Shaw, 1802). Identified by Gray (1849), Boulenger (1890, 1896), Wall (1909) and Smith (1926, 1943).

Remarks: Shaw's (1802) description of *Hydrus Gracilis* was based on a single specimen in the British Museum which, according to Gray (1849) came from the "old collection". This specimen, BMNH 1946.1.17.37 (formerly BMNH III.4.1.a) could conceivably have come from Russell, but Russell's plate and account appeared too late for Shaw to be aware of it and, in addition, neither the type's scale counts nor its locality are consistent with Russell's plate XIII.

No. XIV. *Coluber*, p. 16, pl. XIV.

Scale counts: (144 V + 82 SC).

Names: Ourdia (Bombay), **Dora** (Calcutta).

Localities: Bombay, Calcutta (by implication), "sundry other parts".

Current name: *Xenochrophis piscator* (Schneider, 1799). Identified by Boulenger (1890, 1893) and Smith (1943). Previously identified as *Tropidonotus quincunciatus* by Günther (1858, 1864).

Tropidonotus quincunciatus Schlegel. 1837. *Essai Physion. Serp.* 1: 307, pl. XII, figs. 4 and 5.

Type status: Schlegel's (1837a) description mentioned the size of one specimen from "Bengale" and gave scale counts for two indivuduals, neither of which match those of any of Russell's snakes. He included in the material discussed specimens in Paris from "Malabar", "Pondichery", "Bengale", "Cochinchine" and the "Philippines", specimens from Leiden from "Bengale", "Java" (the specimen illustrated in Schlegel 1837b), the "iles Mariannes", and "Chine". He also made specific reference to Russell's (1801) plates XX and XXXIII and (1802) plates XIV and XVA, and to *Coluber melanozostus* Gravenhorst, 1807, *Coluber funebris* et *sinuatus* (Oppel & Reinwardt, unpublished, *nomina nuda*, see Vogel & David 2012), *Coluber rectangulus* Gray, 1834, *Hydrus palustris* Schneider, 1799, *Coluber anastomosatus* Daudin, 1803, *Coluber braminus* Daudin, 1803 and *Coluber lippus* Reuss, 1834. As argued by Vogel & David (2012), *T. quincunciatus* is not a replacement name, but rather represents Schlegel's concept of a taxon that subsumed a variety of previously proposed nomina. Vogel & David (2012) designated

BMNH 1904.7.27.32, the presumed holotype of *Hydrus piscator* (see Russell 1796 No. XXXIII) as the lectotype, thus restricting the type locality to "northern coastal areas of Andhra Pradesh State, eastern India". The specimen figured on Russell's (1802) plate XIV is thus a paralectotype. Its whereabouts are unknown.

No. XV. A. *Coluber*, pp. 17, pl. XVA.

Scale counts: (146 V + 82 SC).

Names: **Neer Pamboo** (Tranquebar), **Dooblee** (Calcutta).

Localities: Tanquebar, Calcutta, Bombay.

Current name: *Xenochrophis piscator* (Schneider, 1799). Identified by Boulenger (1890, 1893) and Smith (1943). Previously identified as *Tropidonotus quincunciatus* by Günther (1858, 1864).

Tropidonotus quincunciatus Schlegel. 1837. *Essai Physion. Serp.* 1: 307, pl. XII, figs. 4–5.

Type status: Schlegel's (1837a) description mentioned the size of one specimen from "Bengale" and gave scale counts for two individuals, neither of which match those of any of Russell's snakes. He included in the material discussed specimens in Paris from "Malabar", "Pondichery", "Bengale", "Cochinchine" and the "Philippines", specimens from Leiden from "Bengale", "Java" (the specimen illustrated in Schlegel 1837b), the "iles Mariannes", and "Chine". He also made specific reference to Russell's (1801) plates XX and XXXIII and (1802) plates XIV and XVA, and to *Coluber melanozostus* Gravenhorst , 1807, *Coluber funebris* et *sinuatus* (Oppel & Reinwardt, unpublished, nomina nuda, see Vogel & David 2012), *Coluber rectangulus* Gray, 1834, *Hydrus palustris* Schneider, 1799, *Coluber anastomosatus* Daudin, 1803, *Coluber braminus* Daudin, 1803 and *Coluber lippus* Reuss, 1834. As argued by Vogel & David (2012), *T. quincunciatus* is not a replacement name, but rather represents Schlegel's concept of a taxon that subsumed a variety of previously proposed nomina. Vogel & David (2012) designated BMNH 1904.7.27.32, the presumed holotype of *Hydrus piscator*, (which see) as the lectotype, thus restricting the type locality to "northern coastal areas of Andhra Pradesh State, estern India". The specimen figured on Russell's (1802) plate XVA is thus a paralectotype. Its whereabouts are unknown.

No. XV. B. *Coluber*, pp. 17-18, pl. XVB.

Scale counts: (143 V + 83 SC).

Name: **Neer Pamboo** (Tranquebar).

Localities: Tranquebar, Bombay.

Current name: *Amphiesma stolatum* (Linnaeus, 1758). Identified by Günther (1858, 1864), Boulenger (1890, 1893) and Smith (1943).

No. XVI. *Boa*, pp. 18-19, pl. XVI.

Scale counts: (189 V + 18 SC).

Names: *Boa Johnii.* **Erutaley Nagam.**

Localities: Tranquebar (from Rev. Mr. John), Bengal.

Current name: *Eryx johnii* (Russell, 1802). Identified by Gray (1849, incorrectly as pl. 26), Günther (1864), Boulenger (1890, 1893) and Smith (1943).

Remarks: This is the only species of snake actually validly described in either of Russell's volumes.

Boa Johnii Russell, 1802. *Indian Serp.* 2: 18, pl. XVI.

Type status: Based on a single specimen provided to Russell by C. S. John, which Smith (1943) referred to as "Russell's type specimen". Wallach *et al.* (2014) interpreted Smith's (1943) mention as a designation of a lectotype, however it appears that Smith considered this specimen, which has not been traced (Stimson 1969) as the holotype. The type locality is "Tranquebar, coast of Coromandel, India".

Tortrix eryx Schlegel, 1837. *Essai Physion. Serp.* 1: 14, pl. I, figs. 11, 12, 13.

Schlegel's description mentions Russell's pl. XVI and XVII. It also notes a series of specimens in Leiden and Paris that had been received from Pondichéry and specimens sent by Rüppel from Egypt. Other cited works include Hasselquist (1762), Geoffroy-Saint-Hilaire (1827) [= *Eryx thebaicus*], Olivier (1801, pl. 16, fig. 2A,B) [= *Boa turcica*]; Lichtenstein (1823) [= *Boa tatarica*], Schneider (1801), and Guérin-Méneville (1830) [= *Erix Bengalensis*]. Schlegel's concept of the species included taxa today assigned to *E. conicus*, *E. johnii*, *E. tatari-*

cus, E. colubrinus and *E. jaculus*, but Duméril & Bibron (1844) established the primary synonymy with the last of these species. A variety named by Schlegel within the species *T. eryx* as *Eryx Indicus* (i.e., *Tortrix eryx indicus*) has been specifically identified as a synonym of *E. johnii* (e.g., Duméril & Bibron 1844; McDiarmid *et al.* 1999), however, Schlegel explicitly assigns to this form only specimens from Bélanger collected in "Pondichéry". Thus, Russell's (1802) plates XVI and XVII are not part of the type series of *T. e. indicus*, but they are part of the original syntype series of *Tortrix eryx*. Stimson (1969) and McDiarmid *et al.* (1999) stated that the type locality for *T. eryx* was "Pondichéry", however, Article 72.4.1 (ICZN 1999) excludes these specimens from the type series.

No. XVII. *Boa*, p. 20, pl. XVII.

Scale counts: (193 V + 28 SC).

Name: Manedulli Pamboo.

Localities: none noted.

Current name: *Eryx johnii* (Russell, 1802). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1893) and Smith (1943).

Remarks: Plates XVII and XVIII appear on the same page of Russell (1802) and plate XVII has sometimes been referred to as plate XVII, figure 1 by subsequent authors. Russell recognised that XVI and XVII were specimens of the same species.

Tortrix eryx Schlegel, 1837.
Essai Physion. Serp. 1: 14,
pl. I, figs. 11, 12, 13.

Schlegel's description mentions Russell's pl. XVI and XVII. It also notes a series of specimens in Leiden and Paris that had been received from Pondichéry and specimens sent by Rüppel from Egypt. Other cited works include Hasselquist (1762), Geoffroy-Saint-Hilaire (1827) [= *Eryx thebaicus*], Olivier (1801, pl. 16, fig. 2A, B) [= *Boa turcica*]; Lichtenstein (1823) [= *Boa tatarica*], Schneider (1801), and Guérin-Méneville (1830) [= *Erix Bengalensis*]. Schlegel's concept of the species included taxa today assigned to *E. conicus, E. johnii, E. tataricus, E. colubrinus* and *E. jaculus*, but Duméril & Bibron (1844) established the primary synonymy with the last of these species. A variety named by Schlegel within the species *T. eryx* as *Eryx Indicus* (i.e., *Tortrix eryx indicus*) has been specifically identified as a synonym of *E. johnii* (e.g., Duméril & Bibron 1844; McDiarmid *et al.* 1999), however, Schlegel explicitly assigns to this form only specimens from Bélanger collected in "Pondichéry". Thus, Russell's (1802) plates XVI and XVII are not part of the type series of *T. e. indicus*, but they are part of the original syntype series of *Tortrix eryx*. Stimson (1969) and McDiarmid *et al.* (1999) stated that the type locality for *T. eryx* was "Pondichéry", however, Article 72.4.1 (ICZN 1999) excludes these specimens from the type series.

No. XVIII. *Coluber*, pp. 20-21, pl. XVIII.

Scale counts: (191 V + 136 SC).

Name: Sarey Pamboo.

Locality: Tranquebar (from Rev. Mr. John).

Current name: *Ptyas mucosa* (Linnaeus, 1766). Identified by Günther (1864), Boulenger (1890, 1893), but incorrectly noted as plate XXIII in Boulenger (1893). Previously identified as *Coryphodon blumenbachii* by Günther (1858).

Remarks: John (in Russell 1802) provided Russell with the head of a large specimen (6 feet) of this species which John considered to be the Jeri Potoo (see Russell 1809 [1810], No. XXXIV). Plates XVII and XVIII appear on the same page of Russell (1802).

Part 3 (1804) [pp. 21–28, pls. XIX–XXIV]

No. XIX. *Coluber*, pp. 22-23, pl. XIX.

Scale counts: (271 V + 24 SC).

Name: Ataligato Seba Thes. V. ii. Tab. 77, fig. 6. No vernacular names given.

Locality: Java (collected 1801).

Current name: *Calliophis intestinalis* (Laurenti, 1768). Identified by Günther (1858, 1864), Boulenger (1890, 1896) and Smith (1943).

No. XX. *Coluber*, pp. 23-24, pl. XX.

Scale counts: (164 V + 77 SC).

Name: Boodro Pam (Vizagapatam).

Localities: Vizagapatam, Java [sic] (collected 1801).

Current name: *Trimeresurus popeiorum* (M.A. Smith, 1937). Identified by Smith (1943). Previously identified as *Trimeresurus viridis*

by Gray (1849), as *T. erythrurus* by Günther (1864), and as *T. gramineus* by Boulenger (1890, 1896).

Remarks: Russell (1802) thought it likely that this species was "merely a variety of the Bodroo Pam, No. IX. of the Coromandel Collection [e.g., Russell 1796]". Current allocation to species was accepted by Wallach *et al.* (2014). However, there are dissenting opinions on the application of names (see Pope & Pope 1933; Hoge & Romano-Hoge [1978–1979] 1981). McDiarmid *et al.* (1999) reviewed the issues surrounding Russell's green vipers. Smith (1943) indicated that the original spelling of the epithet was the result of a clerical error and that "*popeorum*" was intented. However, the correction is an unjustified emendation and the original spelling should be maintained.

No. XXI. *Coluber*, pp. 24-25, pl. XXI.

Scale counts: (150 V + 51 SC).

Names: none given

Locality: Java.

Current name: *Calloselasma rhodostoma* (Kuhl, 1824). Identified by Günther (1890), Boulenger (1896) and Smith (1943).

No. XXII. *Coluber*, pp. 26-27, pl. XXII.

Scale counts: (151 V + 46 SC).

Names: none given.

Locality: India [no specific locality] (1802).

Current name: *Hypnale hypnale* (Merrem, 1820). Identified by Gray (1849), Boulenger (1890, 1896), Smith (1943), and Gloyd & Conant (1990). Identified by Günther (1864) as *H. nepa.*

Remarks: According to McDiarmid *et al.* (1999), Merrem's (1820) original description of *Cophias Hypnale* was based on Russell's (1804) plate XXII. However, Merrem (1820) cited only *Coluber Lebetinus*/*Vipera Lebetina* and the associated references — Linnaeus (1754, 1758), Forskål (1775), Latreille [Sonninni & Latreille] (1801), and Daudin (1803b) and makes no reference to Russell (1804). The original type locality was given as "Archipelago, Arabia, Aegypto". in the Latin text and "Levante" in the German text. Presumably "Archipelago" refers to the islands of the Aegean Sea and eastern Mediterranean, including Cyprus.

The association of Merrem's name with the Indian/Sri Lankan *Hypnale hypnale* is derived from the use of the name by Schlegel (1837a), who linked Merrem's name to this taxon, but without explicit justification. Believing Merrem's name to be assignable to the South Asian taxon, and accepting that no specimens from Merrem were extant, Maduwage *et al.* (2009) designated BNHM 2531.759, a 350 mm SVL female as the neotype. This specimen is also the lectotype of *Ancistrodon millardi* Wall, 1908 and by neotype selection, the type locality is now "Castle Rock in Karnataka State, India, 15°23'52"N, 74°19'56"E, alt. 620 m".

As it stands the designation of a neotype for *Cophias hypnale* Merrem, 1820 by Maduwage *et al.* (2009) is invalid as it relates to a different species than that actually specified by the original author (all indications by Merrem are to literature describing *Macrovipera lebetina* and his German and Latin descriptions could also be interpreted to apply to this species). However, there is a long-established and now universal usage of this name, currently as *Hypnale hypnale*, to refer to the South Asian taxon intended by Schlegel (see David & Ineich 1999; Wallach *et al.* 2014) and it would be highly disruptive to place it in the synonymy of *Macrovipera lebetina* (Linnaeus, 1758). It would thus be desirable, as per Art. 75.6 of the *Code* (1999) to petition the Commission to use its plenary powers to set aside the original types implied through Merrem's indication of earlier literature and to conserve the current usage of the name through the designation of a neotype, for which that specimen selected by Maduwage *et al.* (2009) would be suitable.

Russell's (1804) plate XXII was reproduced in Gloyd & Conant (1990).

No. XXIII. *Coluber*, pp. 27-28, pl. XXIII.

Scale counts: (210 V + 93 SC).

Names: none given.

Locality: Java.

Current name: *Boiga multomaculata* (F. Boie, 1827). Identified by Günther (1858, 1864), Boulenger (1890, 1896) and Smith (1943).

Remarks: The epithet *multomaculata* is frequently misspelled as *multimaculata.*

Dipsas multomaculata F. Boie, 1827.
Isis von Oken 20: column 549.

Type status: F. Boie's original description was based on specimens referenced in H. Boie's manuscript *Erpétologie de Java* (1823–1825) — RMNH 978–79 (collected H. Boie & H.C. Macklot, Dec. 1825–Sept. 1827) *fide* Wallach *et al.* (2014). In addition to these extant syntypes, Boie (1827) also referred the specimens illustrated by Russell (1804, pl. XXIII), Scheuchzer (1735, pl. 657, fig. 2), and Seba (1735, pl. 26, fig. and pl. 28, fig. 4), all of which also have syntype status. The illustration from Scheuchzer corresponds to specimen 534 in the Linck collection (Bauer & Wahlgren 2013), in which it was identified as *Coluber lacteus* (Linck 1783). The original watercolour on which Scheuchzer's plate was based has been reprinted in Linck & Linck (2014). The specimens figured by Seba are presumed lost, as is that illustrated by Russell (1804). The type locality of *B. multomaculata* is "Java" [Indonesia]. Reinwadrt was credited with authorship by Boie (1827).

No. XXIV. *Coluber*, pp. 28-29, pl. XXIV.

Scale counts: (209 V + 160 SC).

Names: Serpens viridis ore acuminato Aspidis species. Seba Thes. V. ii. Tab. 57, fig. 4, *Col. Nasutus*. Shaw Zool. V. iii. Part ii. P. 548). No Indian vernacular names given.

Locality: Java.

Current name: *Ahaetulla prasina* (F. Boie, 1827). Identified by Günther (1858, as *Dryiophis prasina* Var. *xanthozonia*), Boulenger (1890, 1896) and Smith (1943).

Remarks: The page break between parts 3 and 4 of Russell's second volume falls within the text of this species account.

Dryophis prasina F. Boie, 1827.
Isis von Oken 20: column 545.

Type status: F. Boie's original description (1827) is based on specimens referenced or illustrated in H. Boie's manuscript *Erpétologie de Java* (1823–1825), Seba's (1735) plate 53, figure 4, and Russell's (1804) plate 25. In addion to the indicated types from literature sources, Boie indicated that specimens were present in both the Paris and Leiden collections. Two of these syntypes have been identified as RMNH 782 and RMNH 47582 (formerly RMNH 782) collected by H. Boie & H.C. Macklot, Dec. 1825–Sept. 1827 *fide* Wallach *et al.* (2014). Cox *et al.* (2013) considered RMNH 779 as a syntype as well. The type locality of *Dryophis prasina* is "Java" [Indonesia]. Reinwadrt was credited with authorship by Boie (1827).

Part 4 (1807) [pp. 29–38, pls. XXV–XXXII]

No. XXV. *Coluber*, pp. 29-30, pl. XXV.

Scale counts: (186 V + 153 SC).

Names: Mancas (Guzerat), **Rooka** (Mahratta).

Localities: Bombay (from Dr. Scott), Guzerat, Mahratta.

Current name: *Dendrelaphis tristis* (Daudin, 1803). Identified by Boulenger (1894) and Smith (1943). Previously identified as *Dendrophis picta* by Günther (1858, 1860) and Boulenger (1890).

Remarks: Günther (1858), who included Russell's plates XXV and XXVI in the synonymy of *Dendrophis picta*, noted a bleached adult specimen from India "Presented by Dr. Russell. Named by Dr. Shaw as *C[oluber]. caerulescens*, but does not agree with his description" [note: Shaw did not use Russell's snake in naming this taxon, but rather subsequently referred this specimen to this species, presumably after the publication of his *General Zoology* (1802)]. This specimen is apparently today BMNH 1964.1518.

Leptophis Mancas Bell, 1825.
Zool. J. 2: 329.

Type status: Based on Russell (1807) plate 25, p. 29 (Mancas) and the Rooka (same source). The synonymy of this nominal taxon with *D. tristis* was proposed by Boulenger (1894). Van Rooijen & Vogel (2008) considered that *Leptophis mankas* [sic, *mancas*] (Bell, 1826) [sic, 1825] [note: Bell's paper was translated and published in French (1826) and German (1830); the spelling "*mancas*" is identical in all three versions] could not be unambiguously assigned to *D. tristis* or *D. schokari* (Kuhl, 1820) and subsequently suggested (Vogel & Van Rooijen 2011) that this nominal taxon might be valid, although no formal revalidation was provided. Bell gave the type locality as "Habitat in Indiâ orientali".

Dendrophis maniar F. Boie, 1827.
Isis von Oken 20: column 542.

Type status: Boie associated this name with Russell's (1807) plate XXV and the specimen figured, unlocated, is the holotype. Rooijen & Vogel (2008) and Vogel & Rooijen (2011) attributed this name to Boie (1827) and considered it a junior synonym of *D. mankas* [sic]. The type locality is "Bombay" [= Mumbai, Maharashtra, India].

No. XXVI. *Coluber*, pp. 30-31, pl. XXVI.

Scale counts: (176 V + 127 SC).

Name: Cumberi muken.

Locality: Tranquebar (from Mr. John).

Current name: *Dendrelaphis chairecacos* (Boie, 1827). Previously identified as *Dendrophis picta* by Günther (1858, 1864) and Boulenger (1890) and *D. tristis* by Boulenger (1894) and Smith (1943).

Dendrophis chairecacos Boie, 1827.
Isis von Oken 20: column 541.

Type status: Boie's description was based on Russell's (1807) plate XXVI and Rooijen & Vogel (2009) considered the animal depicted in Russell's plate XXVI to be the holotype of this taxon. The description by Russell was based on the specimen provided by John as well as two additional drawings, but only the plate was cited by Boie, so this interpretation is correct. Rooijen & Vogel (2009) considered the specimen lost and designated BMNH 1924.10.13.15 as a neotype. The data associated with the original holotype was "received from Mr. John of Tranquebar" although Rooijen & Vogel did not consider Tranquebar as the type locality. The neotype locality is "Kottayam, Travancore (South India)".

No. XXVII. *Anguis*, pp. 31-32, pl. XXVII.

Scale counts: (206 abdominal scales + 8 SC).

Name: ***Anguis Scytale*** Lin. Sys. Nat. p. 923. No vernacular names given.

Locality: Java.

Current name: *Cylindrophis ruffus* (Laurenti, 1768). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1893) and Smith (1943).

No. XXVIII. *Anguis*, pp. 32-33, pl. XXVIII.

Scale counts: (207 abdominal scales + 6 SC).

Name: Shilay Pamboo.

Locality: Tranquebar (presumably from Mr. John).

Current name: *Cylindrophis ruffus* (Laurenti, 1768). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1893) and Smith (1943).

No. XXIX. *Anguis*, pp. 33-34, pl. XXIX.

Scale counts: (194 V + 6 SC).

Name: ***Anguis Maculata***; Lin. Sys. Nat. 391. No vernacular names given.

Locality: India (without further data).

Current name: *Cylindrophis maculatus* (Linnaeus, 1758). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1893) and Smith (1943).

Remarks: Gray (1849) identified two discoloured adult specimens from Russell as BMNH IV.23.3.a, b, and these are still extant (P. Campbell, in litt. 9 June 2015).

No. XXX. *Coluber*, pp. 34-35, pl. XXX.

Scale counts: (220 V + 61 SC), (238 V + 61 SC).

Name: Chunalee.

Localities: Buchier (from Mr. Bruce via Bombay from Mr. Scott), Mahratta country.

Current name: *Spalerosophis diadema* (Schlegel, 1837). Identified by Boulenger (1890, 1893) and Smith (1943).

Coluber diadema Schlegel, 1837.
Essai Physion. Serp. 1: 146, 2: 148.

Type status: Schlegel's description is based solely on the two specimens described in Russell's (1807) account on pp. 34–35 and the illustration of the smaller of these on plate XXX. Wallach *et al.* (2014) designated the illustrated specimen as the lectotype. The original type locality was "environs de Bombay". However, as Wallach *et al.* (2014) noted, this was in error as the specimens were actually only forwarded to Russell from Bombay. Wallach *et al.* (2014), based on Russell (1807) restricted the type locality ot "Buchier, [= Bushehr, W Bushehr Prov., SW Iran, 28°59'N, 50°50'E, elevation NSL]".

No. XXXI. *Boa*, pp. 35-36, pl. XXXI.

Scale counts: (204 V + 44 SC).

Names: Seu Walalay, Brown Walalay.

Localities: Tranquebar (from Mr. John).

Current name: *Bungarus caeruleus* (Schneider, 1801). Identified by Smith (1943).

Remarks: Russell considered this a variety of the Gedi Paragoodoo (No. I, Coromandel Collection [e.g., Russell 1796]).

No. XXXII. *Coluber*, pp. 37-38, pl. XXXII.

Scale counts: (170 V + 54 SC).

Names: Serpens Ceilonica Bitin dicta, Seba, II. T. 94; Ulpera, Gron. Amph. No. XLII. P. 63; *Coluber Lachesis*, Shaw Zool. III. P. 2, 402. No vernacular Indian names given.

Localities: Bombay (1803, from Dr. Scott).

Current name: *Daboia russelii*: Identified by Gray (1849), Günther (1864), Boulenger (1890, 1896) and Smith (1943).

Part 5 (1809 [1810])
[pp. ix–xv, 39–53, pls. XXXIII–[45]

No. XXXIII. *Coluber*, p. 39, pl. XXXIII.

Scale counts: (168 V + 84 SC).

Names: none given.

Localities: Java.

Current name: *Homalopsis buccata* (Linnaeus, 1758). Identified by Gray (1849), Günther (1864), Boulenger (1890, 1896) and Smith (1943).

No. XXXIV. *Coluber*, pp. 39-40, pl. XXXIV.

Scale counts: (140 V + 42 SC).

Name: none given.

Locality: Java.

Current name: *Oligodon bitorquatus* Boie, 1827. Identified by Boulenger (1894) and by Günther (1858) as *O. subquadratus*.

No. XXXV. *Coluber*, pp. 35-36, pl. XXXV.

Scale counts: (144 V + 33 SC).

Name: none given.

Locality: Java.

Current name: *Ceratophallus vittatus* (Linnaeus, 1758). Identified by Günther (1858), Boulenger (1896) and Smith (1943).

No. XXXVI. *Coluber*, p. 41, pl. XXXVI.

Scale counts: (186 V + 64 SC).

Names: none given.

Localities: Java, XVII.

Current name: *Naja sputratrix* (Boie, 1827). Identified by Boulenger (1896) as *N. tripudians* and by Smith (1943) as *N. naja*.

Naja sputatrix F. Boie, 1827.
Isis von Oken 20: column 557.

Type status: Boie's original description was based on *Coluber castaneus* (Oppel. unpublished, based on specimens referenced in H. Boie's manuscript *Erpétologie de Java* (1823–1825), the *Elaps fuscus* of Merrem (1820) and plate XXXVI in Russell (1809 [1810]). Merrem's description, in turn, questioningly refers the specimen illustrated by Seba (1735) on plate 15, figure 1. Boie credited Reinwardt with authorship of the name. Wallach *et al.* (2014) considered the syntypes to include an unspecified animal in RMNH and the specimen described and illustrated by Russell (1809 [1810]), which has not been located. Boie's type locality is "Java" [Indonesia].

No. XXXVII. *Coluber*, p. 41, pl. XXXVII.

Scale counts: (194 V + 66 SC).

Names: none given.

Localities: Java, XIII.

Current name: *Lycodon capucinus* H. Boie *in* F. Boie, 1827. Identified by Günther (1858) as *Lycodon aulicus* Var. D. *Lycodon capucinus* and by Boulenger (1893) and Smith (1943) as *L. aulicus*. Recognised as a full species by Taylor & Elbel (1958).

Lycodon capucinus H. Boie
in F. Boie, 1827.
Isis von Oken 20: column 551.

Type status: Original description based on specimens referenced in H. Boie's manuscript *Erpétologie de Java* (1823–1825) and Russell's (1809 [1810]) plate XXXVII. The original syntypes included one or more specimens seen by Boie, presumably in Leiden, and Russell's specimen. Wallach *et al.* (2014) selected the specimen illustrated by Russell, which has not been located, as the lectotype. The published description gave no explicit type locality, although by implication from the reference to *Erpétologie de Java* and to Russell's plate, "Java" is implied, and via lectotype designation Wallach *et al.* (2014) gave "Java [W Indonesia]" as the type locality. The type locality was erroneously

listed as "Trivandrum, India" by Taylor & Elbel (1958).

No. XXXVIII. *Coluber*, p. 42, pl. XXXVIII.

Scale counts: (170 V + 52 SC).

Names: None given.

Locality: Java, XIV.

Current name: *Oligodon octolineatus* (Schneider, 1801). Identified by Günther (1858), Boulenger (1890, 1894) and Smith (1943).

No. XXXIX. *Coluber*, pp. 42-43, pl. XXXIX.

Scale counts: (202 V + 68 SC).

Names: None given.

Locality: India, I.

Current name: *Lycodon aulicus* (Linnaeus, 1758). Identified by Günther (1858), Boulenger (1890, 1894) and Smith (1943).

Lycodon unicolor F. Boie, 1827.
Isis von Oken 20: column 551.

Type status: The original description is based on unspecified specimen(s) referenced in H. Boie's manuscript *Erpétologie de Java* (1823–1825) and presumably in Leiden if still extant, and Russell's (1809 [1810]) plate 39. The type locality is "India".

No. XL. *Coluber*, p. 43, pl. XL.

Scale counts: (151 V + 46 SC).

Names: None given.

Locality: India, II.

Current name: *Cerberus rynchops* (Schneider, 1799). Identified by Günther (1864), Boulenger (1890, 1896) and Smith (1943, although not listed in his "Note on Russell's 'Indian Serpents'").

No. XLI. *Coluber*, p. 44, pl. XLI.

Scale counts: (217 V + 76), (215 V + 78 SC).

Names: none given.

Locality: Java, XVI.

Current name: *Lycodon subcinctus* F. Boie, 1827. Identified by Günther (1858), Boulenger (1894) and Smith (1943).

Lycodon subcinctus F. Boie, 1827.
Isis von Oken 20: column 551.

Type status: Boie's original description was based on unspecified specimen(s) referenced in H. Boie's manuscript *Erpétologie de Java* (1823–1825) and presumably in Leiden, if still extant, Seba (1734) plate CIX, figure 7 and Russell's (1809 [1810]) plate XLI. Wallach *et al.* (2014) designated Russell's specimen as the lectotype. Based on this selection, these authors provide the type locality "Java [W Indonesia] ".

No. XLII. *Coluber*, pp. 44-45, pl. XLII.

Scale counts: (238 V + 95 SC).

Names: none given.

Locality: Java, XVI.

Current name: *Coelognathus radiatus* (F. Boie, 1827). Identified by Günther (1858, 1864), Boulenger (1890, 1894) and Smith (1943).

Coluber radiatus F. Boie, 1827.
Isis von Oken 20: column 536.

Type status: Boie's original description was based on syntypes including specimens referenced in H. Boie's manuscript *Erpétologie de Java* (1823–1825) and the specimen illustrated on plate XLII of Russell (1809 [1810]). The published description gave no explicit type locality, although by implication from the reference to *Erpétologie de Java* and to Russell (1809 [1810]), "Java" is implied. Accrding to Pope (1935) the original type locality, based on the syntype data was "Java, Sumatra and Cochin-China", which he restricted to "Java". According to Wallach *et al.* (2014) the Javan syntype specimens in Leiden are: RMNH 432, RMNH 433, RMNH 47573 (formerly RMNH 432), and RMNH 47574 (formerly RMNH 432), collected by H. Boie and H.C. Macklot, Dec. 1825–Sept. 1827. These authors did not mention Russell's specimen, which has not been located, in the type series, although it is also a syntype. Kramer (1977) erroneously referred to a single holotype when discussing this species.

Additional specimens from the collection of Patrick Russell

The extent of Patrick Russell's collection of snakes is unknown. Based on his own writings it is clear that not every snake he encountered was preserved and it is probable that not every specimen he did preserve was ultimately saved and returned to England. It is also clear that many of the snakes in his collection were not collected by Russell himself, but were sent to him from across India, both while he himself was living

there, and after his return to England. His collection of Indian serpents was deemed "considerable" and it can be assumed that a significant part of it was still in Russell's possession at the time of his demise as he was still actively working on the installments to the second volume of his *Indian Serpents*. However, the snakes of the Coramandel Coast, which had been treated in the earlier volumr (1796) may have already been scattered by this time. At least one snake, the type of *Coluber melanurus* Shaw, 1802, was sent by Russell to the British Museum even before the publication of the first volume. Others may have gone to the Museum of the Royal College of Surgeons, the Museum at the Company's India House in London, or to the Company's Museum in Madras.

Following his death in 1805, Russell left his remaining snake collection to the East India Company's Museum at India House, in London (Bhaumik 2012). In 1819 the Directors of the Company presented to the Royal College of Surgeons a part of Patrick Russell's collection of snakes. Fourty years later, 29 or possibly 30 of these specimens were present in the Museum of the Royal College ([Royal College of Surgeons] 1859) (Table 3). These are clearly identified in the Royal College catalogue of natural history specimens. The questionable 30th specimen is RCSM 604, "the Typhlinale", listed as a lizard in the Royal College catalogue. This name is associated with a Southeast Asian typhlopid, *Ramphotyphlops lineatus*, although the specimen's true identity is unknown as the specimen was supposedly from India. It is the only reptile noted as presented by the Directors of the East India Company in 1819 that is not also flagged as having come from Russell's collection. This is likely an oversight, as the compilers of the catalogue did not regard the specimen as a snake, following the classification then current (e.g., Gray 1845).

According to Günther (1864) by 1860, all of Russell's surviving material was either in the British Museum (which received the remaining reptiles from the East India Company collection that year) or in the Royal College of Surgeons. The fate of at least one of the Royal College specimens (No. 523) is known, as it was re-discovered by Wall (1909), who recognised it as the type of *Hydrophis schistosus* (see above), and eventually transferred to the British Museum. Most of the other specimens are untraced. Some could be additional Russell types, but this is impossible to know without comparison to the published plates and and descriptions. The localities ("Hab.[itat]") listed in the Museum's catalogue are not necessarily those associated with the specimens themselves, but rather places from which the species has been recorded, so the match with Russell's published works is not evidence that they are the figured specimens. The Museum of the Royal College of Surgeons (the Hunterian Museum) lost a large portion of its collections in association with bomb damage during World War II. It is not known if any of Russell's snakes were still present at the time of the war, or if any survived.

The British Museum clearly had at least some Russell material at the time of Shaw, although Shaw (1802) apparently knew Russell's snakes chiefly through Russell's book (1796). By the time of Gray (1849), there were already a reasonable number of Russell's specimens in the collection. In addition to those nine noted above and listed in Table 2, there are at least 13 additional specimens in The Natural History Museum, London that certainly or probably derive from Russell's collection (Table 4). Among these, four have type status. BMNH II.1.1.a is the lectotype of *Coluber russelii* (see account of Russell 1796, No.VII above) which was figured by Shaw & Nodder (1797). The other three specimens, each a holotype of a nominal species level taxon, are:

Hydrophis caerulescens (Shaw, 1802).

Hydrus Caerulescens Shaw, 1802.
Gen. Zool., Amph. 3(2): 561.

Type status: Shaw (1802) mentioned that his description was based on a preserved specimen in the British Museum. This specimen was not noted as being derived from Patrick Russell's collection by either Shaw (1802) or Gray (1849), who identified the type as BMNH III.6.13.a ("Indian Ocean"), as did Smith (1926). Boulenger (1896), however, listed BMNH III.6.13.b as the type of *H. caerulescens* and gave the locality as Vizagapatam and the donor as Patrick Russell. Wall (1921), likewise stated that the type had been collected by Russell, but did not

Table 3. Specimens of snakes from Patrick Russell's collection that were present in the collection of the Royal College of Surgeons Museum (RCSM) in 1859 according to [Royal College of Surgeons] (1859) presented by the Directors of the Honourable East India Company in 1819. The original orthography is used for the catalogue names. Current names assume that the specimens are correctly associated with the plates indicated.

RCSM no.	Catalogue Name(s)	Vol: Plate	Hab.	Current Name
485 (3 spec.)	*Coluber Wannah*, Cogli; *Coluiber stolatus*	i: 11	Samul Cottah	*Amphiesma stolatum*
486	*Coluber Tar Tutta*	i: 15	Vizagapatam	*Boiga trigonata*
487	*Coluber Kallah Jin*	ii: 2	India	*Chrysopelea ornata*
488	*Coluber*	ii: 23	Java	*Boiga multomaculta*
489	*Coluber Chunalee*	ii: 30	Mahratta country	*Spalerosophis diadema*
490	*Coluber*	ii: 34	Java	*Oligodon bitorquatus*
491	*Coluber*	ii: 35	Java	*Ceratophallus vittatus*
492 (2 spec.)	*Coluber*	ii: 33	Java	*Homalopsis buccata*
493	*Coluber naja*	ii.36	Java	*Naja sputratrix*
494	*Coluber*	ii: 37	Java	*Lycodon capucinus*
495	*Coluber*	ii: 38	Java	*Oligodon octolineatus*
496	*Coluber*	ii: 39	India	*Lycodon aulicus*
497	*Coluber*	ii: 40	India	*Cerberus rynchops*
498	*Coluber*	ii: 40	Java	*Cerberus rynchops*
499	*Coluber*	ii: 41	Java	*Lycodon subcinctus*
510	Boa Gedi Paragoodoo, Pakta Poola	i: 1	Masulipatam and Boni	*Bungarus caeruleus*
511	Boa Buorgarum [sic] Pamah, Sackeenee	i: 3	Mansoor Cottah	*Bungarus fasciatus*
515	*Pelamis bicolor*; *Hydrus bicolor*	[i: 41]	Indian Seas	*Hydrophis platurus*
516	Hydrus Shiddul	ii: 12	Tranquebar	*Hydrophis jerdonii*
522	Hydrus Kerril Pattee	ii: 6	Tranquebar	*Hydrophis nigrocinctus*
523	Hydrus Hoogli Pattee	ii: 10	Tranquebar	*Hydrophis schistosus*
524	Hydrus Shootur Sun (*Anguis laticauda*)	ii: 7	Coromandel Coast	*Hydrophis obscurus*
525	Hydrus Chittul	ii: 9	Tranquebar	*Hydrophis cyanocinctus*
526	Hydrus Kalla Shootur Sun (*Anguis laticauda*)	ii: 8	Tranquebar	*Hydrophis obscurus*
527	Hydrus Valakadyen	ii: 11	Tranquebar	*Hydrophis schistosus*
528	Hydrus Shiddil	ii: 12	Tranquebar	*Hydrophis schistisus*
604	The Typhlinale (*Typhlinalis lineata*, Gray)		India	*Ramphotyphlops lineatus*

cite a specimen number. Cogger *et al.* (1983) reported that the current number of the specimen was BMNH 1946.1.3.90 and that the specimen label indicated "Indian Ocean : Vizagapatam". Wallach *et al.* (2014) indicated that this number corresponded to BMNH III.6.13.a. It is unclear how workers before Boulenger (1896) failed to note the connection between the type and Patrick Russell, or if Boulenger was mistaken and the existing label postdates his identification of the type as a Russell specimen.The published type locality is "East-India" but assuming Boulenger's correct identification of the type, this can be restricted to "Vizagapatam".

Hydrophis spiralis (Shaw, 1802).

Hydrophis spiralis Shaw, 1802.
Gen. Zool., Amph. 3(2): 564, pl. 125.

Type status: Gray (1849) noted that BMNH III.6.10.a (now 1946.1.6.94) from "Indian Ocean?" in spirits, but dried, had been presented by Russell and had been "described and figured by Dr. Shaw" as the type of *H. spiralis*. Shaw

himself (1802) stated that the "specimen was in the British Museum, but that its particular history was unknown". Smith (1926) noted that the type of *H. spiralis* was listed as III.6.10.c contradicting Gray (1849), but described the specimen as a shriveled juvenile, which is consistent with Gray's statement of the state of the specimen. Thus the identity of the type specimen is not in doubt, but its association to Russell is (see also Russell 1802, No. XII above).

Gryptotyphlops acutus
(Duméril & Bibron, 1844).

Typhlops Russellii Gray, 1845.
Cat. Liz. Brit. Mus.: 132.

Type status: This species is based on a single holotype specimen listed by Gray (1845) as XIX.1.1.a. and now accessioned as BMNH 1946.1.11.70. The type locality is "India" and the specimen was "Presented by Dr. Patrick Russell". This species is not figured or described by Russell.

In addition to the spirit-preserved material from Patrick Russell's collection, there are two large collections of dried snake skins, which entered the collection of the British Museum in 1837 and 1904. Their history is discussed by Patrick Campbell (this issue) and their specific identity is discussed by Bauer *et al.* (this issue) and they will not be discussed further here.

Discussion

Regardless of the actual origin of the dried skin specimens accessioned into the British Museum in 1837 and 1904, it is clear that at least original fluid preserved specimens from Patrick Russell are present in the Natural History Museum, London today. At least 21 such specimens are present, eight of which are identifiable as the specimens illustrated by Russell (Tables 2, 4) and 12 of which are type specimens. If Vogel & David (2012) are correct in their interpretation of 1904.7.27.32, a dried skin, as the type of *Hydrus piscator*, this would add another specimen to each of these tallies. All of these specimens are a minimum of 210 years old, and those associated with Russell's first volume are at least another decade older. Such specimens are among the oldest reptiles in the Natural History Museum for which clear evidence of the date of collection exists. While the survival of specimens of this age is noteworthy, it is by no means unique. For example, fluid preserved snakes perhaps as much as a century older survive in Waldenburg, Germany (Bauer & Wahlgren 2013) and dried material in the form of mounted skins exists from two centuries earlier in the Aldrovandi collection in Bologna, Italy (Bauer *et al.* 2013). What makes the Russell material so special is that they can be linked via *Indian Serpents* to specific localities and even to particular dates of collection. For example, BMNH 1946.1.17.86, the holotype of *Coluber melanurus*, was collected by Russell himself in June of 1788 in the plains near Nerva.

What is truly remarkable about Russell's legacy is not, however, the specimens that survived, but rather the impact that his descriptions and illustrations have had on systematic herpetology. Because Patrick Russel was among the first to study Indian snakes in a way that might be considered systematic or "scientific" his descriptions and often quite accurate illustrations became the basis for early 19th century knowledge of these animals. Although he himself named only one species, *Boa johnii* [= *Eryx johnii*], his material, mostly through his published plates, served as the types for many species described by others (Adler 1989; Das 2004). Of the 87 reptiles figured by Russell, 61 served as types for one or more nominal species. Aside from Russell himself, his specimens or their illustratons were described by 18 authors or combinations of authors over a period of 57 years. In all, Russell's material served as the types of approximately 106 nominal taxa (the number varies slightly depending upon the interpretation of several *nomina nova* and *nomina nuda*), of which 39 are currently considered valid today.

Shaw & Nodder (1797) were the first to make use of Russell's material, followed closely by Schneider (1799, 1801, 1802 in Bechstein), Sonninni & Latreille (1801), Bechstein (1802), and Daudin (1803a, b, c). Daudin was the most prolific of these authors, describing 35 new species solely or partly on the basis of Russell's snakes, followed by Schneider, with 18 species and Shaw with 13. None of these authors had tropical field experience themselves and their reliance on Russell was evident in the extent

to which he was quoted. Species descriptions in Shaw (1802) and Daudin (1803a, b, c), in particular, were commonly lifted directly from Russell, complete with his comments about venom and local beliefs. In numerous cases several authors described the same specimens independently under different names. This was the result of both the proximity in time of these authors (some were not aware of the publications of others before their own books went to press), and the lack of a strict application of the concepts of priority and typification (new species were described for taxa that included in their scope previously named taxa). Subsequent usages of Russell's material included those by authors dealing with particular groups (e.g., Rafinesque-Schmaltz 1817; Bell 1825; Heinrich Boie 1826; Fitzinger 1827), but especially those who drew from Russell in the context of their more inclusive treatment of snakes on a regional (Jerdon 1854) or global level (Merrem 1820; Friedrich Boie 1827; Schinz 1833; Schlegel 1837a, b; Duméril *et al.* 1854).

Identifying the type material for some of these many names is no simple matter. This stems in part from the lack of clarity of many early authors as to which specimens actually constituted the basis for their descriptions. Specimens were rarely cited by specimen number, making identification more of a search for the plausible (what specimens were of the right age and provenance in a collection to be a potential type). In the case of Russell, this is less of an issue, as nearly all authors referred specifically to one of Russell's plates, thus the animal illustrated was unambiguously a type. However, some authors cited only the illustration and others cited the text as well, which may have been based on more than one specimen (see accounts in the main body of this paper).

A second problem arises from the work of more recent authors, who have frequently referred to types, holotypes, or lectotypes, without having carefully reviewed the relevant original sources. Paradoxically, in an age of unprecedented availability of systematic literature through sources such as Biodiversity Heritage Library http://www.biodiversitylibrary.org/) and AnimalBase (http://www.animalbase.org/), it appears ever more rare that authors actually check original descriptions. It is thus highly likely that incorrect interpretations, once established in the recent literature, will rarely be corrected. In the accounts above I have attempted to identify cases in which authors may have incorrectly interpreted the status of particular types or may have inappropriately applied names based on such misinterpretations. In some cases there is real ambiguity in how certain data may be interpreted.

Because Russell's name is known to most herpetologists only through a species he collected but did not himself describe, *Daboia russelii*, his contribution to Indian herpetology (and that of Java as well) is often under-appreciated. However, the ripple-effects of his contributions through the taxonomy of the half century that followed his death and thence down to the present certainly justify his place as the father of Indian herpetology. More than two centuries after the publication of the last part of Russell's (1801–1809 [1810]), *A Continuation of an Account of Indian Serpents* there may yet be more discoveries to come from Patrick Russell as the snake skin collections attributed to him are studied in detail for the first time (Campbell, this issue).

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The acquisition of Dr. Patrick Russell's snakeskin collections

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ABSTRACT.– Dr. Patrick Russell, M.D., F.R.S. (Medical Doctor and Fellow of the Royal Society) spent a considerable amount of his time in India as an ophiologist. He was particularly concerned with the snakebite epidemic and the devastating effect it had on the local community in the Coromandel, such that he devoted much of his time to describing and conducting experiments with the local snake fauna. He documented the habits and behaviours of several snakes in an attempt to try and educate the local inhabitants in respect of their being able to tell the difference between the venomous and non-venomous snakes in order to avoid being bitten. The Natural History Museum is the repository of two major collections of dried, flattened snakeskins prepared by Russell. These were accessioned in 1837 and 1904. The circumstances of the acquisition of these collections are here reviewed. An original set of snake plates associated with Russell's books was nearly purchased by the Natural History Museum in 1977.

KEYWORDS.– Patrick Russell, snakeskins, history, acquisition, register, catalogue.

Introduction

Patrick Russell was one of seven boys; his half-brothers John, William, Alexander, David, Claud and Balfour were all sons of John Russell, Esq. of Braidshaw and Mary (John's third wife) daughter of the Reverend Mr. Anderson. Russell died in London on 2 July 1805 following a three day illness. After his death he was interred on 6th July, in the Marylebone burial ground in London, with only a few of his close friends in attendance. Sir Hugh Inglis, Bart and Josias Dupree Porcher, Esq. along with his brother Claud, were each given the privilege of being his executors (Anonymous 1809 [1810]). Fluid preserved specimens were donated to the Natural History Museum (then British Museum) during Russell's lifetime or upon his death and these specimens are dealt with extensively by Aaron Bauer (this issue). After his death the Natural History Museum also received two major collections of Russell snakeskins, the documented history of these purchases are dealt with here.

Materials and Methods

British Museum (Natural History) Accession Register entries for 1837 and 1904, the years of receipt of Russell's snakeskin collections, were carefully examined. The skins themselves were examined in light of various archival documents, catalogues and museum publications including the herpetological section of the *History of the Collections* (Boulenger 1906). These were all scrutinised for statements referring to the skins allowing for the gathering of facts helping to complete the story of their arrival at the British Museum (Natural History).

Results and Discussion

The First Major Acquisition in 1837.– The first major collection of a set of dried, flattened skins was purchased by the museum in 1837, long after Russell's death, from 'Mr. Sotherby' (assumed to be affiliated with Sotheby's, the auctioneers). It was an unusual acquisition — herpetology specimens prepared on herbarium sheets, the first of its kind for the museum. In 1753, when

Alexander Russell left Aleppo for London, his brother Patrick succeeded him as physician to the British factory. Working there for 18 years, he gradually developed a keen interest in the local flora and fauna and paid due attention to the description of both plants and animals (Bhaumik 2012). Although we have no direct information, it is not hard to imagine how Russell may have adapted the technique of preparing herbarium sheets to the preservation of snakes.

Nevertheless, specimens fixed to herbarium sheets are difficult to work with and examine using a microscope, plus certain morphological characters are either obscured or missing. However, dried tissue attached to skins may be suitable for molecular analysis and thus give these specimens real advantage over specimens fixed in formalin prior to being preserved in spirit, or even alcohol-fixed material (as Russell's wet specimens would have been). Fish collections also have a history of being prepared in this manner. Unfortunately, Russell's method for preparing these sheets was not documented. Internal organs and skulls appear to have been removed prior to being mounted. Some skeletal elements may also have been preserved with the skin, radiography should be able to reveal to what extent.

The skins were subsequently accessioned in the British Museum (Natural History) register for 1837 (Fig. 1). A total of 71 specimens were entered as having been "Purchased of Mr. Sotherby". Accessions Registers recorded new material entering the museum collection chronologically as were received or identified. Formal registration in the British Museum commenced in 1837 (Wheeler 1996), hence, the 1837 skins were entered into the first Accessions Register of the department of Zoology (Zoology Accessions). The Accessions Registers were in use from 1837 to 2008 in the Reptile and Amphibian section, although the phasing out of this process began much earlier in other sections (mid-1990s) as electronic databases emerged. John Edward Gray, Assistant Keeper of Zoology, was responsible for entering all zoological material in the 1837 register including the skins. Registers are important because, in the event that specimens or lost or destroyed, being subject to decay and insect damage, a record of donors, contents and importance of a collection can be reconstructed. This is especially so in cases in which the early material is now apparently missing or no longer identifiable to its source from the foundation of the museum in 1753 (Wheeler 1996).

The registration numbers in the Herpetology Section of the British Museum (Natural History) before 1960 were created as follows; the year in which the entry is made, the month, the day and specimen number assignment, or range of numbers accounting for the number of specimens within this particular lot. The register numbers created for the skins in the register were then each cross referenced, hand-written in pencil, on the pages to which the skins were glued (Fig. 2). The 1837 collection of skins was recognized as being so important that the sheets were bound in their own volume and stored along with Russell's 1796 publication *An Account of Indian Serpents* (Russell 1796) in the British Museum (Natural History) Library Special Collections Room. This bound volume of snakeskins was simply referenced by the British Museum (Natural History) Library as *Indian Serpents Patrick Russell (178?)*. It must have been hoped that this arrangement would encourage future research further exploring the link be-

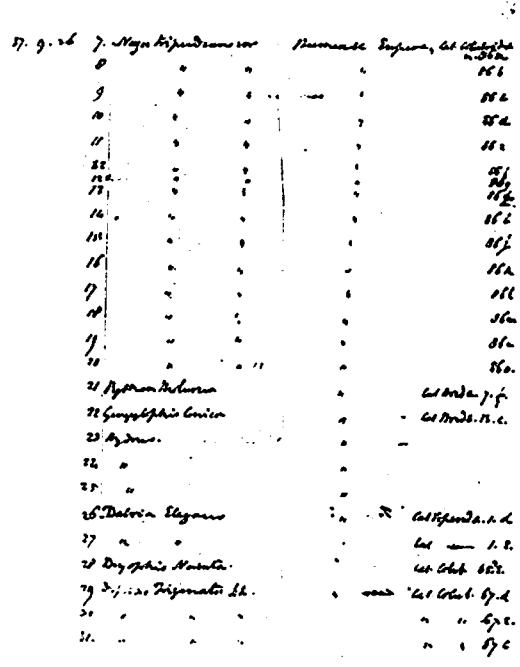

Figure 1. General zoology register of the British Museum (Natural History) from 1837 showing entries for Russell's registered snakeskins 1837.9.26.7–31.

tween the skins and Russell's descriptions and figures in his publication, given the knowledge that these skins were prepared by him. This was an important step in understanding and examining Russell's legacy. The East India Company by which Russell was employed recruited Indian artists as assistants to naturalists on special duty to complete the drawings for his 1796 publication and Russell himself referred to Indian artists who worked for him (Archer 1962). The obvious next step was to examine each skin with illustrations and descriptions in his publication in order to confirm identifications and potential type status. This work has been undertaken by Bauer (this issue).

Boulenger's (1906) 'Chronological account of all the Principal Accessions to the Collection or Reptiles and Batrachians' in *History of the Collections in the Natural History Departments of the British Museum* begins with the statement: "Prior to 1840 the following important collections were in the possession of the British Museum :— The collection of Reptiles made by Dr. Patrick Russell, containing the types of species described by him in his book, "Indian Serpents," published in 1796".

Here we have documented evidence of an acknowledgement of the possible type status of Russell's collections. However, this statement does not specifically mention whether these were wet preserved specimens or skins. It does, however, show a clear link between his collections in general and descriptions accompanied by figures in his book published in 1796. The type status of Russell's wet collections and skins are dealt with in greater detail by Bauer (this issue).

Writing the introduction to an early catalogue, *Specimens of Snakes in the British Museum*, 57 years earlier, in 1849, John Edward Gray (1800–1875) wrote the following "specimens presented by Sir Joseph Banks, Bart., Capt. White, Patrick Russell, M.D., and J. Weeks, Esq., may be regarded as the types of the species described by Dr. G. Shaw, in the *General Zoology* or *Zoological Miscellany*". Gray (1849) referenced Russell's *Indian Serpents* (1796, 1801–1809[1810]) frequently and certainly noted many of Russell's fluid-preserved specimens. However, he made specific references to the skins contained in the bound volume '*Indian Serpents, Patrick Russell (178?)*'.

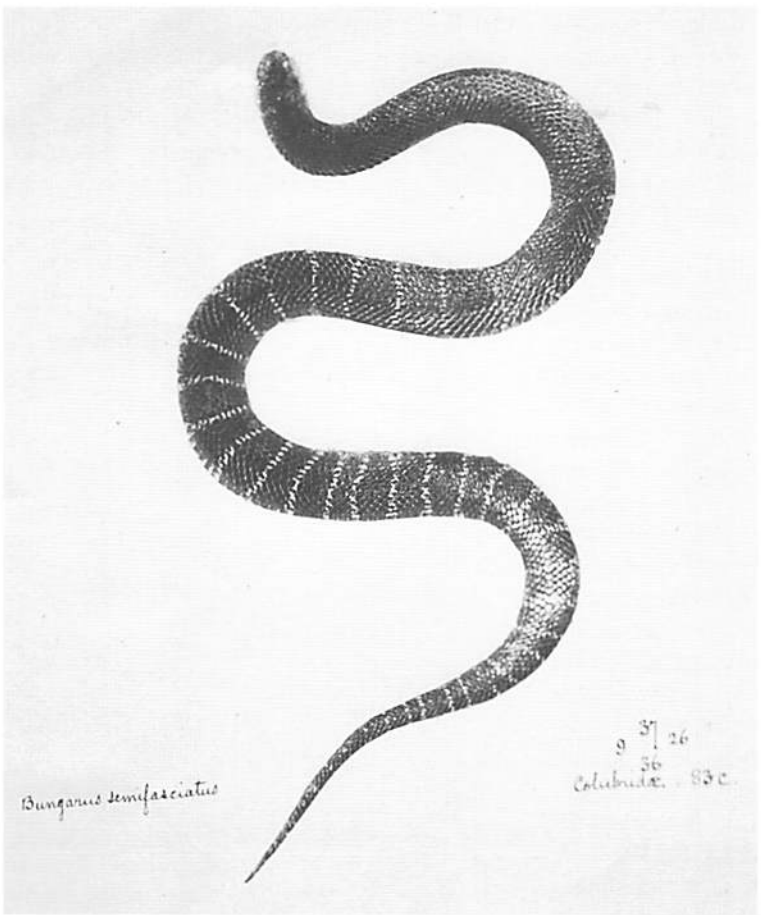

Figure 2. Page from Russell (Patrick). [1727-1805] *"Indian Serpents"* (book of 1837 mounted snakeskins) showing a specimen of *Bungarus semifaciatus* with accession number 37.9.26.36. and the notation "Colubridae 83c".

The second major acquisition 1904.– Many years later, an additional collection of snakeskins prepared by Patrick Rus-

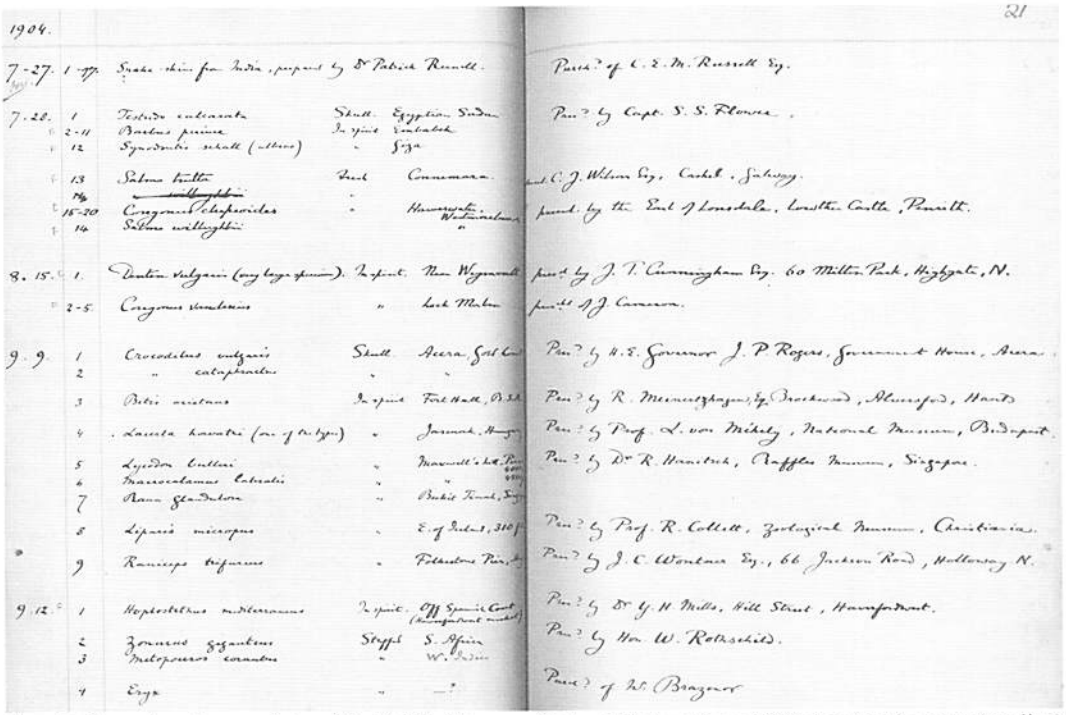

Figure 3. General zoology register of the British Museum (Natural History) from 1904 showing the entry (top line) on 27 July of snake skins from India, prepared by Dr. Patrick Russell and purchased of C.E.M. Russell Esq.

sell were presented to the British Museum (Natural History). George Albert Boulenger, F.R.S., a Belgian-British zoologist and museum curator, purchased the collection from a person by the name of C.E.M. Russell. On arrival, the 97 dried snakeskins were registered as one lot by Boulenger as follows: '1904.7.27.1-97 Snakeskins from India, prepared by Patrick Russell, purch? of C.E.M. Russell Esq.' The Russell snakeskins of 1904 were accessioned on 27 July 1904 (Fig. 3) following the museum code explained earlier of year, month, day, range. They were then placed in a large box and stored in the collection. This is in contrast to the 1837 collection which was all carefully and individually accessioned in the register with the numbers written on the sheets to which the snakes were glued and subsequently bound in their own volume. It appears that this collection was not immediately treated with as much care and attention as the previous.

There is no reason to believe that because of this, they were seen as less important than the first, although this is the impression seemingly given from the register entry and choice of storage. The skins were prepared by Russell as the entry clearly states, and there are stark similarities in the method of preparation and handwriting linking them to the 1837 purchase. There is also a continuation of the use of local names and the person who presented the collection has the Russell name. The imprecise register entry may have been due to Boulenger's other pressing demands at the time and the absence of scientific names. He undoubtedly saw this collection as a 'work in progress' and set about confirming identifications himself although he never quite finished the work (Smith 1943). Boulenger's subsequent non-inclusion of the collection of Russell snakeskins in his later catalogues serves to further confirm the 'work in progress' nature of this collection, confirmed identifications would have been required for their proper cataloguing. However, Malcolm Smith continued this work later and compiled a list of some of his scientific identifications of the plates in Russell's two volumes (1796, 1801–1809 [1810]) of *Indian Serpents* at the end of his own work *The Fauna of British India* (1943). It is clear, having carried out this work in the British Museum (Natural History) (Smith, 1943) that he examined the 1904 skins as well as the plates

because his hand-written lists of identifications have been kept with the skins in the collection.

Boulenger (1906) noted the acquisition of the second collection in the *History of the Collections*: "A collection of skins of Indian Snakes, prepared over a century ago by Dr. Patrick Russell, including the original examples described by this pioneer in Indian Herpetology, was purchased". This particular collection of skins was singled out as one of the highlight accessions of 1904 despite its one line entry in the register. Boulenger believed that they were prepared by Russell around 1804, most likely around the same period as the 1837 skins, linking the two collections. There is a general similarity in the preparation; however, instead of fixing one specimen to one sheet as was the case in the 1837 collection, Russell decided to fix numerous skins to a single sheet in the 1904 collection (Fig. 4).

The reason for the 67 year delay between these two major presentations is uncertain, but these records highlight the museum's persistence in acquiring such important collections when they have become available even for a price. It is not unusual for museums to be offered material years or even decades beyond their collection dates as they are often kept and cherished by family members until either the interest in the collection by descendants wane or the decision to make them more widely available to the scientific community at large is made. The practice is still prevalent today and museums are often offered material which have been 'in the family' for a very long time.

The register lists the item as 'Purcd?' (purchased) confirming that they were actually purchased by the museum (also confirmed by the statement above from *History of the Collections*). Unfortunately, the register does not include an address for C.E.M. Russell or any other details relating to this person's actual relationship to Patrick Russell. A recent, careful search of the museum archives likewise failed to reveal any correspondence from C.E.M Russell or Patrick Russell relating to any particular purchases of skins. However, over the years it has generally been assumed that C.E.M. Russell was a relative of Patrick Russell. A recent online search has revealed a book written by a Charles

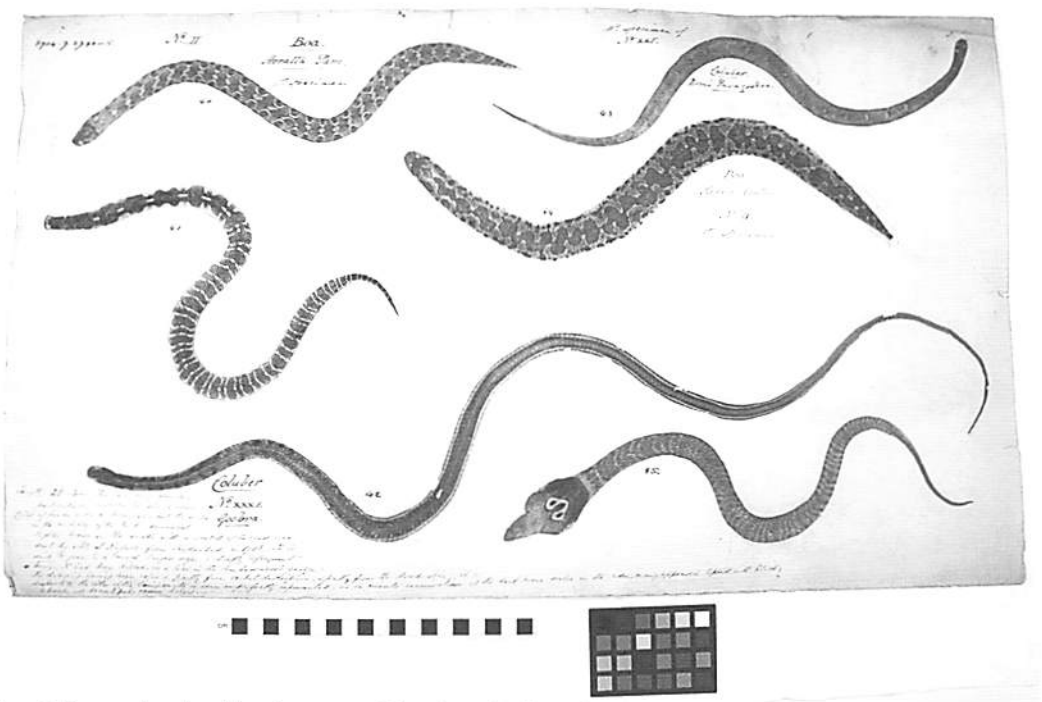

Figure 4. Prepared snake skins from one of the sheets in the collection of snakes skins from Patrick Russell received by the British Museum (Natural History) in 1904. Top row: *Echis carinatus*, *Lycodon aulicus*. Middle row: *Bungarus caeruleus*, *Eryx conicus*. Bottom Row: *Dendrelaphis tristis*, *Naja naja*.

Edward Mackintosh Russell in 1900 called *Bullet and Shot in Indian Forest, Plain and Hill. With Hints to Beginners in Indian Shooting.* Given the similar timeframe of the release of his book and the presentation of the 1904 skins, it is very likely that this is the same C.E.M. Russell. Interestingly, there is a chapter on the skinning and preservation of trophies. Charles Edward Mackintosh Russell first went to India in 1876 (Russell, 1900), remaining there for five years before being offered a position in the Forest Department of Mysore State. He held this position for four years from 1882–1886. He then left Mysore to study at the bar in Madura (South India). The book not only explores Indian shooting but also contains brief descriptions of the principal game animals of that country. Unfortunately, there is no clear reference to how he might be related to Patrick Russell in the book either.

Wet preserved specimens.– The wet preserved specimens held by the Natural History museum donated by Patrick Russell include snakes, as already mentioned previously, in particular those received from India after he returned home. Many were first deposited in the Honourable East India Company's Museum at India House in Leadenhall Street in London. In 1847 the East India Company was abolished and its property transferred to the Crown, but storage became an issue due to overcrowding and the museum was finally demolished in 1861. The natural history collections were dispersed, with the British Museum receiving a great number of mammals, birds, reptiles and insects (Archer 1962). Indeed, "the entire collection of the East India Company, containing many types of species described by Dr. Cantor, was presented [to the British Museum (Natural History)] in 1860" (Boulenger 1906: 530). Russell's wet specimens are mentioned in Günther's (1858) *Catalogue of Colubrine Snakes in the Collection of the British Museum.* For example, under *Bungarus lineatus* (p.220) are listed the following two specimens: 'c. Half-grown. India. Presented by Dr. Russell' and 'n. Half-grown. India. Presented by Dr. Russell'. Gray (1849) also listed specimens from the The Hon. East India Company amongst the British Museum acquisitions in his introduction.

The near purchase of Russell's volume of drawings in 1977.– The museum almost purchased a third collection associated with Patrick Russell, this time a set of original plates rather than skins, 73 years later. A careful search of the Natural History Museum archives revealed that these plates, described as "Reptiles : an important collection of watercolour drawings of reptiles, some being original Company School drawings for Patrick Russell's book on Indian snakes, etc." were put up for sale in London at Sotheby's as lot 325 [sold at] Sotheby's on Tuesday, 22nd November 1977. Museum Herpetology curator, Dr. Andrew Stimson, and Fish Researcher, Dr. P. J. P. Whitehead wrote a memo in advance of the auction stressing the importance of the plates and urging their purchase to the then Keeper of Zoology, John Gordon Sheals. The entire memo, which has faded over time, is reproduced below:

The Keeper of Zoology
Mr. A. F. Stimson and Dr. P. J. P. Whitehead

10th November 1977

Patrick Russell's An Account of Indian Serpents (1801) contains plates and descriptions of 86 snakes. Although Russell only occasionally used binomials, many trivial names of later authors were based on his descriptions. Most of the specimens on which Russell based his descriptions were deposited in the collection of the East India Company. This collection was broken up and sold around 1860 and the vast majority of Russell types can no longer be traced, although a few still survive, some in the B.M (N.H.).

Many of Russell's plates are iconotypes and of great scientific and historical value, especially in those cases where the type specimen is lost. Although the collection now offered for sale contains only 9 of the original plates there are among them 5 iconotypes.

We thoroughly recommend the purchase of this volume, both on the basis of the important Russell drawings, and also because those of the French artists are of considerable historic and artistic interest. We consider that the estimated price

is not unreasonable although we doubt that the top price will be reached.

Although the plates were not purchased, this memo is a testament to the interest in Russell's collections and contributions that herpetologists have maintained over the past two centuries.

Acknowledgements

I thank the Trustees of the Natural History Museum for permission to reproduce images of the zoology registers and catalogues, Natural History Museum librarians Paul Martyn Cooper, Harriet Campbell Longley, Archivist Kate Tyte and Dr. Colin McCarthy for their generous assistance during this study. I also would like to thank Aaron M. Bauer for his kind invitation to write this paper.

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RUSSELL, P. 1796. An Account of Indian Serpents, Collected on the Coast of Coromandel; Containing Descriptions and Drawings of Each Species; Together with Experiments and Remarks on Their Several Poisons. George Nicol, London. vii + 91 pp., 46 pls.

RUSSELL, P. 1801–1809 [1810]. A Continuation of an Account of Indian Serpents; Containing Descriptions and Figures, from Specimens and Drawings, Transmitted from Various Parts of India, to the Hon. the Court of Directors of the East India Company. G. and W. Nicol, London. v + 57 pp., 42 pls. [issued in five sections: pp. i–v + 1–12, pls. 1–10 (1801), pp. 13–20, pls. 11–18 (1802), pp. 21–28, pls. 19–24 (1804), pp. 29–38, pls. 25–32 (1807), and pp. 39–57, pls. 33–42 (1809/1810) see Adler this issue].

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A preliminary consideration of the dry snake skin specimens of Patrick Russell

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ABSTRACT.– Two collections of dried, mounted snake skins, including 175 specimens, presumably from Patrick Russell, are extant in the collection of the Natural History Museum, London. One of these skins has been recognized as the holotype of *Hydrus piscator* Schneider, 1799, but most do not seem to correspond to the types illustrated in Russell's *An Account of Indian Serpents* (1796) or its continuation (1801–1809 [1810]). The majority of these skins are here identified and the meagre data associated directly with them are noted. The provenance of at least some of these are in question and require further study.

KEYWORDS.– Patrick Russell, snake skins, history, India.

Introduction

Patrick Russell's impact on systematic herpetology was primarily through his book *An Account of Indian Serpents* (1796) and its continuation (Russell 1801–1809[1810]), as it was from these sources that many common Indian snakes were first described by the authors who followed (see Bauer, this issue). Whether Russell's specimens, upon which his plates and descriptions were based, are extant or not has no bearing on their status as types. Nonetheless, extant types provide the opportunity to make direct comparisons and can be crucial in resolving complex issues in the correct application of names, particularly in cases of cryptic species. In addition, historical specimens, whether types or not, provide us with a direct link to the time and place when they were collected. Thus, the fate of Patrick Russell's snake specimens are of both scientific and historical interest.

The spirit preserved specimens donated by Russell or the British East India Company to the British Museum and the Royal College of Surgeons have been discussed by Bauer (this issue) and their provenance seems well established. In addition to these there are two large collections of dry snake skins associated with Patrick Russell in the Natural History Museum, London today. Their history is discussed by Patrick Campbell (this issue). These came to the British Museum in two different lots, one in 1837 and the other in 1904. Boulenger (1906) believed these collections to include "the types of the species described and figured by him [Patrick Russell] in his book on "Indian Serpents", published in 1796". Vogel & David (2012) identified one of these specimens, from the 1904 collection, as the holotype of *Hydrus piscator* (see account of Russell 1796, No. XXXIII in Bauer, this issue). These collections have never been critically evaluated in their entirety. As Campbell explains, there remain significant gaps in the "chain of custody" of this material and the connection back to Russell is not clear. Although all of Russell's snakes were to go to India House at his death (Bhaumik 2012), these evidently did not or, if they did, they were eventually placed on the commercial market, which seems unlikely. Alternatively, perhaps only the spirit preserved specimens went to India House

and Russell's family retained the dry specimens. However, a preliminary examination of the snake skins raises some questions about whether some or any of these specimens are actually from Patrick Russell. In addition to the lack of detail about their history in the years following Russell's death, neither collection appears to be a particularly plausible match to Russell's published snake illustrations in terms of species composition or match of individual specimen features.

Regardless, even if some or all of the dry skin specimens are not directly associated with Patrick Russell, they are of historical interest and their relationship, if any, to Russell can only be investigated if the nature of these specimens and the species they include are known to the herpetological community. Thus, in this paper we provide an initial list of the 1837 and 1904 snake specimens, along with their specific identities and any information accompanying them.

Material and Methods

The dry snake skin specimens in the Natural History Museum, London were photographed to permit subsequent identification based on colour pattern, body proportions, and scale counts. These photographic records allowed detailed examination without undue handling of the delicate and sometimes fragile specimens. Identifications to species were made by one or more of the authors and were verified by comparisons with specimens, data and photographs from the authors and compared with descriptions and illustrations of chiefly Indian snakes using a diversity of literature sources including Smith (1943), Whitaker & Captain (2004) and Murphy (2007), and, in addition to species descriptions and generic revisions.

Results

The 1837 dry skin collection is mounted in book form and is stored in the Natural History Museum, London's library. It includes 66 specimens, all of which could be identified to species level (Table 1). In addition to the registration numbers written on the paper to which they are attached, some have additional information. In three cases this relates to a specific plate in Russell (1796). In four others one of the Indian vernacular names used by Russell is given and in two cases "Col. Russ. Und. Serp. I + II" is written. Eleven specimens appear to have localities and dates (Figs. 1, 2). The dates include 1826, 1827 and 1830, 1831 and 1832, all long after Patrick Russell's death. Some skins also have an indication of "harmless" or "venomous".

The 1904 collection (Table 2) is stored on separate (unbound) sheets of paper (Figs. 3–5) and includes 97 catalogued specimens and an additional 12 specimens without BMNH numbers. We were able to identify all but one of the catalogued specimens, although in one case, BMNH 1904.7.27.11, the lack of a head permitted identification only to the *Microcephalophis* clade within *Hydrophis*, but not to species level. It is unclear if the uncatalogued material is part of the same collection or if it was merely stored with the others because of its similar preparation type. At least some of the snakes

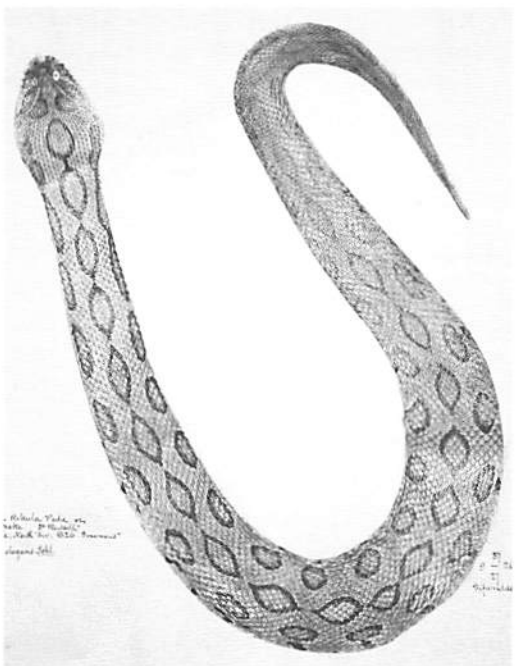

Figure 1. *Daboia russelii*. Dry skin specimen 37.9.26.27 from the collection of Patrick Russell's snakes received in 1837 by the British Museum of Natural History. In addition to its registration number and classification based on Gray's system ("Viperidae 1.e"), the sheet bears the information: "Katuka Rekula Poda or Carpet Snake Dr. Russell", *Vipera elegans* Schl.", and "Chicacole North Div. [= Srikakulam, Andhra Pradesh] 1826. Venomous". This late date calls into question the actual provenance of some of the dry skin collections attributed to Patrick Russell. Photo by Patrick Campbell.

Table 1. Dried snake skins presumably from Patrick Russell accessioned into British Museum in 1837. Except for the Current Names, all information is taken directly from the writing on the sheets of paper to which the snakes are glued. References to Russell's *Indian Serpents* includes any mention of a plate number or name from Russell (1796, 1801–1809 [1810]). J.E. Gray's numbering is the family name, species number and specimen letter assigned by Gray to the specimens. Note that there is no BMNH 37.9.26.62, but there are two specimens listed as 37.9.26.61, one indicated as 98b and the other as 98c. Presumably one of these was intended to be the missing number.

BMNH Number	Current Name	Name on Sheet	References to Russell's Indian Serpents	J.E. Gray's Numbering	Locality, Date, Comments
1837.9.26.7	*Naja naja*	*Naja tripudians*		Colubridae 86.a	
1837.9.26.8	*Naja naja*	*Naja tripudians*		Colubridae 86.b	
1837.9.26.9	*Naja naja*	*Naja tripudians*	Cobra de Capella or Spectacle snake		Northern Division. 1827 "venomous"
1837.9.26.10	*Naja naja*	*Naja tripudians*		Colubridae 86.d	
1837.9.26.11	*Naja naja*	*Naja tripudians*		Colubridae 86.e	
1837.9.26.12	*Naja naja*	*Naja tripudians*		Colubridae 86.f	
1837.9.26.12x	*Naja naja*	*Naja tripudians*		Colubridae 86.g	
1837.9.26.13	*Naja naja*	*Naja tripudians*		Colubridae 86.h	
1837.9.26.14	*Naja naja*	*Naja tripudians*		Colubridae 86.i	
1837.9.26.15	*Naja naja*	*Naja tripudians*		Colubridae 86.j	
1837.9.26.16	*Naja naja*	*Naja tripudians*		Colubridae 86.k	
1837.9.26.17	*Naja naja*	*Naja tripudians*		Colubridae 86.l	
1837.9.26.18	*Naja naja*	*Naja tripudians*		Colubridae 86.m	
1837.9.26.19	*Naja naja*	*Naja tripudians*		Colubridae 86.n	
1837.9.26.20	*Naja naja*	*Naja tripudians*		Colubridae 86.o	
1837.9.26.21	*Python molurus*	*Python mollurus Junr.*		Boidae 7.f.	Hyderabad. Nizam's Dom. 1832
1837.9.26.22	*Eryx conicus*	*Boa conica, Gongylophis conica*		Boidae 13.e.	
1837.9.26.23	*Hydrophis fasciatus*	*Hydrophis fasciata*			
1837.9.26.24	*Hydrophis cyanocinctus*	*Hydrophis cyanocinctus*			Dhurmaverum Sea coast N. D. 1827
1837.9.26.25	*Hydrophis spiralis*	*Hydrophis spiralis*			
1837.9.26.26	*Daboia russelii*	*Vipera elegans Schl.*		Viperidae 1.d.	
1837.9.26.27	*Daboia russelii*	*Vipera elegans Schl.*	Katuka Rekula Poda or Carpet Snake Dr. Russell	Viperidae 1.e.	Chicacole North Div. 1826. Venomous.
1837.9.26.28	*Ahaetulla nasuta*	*Dryophis nasuta Schl.*	I. t.13	Colubridae 65.e.	

1837.9.26.29	*Boiga trigonata*	*Dipsas trigonata Schl. 267*	Tar tutta Dr. Russell	Colubridae 67.d.	Nagpoor Nizam's Dom. 1830 "harmless"
1837.9.26.30	*Boiga trigonata*	*Dipsas trigonata Schl. 267*		Colubridae 67.e.	
1837.9.26.31	*Boiga trigonata*	*Dipsas trigonata Schl. 267*		Colubridae 67.c.	
1837.9.26.32	*Oligodon arnensis*	*Coronella Russellii Schl. var.*	1.38	Colubridae 66.e.	
1837.9.26.33	*Oligodon arnensis*	*Coronella Russellii Schl. 7B*	1.35	Colubridae 66f.	
1837.9.26.34	*Bungarus caeruleus*	*Bungarus semifasciatus*		Colubridae 83a.	
1837.9.26.35	*Bungarus caeruleus*	*Bungarus semifasciatus*		Colubridae 83.b.	
1837.9.26.36	*Bungarus caeruleus*	*Bungarus semifasciatus*		Colubridae 83.c.	
1837.9.26.37	*Bungarus caeruleus*	*Bungarus semifasciatus*		Colubridae 83.d.	
1837.9.26.38	*Bungarus caeruleus*	*Bungarus semifasciatus*		Colubridae 83.e.	
1837.9.26.39	*Bungarus fasciatus*	*Bungarus annulatus Schl.*	[pencil "8'] Bungarum. Pama. or Golden banded Snake	Colubridae 87a.	Chicacole North Circ. 1826 Venomous
1837.9.26.40	*Bungarus fasciatus*	*Bungarus annularis*		Colubridae 87b.	
1837.9.26.41	*Bungarus fasciatus*	*Bungarus?*		Colubridae 87c..	
1837.9.26.42	*Macropisthodon plumbicolor*	*Tropidonotus*		Colubridae 88.a.	
1837.9.26.43	*Macropisthodon plumbicolor*	*Tropidonotus*		Colubridae 88.b.	
1837.9.26.44	*Cerberus rynchops*			Colubridae 89.a.	
1837.9.26.45	*Xenochrophis piscator*			Colubridae 90.a.	
1837.9.26.46	*Lycodon flavomaculatus*			Colubridae 91.1.	
1837.9.26.47	*Xenochrophis piscator*			Colubridae 90.b.	
1837.9.26.48	*Argyrogena fasciolata*			Colubridae 92.a.	Rajamundry North Circars 1831 "harmless"
1837.9.26.49	*Argyrogena fasciolata*			Colubridae 93.a.	
1837.9.26.50	*Lycodon aulicus*	*Lycodon aulicus*		Colubridae 94a.	
1837.9.26.51	*Lycodon aulicus*	*Lycodon aulicus*		Colubridae 94b.	
1837.9.26.52	*Lycodon aulicus*			Colubridae 95.a.	
1837.9.26.53	*Oligodon taeniolatus*			Colubridae 96.a.	
1837.9.26.54	*Oligodon taeniolatus*			Colubridae 96.b.	

1837.9.26.55	*Amphiesma stolatum*			Colubridae 97.a.	
1837.9.26.56	*Amphiesma stolatum*			Colubridae 97.b.	
1837.9.26.57	*Amphiesma stolatum*			Colubridae 97.c.	
1837.9.26.58	*Amphiesma stolatum*			Colubridae 97.d.	
1837.9.26.59	*Cerberus rynchops*	*Cerberus cinereus*		Colubridae 89.b.	
1837.9.26.60	*Amphieisma stolata*	*Tropidonotus stolatus*		Colubridae 98.b.	
1837.9.26.61	*Amphieisma stolata*	*Tropidonotus stolatus Schl. 317*		Colubridae 98.b.	
1837.9.26.61	*Amphieisma stolata*	*Tropidonotus stolatus Schl. 317*	Col. Russ. Ind. Serp. I + II	Colubridae 98.c.	
1837.9.26.63	*Coelognathus radiata*	*Coluber radiatus*		Colubridae 38.d.	Kamplee. Nagpoor Dom 1830
1837.9.26.64	*Coelognathus radiata*	*Coluber radiatus*	Col. Russ. Ind. Serp. I + II	Colubridae 38.e.	
1837.9.26.65	*Xenochrophis piscator*	*Tropidonotus quincunciatus Schl. 307*		Colubridae 99.a.	
1837.9.26.66	*Xenochrophis piscator*			Colubridae 99.b.	
1837.9.26.67	*Xenochrophis piscator*			Colubridae 99.c.	
1837.9.26.68	*Xenochrophis piscator*			Colubridae 99.d.	
1837.9.26.69	*Xenochrophis piscator*			Colubridae 99.e.	
1837.9.26.70	*Xenochrophis piscator*			Colubridae 99.f.	Chicacole. N. Div. 1826
1837.9.26.71	*Xenochrophis piscator*			Colubridae 99.g.	Chicacole. N. Div. 1826

represent species that do not occur in India or adjacent areas. Because of this, and because these specimens are generally in quite poor condition, we have not attempted identifications here. The numbered specimens are more consistently linked to Russell's *Indian Serpents* through their reference to vernacular names and plate numbers than are the 1837 specimens. They also list specimen numbers (i.e., 2nd specimen of No. VI; Fig. 5). Some specimens are accompanied by extensive text which matches that in Russell's books (Figs. 4, 5).

Discussion

Both the 1837 and 1904 dry skin collections reached the British Museum with no real data, but were offered as specimens from Patrick Russell's collection and were accepted as such by J. E. Gray and G. A. Boulenger, the respective curators at those times. However, neither of these men, nor A. C. L. G. Günther, ever identified any specific skin with a Russell plate. On the other hand, numerous spirit preserved specimens from Russell were explicitly acknowledged as being those illustrated by Russell (1796, 1801–1809 [1810]) by Gray (1849), Günther (1858) and Boulenger (1893, 1894, 1896) in their catalogues of the snakes in the British Museum.

The lack of data with the dry skins makes it difficult or impossible to determine with certainty, anything about their true origin. As reviewed by Bhaumik (2012), Russell had indicated that after his death, his snake collection should go to the East India Company's Museum at India House in London. Between that time and 1860 all of the East India Company's collections were given to either the British Museum or the Royal

Table 2. Dried snake skins presumably from Patrick Russell accessioned into British Museum (Natural History) in 1904. Except for the Current Names, all information is taken directly from the writing on the sheets of paper to which the snakes are glued. Note that the specific identity of the vernacular names does not always match that in Russell (1796, 1801–1809 [1810]). In addition to the catalogued specimens there are eight sheets of paper with a total of 12 additional snakes that are present in the collection. These are in generally poor condition and they have not been identified. The snakes in this collection are mostly grouped with several per sheet of paper. These groupings are indicated here by the alternating white and gray background colour.

BMNH Number	Current Name	Genus (*fide* Russell)	Vernacular Name	Plate Number	Specimen Number
1904.7.27.1	*Naja naja*		Jonna Nagoo	VI	2nd
1904.7.27.2	*Ptyas mucosa*	*Coluber*	Jeri Potoo or Dameen	XXXIV	3rd
1904.7.27.3	*Xenochrophis piscator*	*Coluber*	Neeli Koea		4th
1904.7.27.4	*Eryx conicus*	*Boa*	Padain Cootoo	IV	2nd
1904.7.27.5	*Xenochrophis piscator*	*Coluber*	Neeli Koea	XXXIII	1st
1904.7.27.6	*Echis carinatus*	*Boa*	Horatta Pam	II	2nd
1904.7.27.7	*Boiga trigonata*	*Coluber*	Tar Tutta	XV	1st
1904.7.27.8	*Daboia russellli*	*Coluber*	Katuka Rekula Poda	VII	3rd
1904.7.27.9	*Daboia russellli*	*Coluber*	Katuka Rekula Poda	VII	4th
1904.7.27.10	*Bungarus caeruleus*	*Boa*		I	2nd
1904.7.27.11	*Hydrophis* (*Microcephalophis*) sp.	*Anguis*	Shooter Sun	VII	—
1904.7.27.12	*Hydrophis curtus*		Kerril Pattee or Shooter Sun or Kadell Napam		—
1904.7.27.13	*Hydrophis* cf. *hendersoni*	*Anguis*	Shiddil	XII	—
1904.7.27.14	*Hydrophis curtus*	*Anguis*	Kerril Pattee	VI	1st
1904.7.27.15	*Hydrophis cyanocinctus*	[*Anguis*]	Kerril Pattee or Kalla Shooter Sun	VI or VIII	2nd
1904.7.27.16	*Naja naja*	*Coluber*	Nagoo	V	—
1904.7.27.17	*Naja naja*	*Coluber*	Nella Jas Pam (Nagoo)	VI	3rd
1904.7.27.18	*Ptyas mucosa*	*Coluber*	Jeri Potoo or Dameem	XXXIV	1st
1904.7.27.19	*Daboia russellli*	*Coluber*	Katuka Rekula Poda	VII	2nd
1904.7.27.20	*Naja naja*	*Coluber*	Kistna (Nagoo)	VI	4th
1904.7.27.21	*Enhydris enhydris*	—	—	—	—
1904.7.27.22	*Coleognathus helena*	—	—	—	—
1904.7.27.23	*Enhydris enhydris*				
1904.7.27.24	*Calliophis nigrescens*?				
1904.7.27.25	*Ahaetulla nasuta*	*Coluber*	Botla Passeriki	XIII	2nd
1904.7.27.26	*Daboia russellli*	*Coluber*	Katuka Rekula Poda	VII	1st
1904.7.27.27	*Eryx conicus*	*Boa*	Padain Cootoo	IV	3rd
1904.7.27.28	*Ptyas mucosa*	*Coluber*	Jeri Potoo or Dameem	XXXIV	2nd
1904.7.27.29	*Acrochordus granulatus*	—	—	—	—
1904.7.27.30	*Amphiesma stolatum*	*Coluber*	Wanapa Pam	XIX	1st
1904.7.27.31	*Xenochrophis piscator*	*Coluber*	Neeli Koea	XXXIII	2nd
1904.7.27.32	*Xenochrophis piscator*	*Coluber*	Neeli Koea	XXXIII	1st
1904.7.27.33	*Boiga trigonata*	*Coluber*	Tar Tutta	XV	2nd
1904.7.27.34	*Lycodon aulicus*	—	—	—	—
1904.7.27.35	*Xenochrophis piscator*	*Coluber*	Neeli Koea	XXXIII	3rd
1904.7.27.36	*Naja naja*	*Coluber*	—	—	—

1904.7.27.37	*Naja naja*	*Coluber*	Korie Nagoo	VI	5th
1904.7.27.38	*Naja naja*	*Coluber*	Wusintoo Nagoo	—	—
1904.7.27.39	*Naja naja*	*Coluber*	Mogla Nagoo	VI	1st
1904.7.27.40	*Echis carinatus*	*Boa*	Horatta Pam	II	1st
1904.7.27.41	*Bungarus caeruleus*	—	—	—	—
1904.7.27.42	*Dendrelaphis tristis*	*Coluber*	Goobra	XXXI	—
1904.7.27.43	*Lycodon aulicus*	*Coluber*	Nooni Paragoodoo	XXI	2nd
1904.7.27.44	*Eryx conicus*	*Boa*	Padain Cootoo	IV	1st
1904.7.27.45	*Naja naja*	—	—	—	—
1904.7.27.46	*Coelognathus helena*	—	—	—	—
1904.7.27.47	*Boiga trigonata*	*Coluber*	Tar Tutta	XV	4th
1904.7.27.48	*Lycodon aulicus*	*Coluber*	Nooni Paragoodoo	XXI	4th
1904.7.27.49	*Echis carinatus*	*Boa*	Horatta Pam	II	3rd
1904.7.27.50	*Enhydris enhydris*	*Coluber*	Hurriah	XL	2nd
1904.7.27.51	*Lycodon jara*	*Coluber*	Jara Potoo	XIV	1st
1904.7.27.52	*Lycodon aulicus*	*Coluber*	Nooni Paragoodoo	XXI	5th
1904.7.27.53	*Enhydris enhydris*	*Coluber*	Hurriah	XL	1st
1904.7.27.54	*Bungarus caeruleus*	—	—	—	—
1904.7.27.55	*Lycodon aulicus*	*Coluber*	Nooni Paragoodoo	XXI	6th
1904.7.27.56	*Lycodon jara*	*Coluber*	Jara Potoo	XIV	2nd
1904.7.27.57	*Amphiesma stolatum*	*Coluber*	Wanna Pam	X	—
1904.7.27.58	*Amphiesma stolatum*	*Coluber*	Wanna Pam	X	—
1904.7.27.59	*Amphiesma stolatum*	*Coluber*	Wanna Pam	X	—
1904.7.27.60	*Boiga trigonata*	*Coluber*	Tar Tutta	XV	3rd
1904.7.27.61	*Lycodon striatus*	*Coluber*	Karetta	XXVI	—
1904.7.27.62	*Lycodon striatus*	*Coluber*	Karetta	XXVI	—
1904.7.27.63	*Atretium schistosum*	—	—	—	—
1904.7.27.64	*Atretium schistosum*	—	—	—	—
1904.7.27.65	*Atretium schistosum*	—	—	—	—
1904.7.27.66	*Eryx conicus*	*Coluber*	Karetta	XXVI	1st
1904.7.27.67	*Lycodon striatus*	*Coluber*	Gajoo Tutta	XVI	
1904.7.27.68	*Xenochrophis piscator*	—	—	—	—
1904.7.27.69	*Bungarus fasciatus*	*Boa*	Bungarum Pamah	II	—
1904.7.27.70	*Xenochrophis piscator*	—	—	—	—
1904.7.27.71	*Eryx conicus*	*Coluber*	Karetta	XXVI	2nd
1904.7.27.72	*Lycodon aulicus*	*Coluber*	Nooni Paragoodoo	XXI	3rd
1904.7.27.73	*Ahaetulla nasuta*	*Coluber*	Botla Passeriki	XIII	1st
1904.7.27.74	*Typhlops diardii*	—	—	—	—
1904.7.27.75	*Enhydris enhydris*	*Coluber*	Mutta Pam or Ally Pam	XXX	2nd
1904.7.27.76	?	—	—	—	—
1904.7.27.77	*Macrophistodon plumbicolor*	—	—	—	—
1904.7.27.78	*Macrophistodon plumbicolor*	—	—	—	—
1904.7.27.79	*Macrophistodon plumbicolor*	—	—	—	—
1904.7.27.80	*Enhydris enhydris*	—	—	—	—

1904.7.27.81	Argyrogena fasciolatus	—	—	—	—
1904.7.27.82	*Echis carinatus*	*Boa*	Horatta Pam	II	4th
1904.7.27.83	*Enhydris enhydris*	*Coluber*	Mutta Pam or Ally Pam	XXX	1st
1904.7.27.84	*Xenochrophis piscator*	—	—	—	—
1904.7.27.85	*Cylindrophis ruffus?*	—	—	—	—
1904.7.27.86	*Amphiesma stolatus*	*Coluber*	Wanna Pam	X	4th
1904.7.27.87	*Echis carinatus*	*Boa*	Horatta Pam	II	5th
1904.7.27.88	*Bungarus caeruleus*	*Boa*	Gedi Paragoodoo or Paata Poola		
1904.7.27.89	*Lycodon aulicus*	—	—	—	—
1904.7.27.90	*Boiga trigonata*	*Coluber*	Tar Tutta	XV	5th
1904.7.27.91	*Amphiesma stolatum*	*Coluber*	Wanapa Pam	XIX	2nd
1904.7.27.92	*Amphiesma stolatum*	*Coluber*	Wanapa Pam	X	6th
1904.7.27.93	*Lycodon aulicus*	*Coluber*	Nooni Paragoodoo	XXI	1st
1904.7.27.94	*Amphiesma stolatum*	*Coluber*	Wanna Pam or Cogli	X	5th
1904.7.27.95	*Ptyas mucosa*	*Coluber*	Jeri Potoo or Dameen	XXXIV	4th
1904.7.27.96	*Naja naja*	*Coluber*	Nagoo		
1904.7.27.97	*Ophiophagus hannah*	—	—	—	—

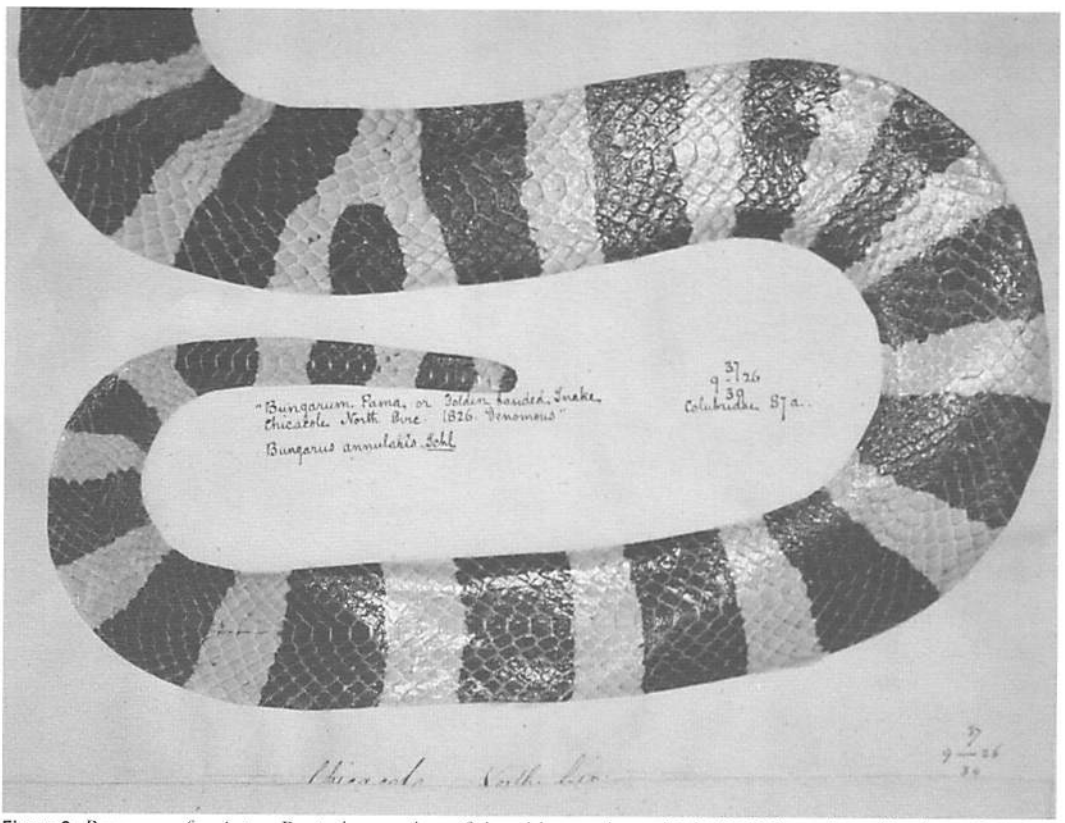

Figure 2. *Bungarus fasciatus*. Posterior portion of dry skin specimen 37.9.26.39 from the collection of Patrick Russell's snakes received in 1837 by the Britisdh Museum of Natural History and showing a date, 1826, long after Patrick Russell's death. The bottom of the sheet to which it is affixed shows the partially obscured locality "Chicacole [= Srikakulam, Andhra Pradesh] North Circ. [Circars]", which has been copied over beneath the yip of the snake's tail. The dry preparation has retained the bold yellow of the living animal. Photo by Patrick Campbell.

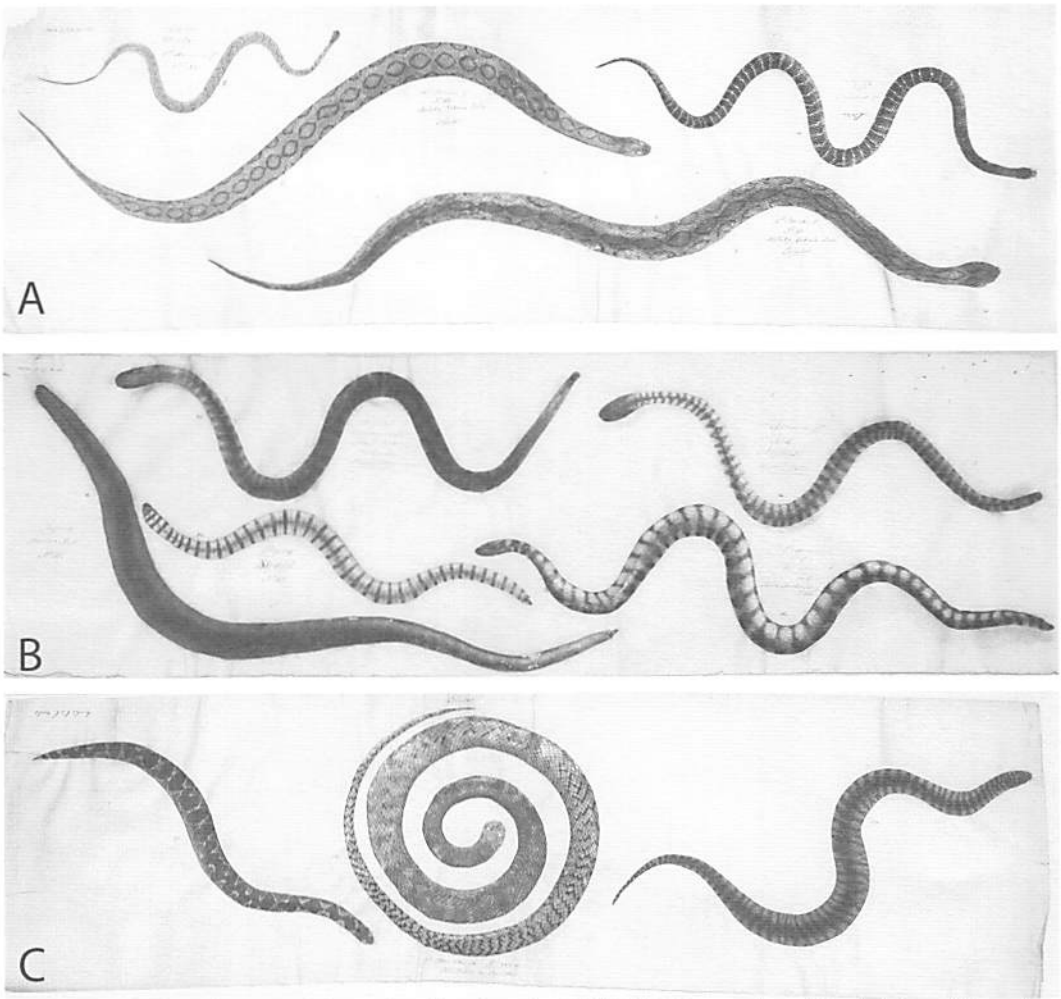

Figure 3. A selection of mounted dry snake skins from the 1904 BMNH accession of Patrick Russell's snakes. Unlike the earlier, book mounted sheets, these typically exhibit more than one snake each. A. BMNH 1904.7.27.7–10 (*Boiga trigonata* — top left, *Daboia russelii*, — top middle and bottom, *Bungarus caeruleus* — top right). B. BMNH 1904.7.27.11–15, seasnakes of the genus *Hydrophis* (*H. curtus* — top left and right, *H.* cf. *hendersoni* — middle left, *H. cyanocinctus* — middle right, *H.* (*Microcephalophis*) sp. — bottom). C. BMNH 1904.7.27.27–29 (from left to right: *Eryx conicus*, *Ptyas mucosa*, *Acrochordus granulatus*). Photos by Gernot Vogel.

College of Surgeons (Günther 1864; Bauer, this issue). Both the 1837 and the 1904 skins came from other sources (Campbell, this issue). If truly from Russell, it is likely that this would have been through his family members — most likely collateral descendants, as Russell never married and had no children himself (Das, this issue).

It is possible that the skin collections include specimens from Russell himself, or those sent to Russell from others after his return from India, as well as later additions, prepared in a similar way. The preservation of color on the specimens, especially the 1837 ones, strongly suggests that the snakes were prepared as skins initially, rather than having spent long periods in alcohol prior to preparation. The fact that some specimens seem to have data explicitly noting collection/preparation dates that are decades after Russell's death suggests that at least some snakes must be from a later period. Certainly, the 1837 book of snake skins is not the source of the 1796 or 1801–1809 [1810] published works by Russell. Only 21 different species are included, some of these with many individuals (Table 1). In addition, several species not covered in Russell's books are included in the collection.

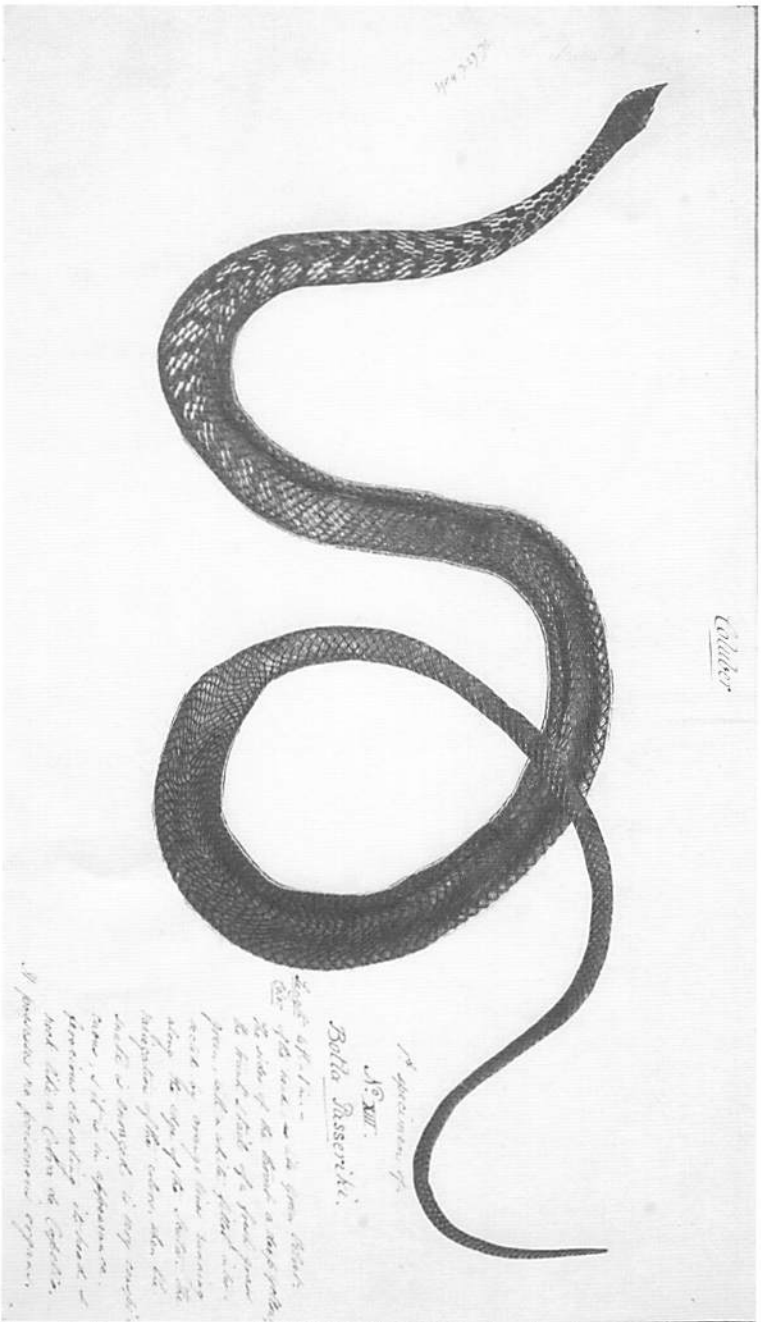

Figure 4. *Ahaetula nasuta* (BMNH 1904.7.27.73) showing the use of Russell's vernacular name (Botla Passeriki) and his descriptive text (lower right), an exact match to the wording published in the corresponding account of Russell (1796). Photo by Gernot Vogel.

The species that are represented in Russell's plates are typically not particularly close matches to the patterns or other identifying marks on the dry skins.

Boulenger (1906) considered the 1904 collection to be genuinely from Patrick Russell, but if it includes the actual specimens from which the illustrations were made is difficult to prove. As in the earlier collection, most of the skins are not particularly good matches to Russell's plates, although at least one specimen, 1904.7.27.92 — the Wanapa Pam (*Amphiesma stolatum*) has quite a strong resemblance to the corresponding plate. As is the case of the 1837 skins, there also appears to be evidence that some material, at least, is too young to have been part of Patrick Russell's collection. For example, 1904.7.27.77 is accompanied by a pencil marking noting June 1837. This collection as a whole, is also clearly not the model for Russell's books as numerous species are included that are not covered by Russell (1796, 1801–1809 [1810]). Further, there are numerous mismatches between Russell's vernacular names and the species present, suggesting that the preparator of the collection was, in some cases, uncertain of the identities of the snakes. The 1904 specimens also appear to be prepared differently than those of 1837. In the latter skins the ventral scales typically not visible or are barely so, whereas in the former the ventrals are often clearly shown. Similarly, the older accession has snakes displayed one per page, whereas the later one has many sheets

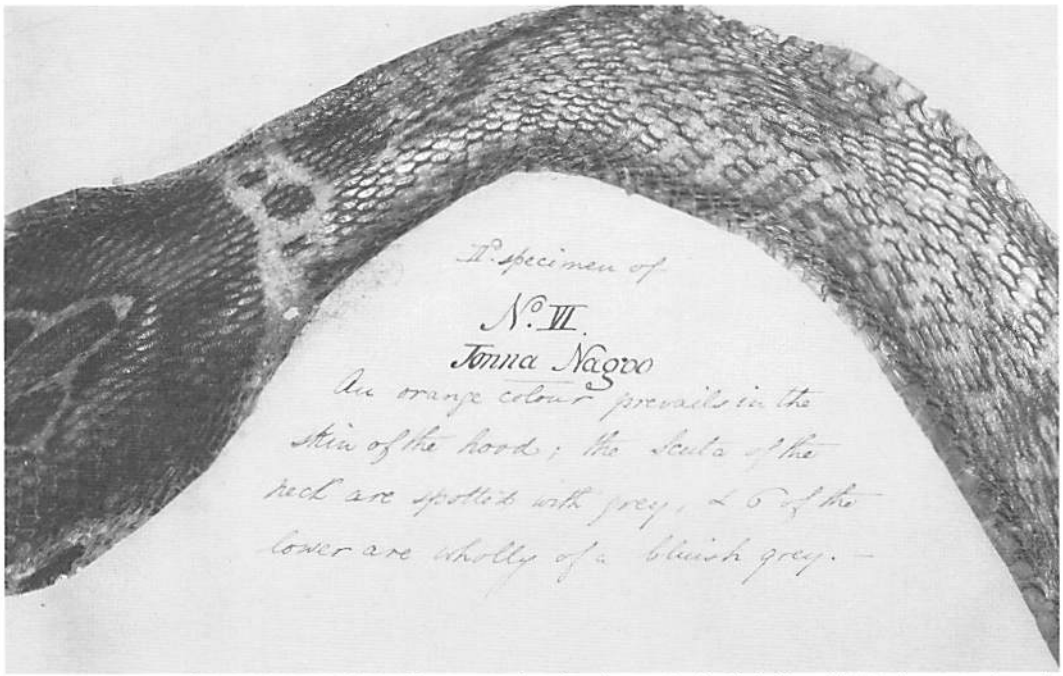

Figure 5. Close up of BMNH 1904.7.27.1 (*Naja naja*) showing the method of labeling. This is the second specimen of No. VI (corresponding to Russell's account of the cobra in his 1796 book). The wording matches exacty the comments given by Russell. This appears to represent a copy from the book, rather than the model for it. Photo by Gernot Vogel.

with more than one animal attached (compare Figs. 1 and 3).

Do these dry snake skins, then, have anything to do with Patrick Russell? They might. It is conceivable that some of Russell's specimens, as well as those of other collectors (e.g., those with later dates) may have been prepared as they appear now, either privately or through India House at some point after Russell's death, with Russell's text added in the case of some of the 1904 specimens (e.g., Fig. 5). Some additional dating information may be gleaned by further analysis of the watermarks and/or ink used. Based on the former, the 1904 collection appears to have been attached to paper dating to the approximate period of Russell's activity (see Campbell & Verveniotou, this issue). Very careful comparison of the skins to Russell's plates may also reveal unique features of scalation or colour that argue for individual identity with the illustrated specimens. Vogel & David (2012) have made this argument for the type of *Hydrus piscator*, but this is a difficult task and dependent upon the accuracy of the artists who drew Russell's plates.

More than two centuries after the publication of the last part of Russell's (1801–1809 [1810]) *A Continuation of an Account of Indian Serpents* there may yet be more discoveries to come from Patrick Russell as the snake skin collections attributed to him are studied in detail for the first time (Campbell and Campbell & Verveniotou, this issue).

Acknowledgements

We thank Edward Stanley for providing additional photographs of the dry snake skins from the 1904 acquisition. Arne Redsted Rasmussen provided assistance in identifying the skins of sea snakes. Indraneil Das provided valuable comments on the manuscript. AMB was supported by the Gerald M. Lemole, M.D. Endowed Chair Research Fund at Villanova University.

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Collection storage improvement and the rehousing of the 1904 Patrick Russell snakeskins

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ABSTRACT.– The collection of Patrick Russell snakeskins purchased by the Natural History Museum in 1904 had been stored in an old wooden box for over 107 years and was subjected to both pest and chemical damage during this period. These problems were finally addressed and the collection was repaired and rehoused. The storage conditions of the skins before conservation are reviewed and the measures taken to improve and stabilise the skins, their storage containers, and environmental conditions are detailed.

KEYWORDS.– Patrick Russell, snake skins, conservation, temperature, humidity, Whatman paper.

Introduction

The Collections Storage and Infrastructure Programme (CSIP) at The Natural History Museum (NHM), South Kensington was set up in December 2008. The purpose of CSIP was to consolidate the collections and to bring the conditions under which all the museum's scientific collections were housed up to acceptable minimum standards across three main sites: The Natural History Museum South Kensington, the Wandsworth Facility (an outstation storage facility) and The Natural History Museum, Tring. Currently agreed environmental parameters for zoology collections (Natural History Museum, Department of Zoology, Collections Position Statement on the Implications of the Masterplanning Proposals to Address Collections Space Problems in the Waterhouse Basement, 2007) based on accepted best practice and MGC (Museums and Galleries Commission 1992) guidelines are:

Wet collections.– Darwin Centre (air-conditioned spaces)

Temperature:

Target = 14°C
Range = 13 to 15°C
Alarm level = 16°C or above

Relative humidity:

Target = 50%
Range = 40 to 55%
Alarm level = 60% or above (danger of condensation and mould growth above 59% RH)

Dry collections .– North West Tower, Waterhouse basement areas (non air-conditioned spaces)

Temperature:

Target = 18°C
Range = 16 to 19°C
Alarm level = 19°C or above (increased risk of pest infestation)

Relative humidity:

Target = 50%
Range = 40 to 55%
Alarm level = 56% or above (danger of increased pest activity above 55% RH)

It had been noted that selected collection storage spaces within the scope of this project were far below acceptable minimum standards with fluctuating humidity, high temperatures, high UV, poor pest control and poor security. Temperatures for all basement collection areas at The Natural History Museum, South Kensington site were above the recommended maximum between 1 October 2007 and 31 December

Table 1. Actual temperature and humidity readings for the Waterhouse Building basement - Zoology Storeroom 1, where the 1904 Russell snakeskin collection was stored, between October and December, 2007.

Area/ floor	Transmitter name	Temp min (°C)	Temp max (°C)	% RH min	% RH max	% Time below tolerance		% Time above tolerance		% Time within tolerance	
						Temp	RH	Temp	RH	Temp	RH
Zoo store 1	Shelf above case 1	19	23	30	56	0	46	100	0	0	54
Zoo store 1	Top of glass case 26	19	23	30	56	0	56	100	1	0	43
Zoo store 2 (Porifera)	Top of cab 555	20	24	23	57	0	52	100	1	0	47

2007 (Table 1). Also the relative humidity across the Zoology Waterhouse basement is shown to be at the lower end of, or below, recommended levels (Table 1). The temperature fluctuated between 19 and 23°C and the humidity between 30 and 56 % in this storeroom. The target temperature of 18°C (range 16–19°C) and target RH of 50% (range 40–55%) was not achieved, as the temperature was much too high and humidity fluctuated well outside the range required. The relative humidity of a document storage area is even more crucial than its temperature. If the air is too dry, the paper becomes brittle and animal skins (such as leather) may crack (Bottomley 1984). After the feasibility report was published for CSIP, the CSIP capital bid was approved on 24 September 2009 and Business Case on 13 November 2009 (Natural History Museum, Collections Storage Infrastructure Programme Wildebeest Project Outline Business Case — Strategic April 2009) in order to carry out the improvements necessary.

Amongst the many biological specimens housed in the Zoology Waterhouse basement in The Natural History Museum at the initiation of the Collections Storage and Infrastructure Programme was a collection of dry, paper-mounted snakeskins, presumably from Patrick Russell, which were obtained by the Museum in 1904 (see Campbell and Bauer *et al.*, this volume). These recently re-discovered skins were stored above a cabinet in the Zoo Stores 1 area. The purpose of this contribution is to outline the nature of the improvements made to the storage area in which these skins are kept, to describe the condition of the skins prior to active curation and rehousing, and to document the steps taken to clean and repair the specimens and provide them with suitable storage conditions that meet current guidelines.

CSIP and the Large Vertebrate Store

The budget for works for the Financial Year 2010–11 was set at £1,018,000 based on the successful submission and approval of the Outline Business Case. The works included the following: (1) new collections cabinets, (2) rationalisation of the collection space in South Kensington to accommodate the zoology collections, (3) rationalisation of the collection space in Wandsworth to accommodate zoology collections, (4) development of tender documents including defined cabinet specification and building requirements, (5) seeking of bids from removal firms to move cabinets out of the existing store., (6) issuing of tender documents through The Official Journal of the European Union (OJEU) where appropriate and select builders and suppliers, and (7) improvement of environmental and working conditions for curators/visitors and researchers.

The Four main CSIP projects were the Wandsworth Large Vertebrate Facility, the Quarantine Facility, the Molecular Biology Facilities Project, and Wildebeest (the project including specimen storage facilities in South Kensington). The CSIP Wildebeest feasibility project was completed in 2010 and was split into two sub-projects, Zoology and Entomology. The **CSIP Wildebeest** project focussed mainly on Zoo Store 1. The main objectives were (1) to house collections to ensure their accessibility and long-term preservation in the most cost-effective way and according to best practice and

(2) to create the expansion space required for 15+ years, allowing the collections to grow in line with the NHM Acquisition Policy & the Zoology Department's collections Development Plan. This was achieved by (1) identifying a suitable building contractor to undertake the refurbishment required for these areas through the NHM procurement procedures, (2) identifying suitable suppliers of NHM standard furniture and equipment through the NHM procurement procedures, (3) re-using existing cabinetry where possible, and (4) re-arranging and re-housing the collection using approved quality materials. Essentially, the project sought to completely outstrip, refurbish and refit the space, using compactorisation to increase space whilst also seeking to minimise dry specimen decay by installing new purpose-built, lockable cabinets for the collections. Metal cabinets have the advantage that they are cheaper to make than wooden ones and much more reliable in consistency but metal drawers are more costly (Carter & Walker 1999).

Before any of the work on the actual infrastructure was started, it was essential to move the specimens safely offsite into temporary storage at Wandsworth for the store to be re-surfaced and re-fitted with compactor bases. The collection was surveyed, photographed, and selected specimens cleaned during the move. A labelling system was developed so that specimens could be traced giving locations and sizes, indicating the contents of each box, how it should be treated, and where it should be placed. Photographs were taken to record conditions before the move so that any damage caused during the move could be monitored; photographs could be later stored on the specimen database.

Large container freezers were purchased to comply with the NHM IPM policy and most of the boxed specimens were frozen before being taken to Wandsworth. Specimens filled with plaster that could not be frozen due to the threat of damage were cleaned, visually inspected and sprayed with Constrain pesticide. Zoo Store 1 itself was also treated by a skirting spray around all floor, wall, and cabinet edges that were accessible with Demand CS, a residual insecticide based on lambda cyalothrin. The store was then cold fogged with a 20% solution of Pyblast, a pyrethrin-based insecticide, before the specimens were re-introduced. Upon completion of the CSIP Wildebest project, the name of the refurbished storeroom was changed from Zoo Store 1 to Large Vertebrate Store (LVS).

Previous Condition of the 1904 Russell Snakeskins

Storage box.– It took 12 weeks to move approximately 30,000 zoology specimens off site between 2010 and 2011 whilst the work was being completed. Included in this were the 1904 Patrick Russell snakeskins which were stored flat, on top of each other, in a wooden box (Fig. 1) that probably dates back to when they were first received at the museum. In a sense, this offered a certain amount of security for the skins because it was hidden among numerous, similar looking and similar sized wooden boxes on open shelving in the storeroom, however, the location was not ideal. The storeroom contained a variety of other reptile specimens such as crocodile skins, crocodile skulls, tortoises, and other snakes which only served to disguise this important collection more. The actual location of the box of skins was known only to the curator. Inappropriate levels of humidity, temperature, light levels and the presence of pollutants may have had an adverse effect on the condition of the materials and may have caused accelerated aging (a general statement true in all museum specimens). The climate in the main storage area is now relatively stable, albeit rather humid, at 50% RH and 21° C but in the past to the storage environment would have undergone a fair amount of fluctuation (see above).

Storage conditions were crucial in understanding the current state of the snakeskins and how those factors could be minimised. Inap-

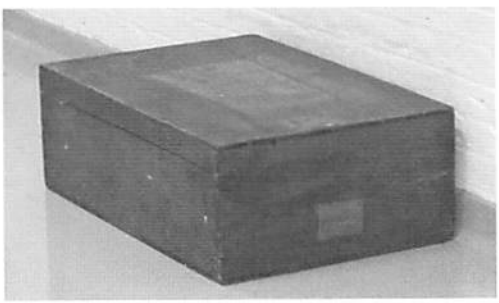

Figure 1. Previous wooden box storage system for the 1904 Russell snakeskin collection.

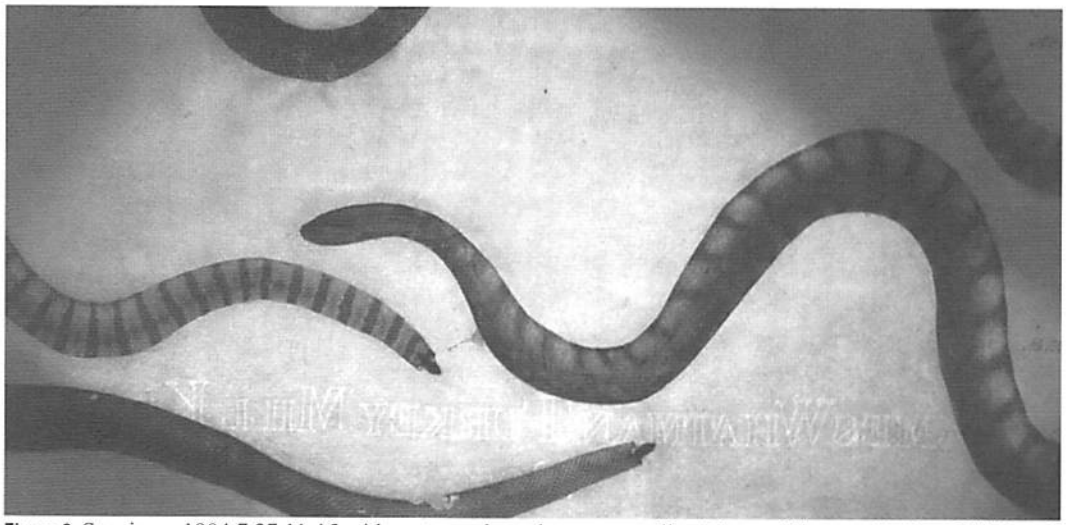

Figure 2. Specimen 1904.7.27.11-15 with watermark on the paper reading "James Whatman Turkey Mill Kent." Note that contrast and brightness have been adjusted to accentuate the waternark.

propriate storage and careless handling are the main causes of conservation problems. The skins were crammed into their box, with the sheets having skins attached stacked on top of one another. One sheet was folded in half prior to being placed inside the box, causing damage to the skin fixed to it. The box offered almost no protection against pests despite having a lid but no seals. The box was placed on top of a storage cabinet rather than inside (which would have offered more protection from pests). The old storage box contributed to the observed damage, as the snakeskins were stored on top of each other wrapped in thick dust sleeves without further individual mounting. This has made handling of the snakeskins rather difficult and had also limited access to the specimens. Knowledge of previous storage conditions, repair treatments and storage of the specimens is not complete. The skins were probably placed in storage on their arrival (as mentioned above) but the dust sleeves must have been added later because the nature of the paper suggests a later date.

Pest infestations are also particularly problematic for herbarium-style preserved specimens (Stansfield 1984), of which these snakeskins are a type. Insect attack was an ever-present threat for the snakeskins, especially as the storeroom perimeter was not completely sealed. Because the use of arsenic and dichlorvous as pest deterrents had been superseded by an integrated pest management system (IPM) in Zoo store 1, sensible containment was even now much more important. The snakeskins within the box were susceptible to pest infestation, difficult to inspect, and difficult to clean and, thus, this storage system was deemed wholly unsuitable for such an important collection.

The box was tested to determine its pH value. A piece of 1g of the box material was placed in 10 ml of distilled water and measured with indicator strips from two different manufacturers, and a pH meter (Tétreault 1992). The box material had a pH of 8, which implies the use of buffered material. However, the sleeves which had been in close contact with the objects had an acidic pH of 4, common for aged, non-conservation-grade material. It can be concluded that the objects have been in contact with moderate amounts of organic acids originating from the original sleeves during storage.

The box that housed the snakeskins was also tested for its ability to provide protection against temperature and humidity variation by placing a humidity and temperature monitor inside it. The results from the monitor indicated no major buffering effects to extreme temperature and humidity variations.

Paper and specimens.– All the snakeskins were in similar condition, attached to sheets that were dirty, torn, creased and weak due to the failing adhesive. Considering the nature and age of the snakeskins, the paper had survived surprisingly well and still feels robust. Close examination of specimen 1904.7.27.11-15 indicates the presence of a watermark on the paper that clearly

reads "James Whatman Turkey Mill Kent" when the paper is placed on a light box. There is also a number which possibly relates to the year the paper was manufactured (written under the watermark and not clearly visible, being obstructed by a portion of a snake skin) (Fig. 2).

The Whatman business was founded by James Whatman (1702-1759) in the 1730s. The paper mill, near Maidstone, Kent, was called Turkey Mill. Whatman's traditionally laid paper quickly gained a high reputation. In 1756 Whatman became the first European manufacturer of wove paper, which was smoother and finer without the linear structural markings of traditional paper. Whatman's son of the same name (1741–1798) developed a market for wove paper among artists and printers. He sold the business in 1794, with the rights to continue using the, by then famous, "J Whatman" name and watermark. Whatman Paper is still made, and favoured especially for fine art purposes, though there is also a variety used for medical filtration (Balston 1979). Though the date under the watermark is not clearly visible, examples of the same watermark type are dated around the latter portion of the 18th century, which fits very well with the time of Patrick Russell's sojourn in India.

The specimens appeared to be adhered to paper with animal glue. The adhesive was failing in places causing the skins to lift from the surface of the paper and become detached. The adhesive was yellowed and brittle with age. The paper on which almost all of the specimens were mounted showed cockling that was more pronounced around the specimens due to the uneven drying of the adhesive. Localised stains were evident on some of the dust sleeves (mat burns). The ends of the paper were particularly brittle with many deep tears. The edges of the paper in many instances showed creases as though it had been unintentionally folded. In most cases small tears were evident around the edges.

The scales on some of the specimens had become white and opaque. This is a sign of blooming or blanching) which happens when there is a loss of pigment. In general, the colours of the skins were preserved extremely well but in some instances colours have faded or changed completely. For example there is a written note on the sheet containing specimen 1904.7.27.37 concerning the unusual bluish sutra of the specimen, however, the specimen now is earth brown in colour. This is particularly important for taxonomic purposes. Discolouration of the paper on which the skins are mounted can sometimes be seen on the edges. This discolouration could have been caused by the paper being stored in an acidic environment (either the original old dust sleeves or the wooden box in which they were previously stored, see Previous environmental storage conditions).We could not identify the actual chemicals involved but the effects were certainly visible. Some random points of foxing are evident on a small number of the papers but it is unclear whether these were caused by mould growth or metal impurities within the paper that were exacerbated by high humidity or volatile acids.

It was noted that the paper on which the snakeskins were mounted had accumulated dust and remains of past infestations Almost all mounted skins showed signs of past pest infestations with many containing accretions from past pest activities in the form of frass, webbing and larval skins. Grazing is evident in many specimens and there is extensive damage to the paper and the skin caused by pest attack (Fig. 3).

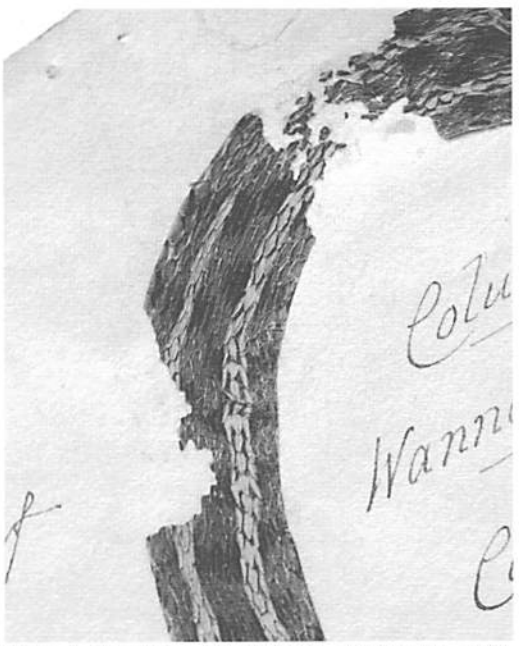

Figure 3. Specimen 1904.7.27.94 *Amphiesma stolatum*, 'Wanna Pam' or 'Cogli' (see Bauer, this issue). Damage caused by insect attack.

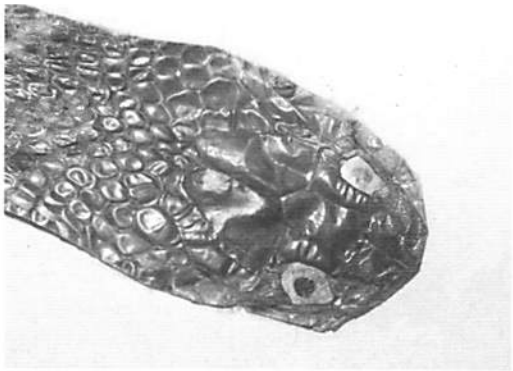

Figure 4. Specimen 1904.7.27.35 showing what appears to be mica eye replacements. The skin is accompanied by handwritten notes: "Specimen of no. XXXIII Coluber Neeli Koea from its frequenting the Paddy fields, it is commonly reckoned a watersnake. It is not venomous".

The ink used is still vibrant and does not show signs of bleeding. Fine particulate matter has been deposited on the surface of the skins and paper. Both loose and ingrained dirt was noticed which undoubtedly contributed to the brittleness of the paper by reducing the papers elasticity. Some of the specimens appear to have had mica inserted as eye replacements (Fig. 4).

Conservation of the 1904 Patrick Russell snakeskins

Cabinet.– Ocean Design supplied and fitted all the new cabinets for Zoo Store 1, however the standard width of these cabinets was too narrow and drawers too deep (drawers of internal heights of 44 mm, 72 mm and 100 mm were available in the general collection) for the Russell snakeskins. The skins had to be stored flat and face up at all times (not hung) and very fragile specimens should never be turned over (Bedford 1999) as in botanical mounts, so it was decided that a brand new cabinet had to be designed. Hence, discussions were held with the Head of Collections and LVS Project Planning Board to secure funding for a new cabinet design. In November 2011, a new multi-drawer conservation cabinet (2400 mm high x 690 x 1550 mm) was designed and commissioned for the skins. The housing comprised two side panels, a top panel, a base panel and a back panel. It was manufactured from Zintec coated sheet steel. There were closed box section frames at the front and rear to ensure strength and rigidity; they also enable a loaded cabinet to be transported on pallet trucks for delivery or for transference elsewhere. The components were riveted with high tensile rivets, which have excellent hole-fill capability, with a large blind side bearing area. This ensures a strong vibration resistant joint. The placed rivets are resistant to ingress by air and non-pressurised water. The housing has no holes, voids or crevices that permit the entrance and housing of harmful pests. Joins are sealed with Dow Corning 7091 silicon sealant and the door has a crush seal manufactured from EPDM. The Shelves are adjustable on a 28 mm pitch, supported along the full width of each edge and manufactured in three panels, for strength and ease of adjustment.

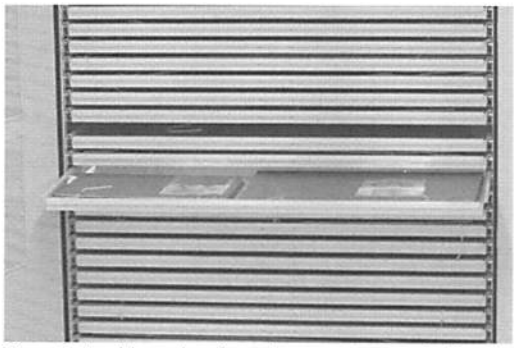

Figure 5. A mid-section from the new purpose built cabinet now housing the 1904 Russell snakeskins in Zoo Store 1 (Large Vertebrate Store) at South Kensington.

In addition to this, the new cabinet offered a huge increase in storage space for the skins compared to the tiny box they were housed in previously and ensures that the skins are kept out of the light to prevent deterioration of colour and other light-induced degradation (Carter & Walker 1999). It is also fitted with 36 very shallow drawers (only 50 mm high, 1400 mm wide) (Fig. 5) allowing for an efficient use of space and ensuring that the skins are not being stored directly on top of each other, thus minimising mechanical damage. Materials, hinges, roller mechanisms and general robustness of the Ocean Design cabinets were all thoroughly examined at the factories prior to the company being selected for the task. Various tests were also carried out including the 'paper holding test' where a single A4 sheet of paper was slotted in between the two doors of the cabinet prior to closing tight. Attempts were then made to dislodge the sheet once the doors were shut; this was impossible demonstrating the integrity of the seal.

The new cabinet would ensure that there would be a huge improvement in environmental conditions for the skins, at least internally. Externally there would still be some problems. It was a stand-alone system such that, should the need arise, it would be possible to remove it from its position in the store without the need for dismantling prior to relocating it whole into a completely new storeroom.

Storage boxes.– The conservation department assisted with the expert repair and cleaning of skins prior to their transfer. The cabinet and materials needed for the work was agreed upon and purchased. The skins were individually boxed using acid-free, archivally sound materials mostly purchased from Preservation Equipment Limited.

Before the conservation work was begun, a full survey of the skins was undertaken to provide a general overview of the condition of the snakeskins, what treatments had been applied, and what actions were now needed. A representative snakeskin was chosen to design the prototype for the new mounts in order to provide an accurate cost for the project. Due to the various sizes, number, and nature of the snakeskins, sourcing a manufacturer for custom commercial mounts was not an option. It was decided that bespoke archival cardboard boxes for each skin was the best system. Fabricating new mounts and storage solutions in-house amounted to a third of the cost of anything commercially available, making for a practical and viable development initiative in terms of labour and materials despite being time-consuming. Materials used were: Premier Fluted Board EB Flute — Grey/White 1640 mm (flute) x 2450 mm (grain) Boxed/10 shts; Timecare Heritage CMB 100% Cotton — TG Off White 2200 Micron, 1682 x 1189 mm; Timecare Heritage CMB 100% Cotton—Museum Cream 1100 Micron, 1189 x 841 mm; Bondina Roll 920 mm x 10 m, 30 gsm; Rivet male/female head nickel plated 2 part; and Linen Bookbinding Cord 1kg ball, 8 ply.

The storage boxes protect the specimens from dust and heavy handling while providing some buffering against sharp environmental changes. Due to their size, the specimens needed to be fully supported while moved from the draws to the benches for study. Each specimen, though flat, had a unique profile due to the paper cockling which needed to be addressed as a 3D object. Though the new cabinet provides protection from dust, pollutants, pests and fluctuations in temperature and humidity, the new storage system needed to provide some level of environmental buffering as well. Additionally, the new storage should allow for easy identification of the specimens. The original dust sleeves where retained and kept within the new boxes as they bear the identification numbers and are of historical value whilst photos of the contents were placed on the outside of each box (see below).

The new storage boxes (or three dimensional folders) are made of archival corrugated board that is strong enough to hold the large sized specimens but light enough to be carried by one person. Inside each folder there is a mount window for each specimen to sit bespoke to its dimensions. The specimens are further enveloped in bondina so that no detached part of the skin can be accidentally caught on the window or on the sides of the boxes (Fig. 6). The folder is 3 cm deep so as to house the paper with the most pronounced cockling and closes with archival buttons and cotton tape in order to stay securely closed. The dust sleeves were slightly acidic so the decision was made to encapsulate them to prevent further damage to the specimens from off-gassing.

Paper and specimens.– Large particulates were removed with a soft round brush and a modified VacR (HEPA filtered museum vacuum). Ingrained dust was removed with the use of soot sponges (vulcanized natural rubber). Ground paper or paper cleaning erasers were used only when necessary because residues may be left behind using erasers of this kind. Small scale paper repairs were carried out where necessary to prevent further damage during handling.

The sheets supporting the snakeskins were relaxed using glass weights where necessary. Paper that was torn in a manner such that handling might damage it further was repaired on the back of the paper sheets with toned Japanese paper and a mixture of shofu (wheat starch) and methyl cellulose. Detached snake scales on the skins were re-adhered to the skins using methyl cellulose applied with a small sable brush. It was possible to determine the original locations of most of the scales which had become detached. Where it was not possible to locate the position from which the

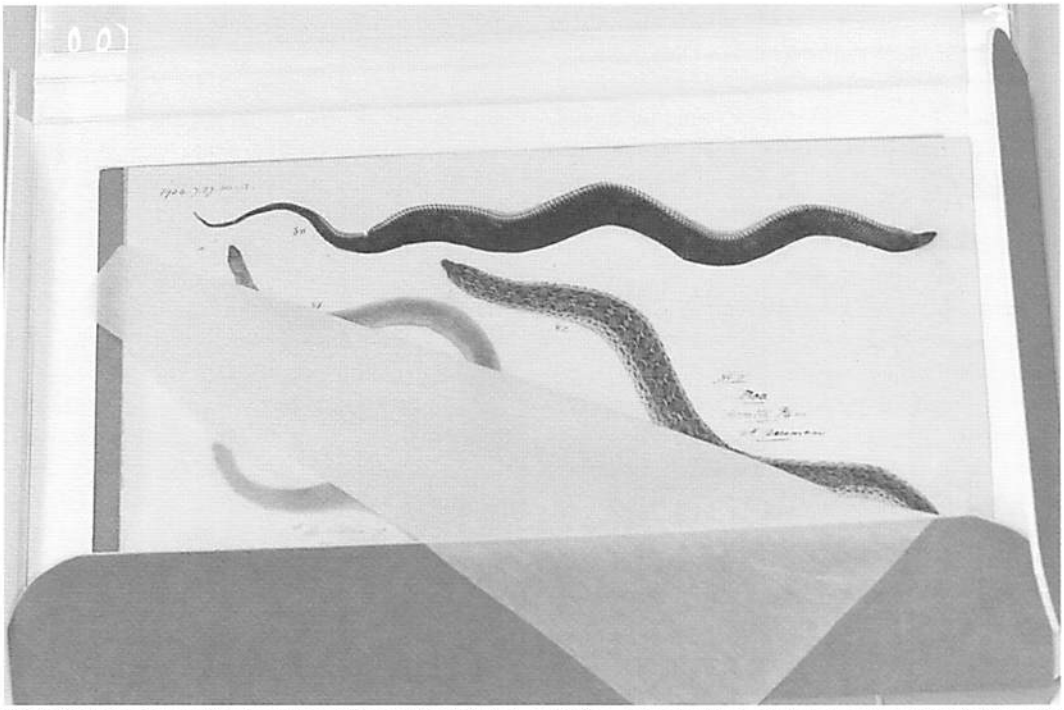

Figure 6. Bespoke archival cardboard boxes/Individual acid free conservation grade boxes hand-made for each sheet in loose bondina covers.

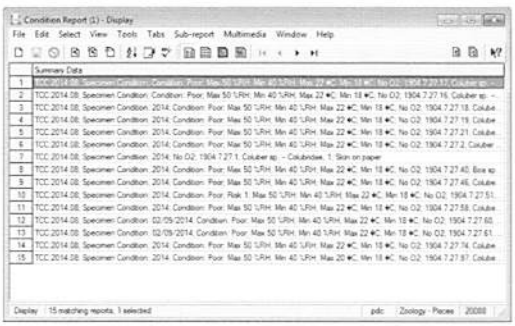

Figure 7. Condition reports were completed in Natural History Museum database KeEmu.

Figure 8. Eltek environmental monitoring system transmitter.

scale was detached, they were placed in paper envelopes and kept with that particular skin (similar to detached plant parts in an herbarium). Snake skins that were lifting from the paper were not re-attached, but the damage was documented.

Documentation.– Each snakeskin was photographed and a printed copy placed in a melinex sleeve adhered on the outside of the box along with the accession number for easy identification. Condition reports were completed (Fig. 7) and attached to individual records which were entered into the museum database system KeEmu for the first time. There were no database records of the skins prior to this project. The only record in existence of these skins was a one line entry in the original register for 1904 (see Campbell, this volume). Hence, database records were created for each skin individually allowing for conservation reports to be attached directly to corresponding records in the database along with the photographs.

Improved environmental conditions and environmental monitoring

Environmental monitoring is an important step towards creating and keeping good storage conditions for collections (Weintraub & Wolf 1995). In 2009 a basic radio-telemetric network of transmitters and data loggers was installed across the collections areas and galleries at The Natural History Museum, covering zoology specimens at South Kensington (including the

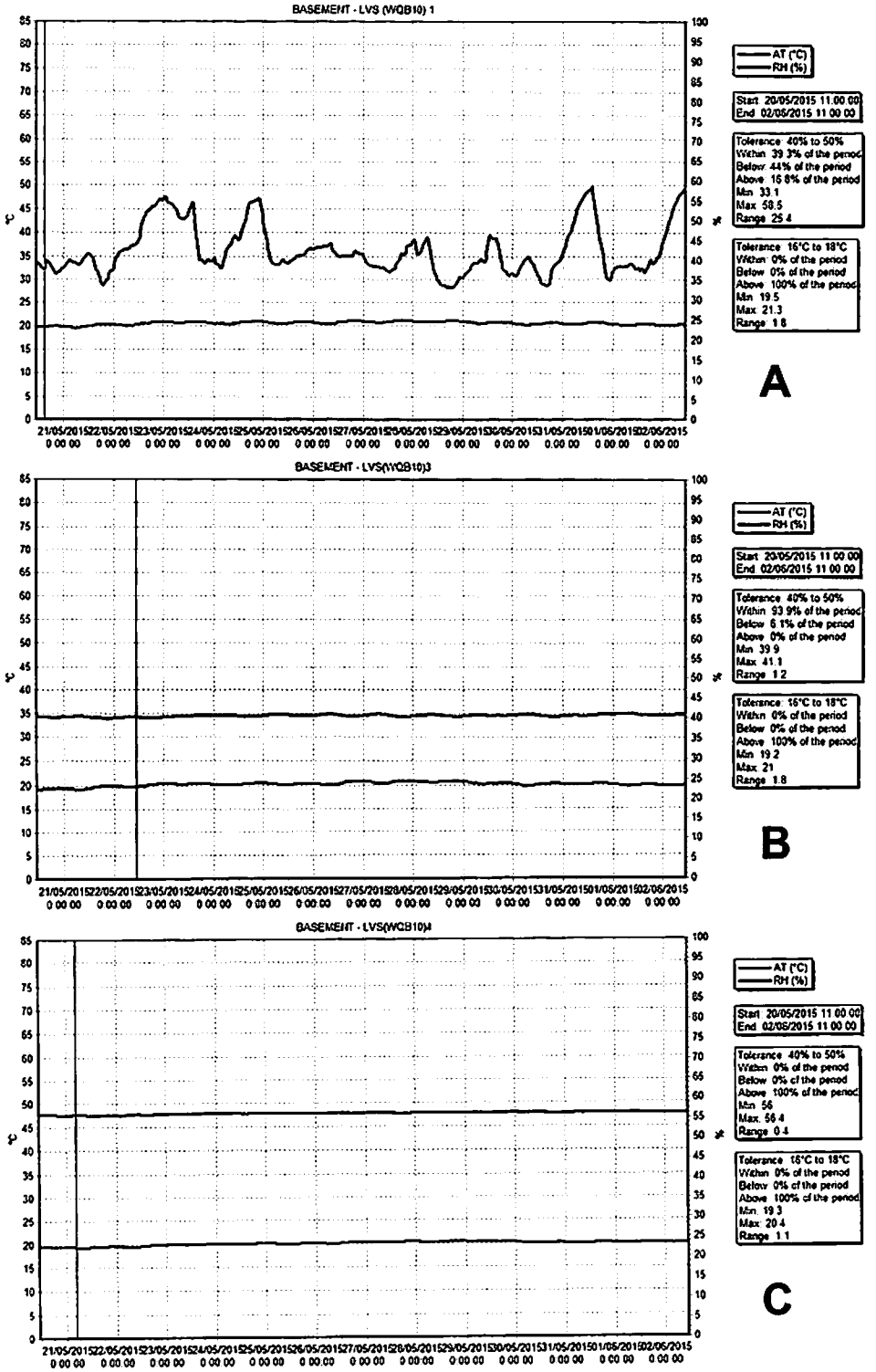

Figure 9. Temperature and relative humidity data from the Eltek environmental monitoring system in the LVS facility from between 21 May 2015 and 2 June 2015. A. Data from LVS1, a monitor placed outside a cabinet, on workbench, near the main entrance to the storeroom. B. Data from LVS3, a monitor inside reptile and amphibian skeleton cabinet. C. Data from LVS4, a monitor inside radiographs cabinet 68, near the entrance into the Porifera dry store.

new LVS store), Tring, and Wandsworth. The Eltek GenII Heritage monitoring and analysis system was designed specifically for the requirements of museums, libraries and conservation studies. The system uses wireless transmitters to gather data from multiple sensors and transmit the information back to a central data logger. The system is able to continue functioning in the event of PC or mains AC failure for independent and robust monitoring. In 2010, allocation of further funds allowed purchase of additional equipment, to enhance the efficacy of monitoring and improve data quality. The use of archived environmental data collected by the monitors across the department has since allowed problematic areas within the collections to be identified. The Eltek environmental monitoring system, now installed in LVS, constantly monitors temperature, relative humidity, and ultra violet levels. Transmitters (Fig. 8) are placed at strategic positions both inside and outside new Ocean Design cabinets. The associated software, Darca, is site-based, offering data acquisition, analysis and reporting at source.

The Eltek's radio-telemetric, wireless data logging system can produce data in graphical form and has confirmed the new cabinets' vastly improved internal environment in the new LVS store (Fig. 9). Relative humidity (blue line) fluctuated widely while temperature (red line) remained fairly stable in areas outside cabinets (Fig. 9A). This was expected as it has been generally accepted that there is little that can be done to seal the storeroom itself in an attempt to control the environment. However, the environment within cabinets was stable (Figs. 9B–C), and is typical of all the Ocean Design cabinets in the new LVS store including the cabinet housing the Patrick Russell 1904 snakeskins. The fluctuating humidity problem and high temperatures are now both under control within the cabinets where specimens, including the Patrick Russell snakeskins, are stored and the cabinets provide a more formidable barrier to pests. Security had also been increased because cabinets were fitted with locks.

Acknowledgements

We thank the Trustees of the Natural History Museum for permission to reproduce images of the zoology storeroom, cabinets and specimens, The Natural History Museum conservators Chris Collins and Erica Read for their generous assistance during this project, Clare Valentine, Richard Sabin and Laura McCoy for their support during the CSIP project, Roberto Portelo Miguez and Andrew Cabrinovic for supplying monitoring system data and Aaron Bauer for his kind invitation to write this paper.

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Lycodon odishii, a junior synonym of *Lycodon jara*, with notes on morphological variation in this species (Squamata, Colubridae)

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ABSTRACT.– In this paper we present morphometric data recorded on 11 specimens of *Lycodon jara* (Shaw, 1802) and compare them with those of the recently described species *Lycodon odishii* Mallik, Parida, Mohanty, Mallik, Purohit, Mohanty, Nanda, Sindura, Purohit, Mishra & Sahoo, 2014. Multivariate comparison of the two species revealed that variation in *L. odishii* falls well within the range of the *L. jara*. *Lycodon odishii* should, therefore, be treated as a junior synonym of *L. jara*.

KEYWORDS.– *Lycodon*, India, morphological variation, synonymy, distribution.

Introduction

The Asian snake genus *Lycodon* Fitzinger, 1826 is presently represented by 51 species (Uetz & Hosek 2015). In India the genus is represented by 16 species (Mallik *et al.* 2014) with *Lycodon odishii* Mallik, Parida, Mohanty, Mallik, Purohit, Mohanty, Nanda, Sindura, Purohit, Mishra &Sahoo, 2014 being the latest described. *Lycodon odishii* was described as a species closely allied to *L. jara*, which was described by Shaw (1802) as *Coluber jara* based on an illustration by Patrick Russell (1796: 19–20, pl. 44; actually plate 14, as noted by Wallach *et al.* 2014) with Ganjam, Orissa State of India as the type locality. The description stated that the snake is black above with each scale marked with minute white lines, yellow collar present on back of the head, and venter yellow. Cantor (1839) described *Coluber bipunctatus*, which is regarded as a synonym of *L. jara*, with 181 ventrals and 52 subcaudals and included Bengal and Asam [now Assam] in its distributional range. Peters (1863) described the same species again as *Lycophidion bipunctatum* based on a single specimen (ZMB [Zoologisches Museum Berlin, now Museum für Naturkunde, Berlin] 4886) with 172 ventrals, single anal, 70 subcaudals, 17 middorasal scale rows, 9/8 supralabials, and a total length of 440 mm. Günther (1864), under the combination *Leptorhytaon jara*, characterised it as a snake that is brown above with two white dots on each scale, generally with a white collar, venter uniform white. Theobald (1868) noted the species as *Leptorhytaon jara* with distribution range as "India generally". Wall (1923a) listed the species as *Ophites jara* with 167–188 ventrals, 52–74 subcaudals, 539 mm in length and distributed in Bengal, Eastern Himalayas, Assam and Manipur. Smith (1943) gave the characters of *Lycodon jara* as follows: ventrals 167–188, subcaudals 52–74, divided anals, supralabials 8/9, dorsal scales in 17/17/15 rows, total length 535 mm in males and 500 mm in females, brown or purplish-black above with yellow dots on each scales and a white collar always present in young snakes, with a distribution in Assam and Bengal.

In its description the characters of *L. odishii* were given as follows: snout vent length of 100–289 mm, total length of 128–354 mm, dorsal scales in 17:17:15 rows, snout projecting beyond the lower jaw, loreal in contact with preocular and not with eye, preocular 1, postoculars 1–2, 5 infralabials contacting chin shield, ventrals 167–188, anal divided, subcaudals 52–64, divided, head glossy, greyish or blackish-brown, body glossy-purplish-greenish-black in adults and greyish-black in hatchlings. Prominent collar always present behind the head. Collar white in hatchlings and white with yellow blotches in

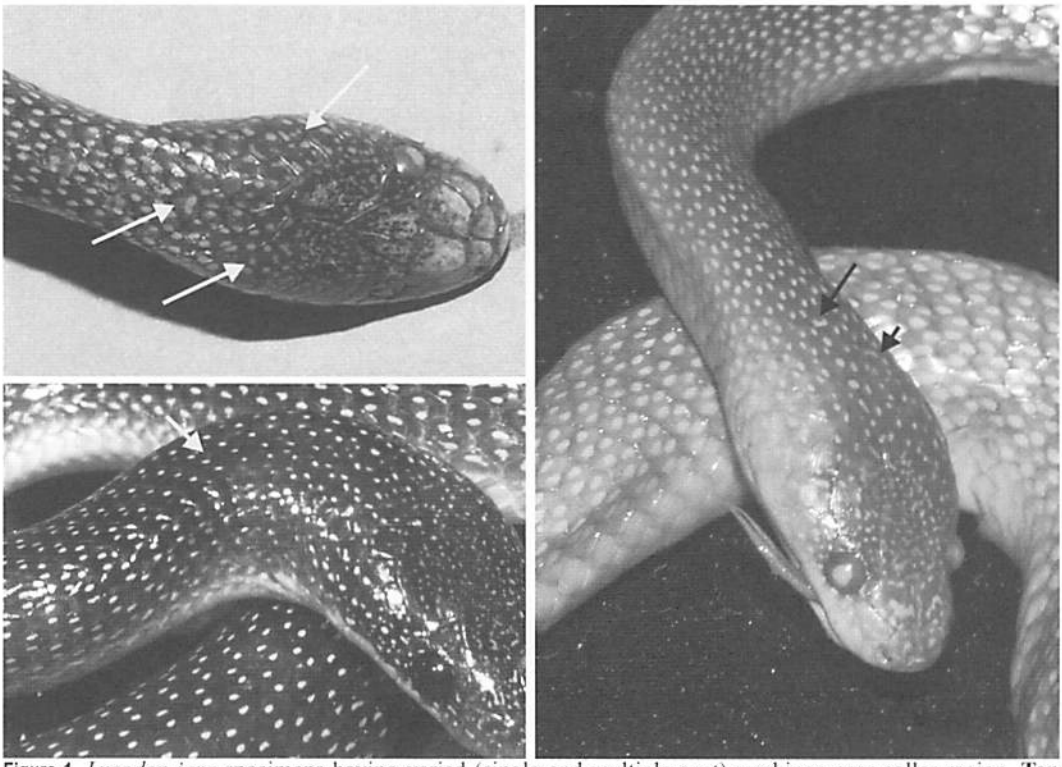

Figure 1. *Lycodon jara* specimens having varied (single and multiple spot) markings near collar region. **Top left:** *Lycophidion bipunctatum* (junior syn. of*L. jara*), ZMB 4886 (Photo Credit: Gernot Vogel). **Bottom left:** Living specimen from Alipurduar, West Bengal, India (Photo Credit: Tirthankar Biswas). **Right:** ZSI 14747, Rampore Tea Estate.

adults. Two spots are present on each scale of body except in the 6–7 rows of scales in the collar region.

Mallik *et al.* (2014) stated that *L. odishii* could be diagnosed from *L. jara* by having a well-defined collar that is white in hatchlings and white with yellow blotches in juveniles and adults vs. no collar; the snout projecting beyond the lower jaw vs. not; 1 or 2 postoculars vs. always 2 in *L. jara*; 2 spots present on each body scale except the 6th–7th rows of scales in the collar region vs. 2 spots on each scale; and yellow tinges on the head shields much less numerous than in *L. jara*.

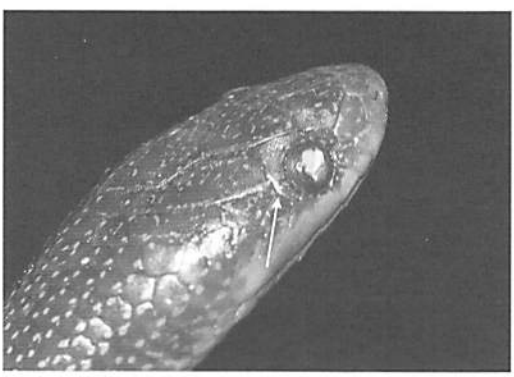

Figure 2. ZSI 8018, Garo Hills; *Lycodon jara* having single postocular.

In this paper we provide additional morphometric information on *L. jara* and compare it with the newly described *L. odishii*.

Material and Methods

Museum specimens examined were from the collection of Zoological Survey of India, Kolkata (ZSI), including the type series of *L. odishii*. Measurements (in mm) were taken using Mitutoyo dial caliper with 0.02 mm precision. Live specimens used in the comparison were from West Bengal and Mizoram. Ventral scales were counted as per Dowling (1951) and the subcaudals were counted excluding the terminal scute. Principal component analysis was done using Biodiversity Pro (Version 2). Abbreviations used are Vent: ventral scales, SC: sub caudal scales, Pre Oc: pre ocular, Post Oc: post ocular, Temp: temporals, SL: supralabials, SL (te): supralabial touching eye, IL: Infralabials, SVL: snout vent

Table 1. Mensural, meristic and proportional data from specimens of *L. jara* and *L. odishii*. All specimens are in the ZSI collection. Measurements are in mm. See text for abbreviations.

	Lycodon jara										*Lycodon odishii*		
Characters	**8012**	**8014**	**8017**	**8018**	**11364**	**13813**	**14747**	**23616**	**23823**	**26142**	**25992**	**25993**	**25994**
Vent	172	184	183	189	169	170	168	176	178	178	167	172	172
Sc	65	65	70	66	69	74	68	75	56	57	58	52	63
Pre Oc	1,1	1,1	2,1	1,1	1 2	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,1
Post Oc	2,2	2,2	2,2	1,1	2,2	2,2	2,2	2,2	2,2	2,2	1,1	2,2	2,2
Temp	2+3/2+3	1+2/1+2	2+2/1+2	2+3/1+2	2+2/1+2	2+2/2+2	2+2/2+2	2+3/2+3	2+3/1+2	1+3/1+3	1+2/2+2	2+3/2+3	2+3/2+2
SL/ IL	9,9/9,10	8,8/10,10	8,8/10,10	8,8/10,9	8,8/10,10	8,8/10,10	8,8/10,10	8,8/10,9	8,9/10,10	8,8/10,10	9,9/10,9	9,9/9,9	9,9/9,10
SVL	217	425	436	198	364	390	342	360	120	162	248	143	95
TL	50	92	106	42	104	102	95	95	24	30	63	33	30
HL	8.60	11.76	12.46	8.06	11.21	11.22	11.81	10.06	5.32	6.68	7.16	5.78	4.90
HW	4.92	7.29	6.34	4.70	7.17	6.91	8.66	6.68	4.15	4.54	5.28	3.62	3.04
HD	4.28	5.58	6.00	3.36	5.94	5.71	6.92	4.76	2.88	3.64	3.78	3.00	2.16
Eye D	1.34	2.60	2.40	1.50	1.82	2.32	1.73	1.92	1.08	1.16	1.82	0.88	1.68
E-Sn	3.08	3.88	5.00	2.88	4.80	4.74	4.95	3.92	2.22	2.82	3.12	2.26	2.02
E-Ns	2.14	2.00	3.40	2.06	2.76	3.68	2.98	3.50	1.16	1.48	2.44	1.28	1.06
IOS	2.60	3.70	3.96	2.46	4.12	3.76	4.60	3.20	2.08	2.68	3.14	2.10	2.10
RH	0.85	1.44	1.61	0.86	1.45	1.26	1.25	1.32	0.84	0.70	0.88	0.44	0.54
RW	2.18	2.55	2.84	1.42	2.72	2.65	3.95	3.46	2.04	1.80	2.10	1.34	1.18
TOT/TL	5.34	5.62	5.11	5.71	4.50	4.82	4.60	4.79	6.00	6.40	4.94	5.33	4.17
HL/HW	1.75	1.61	1.97	1.71	1.56	1.62	1.36	1.51	1.28	1.47	1.36	1.60	1.61
HL/HD	2.01	2.11	2.08	2.40	1.89	1.96	1.71	2.11	1.85	1.84	1.89	1.93	2.27
E-Sn/E-Ns	1.44	1.94	1.47	1.40	1.74	1.29	1.66	1.12	1.91	1.91	1.28	1.77	1.91
RW/RH	2.56	1.77	1.76	1.65	1.88	2.10	3.16	2.62	2.43	2.57	2.39	3.05	2.19
Snout projection	0.74	1.12	1.28	0.88	1.20	1.18	1.10	1.00	0.78	0.62	0.52	0.56	0.32
Collar	Present	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Present	Present	Present	Present	Present

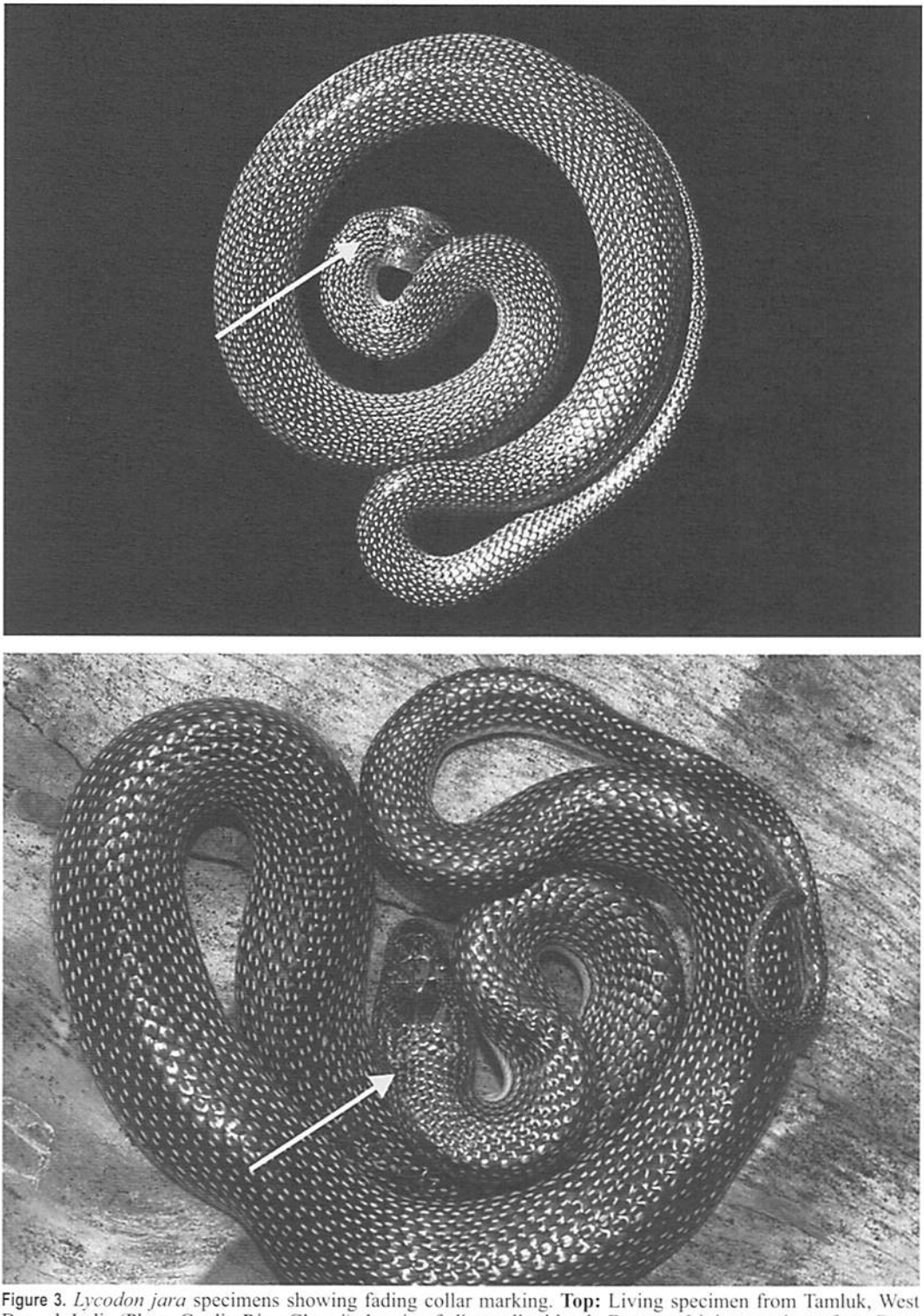

Figure 3. *Lycodon jara* specimens showing fading collar marking. **Top:** Living specimen from Tamluk, West Bengal, India (Photo Credit: Rivu Ghorai) showing fading collar blotch. **Bottom:** Living specimen from Buxa Hills, West Bengal, India (Photo Credit: Tirthankar Biswas) showing faded collar band.

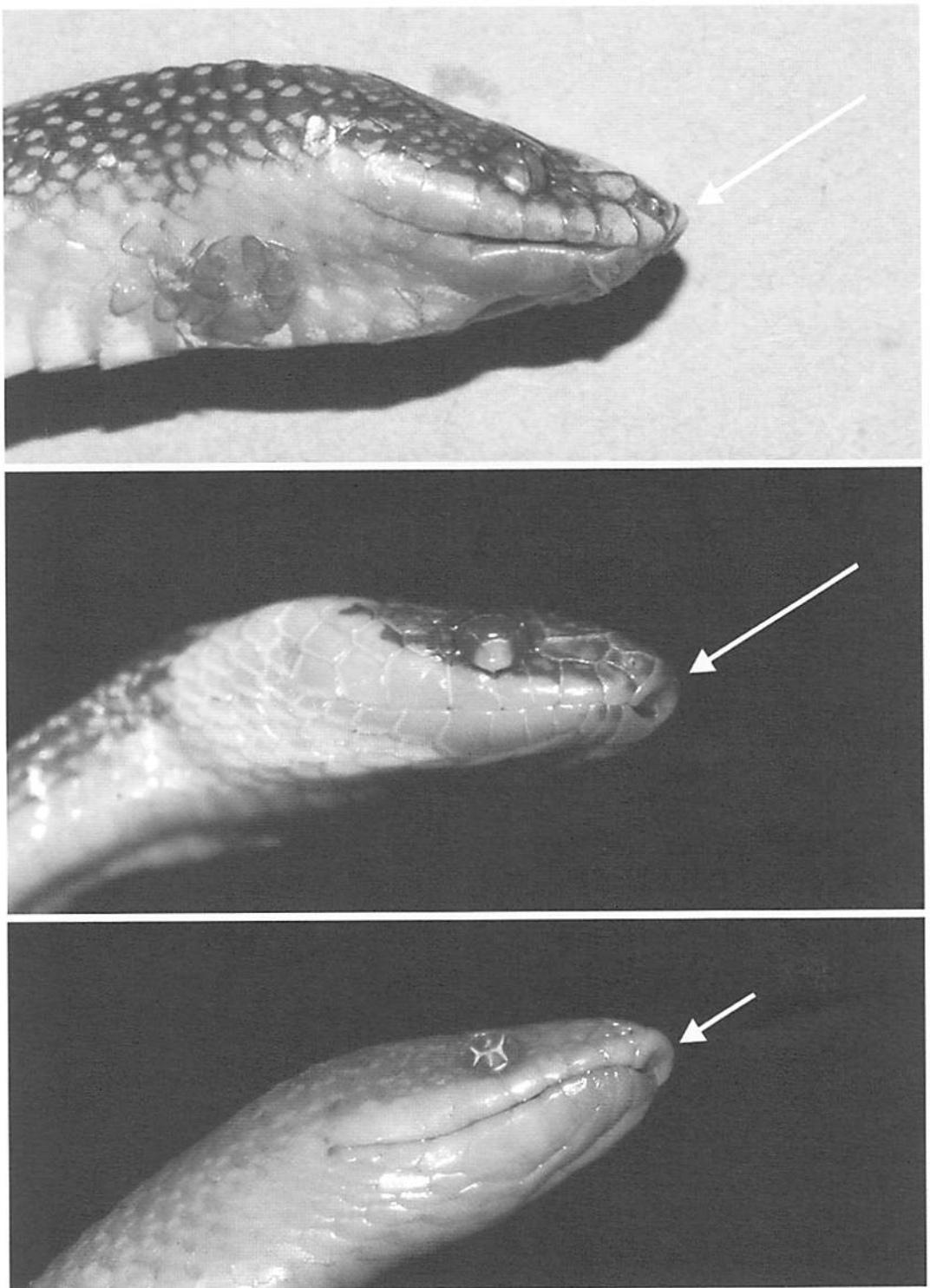

Figure 4. *Lycodon jara* specimens showing projection of snout beyond lower jaw. **Top:** *Lycophidion bipunctatum* (syn: *L.jara*) ZMB 4886 (Photo Credit: Gernot Vogel). **Middle:** ZSI 23823, Sherpur. **Bottom:** ZSI 8017, Sibsagar, Assam.

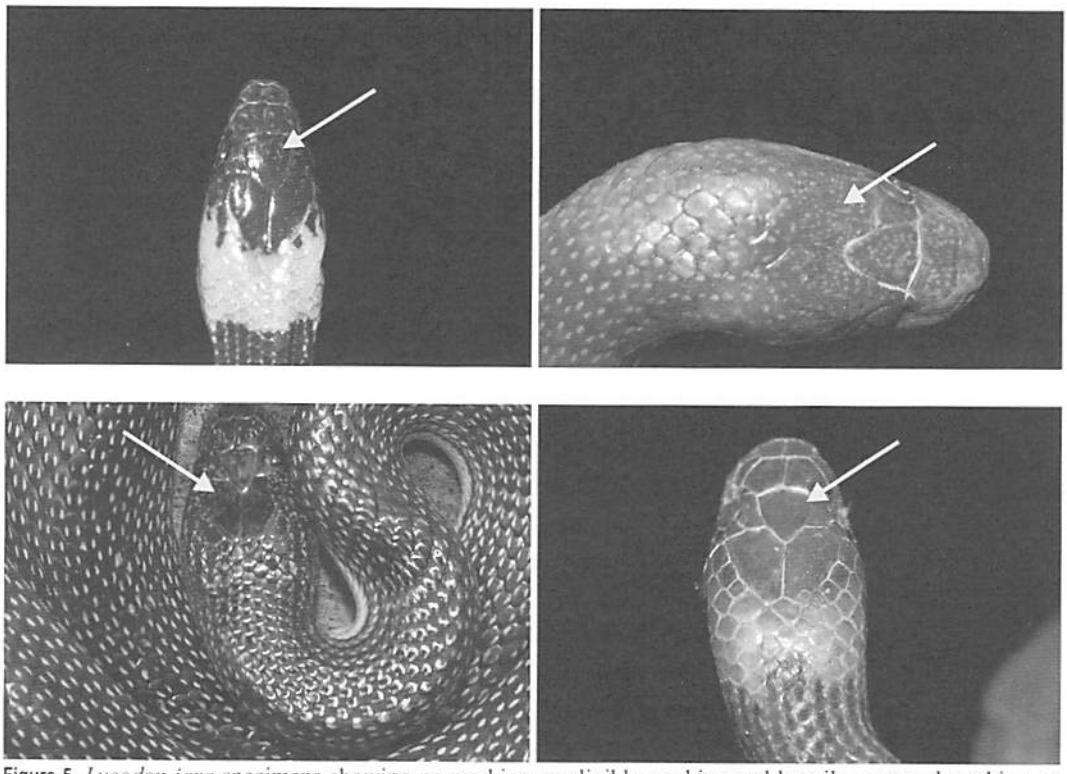

Figure 5. *Lycodon jara* specimens showing no marking, negligible marking and heavily scattered marking on head region. **Top Left:** ZSI 8014, Cachar. **Top Right:** ZSI 23823, Sherpur. **Bottom Left:** Live specimen from Buxa Hills, West Bengal India (Photo Credit: Tirthankar Biswas). **Bottom Right:** ZSI 26142, N/A.

length, TL: tail length, TOT: total length (SVL+TL), HL: head length at angle of jaw, HW: head width at angle of jaw, HD: head depth at angle of jaw. Eye D: eye diameter, E-Sn: distance between eye and snout, E-Ns: distance between eye and nostril, IOS: inter orbital space, RH: rostral height, RW: rostral width, avg: average, max: maximum, min: minimum

Results and Discussion

Of the 11 specimens of *L. jara* we examined, the ventral number ranged from 168–184; subcaudals: 56–74. Dorsals scales are in 17:17:15 rows, both preoculars and postoculars 1 or 2. Temporal formula 1+2, 1+3, 1+2, 2+2, 2+3; supralabials 8–9 with 3rd, 4th and 5th touching the eye, infralabials are 9–10. Snout-vent length more than four times tail length (TOT/TL: avg = 5.18, min = 4.17, max = 6.40); head longer than broad (HL/HW: avg = 1.57, min = 1.28, max = 1.97); nostril situated much closer to the snout than to the eyes (E-Sn/E-Ns: avg = 1.62, min = 1.12, max = 1.94); Rostral much wider than long (RW/RH: avg = 2.25, min = 1.76, max = 3.16), snout projects about 1 mm beyond the lower jaw (min = 0.62, max = 1.28) (see Table 1 for all mensural, meristic and proportional data). Living specimens are brown, purple or olive green above with two yellowish-white or yellow spots on each scale. Some scales (often in the nape region) may have varying number of spots ranging from zero to four (Fig. 1). The venter is white or yellowish-white. Juveniles and subadult snakes have a collar on the nape region which fades with age. Thus, there is a varying degree of collar thickness and pattern that changes with age.

According to Mallik *et al.* (2014) *L. jara* has 2 postoculars, but we found one specimen (Fig. 2) with only a single postocular. Mallik *et al.* (2014) denoted the presence of twin spots on each dorsal scale of *L. jara* with *L. odishii* lacking twin spots in 6–7 rows in the collar region. We found *L. jara* specimens with a variable number of spots on dorsal scales in collar region ranging from zero to four (Fig. 1). *Lycodon odishii* was mentioned (Mallik *et al.* 2014) as having a well-defined collar. But same is the

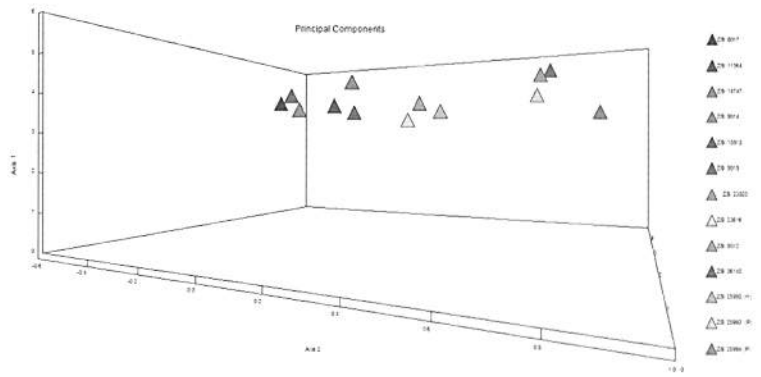

Figure 6. Principal component analysis of 10 specimens of *L.jara* and three specimens of *L. odishii*.

case with *L. jara*, as the original species description clearly mentions (Shaw 1802). There are ontogenetic stages in which the evidence of the fading of the collar can be seen (Fig. 3). The presence or absence of the collar thus seems to be age related. The largest specimen of *L. odishii* has a total length of 354 mm; Smith (1943) mentioned the length of *L. jara* to be 535 mm, thus pointing to the fact that all the studied specimens of *L. odishii* were equivalent to the length of juvenile or subadult specimens of *L. jara*.

As for snout shape, Mallik *et al.* (2014) mentioned that *L. odishii* has a snout extending beyond the lower jaw which is not the case in *L. jara*. Smith (1943) mentioned that the snout of *L. jara* did not extend beyond the lower jaw, but the holotype of *Lycophidion bipunctatum* (a synonym of *L. jara*) and all other specimens we studied clearly show such an extension (Fig. 4). The markings on the head region of *L. jara* vary from almost none to faint markings to scattered

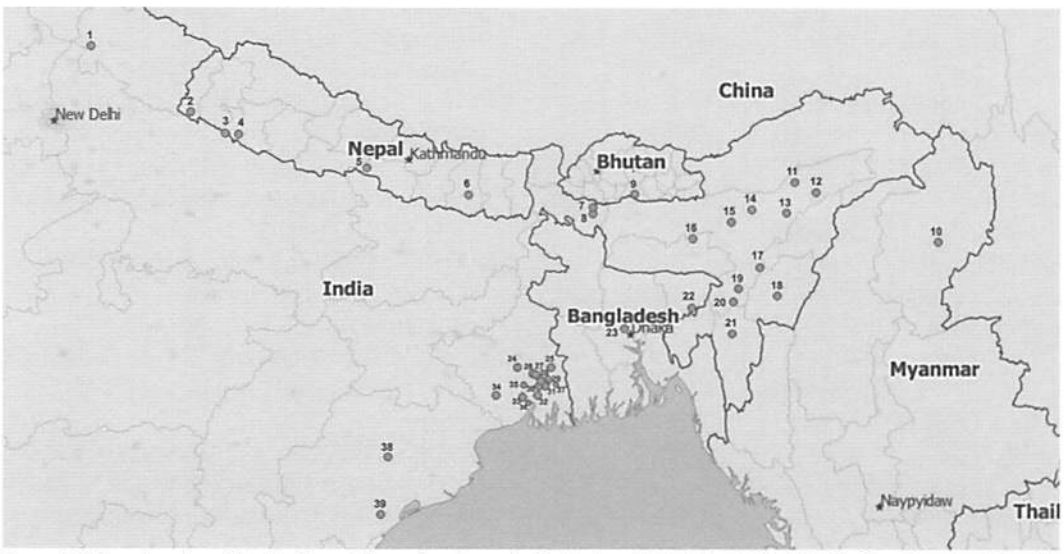

Figure 7. Map showing distribution of *Lycodon jara*, 1. Derhadun (Uttarkhand, India), 2. Kanchanpur (Nepal), 3. Bardia (Nepal), 4. Katerniaghat (U.P., India), 5. Chitwan (Nepal), 6. Udaypur (Nepal), 7. Buxa (Alipurduar District, West Bengal, India), 8. Aliporeduar City (Alipurduar District, West Bengal, India), 9. Sarpang (Bhutan), 10. Kachin (Myanmar), 11. Sibsagar (N. Lakhimpur District, Assam, India) [ZSI 8017], 12. Lakhimpur (Assam, India), 13. Golaghat (Assam, India), 14. Kaziranga (Assam, India), 15. Nagaon (Assam, India), 16. Nongkhyllem (Meghalaya, India), 17. Barail (Assam, India), 18. Bishnupur (Manipur, India), 19. Cachar (Assam, India) [ZSI 8014, 11364], 20. Vairengte (Mizoram, India), 21. Aizawl (Mizoram, India), 22. Lawachara N.P (Bangladesh), 23. Savar (Bangladesh), 24. Sherpur (Murshidabad District, West Bengal, India) [ZSI 23823], 25. Haringhata (Nadia District, West Bengal, India), 26. Nalikul (Hoogly District, West Bengal, India), 27. Singur (Hoogly District, West Bengal, India), 28. Uttarpara (Hoogly District, West Bengal, India), 29. Badu (North 24 Parganas, West Bengal, India), 30. Sibpur (Howrah District, West Bengal, India) [ZSI 8015], 31. East Calcutta Wet Lands (Kolkata, West Bengal, India), 32. Alipore (South 24 Parganas, West Bengal, India) [ZSI 18531], 33. Tamluk (East Midnapur District, West Bengal, India), 34. Kharagpur (West Midnapur District, West Bengal, India), 35. Joka (South 24 Parganas, West Bengal, India), 36. Raichak (South 24 Parganas, West Bengal, India), 37. Panchla (Howrah District, West Bengal, India), 38. Angul Dist (Orissa, India), 39. Ganjam District (Orissa, India).

heavy markings (Fig. 5). It was also mentioned (Mallik *et al.* 2014) that *L. odishii* has a rostral that is not broader than long but upon examination of the three type specimens of *L. odishii* we found the rostral to be distinctly broader than long (avg 2.54 times broader than long), similar to that of *L. jara* (Table 1). Mallik *et al.* (2014) mentioned that the infralabial touches the eye, which is obviously an error, it should have been infralabial touching the chin shield instead.

For the eleven specimens of *L. jara* and three specimens of *L. odishii* examined, we calculated the ratio and average of TOT/TL, HL/HW, HL/HD, E-Sn/E-Ns, RW/RL and did a principal component analysis (ZSI 8015 excluded as its head was damaged). The result shows *L. odishii* to be nested well within *L. jara* (Fig. 6). Thus, it can be said that the important morphological aspects of *L. odishii* are in agreement with those of *L. jara*. The parameters on which *L. odisii* was separated from *L .jara* are obviously insufficient and inconclusive. Owing to these facts we here consider *L .odishii* to be a junior synonym of *L. jara.*

According to the literature, (Wall 1923a, b; Das *et al.* 2007, 2009; Wogan *et al.* 2008; Chettri *et al.* 2011; Das 2012; Pandey 2012; Wangyal 2012; Rahman *et al.* 2013; Wallach *et al.* 2014) and based on specimens deposited in museums and field survey records, *L. jara* has been recorded from across northern and eastern India and adjacent areas (Fig. 7).

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Studies on anuran diversity and threats to the herpetofauna on Assam University Campus, Northeast India

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ABSTRACT.- We studied anuran diversity in degraded and natural eco-forest in and around Assam University Campus, Silchar. We examined different habitat types for anurans. We found similar species richness in degraded and natural eco-forest areas. High breeding habitat diversity in degraded areas supported higher numbers of individuals in disturbed areas than in eco-forest. Herpetofaunal mortality due to vehicular movement on road was found to be a serious threats specially to frogs. We found that the variability and availability of habitat types was the primary influence on anuran diversity, followed by other anthropogenic threats.

KEY WORDS.- Anurans, habitat types, diversity, road-kills, Assam University.

Introduction

Habitat loss or modification due to human interference is the major threat contributing to the decline of amphibians (Blaustein and Wake 1995; Stuart *et al.* 2004). Habitat loss due to expansion of croplands, logging, urbanization/ industrial development, or over harvesting may lead to the disappearance of amphibian species, especially those that are not tolerant of habitat disturbance (Stuart *et al.* 2004). An alternative way of viewing this is that greater habitat diversity will be associated with greater species diversity (Rosenzweig 1995). This has been supported by several studies of amphibian occurrence along stream channels (Platts *et al.* 1983; Gillespie *et al.* 2004; Kratzer *et al.* 2006; Ficetola *et al.* 2011). Since different species have different requirements, habitat variability from one place to another affects the composition of amphibian assemblages (Loehle *et al.* 2005). An area with greater habitat diversity may support high species diversity (Rosenzweig 1995; Fox *et al.* 2004). Forest management practices (Stoddard *et al.* 2004) and local and landscape factors (Buskirk 2005) also influence amphibian occurrence. Prior to the establishment of Assam University in 1994, the area around our study area had dense tropical semi-evergreen forest (Dutta *et al.* 2008) and over time new buildings resulted in the degradation of the high canopy of forest and habitat cover (pers. obs.). The rapid expansion of tea gardens (Mazumdar *et al.* 2011) in and around the University Campus also led to anuran habitat loss in the study area. Anthropogenic activities such as forest fragmentation and exploitation have been identified as factors that cause decline of amphibian population (Pawar & Birand 2001). Vehicular movement (Das *et al.* 2007; Seshadri *et al.* 2009; Seshadri & Ganesh 2011; Bhupathy *et al.* 2011) in urban areas is also regarded as a serious threat to herpetofaunal species. The main objective of this study was to record the anuran species with their different habitat types on the Campus of Assam University and also to identify the factors affecting anuran distribution, along with vehicular traffic, as threats to herpetofauna in and around the Silchar Campus of Assam University.

Material and Methods

Study area.– The study was carried out at Assam University, Silchar Campus (24°41′N, 92°45′E) and the surrounding residential area (Fig. 1) Cachar District, Assam. The study area was divided into two different types, disturbed and undisturbed, based on human settlement, forest management practices and anthropogenic threats (Table 1). The disturbed areas were those residential areas outside the University Campus and newly established reinforced concrete

Table 1. Study area descriptions.

Study area	Study area details	Habitats	Site names
Disturbed	Highly disturbed forest patches with residential areas and areas around RCC buildings of various departments inside the University Campus.	Marshy area, Pond side, Near human settlements, Stream side.	Irongmara (Village), residential/academic blocks in Assam University Campus.
Undisturbed	Natural forest with few anthropogenic threats (NTFP collection).	Stream side and Forest trails.	eco-forest

buildings of various departments inside the University Campus. On the other hand, the eco-forest was considered as an undisturbed area with few anthropogenic threats (non-timber forest product collection) inside the Assam University Silchar Campus. The eco-forest is spread over an area of 15 acres and is continuous with Durgakona and Barjalenga Tea Estate. The eco-forest is characterised by numerous low hills bisected by narrow ravines and slow flowing, rain-fed, small streams with thick understory vegetation (Fig. 2). The climate in the study area is sub-tropical; warm and humid with an average rainfall of 2660 mm, most of which is received from the South-west monsoon. The mean maximum temperature ranges from 25.1°C to 32.6°C (Dutta *et al.* 2008). The vegetation is dominated by *Artocarpus chama* and *Tetrameles nudiflora* in the canopy layer, *Ficus* spp. and *Artocarpus lacucha* in the middle layer and the lower layer is dominated by species like *Shizostachyum dullooa*, saplings of *Goniothalamus* sp., *Cyclostemon* sp. and *Mimosa himalayana*. The undergrowth is dominated by *Desmodium trifolium*, saplings of *Calamus guruba*, *Daemonorops* sp., *Homalomena* sp. and seedlings of *Artocarpus chama*. (Dutta *et al.* 2008).

Survey and Data collection.– The pilot survey on anurans coincided with the pre-monsoon rainfall (starting April) and the breeding time of amphibians (May–July) in the study area. Data was collected from August 2010 to July 2011 in and around Assam University, Silchar Campus. Data were collected through visual encounter surveys (VES) (Crump & Scott 1994). We surveyed different breeding habitats in disturbed and undisturbed areas. The basic criteria for selecting breeding habitats included the presence of water and accessibility by foot along forest trails and breeding pools near human settlement areas. To minimise sampling errors, both the areas were sampled twice per week. The locality, date, time, and microhabitat of each individual

Figure 1. Study area map, Assam University Campus, Cachar.

Figure 2. Study sites for anuran study during 2010–2011, in and around Assam University Campus: 1) marshy land, 2) nullah with thick streamside vegetation, 3) eco-forest with thick understory vegetation.

Table 2. Species richness, Shannon-Weiner index and number of individuals of 14 anuran species encountered from Assam University, Silchar Campus during 2010–2011.

	Undisturbed area		Disturbed area				Total number of individuals
	Stream side	Forest trail	Marshy area	Pond side	Near human settlements	Stream side	
Species richness	11				11		
Shannon-Weiner index	2.13				1.96		
Number of individuals encountered	248	54	45	169	88	58	662

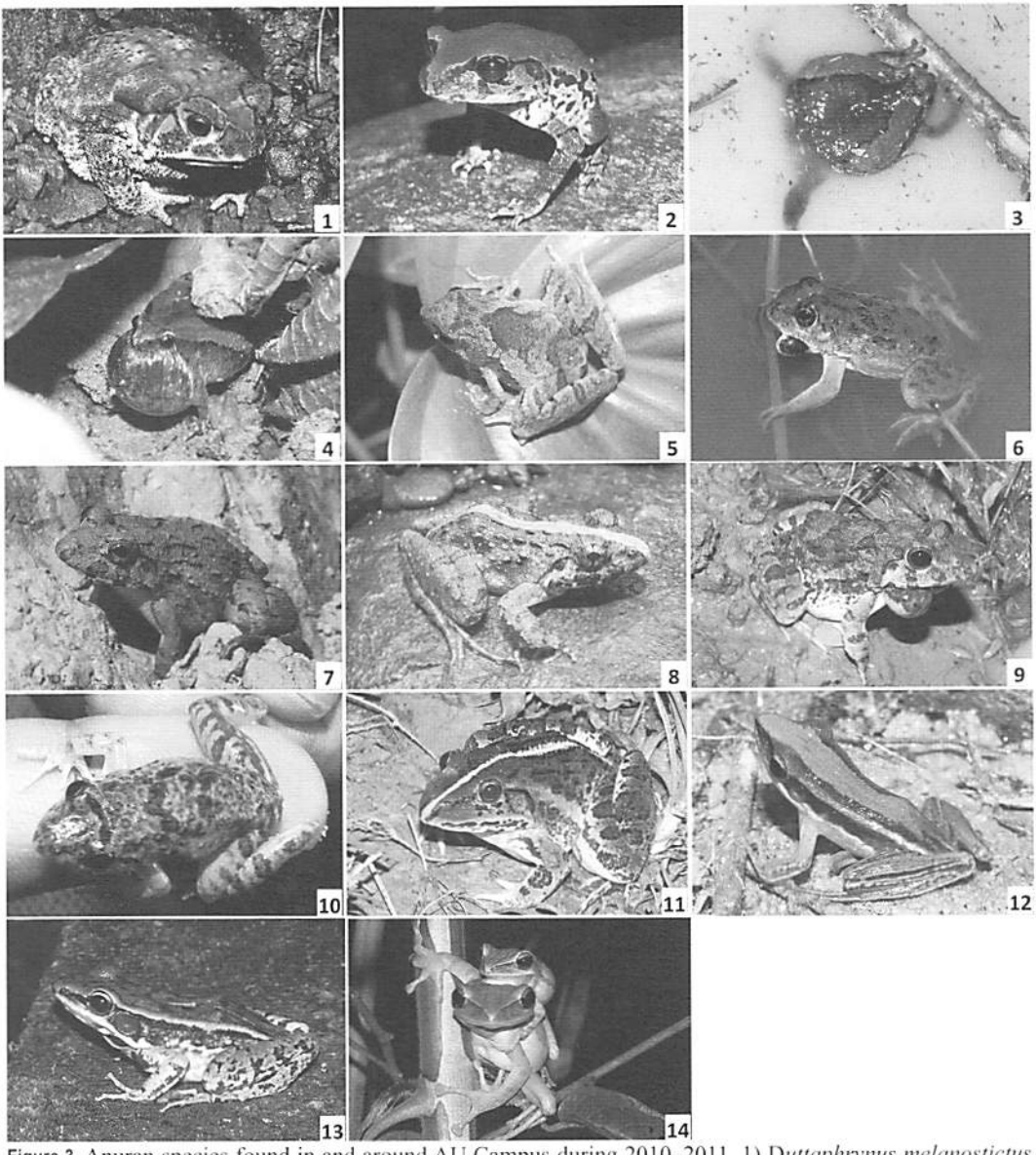

Figure 3. Anuran species found in and around AU Campus during 2010–2011. 1) *Duttaphrynus melanostictus*, 2) *Leptobrachium smithi*, 3) *Kaloula pulchra*, 4) *Microhyla ornata*, 5) *Microhyla berdmorei*, 6) *Euphlyctis cyanophlyctis*, 7) *Fejervarya teraiensis*, 8) *Fejervarya pierrei*, 9) *Fejervarya nepalensis*, 10) *Fejervarya sahydransis*, 11) *Hoplobatracus tigerinus*, 12) *Hylarana taipehensis*, 130 *Hylarana leptoglossa*, 14) *Polypedates teraiensis*.

encountered were recorded. Nocturnal surveys were conducted in disturbed and undisturbed areas (Fig. 1) alternatively and the number of individuals seen in the field was recoded. Surveys for road-kills were made in the early morning (Vijayakumar *et al.* 2001) twice weekly between May and July 2011 along a 3.5 km road starting from the entrance of the Assam University Campus. Road-killed individuals except for highly damaged specimens, were identified to species. To minimise multiple counts, all specimens were removed from the track after identification (Vijayakumar *et al.* 2001).

Data Analysis.– The study area was categorised into disturbed and undisturbed portions. Shannon-Weiner diversity indices were calculated (Loehle *et al.* 2005). In order to determine whether any significant difference exists in the number of individuals in the disturbed and undisturbed areas, a Chi-square test was done. The species distribution in the study area (disturbed and undisturbed) from different habitats was also tested using Chi-square tests.

To know the mortality rate of herpetofauna on the road due to vehicular movements, the road-killed were categorised into two weather conditions: non-rainy and rainy days. We also estimated the mortality rate into two roadside land use types (human settlements and no human settlements). A Mann-Whitney U-test was done to determine if there was a significant difference between the frequency of herpetofauna killed during rainy days and non-rainy days (Vijayakumar *et al.* 2001). A Chi-square test was performed to see if there was any significant difference between the amphibians and reptiles killed based on the two different land use types (human settlement and without human settlement).

Results

Fourteen anuran species belonging to 10 genera and six families (Bufonidae, Megophryidae, Microhylidae, Dicroglossidae, Ranidae, Rhacophoridae) were encountered during this study (Fig. 3). Eight species (*Fejervarya teraiensis, F. pierrei, F. nepalensis, F. sahydransis, Hylarana leptoglossa, Microhyla ornata, Hoplobatracus tigerinus, Euphlyctis cyanophlyctis*) were common in both the disturbed and undisturbed areas. Among the remaining six species *Leptobrachium smithi, Microhyla berdmorei,* and *Hylarana taipehensis* were found only in the undisturbed area whereas *Duttaphrynus melanostictus, Kaloula pulchra* and *Polypedates teraiensis,* were found only in the disturbed areas.

A total 662 individuals of fourteen anuran species were encountered during the whole survey period. The species richness (S) for the disturbed and undisturbed areas was the same (S=11). The Shannon-Weiner index of diversity was found to be higher in the undisturbed area (2.13) in comparison to the disturbed area (1.96) (Table 2). We encountered fewer breeding habitats in the undisturbed eco-forest than in disturbed or human settlement areas. We encountered significantly higher number of individuals in the disturbed area than in the undisturbed area (Chi sq. test: $\chi 2 = 5.08$, df = 1, $p < 0.05$). In the disturbed area, the pondside had higher number individuals in comparison to that of other three habitats: marshy area, near human settlements and streamside (Fig. 4). On the other hand, the streamside (N=248) had more individuals than forest trails (N=54) in the undisturbed eco-forest areas. We found no significant difference ($\chi 2 = 3.053$, df = 4, NS) to the distribution of anuran species in five different habitats: streamside, forest trail, marshy area, pondside and near human settlements. The encounter rate was almost the same in all five different habitat categories irrespective of both the study areas.

A total of 149 herpetofaunal road-kills were recorded (Table 3). Among these, anurans represented the largest group (89.3%, N=133) followed by snakes (8.7%, N=13), and lizards (*Calotes versicolor*) (2%, N=3). Specifically, in case of anurans, *Duttaphrynus melanostictus* represented the highest mortality (88.7%, N=118) followed by *Polypedates teraiensis* (5.3%, N=7), *Hoplobatrachus tigerinus* (3.8%, N=5), *Fejervarya nepalensis* (1.5%, N=2), and *Kaloula pulchra* (0.8%, N=1). Among the road-killed snake species *Xenochrophis piscator* represented more than half of the specimens (53.8%, N = 7), with *Lycodon aulicus* (23.1%, N=3),), *L. jara* (7.7%, N = 1), *Typhlops diardii* (7.7%, N = 1) and *Ptyas mucosa* (7.7%, N = 1) making up smaller percentages.

The numbers of herpetofauna killed adjacent to human settlements (N=112) is significantly greater in comparison to that away from human

Table 3. Herpetofaunal species found dead on road due to vehicular movement.

Frogs		
	Common English name	**Number**
Family Bufonidae *Duttaphrynus melanostictus*	Common Asian Toad	118
Family Rhacophoridae *Polypedates teraiensis*	Common Tree Frog	7
Family Dicroglossidae *Hoplobatracus tigerinus*	Indian Bull Frog	5
Fejervarya nepalensis	Nepal Cricket Frog	2
Family Microhylidae *Kaloula pulchra*	Painted Balloon Frog	1
	Total number	**133**
Snakes		
Family Colubridae *Lycodon aulicus*	Common Wolf Snake	3
Xenochrophis piscator	Checkered Keelback (Dhura)	7
Lycodon jara	Yellow-spotted Wolf Snake	1
Ptyus mucosa	Indian Rat Snake	1
Family Typhlopidae *Typhlops diardii*	Diard's Blind Snake	1
	Total number	**13**
Lizards		
Family Agamidae *Calotes versicolor*		3
	Total number	**3**
Total number of herpetofauna killed		**149**

settlements (N = 34) (χ^2 test: $\chi^2 = 44.034$, df = 1, $p < 0.01$). It was also found that the number of individuals killed was greater on non-rainy days (N=80) than on rainy days (N = 69) although not significantly so. On the other hand, the number of specimens killed along human settlements (N=112) was greater than in settlement-free areas (N = 34) (χ^2 test: $\chi^2 = 44.034$, df = 1, $p < 0.01$).

Discussion

Habitat diversity has a great effect on species distribution (Rosenzweig 1995; Kratzer *et al.* 2006), with areas with the most breeding habitats supporting the highest species diversity (Rosenzweig 1995; Fox *et al.* 2004; Loehle *et al.* 2005). In all five habitat types in both study areas we recorded the most breeding along with the highest number of individuals in disturbed rather than undisturbed areas. Barak Valley, which is characterised by numerous floodplain wetlands and fishery ponds maintained by the villagers, supported most of the anuran species in the area. On the other hand, in undisturbed eco-forest, all the streams were seasonal and rain-fed (i.e., ephemeral streams) and decreased with forest cover. There were three anuran species — *Kaloula pulchra, Duttaphrynus melanostictus* and *Polypedates teraiensis*, which were only recorded from the disturbed areas and three from the undisturbed eco-forest — *Hylarana taipehensis, Leptobrachium smithi* and *Microhyla berdmorei*. The difference in the distribution of these anuran species was due to habitat variability. *Hylarana taipehensis* is generally present in marshy low lying areas among thick vegetation but with the establishment of residential areas the species has not been seen since 1998 (Dey 2011). *Duttaphrynus melanostictus* were mostly encountered from human set-

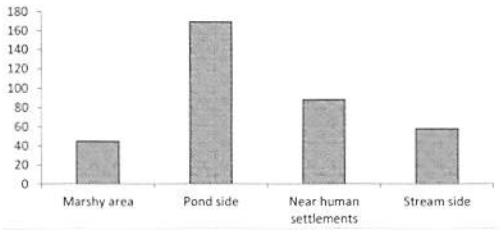

Figure 4. Number of individuals in four different habitats from the disturbed areas: marshy area, pond side, near human settlements and stream side.

tlements whereas *P.teraiensis* was encountered from stagnant water bodies such as construction water tanks, ponds, and water in ephemeral pools near the road in disturbed areas. *Leptobrachium smithi* was common in the eco-forest area and inhabited areas with thick litter fall; they were usually calling from those areas having moist litter fall. All six anuran species were habitat specific and showed association with the above mentioned habitat types.

In our road-kill study, bufonids had the highest mortality close to human settlements, reflecting their use of anthropogenic environments (Seshadri *et al.* 2009; Bhupathy *et al.* 2011). Generally, herpetofaunal mortality is known to be higher during rainy days (Vijayakumar *et al.* 2001), which was not the case in our study. Diel variation in vehicular traffic can affect mortality (Das *et al.* 2007; Seshadri & Ganesh 2011). Although we had no precise record of vehicular movement, fewer vehicles were present as the night progressed and rain in the early morning increased the occurrence of road kills (pers. obs.).

In our study, we found that habitat availability and variability has an influence on anuran diversity. However, human activity has its impact on the quality of habitat and on the survival of anurans. Barak Valley, which is rich in numerous floodplain wetlands, provides habitat for amphibians and it is important to quantify such habitat availability, along with other environmental factors, for the long term conservation of amphibians in their natural habitats.

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Range extension of the Asiatic softshell turtle, *Amyda cartilaginea* (Boddaert, 1770) in Bangladesh

Bangladesh supports at least 28 species of chelonians included in five families (Kabir *et al.* 2009). Members of the Trionychidae in Bangladesh include *Nilssonia gangeticus, N. hurum, N. nigricans, Chitra indica, Lissemys punctata* and *pelochelys cantorii* (M.A.R. Khan 1982, 2010; Sarker & Sarker 1988; M. M. H. Khan 2008; Kabir *et al.* 2009); however, there is only one record of the Asiatic softshell turtle, *Amyda cartilaginea* (Boddaert, 1770) from the country (M. M. H. Khan 2012). Globally, *Amyda cartilaginea* is considered Vulnerable (IUCN 2013). The existing geographical range of *A. cartilaginea* includes southern and eastern Myanmar, India, China, Thailand, Cambodia, Laos, central and southern Vietnam, the Malay Peninsula, and the islands of Sumatra, Bangka, Belitung, Java, Bali, Lombok, and Borneo (Iverson 1986; Jenkins 1995).

Source: Bangladesh Forest Department, 1999

Figure 1. Map of Bangladesh (black dot inside black circle shows present sighting place and dot inside rectangular box shows the first sighting record (Map source: Bangladesh Forest Department).

On 17 January 2013, a specimen of *A. cartilaginea* was found at the Inani Reserved Forest in the Inani Forest Range of Cox's Bazar South Forest Division in Bangladesh (Figs. 1–2). Geographical coordinates of the site are 21°08.186′ N, 092°05.380′ E. This is the second record of *A. cartilaginea* in Bangladesh. The first observation was made by M. M. H. Khan (2012) at Remocri Khal in Thanchi Upazila in the Bandarban District, which is approximately 85 kilometers southeast of the new locality reported here. *Amyda cartilaginea* has also been reported by Choudhury *et al.* (2000) from northeastern India. The distributional range of the species currently extends to the Bandarbans and Cox's Bazar in the southeastern Bangladesh. The species might also be found in the Chittagong Hill Tracts and in the hilly streams of the Sylhet Division.

The turtle was found in a hilly stream in the Inani Reserved Forest (Figs. 1–3), which is about 15 km west of the Myanmar-Bangladesh border. The stream is characterized by large and small boulders on a sandy bottom. The heavy rainfall during the monsoon results in the perennial flow of many small streams of 1–2 m depth. There were no large trees close to the stream bank; however, both sides of the stream were covered with dense undergrowth and shrubs. This hilly stream discharges water directly into the Bay of Bengal.

Amyda cartilaginea is distributed across the Arakan Hills to the mountainous regions of eastern and peninsular Myanmar (Annandale

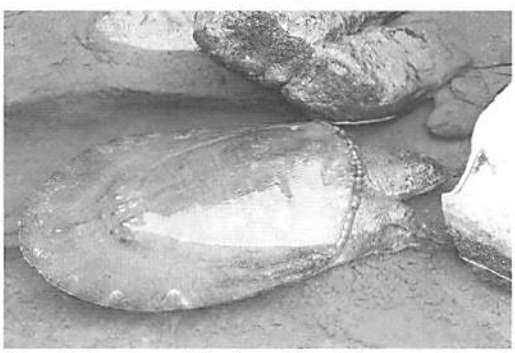

Figure 2. *Amyda cartilaginea* at Inani Reserved Forest.

Figure 3. New locality of *Amyda cartilaginea* turtle in the Inani Reserved Forest, Bangladesh.

1912). Platt *et al.* (2007) mentioned the presence of the species in the Arakan Yoma Hills of Rakhine (Arakan) State and suggested that this record provided continuity with records from Mizoram, India. It was also recorded from Natma Taung National Park, Myanmar (Platt *et al.* 2012), which is ~125 km from the southeastern border of Bangladesh. Our observation was made close to the northwest part of the Arakan Yoma Hills. The present and the earlier records provide evidence of the continuous range of *A. cartlaginea* from southeast Bangladesh to the Rakhine Hills and Chin State in Myanmar and to adjacent Mizoram in Northeast India.

The area is situated at the junction of the Indo-Burma and Indo-Malayan sub-regions, so it represents a unique biodiversity hotspot with both faunal and floral compositions. Therefore, extensive field survey between bordering areas of Bangladesh and Myanmar may supplement many species in the national checklist of Bangladesh.

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Notes on reproduction of the Butterfly Lizard, *Leiolepis belliana* (Squamata: Agamidae) from South-east Asia

Leiolepis belliana occurs in Vietnam, Myanmar, Laos, Thailand, Cambodia, Malaysia and Indonesia (Nguyen *et al.* 2009). Anecdotal information on its reproduction consists of clutch sizes of three (Das 2010), three to eight (Manthey & Grossmann 1997; Cox *et al.* 1998) and possible breeding throughout the summer months (Grismer 2011). The purpose of this paper is to add information on the reproductive biology of *L. belliana* from a histological examination of museum specimens.

A sample of 74 *L. belliana* collected in 2002, 2004–2007, and 2009 from Cambodia and West Malaysia consisting of 34 adult males (mean SVL = 96.3 mm ± 19.4 SD, range = 65–143 mm), 28 adult females (mean SVL = 88.1 mm ± 15.2 SD, range = 72–119 mm), five subadult females (mean SVL = 66.4 mm ± 2.2 SD, range = 64–68 mm) and seven unsexed juveniles (mean SVL = 47.4 ± 7.8 SD, range = 38–58) was examined. Specimens utilized are deposited in the herpetology collection of La Sierra University (LSUHC), Riverside, California, USA (Appendix).

The snout-vent length (SVL) of each specimen was measured in mm from the tip of the snout to the posterior margin of the vent. The left gonad was removed and embedded in paraffin. Histological sections were cut at 5µm and stained with hematoxylin followed by eosin counterstain (Presnell & Schreibman 1997). Enlarged follicles > 5 mm and oviductal eggs were counted only. Histology slides were deposited at LSUHC.

Four stages were observed in the monthly testicular cycle of *L. belliana* (Table 1): (1) regressed, seminiferous tubules contain spermatogonia and Sertoli cells; (2) recrudescent, proliferation of germinal cells is underway for the next period of spermiogenesis; (3) spermiogenesis, seminiferous tubules are lined by clusters of sperm or metamorphosing spermatids; (4) late spermiogenesis, germinal epithelium is exhausted, small quantities of sperm remain in the lumina. The smallest males with spermiogenesis in progress measured 67, 68 and 68 mm SVL (LSUHC 8453, 8465, 8471, respectively) and were collected in June. The testicular cycle appears similar to that of other South Asian lizards in exhibiting a prolonged period of sperm formation although samples were not available from all months. However, there were three individuals that did not appear to fit the pattern of extended spermiogenesis. These were: (1) LSUHC 6887, 138 mm SVL (from September) which contained a regressed testis with occasional residual sperm from a past spermiogenesis; (2) LSUHC 8503, 108 mm SVL (from July) which exhibited testicular recrudescence; (3) LSUHC 8006, 65 mm SVL (from August) which contained only small quantities of sperm; this may be a sub-adult that not had not yet joined the breeding population. The two lizards of adult size (138, 108 mm SVL) that had completed spermiogenesis indicates there may be a seasonality component in the testicular cycle,

Table 1. Monthly stages in the testicular cycle of 34 *Leiolepis belliana* adult males from West Malaysia and Cambodia.

Month	N	Re-gressed	Recrudes-cent	Spermio-genesis	Late spermio-genesis
June	13	0	0	13	0
July	7	0	1	6	0
August	5	0	1	3	1
September	1	1	0	0	0
October	2	0	0	1	1
December	6	0	0	6	0

Table 2. Monthly stages in the ovarian cycle of 28 *Leiolepis belliana* adult females from West Malaysia and Cambodia.

Month	N	Quiescent	Early yolk deposition	Enlarged follicles > 5 mm	Oviductal eggs
April	2	2	0	0	0
June	8	5	0	1	2
July	4	4	0	0	0
August	11	11	0	0	0
September	1	1	0	0	0
December	2	1	1	0	0

but further sampling is required to test this hypothesis because males were not examined from all months.

Four stages were noted in the monthly ovarian cycle of *L. belliana* (Table 2): (1) quiescent, no yolk deposition; (2) early yolk deposition; (3) enlarged follicles > 5 mm; (4) oviductal eggs. While all months were not studied, it appears females are reproductively active for only part of the year with most reproductive activity occurring in June. As may be the case for *L. belliana* males, it appears the female reproductive cycle exhibits seasonality. The two smallest reproductively active females (from June) were: LSUHC 8495, 75 mm, three oviductal eggs and LSUHC 8467, 78 mm, 3 enlarged follicles > 10 mm length. Mean clutch size (n = 3) was 3.3 ± 0.58 SD, range = 3–4. Five females in the 60–69 mm SVL range were considered as subadults.

It was similarly reported by Du *et al.* (2011) that the congener *L. reevesii* from Hainan, China produced a single clutch of 2–8 eggs in a breeding season stretching from mid-April to mid-July. Since there are nine species of *Leiolepis* (Uetz & Hošek 2013), further studies will be needed to ascertain if the reproductive period of *Leiolepis* sp. is limited to only part of the year. This would contrast with many other South Asian lizard species that reproduce during most of the year (Inger & Greenberg 1966).

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Appendix

The following LSUHC specimens of *L. belliana* from Cambodia (by province) and West Malaysia (by state) were utilized in this study:

West Malaysia

Kedah: LSUHC 6810, 6822, 6836, 6842, 6887, 7491, 7492, 7595; Melaka: LSUHC 8964; Pahang: LSUHC 4844–4846, 4848, 4859, 4864; Perak: LSUHC 8984; Terengganu: LSUHC 8353, 8354, 8376.

Cambodia

Kampot: LSUHC 8761, 8762, 8764–8769; Preah Vinear: LSUHC 8003–8008, 8454; Pursat: LSUHC 7980, 7981, 7983–7987, 8000, 8006, 8451–8453, 8455, 8458–8461, 8463–8465, 8467–8474, 8476, 8494–8496, 8503, 8505–8508, 8510–8512.

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Reproduction in the Bronze Skink, *Eutropis macularia* (Squamata: Scincidae) from Nakhon Ratchasima Province, Thailand

Eutropis macularia (Blyth, 1853) occurs in Bangladesh, Bhutan, Cambodia, India, Laos, Mynamar, Nepal, Northwest Malaysia, Pakistan, Sri Lanka, Thailand and Vietnam (Uetz & Hošek 2014). It is an oviparous species (Tikader & Sharma 1992) and there are anecdotal reports on its reproduction: Smith (1935); McCann (1940); Minton (1966); Pongsapipatana (1975); Manthey & Grossman (1997); Tikader & Sharma (1992); Das (2002); Das *et al.* (2009); Das (2010); Das & de Silva (2011); and Origia *et al.* (2012). The purpose of this paper is to report the first information on reproduction of *E. macularia* from Nakhon Ratchasima Province, Thailand utilizing data gathered from a histological examination of gonadal materials from museum specimens. Comparisons are made with the reproductive cycles of other lizards from Thailand. Information on the reproductive biology of lizards such as time of egg and sperm production, clutch size, and number of clutches produced is useful in formulating conservation policies (Gibbons 1994). Due to the difficulty in justifying collections of large monthly lizard samples, use of museum collections for obtaining reproductive data has become increasingly important.

A sample of 53 *E. macularia* was examined consisting of 17 males (mean snout-vent length = 55.8 mm SVL [±1 SD] = 6.0 SD, range = 45–68 mm), one subadult male (SVL = 43.0 mm), 19 females (mean SVL = 60.0 mm ± 4.0 SD, range = 54–68 mm), 11 subadult females (mean SVL = 47.8 mm ± 3.0 SD, range = 42–53 mm) and 5 unsexed juveniles (mean SVL = 40.0 mm ± 2.0 SD, range = 38–42 mm) collected in Nakhon Ratchasima Province (13.1889°N, 00.9469°E), Thailand in 1969 and deposited in the herpetology collection of the Field Museum of Natural History (FMNH), Chicago, Illinois, USA (Appendix). Snout-vent length was measured on each *E. macularia* to the closest mm.

A small slit was made on the left side of the abdomen and the left testis was removed from males and the left ovary was removed from females for histological examination. Enlarged ovarian follicles (> 4 mm) or oviductal eggs were counted in situ. No histological examination was performed on them. Removed gonads were embedded in paraffin; sections were cut at 5µm and stained with Harris' hematoxylin followed by eosin counterstain (Presnell & Schreibman 1997). Histology slides were deposited at FMNH. Mean SVL of male and female samples of *E. macularia* were compared using an unpaired *t*-test (Instat vers 3.0b. Graphpad Software, San Diego, CA, USA).

Table 1. Monthly distribution of stages in the testicular cycle of 17 *Eutropis macularia* males from Nakhon Ratchasima Province, Thailand.

Month	n	Recrudescence	Spermiogenesis
January	1	1	0
February	2	0	2
March	5	0	5
April	1	0	1
June	3	0	3
August	1	0	1
September	1	0	1
October	2	0	2
December	1	1	0

Table 2. Monthly stages in the ovarian cycle of 19 *Eutropis macularia* females from Nakhon Ratchasima Province, Thailand. * = some follicles damaged, clutch could not be counted.

Month	n	Quiescent	Early yolk deposition	Follicles > 4 mm	Oviductal eggs	Oviductal eggs and yolk deposition
February	1	0	1	0	0	0
March	2	0	2	0	0	0
April	4	1	1	1	1	0
May	3	0	0	1	1	1
June	3	1	1	1	0	0
July	1	0	0	0	0	1
August	1	0	0	0	0	1
September	2	0	0	1*	0	1
October	1	0	0	0	0	1
December	1	1	0	0	0	0

Two stages were present in the testicular cycle (Table 1): (1) recrudescence in which renewal of germinal cells for the next period of sperm formation occurs; primary spermatocytes predominate; and (2) spermiogenesis (sperm formation), where the seminiferous tubules are lined by clusters of spermatozoa or metamorphosing spermatids. The smallest reproductively active male in this study (spermiogenesis) measured 45 mm SVL (FMNH 181129) and was collected in March. Two smaller males were considered as subadults: FMNH 181280, SVL = 43 mm, which contained regressed seminiferous tubules, with spermatogonia and Sertoli cells present and FMNH 181290, SVL = 48 mm, which contained recrudescent seminiferous tubules. Spermiogenesis was recorded in all sampled months except January (Table 1). The significance of the recrudescence occurring in the December and January males is not clear, as the sample size is too small to determine if a period of male reproductive inactivity occurred.

The mean SVL of females of *E. macularia* was significantly larger than that of males (unpaired *t*-test, P = 0.02, $t = 2.53$, $df = 34$). Five stages were noted in the ovarian cycle (Table 2): (1) quiescent, no yolk deposition; (2) early yolk deposition, basophilic vitellogenic granules in the ooplasm; (3) enlarged follicles > 4 mm; (4) gravid with oviductal eggs; (5) oviductal eggs and concurrent yolk deposition for a subsequent clutch. The smallest reproductively active female (FMNH 181144) measured 54 mm SVL (yolk deposition underway) and was collected in April. Eleven smaller females (range = 42–53 mm) exhibited no reproductive activity and were considered subadults. Mean clutch size for ten females was 2.3 ± 0.95 SD, range = 1–4. Five females with oviductal eggs were undergoing concurrent yolk deposition for a subsequent clutch (Table 2) indicating production of multiple clutches is possible for *E. macularia*. This has also been reported to occur in other populations of *E. macularia* (Das 2002). The monthly samples of *E. macularia* from Nakhon Ratchasima Province were too small to identify a peak in reproduction, if one exists.

The reproductive cycle of *E. macularia* from Nakhon Ratchasima Province, resembles those of two gekkonid species studied in Thailand which also exhibit extended periods of reproduction (Goldberg 2008, 2012). Thus, it appears, *E. macularia*, like numerous other lizards in the tropics, has an extended reproductive cycle (Inger & Greenberg 1966). With over 50 other species of skinks reported from Thailand (Das 2010), additional studies are needed to ascertain the reproductive diversity exhibited by skinks of Thailand.

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Appendix

The following specimens of *Eutropis macularia* from Nakhon Ratchasima Province, Thailand were examined from the herpetology collection of the Field Museum of Natural History (FMNH).

FMNH 181109–181113, 181118, 181119, 181126, 181127, 181129, 181130, 181134, 181137, 181138, 181143, 181144, 181146, 181148–181150, 181155, 181158, 181160, 181162, 181164–181166, 181169, 181173, 181175, 181182, 181195, 181207, 181213, 181217, 181218, 181231, 181232, 181235, 181239, 181247, 181249, 181254, 181263, 181264, 181270, 181280, 181281, 181285, 181290, 181295–181297.

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Notes on reproduction of seven species of *Draco*: *D. abbreviatus*, *D. blanfordii*, *D. formosus*, *D. maculatus*, *D. maximus*, *D. sumatranus*, *D. taeniopterus* (Squamata: Agamidae) from South-east Asia

Draco abbreviatus occurs from Thailand, southward through Peninsular Malaysia to Singapore, Sumatra, Borneo (Grismer 2011). *Draco blanfordi* ranges from Myanmar, southern China, southward through the Malay Peninsula to at least Selangor (Grismer 2011). The range of *Draco formosus* extends from southern Thailand southward throughout the Malay Peninsula to at least central Johor (Musters 1983). *Draco maculatus* occurs from southern China to northern Peninsula Malaysia (Musters 1983). *Draco maximus* ranges from southern Thailand, southward throughout Peninsular Malaysia to Sumatra and Borneo (Grismer 2011). *Draco sumatra-*

nus occurs from southern Thailand southward through Peninsular Malaysia and Singapore to Sumatra and Borneo (Musters 1983). *Draco taeniopterus* is known from Myanmar, central Thailand and Cambodia to northern Peninsular Malaysia (Musters 1983; Grismer 2011). All are diurnal and arboreal (Grismer 2011). The purpose of this note is to provide information on reproduction of these seven species based upon a histological examination of gonadal material. A total of 169 *Draco* were examined.

Specimens examined are deposited in the herpetology collection of La Sierra University (LSUHC), Riverside, California, USA (Appendix). Samples of the above seven species were examined: *Draco abbreviatus* (n = 6) consisting of two adult males (mean SVL = 117 mm ± 1.4 SD, range = 116–118 mm), four adult females (mean SVL = 120.3 mm ± 15.4 SD, range = 103–140 mm) from West Malaysia, collected 2001, 2002, 2005; *Draco blanfordii* (n = 40) consisting of 15 adult males (mean SVL = 112.7 mm ± 7.6 SD, range = 95–123 mm), 12 adult females (mean SVL = 98.8 mm ± 6.8 SD, range = 88–113 mm), four subadult males (mean SVL = 72.5 mm ± 2.6 SD, range = 70–76 mm), three subadult females (mean SVL = 75.0 mm ± 3.5 SD, range = 73–79 mm), and six unsexed subadults (mean SVL = 57.8 mm ± 8.2 SD, range = 42–64 mm) from West Malaysia, collected 2002, 2004–2006, 2008, 2010; *Draco formosus* (n = 60) consisting of 39 adult males (mean SVL = 96.1 mm ± 5.9 SD, range = 85–112 mm), 12 adult females (mean SVL = 84.2 mm ± 5.1 SD, range = 76–93 mm) and 9 juveniles (mean SVL = 55.1 mm ± 9.2 SD, range = 42–70 mm SVL) from West Malaysia, collected 2001–2006, 2008–2010; *Draco maculatus* (n = 13) consisting of six adult males (mean SVL = 64.8 mm ± 2.3 SD, range = 62–68 mm), five adult females (mean SVL = 66.2 mm ± 2.8 SD, range = 63–70 mm) and two juveniles (mean SVL = 36.0 mm ± 5.7 SD, range = 32–40 mm) from Cambodia, collected 2005-2007; *Draco maximus* (n = 6) consisting of four mature males (mean SVL = 137.5 mm ± 14.9 SD), two mature females (SVL = 144.5 mm ± 3.5 SD, range = 142–147 mm) from West Malaysia collected 2003-2004; *Draco sumatranus* (n = 23) consisting of eleven mature males (SVL = 74.5 mm ± 4.6 SD, range = 67–83 mm), eleven mature females (SVL = 74.8 mm ± 3.4 SD, range = 70–80 mm), and one subadult female (SVL = 60 mm) from West Malaysia collected 2001 to 2010; and *Draco taeniopterus* (n = 21) consisting of 14 mature males (mean SVL = 74.5 mm ± 4.2 SD, range = 68–83 mm), one subadult male (SVL = 65 mm) and six mature females (mean SVL = 73.8 mm ± 2.0 SD, range = 71–77 mm) from Cambodia and Peninsular Malaysia, collected 2008, were examined.

A cut was made in the lower abdominal cavity and the left testis or ovary was removed, embedded in paraffin, cut into 5 µm sections and stained with Harris hematoxylin followed by eosin counterstain (Presnell & Schreibman 1997). Enlarged follicles (> 4 mm) or oviductal eggs were counted. Histological slides are deposited in LSUHC.

Two males of *D. abbreviatus*, both from August, were undergoing spermiogenesis in which the lumina of the seminiferous tubules were lined by sperm or clusters of metamorphosing spermatids. Four *D. abbreviatus* females contained a mean clutch size of 3.8 ± 0.50 SD, range = 3–4 eggs. Three of the four females were from July, and one was from December. The presence of reproductively active females at opposite ends of the year suggests *D. abbreviatus* has an extended reproductive cycle. Grismer (2011) proposed the likelihood that *D. abbreviatus* breeds throughout the year.

The only stage present in the testicular cycle of adult male *D. blanfordi* was spermiogenesis. The smallest reproductively active male measured 95 mm SVL (LSUHC 7085) and was collected in March. Specimens from the following months were examined: March (N = 8), June (N = 1), August (N = 3), September (N = 1), November (N = 2). Four males (SVL range = 71–76 mm) exhibited testicular recrudescence (renewal of germinal epithelium) for the next period of spermiogenesis and were considered to be subadults. Three stages in the ovarian cycle of *D. blanfordi* were present (Table 1); (1) yolk deposition (basophilic granules in ooplasm); (2) enlarged follicles > 4 mm; (3) oviductal eggs. Three females with oviductal eggs exhibited concurrent yolk deposition for a subsequent clutch indicating that *D. blanfordi* produces multiple clutches in the same reproductive season. Mean clutch size (n = 11) for *D. blanfordii* was

Table 1. Monthly stages in the ovarian cycle of 12 adult female *D. blanfordii* from West Malaysia: * = one oviductal female, ** = two, oviductal females with concurrent yolk deposition for a subsequent clutch

Month	n	Yolk deposition	Enlarged follicles > 5 mm	Oviductal eggs
March	6	0	2	4**
June	2	1	0	1
August	3	0	2	1*
September	1	0	0	1

Table 2. Monthly stages in the ovarian cycle of 12 adult female *D. formosus* from West Malaysia; *indicates one vitellogenic female with a corpus luteum from a previous clutch; ** indicates two oviductal females with concurrent yolk deposition for a subsequent clutch.

Month	n	Yolk deposition	Enlarged follicles > 4 mm	Oviductal eggs
July	5	0	0	5**
August	5	0	3	2**
September	2	1*	1	0

4.7 ± 1.3, range = 4–7. Three smaller females (SVL range = 73–79 mm) had quiescent ovaries (no yolk deposition) and were considered subadults. Six small *D. blanfordi* of undetermined sex (SVL range = 42–64 mm) were considered subadults. Taylor (1963) reported a clutch of four eggs from *D. blanfordii* in Thailand. Cox *et al.* (1998) reported *D. blanfordii* laid clutches of up to four eggs. Grismer (2011) observed gravid females carrying four eggs during March, June, and September in West Malaysia and suggested breeding occurred throughout the year. We cannot verify this. Seven is a new maximum clutch size for *D. blanfordii* (LSUHC 7164). Manthey and Grossmann (1997) reported *D. blanfordii* produced clutches of four eggs.

The only stage present in the testicular cycle of *D. formosus* was spermiogenesis. The smallest reproductively active male measured 85 mm SVL (LSUHC 6538) and was collected in August. The following monthly samples of males were examined: June (n = 1), July (n = 10), August (n = 23), and September (n = 5). Three stages in the ovarian cycle of *D. formosus* were present (Table 2): (1) yolk deposition (basophilic granules in ooplasm); (2) enlarged follicles > 4 mm; (3) oviductal eggs. Mean clutch size (n = 11) was 3.5 ± 0.52 SD, range = 3–4. Evidence that *D. formosus* produced multiple clutches in the same year came from two sources: (1) one vitellogenic September female with contained a corpus luteum from an earlier clutch; (2) two females each, from July and August with oviductal eggs were undergoing concurrent yolk deposition for a subsequent clutch. The smallest reproductively active female (oviductal eggs) measured 76 mm SVL (LSUHC 4833) and was collected in July. *Draco formosus* produces clutches of three or four eggs (Das 2010). There is a report of a clutch of four *D. formosus* eggs from June, gravid females were seen in February, July, August, and September and hatchlings were seen in June, July and September by Grismer (2011) who suggested that *D. formosus* breeds throughout the year. We cannot verify this.

Six adult males of *D. maculatus* from August were undergoing spermiogenesis. Five gravid *D. maculatus* females (one from June, four from August) had a mean clutch size of 3.6 ± 1.1 SD, range = 2–5. Two subadult *D. maculatus* were both from August. Clutches of four and five eggs and gravid females from March have been reported for *D. maculatus* (Manthey & Grossman 1997; Grismer 2011). Two is a new minimum clutch size for *D. maculatus*.

Table 3. Monthly stages in the ovarian cycle of 11 adult female *Draco sumatranus* from West Malaysia; ** indicates two oviductal females with concurrent yolk deposition for a subsequent clutch.

Month	n	Quiescent	Yolk deposition	Enlarged follicles > 4 mm	Oviductal eggs
June	2	0	0	0	2
July	6	1	2	1	2**
August	2	0	0	1	1
September	1	1	0	0	0

Table 4. Monthly stages in the ovarian cycle of 6 adult female *Draco taeniopterus* from Cambodia and West Malaysia.

Month	n	Quiescent	Enlarged follicles > 5 mm	Oviductal eggs
March	2	1	0	1
August	4	1	1	2

Four adult males of *D. maximus* (two each from August and September) were undergoing spermiogenesis. Clutches were found in each of two females from August (mean = 4.5 ± 0.70 SD, range = 4–5). One of these females (LSUHC 5659) was undergoing concurrent yolk deposition indicating *D. maximus* may produce multiple clutches in the same reproductive season. Grismer (2011) found gravid female *D. maximus* with 4–6 eggs in August. Manthey and Grossmann (1997) reported *D. maximus* females produced 1–5 eggs.

All adult males of *D. sumatranus* were undergoing spermiogenesis during July (n = 6), August (n = 3), and September (n = 2). The smallest reproductively active male (spermiogenesis) (LSUHC 8140) measured 67 mm SVL. Monthly stages in the ovarian cycle of *D. sumatranus* are presented in Table 3. The smallest reproductively active females measured 70 mm SVL (LSUHC 6204), with four oviductal eggs and (LSUHC 5404) yolk deposition. One smaller female (LSUHC 5565), which measured 60 mm SVL, contained quiescent ovaries and was considered a subadult. The presence of two July females exhibiting oviductal eggs and concurrent yolk deposition indicates *D. sumatranus* females may produce multiple clutches during the same year. Mean clutch size (n = 7) was 3.6 ± 0.53 SD, range = 3-4. Our findings of 3-4 eggs are close to Grismer (2011) who reported four eggs are usually produced. Das (2010) reported *D. sumatanus* produced clutches of 1–5 eggs. Whether *D. sumatranus* breeds throughout the year (Grismer 2011) merits further investigation.

All adult males of *D. taeniopterus* were undergoing spermiogenesis during March, July and August. The smallest reproductively active male (spermiogenesis) measured 68 mm SVL (LSUHC 9309) and was collected in March 2008. One smaller juvenile male (SVL = 65 mm) exhibited testicular recrudescence (in this case mainly primary spermatocytes) in seminiferous tubules prior to spermiogenesis (LSUHC 9309) and was considered a subadult. Three stages were noted in the ovarian cycle of *D. taeniopterus* (Table 4): (1) quiescent; no yolk deposition; (2) enlarged pre-ovulatory follicles > 5 mm; (3) oviductal eggs. Mean clutch size was 3.0 ± 1.4 SD, range = 1–4. The smallest reproductively active female measured 71 mm (LSUHC 7418), contained one oviductal egg, and was collected August 2005. Taylor (1963) reported a clutch of four eggs from *D. taeniopterus* from Thailand. Cox *et al.* (1998) reported *D. taeniopterus* produced clutches of up to four eggs. The presence of reproductive activity at opposite ends of the year suggests *D. taeniopterus* exhibits a prolonged period of reproduction.

Extended (year-round) reproduction has been reported as well as production of multiple clutches (oviductal eggs with concurrent enlarging yellow follicles) for the congeners *Draco melanopogon* and *D. quinquefasciatus* from Borneo (Inger & Greenberg 1966). Also, Auffenberg (1980) gave evidence *D. volans* from the Komodo Islands, Indonesia produced multiple clutches and Mägdefrau (1992) reported one captive *D. spilopterus* female laid three clutches (four, four, five) of eggs. There are currently 42 species recognized for the genus *Draco* (Uetz & Hošek 2014). Further study is needed to ascertain whether year-round reproduction and production of multiple clutches in the same year is characteristic for other members of the genus *Draco*.

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Appendix

The following specimens of *D. abbreviatus* (n = 6), *D. blanfordii* (n = 40), *D. formosus* (n = 60), *D. maximus* (n = 6), *D. sumatranus* (n = 23) from West Malaysia and *D. maculatus* (n = 13) from Cambodia (by province) and *D. taeniopterus* (n = 21) from Cambodia (by province) and West Malaysia (by state) were utilized in this study: *Draco abbreviatus* (West Malaysia) Johor: LSUHC 7613, 7717; Pahang: LSUHC 3823, 4601, 5102; Perlis 8799; *Draco blanfordii* (West Malaysia) Kedah: LSUHC 6792, 6812, 6818, 7085–7091, 7100, 7116, 7127–7129, 7159–7165, 7183, 7489, 7537, 7538, 7539, 7562, 7563, 9427; Pahang: LSUHC 5090, 8045, 9081; Perak: LSUHC 9034, 9044, 9134; Perlis: LSUHC 8794, 8844, 8982, 8983; *Draco formosus* (West Malaysia) Johor: LSUHC 4712, 4713, 4786, 4787, 4802–4804, 6322, 6325, 7604, 7657, 8148, 8176, 8177, 8233, 8908, 8909, 9937; Pahang: LSUHC 4850, 4851, 4878-4880, 4952, 4953, 4977, 4978, 4983, 4986, 4987, 4989, 4999, 8047, 8048; Penang: LSUHC 6669, 6696–6698, 6721, 6740, 6741; Perak: LSUHC 5082, 5615, 5616, 5621, 5626–5628, 5632, 5649; Selangor: LSUHC 4017, 4832, 4833, 6538, 6538, 6553; Terengganu LSUHC 9360, 9361, 9365, 9366; *Draco maculatus* (Cambodia) Kampong Speu: LSUHC 7321, 7322, 7343, 7344, 7389, 7390, 7411, 7851; Pursat 7849–7852, 7919, 8411; *Draco maximus* (West Malaysia) Johor: LSUHC 8206; Perak: LSUHC 5629, 5636, 5651, 5659, 7043; *Draco sumatranus* (West Malaysia) Johor: LSUHC 4715, 4785, 4788, 5565, 7658, 8140, 9935; Pahang: LSUHC 3838, 3899, 4555, 4556, 5404, 5405, 5480, 6204, 6228, 8037; Selangor LSUHC 4026, 5019, 6624; Terengganu: LSUHC 9393; *Draco taeniopterus* Cambodia: Kampong Cham: LSUHC 7332, 7336, 7340, 7366–7368, 7372, 7373, 7414–7416, 7418, 7419, 7456; Pursat: LSUHC 9305, 9309, 9331; Peninsular Malaysia: Perlis: LSUHC 8779, 8781, 8782, 8797.

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Observations on a live *Pseudoxenodon baramensis* (Smith, 1921)

The genus *Pseudoxenodon* Boulenger, 1890 includes six nominal species (Uetz 2014; Wallach *et al.* 2014), with a distribution across eastern China and south-east Asia, including the islands of the Greater Sundas (de Rooij 1917; Manthey & Grossmann 1997; Zhao 2006a; Das 2010). A recent phylogeny shows that the lineage is nested within the Neotropical xenodontines, suggesting a trans-Beringian migration between the early Tertiary and the mid-Miocene (Zhang & Huang 2013). Nonetheless, monophyly of the group remains undemonstrated, and several members of the genus are poorly known. Further, unnamed populations remain even from the relatively better-sampled northern regions (such as Xizang/Tibet) and none of the south-east Asian, especially Sundaic, species have been included in molecular studies, for scarcity of specimens (see Rahadian & Das 2013; Zhang & Huang 2013).

One of the least known of the snake species of Borneo is *Pseudoxenodon baramensis* (Smith, 1921). The species was originally described (as a *Tropidonotus*) by Smith (1921), from "Mount Dulit, Sarawak, North Borneo, at 1,000 metres" (equivalent to Gunung Dulit, Third Division, Baram District, north-western Sarawak, East Malaysia [Borneo], at ca. 1000 m; 03°15'N, 114°15'E); BMNH 1946.1.13.11 (ex-MAS 4579), holotype. The species was reallocated to *Pseudoxenodon* by Malnate (1960) for showing obliquely arranged dorsal scales and a long hemipenis, extending to the 20th subcaudal and forked at the eighth subcaudal. Few records of the species exist, all from the northern areas of

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Addition of *Hemidactylus aquilonius* (McMahan & Zug, 2007) to the state fauna for four states of Northeast India

Hemidactylus Oken, 1817, is the second most species rich genus in the family Gekkonidae, and is represented by 141 species worldwide (Uetz 2015). Ahmed *et al.* (2009) reported the occurrence of seven species of *Hemidactylus* from northeastern India, namely: *H. frenatus* Schlegel, 1836, *H. brookii* Gray, 1845, *H. garnotii* (Duméril & Bibron, 1836), *H. platyurus* (Schneider, 1792), *H. flaviviridis* (Rüppell, 1835) and *H. karenorum* (Theobald, 1868). The presence of *H. karenorum* is questionable (Mahony & Zug 2008).

Smith (1935) reported the distribution of *H. bowringii* as including India (then including Bangladesh), Burma (now Myanmar), and China. Additional records from Southeast Asia, including Laos (Bourret 1939) and Vietnam (Bobrov 1992), have since been reported. The *H. bowringii* species complex is now known to occur across tropical and subtropical Asia (Zug *et al.* 2007; McMahan & Zug 2007). The oldest records of the species from the Indian subcontinent were given by Stoliczka (1871),

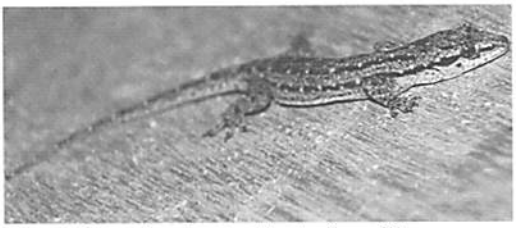

Figure 1. *Hemidactylus aquilonius* from Dharmanagar, Tripura.

Figure 2. Map showing the new state records for *H .aquilonius*: 1. Basar, 2. Along, 3. Daring, 4. Mon, 5. Dimapur, 6. Imphal, 7. Moirang ,8. Moreh, 9. Dharmanagar, 10. Agartala, 11. Udaipur, 12. Aizwal (see text for names and coordinates of localities). Abbreviation WB = West Bengal.

who listed localities for *H. berdmorei* [sic] as "Burma, Cachar, Sikkim Terai, Tista Valley and Kumaon". Later Stoliczka (1872) reported the species from "Khasi Hills" (Assam, now in Meghalaya), "Pankabari just above the Sikkim Terai" (Sikkim), and "Almorah, in Kamaon" (now Kumaon in Uttarakhand). Boulenger (1885, 1890) recorded the species from Sikkim and the Godavari Valley and vouchered records from West Bengal include "Teesta P.W.D bunglow, Jalpaiguri District". In Northeast India, the first new record after Stoliczka's (1872) was that of Annandale (1912), who noted that *H. bowringii* as "not uncommon at low altitudes in the eastern Himalayas and in Assam and Burma" and cited a specimen from Sadiya in the Tinsukia District of Assam. This was followed by Baldauf's (1949) record of a single vouchered specimen (AMNH [American Museum of Natural History] 67611) from "Chabua" near Dibrugarh city, Jorhat District (now in Dibrugarh District). The presence of *H. bowringii* in Sikkim has also been confirmed by Jha and Thapa (2002) and Chettri and Bhupathy (2007) but Sanyal *et al.* (2006) did not include it in their list for the region. Although *H. bowringii* has since been included in the lists of the fauna of Assam (Sengupta 2006), there have been no further published records of specific localities and some works (Tikader & Sharma 1992; Sharma 2002).

On the basis of morphology and molecular phylogenetic analyses, the *H. bowringii* complex was split into *H. aquilonius*, *H. thayene*, and *H. bowringii* by McMahan and Zug (2007). The status of *H. bowringii* on the Indian subcontinent was subsequently reassessed, and populations previously attributed to this species were identified as *H. aquilonius* (Purkayastha *et al.* 2010) (Fig. 1). Northeast Indian records of *H. aquilonius* to date include those historical records noted above as well as newer locality records from four districts of Assam, viz: North Lakhimpur, Sonitpur, Kamrup and Nagaon (Purkayastha *et al.* 2010). In addition, Purkayastha *et al.* (2010) reported a record from Moirang, Bishnupur, Manipur.

We here present additional locality records for *H. aquilonius* from the Indian states of Arunachal Pradesh, Mizoram, Nagaland and Tripura, constituting the first specific records for these states, as well as additional records from Manipur. All specimens were euthanized, stored in 10% formaldehyde solution and deposited in the Zoological Survey of India, Eastern Regional Centre, Shillong bearing Museum numbers: VR/ERS/ZSI/539, VR/ERS/ZSI/540, VR/ERS/ZSI/541, VR/ERS/ZSI/542, VR/ERS/ZSI/543. GPS coordinates of the collection localities were taken using a Garmin E-trex GPS. Specimen identification followed McMahan and Zug (2007).

In the present study, we have recorded *H. aquilonius* from the following localities: **Arunachal Pradesh**: Basar (27°59'9.04"N, 94°41'23.55"E), Along (28°10'1.75"N, 94°48'1.86"E), Daring (27°51'30.33"N, 94°48'8.88"E); **Nagaland**: Mon (26°43'21.84"N, 95° 1'44.56"E), Dimapur (25°54'17.07"N, 93°44'0.15"E); **Manipur**: Imphal (24°48'34.63"N, 93°55'41.20"E), Moirang (24°29'28.84"N, 93°46'20.73"E), Moreh (24°15'26.27"N, 94°17'25.76"E); **Tripura**:

Dharmanagar (24°22'44.37"N, 92° 9'39.32"E), Agartala (23°50'43.38"N, 91°15'50.55"E), Udaipur (23°31'27.90"N, 91°29'15.40"E); **Mizoram:** Aizwal (23°43'14.27"N, 92°43'13.10"E) (Fig. 2).

Earlier Northeast Indian records of *H. aquilonius* (as *H. bowringii*) included localities in Assam, Meghalaya and Manipur (Stoliczka 1872; Annandale 1912; Smith 1935; Baldauf 1949; Purkayastha *et al.* 2010). The present study extends the range into Arunachal Pradesh, Nagaland, Tripura and Mizoram, confirming the occurrence of this gecko in all of the states of Northeast India. It is expected that the actual distribution of the species is continuous across all of the northeast states into northern Myanmar and Yunnan, China (McMahan & Zug 2007).

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Notes on the distribution and natural history of *Dinodon septentrionalis* (Günther, 1875) from India

In India, *Dinodon* is represented by two species, *Dinodon gammiei* (Blanford, 1878) and *Dinodon septentrionalis* (Günther, 1875). Both are considered rare (Murthy *et al.* 1993) and little is known about their natural history. We herein report three specimens of *Dinodon septentrionalis*. These constitute the first authentic records of the species from the state of Arunachal Pradesh, India and fill in the distribution gap between the eastern and westernmost limits of the species. We also provide information on its diet.

Dinodon septentrionalis is a widely distributed species known from China: Yunnan; India: Northern West Bengal (Darjeeling), Assam, Nagaland, Mizoram; Bhutan: Trashiyangtse District, Bumdeling Wildlife Sanctuary; Myanmar: Kayin State, Mogok Region, Northern Kachin State, Northern Mon State; Laos: Xieng Khoang Province; Cambodia: Mondolkiri Province; Vietnam: Thua-Thien Hue Province, Lai Chau, Lao Cai, Bac Kan, Cao Bang, Vinh Phuc, Nghe An, Quang Binh, Ha Tinh; and Thailand: Chiang-Mai (Boulenger 1893; Wall 1908; Bourret 1936; Smith 1943; Taylor 1965; Zhao & Adler 1993; Hallermann *et al.* 2002; Orlov & Ryabov 2004; Stuart *et al.* 2006; Bain *et al.* 2007; Wogan *et al.* 2008; Wangyal 2011).

Six specimens of *D. septentrionalis* have hitherto been reported from India — the type specimen, BMNH (Natural History Museum, London) 1946.1.14.96, was collected from "Eastern Himalayas or Khasi Hills"; ZSI (Zoological Survey of India, Kolkata) 7741 was collected by J. Gammie on 26 March 1877 from Darjeeling; Wall (1909a) reported one specimen from Phubsering in Darjeeling; Wall (1909b) reported one specimen from Namsang (currently within Jeypore Wildlife Sanctuary, Assam); Talukdar and Sanyal (1978) reported one specimen from Bhumtilong in Mizoram State, and Ao *et al.* (2004) reported one male specimen from Kohima, Nagaland.

The type locality "Eastern Himalaya or Khasi Hills" refers to two widely separated areas (*sensu*, Mani, 1974). Blanford (1878) mentioned that the specimen might have been collected from the Himalayas or Assam (currently mostly within northern and north-east India, although plausibly also from Nepal, Bhutan and northern Bangladesh) as the type specimen was collected by Jerdon soon before his departure from India and found unlabeled in his collection after his death. Boulenger (1893) followed Blanford (1878) when commenting on the type locality of the species. Subsequently, Zhao and Adler (1993) reported "northern parts of India" and Daltry and Wüster (2002) gave only "Khasi hills" as the origin of the type specimen. Although the presence of the species is confirmed from the Eastern Himalayas (Darjeeling, Bhutan), it has never been documented from the Khasi Hills of Meghalaya state (see Wall 1908; Mathew 1983; Mathew 1995; Mathew & Meetei 2004).

No explicit record of *D. septentrionalis* so far exists from Sikkim state (see, Günther 1875; Smith 1943; Chettri & Bhupathy 2007). However the species was listed from Sikkim by Waltner (1973), Shaw *et al.* (1999) and Jha and Thapa (2002). Such discrepancies are presuma-

bly due to the fact that the Darjeeling Hills were often considered as part of the greater Sikkim Himalaya (Gammie 1928) and the latter was largely derived from the former (Chettri & Bhupathy 2009).

Similarly there was no published information on the occurrence of the species from the present state of Arunachal Pradesh, although faunal checklists and reports are provided in Captain & Bhatt (1997, 2000), Borang *et al.* (2005) Athreya (2006), Sanyal & Gayen (2006), and Agarwal *et al.* (2010).

The published localities of *D. septentrionalis* are summarized in Figure 1. We herein report our observation of three additional specimens as follows:

(1) AD (Abhijit Das personnel collection) S072 from Arunachal Pradesh, Lower Subansiri District, Ziro, 27°32'48.38" N, 93°49'00.39" E, elevation ~ 1567 m, 30 July 2010, found killed on road close to a subtropical forest clearing (Fig. 2).

(2) AD S073 from Tawang District, Zimithang, 27°42'29" N, 91°43.41" E, elevation ~ 2100 m, 29 September 2009. This snake was collected at night while lying on a metaled road passing through degraded forest close to crop field.

(3) IISERP (Indian Institute of Science Education and Research, Pune) S005 from Lohit District, near Kamlang Wildlife Sanctuary, Kahare stream, 27°45'28.09" N, 96°19'32.15"E, elevation ~ 390 m, 8 June 2012, found at 2030 h. at edge of a rocky in a evergreen forest (Fig. 3).

These constitute first authentic records of the species from Arunachal Pradesh state and fill in the distribution gap between eastern and westernmost distribution limit of the species (Fig. 1).

Bain *et al.* (2007) reported the species from 220 m in Vietnam. In Cambodia, it was recorded from hilly evergreen forest at 500 m. Orlov *et al.* (2000) reported its habitat in Tam Dao as forest on mountain slopes at elevations up to 1200 m. Ao *et al.* (2004) reported the species from

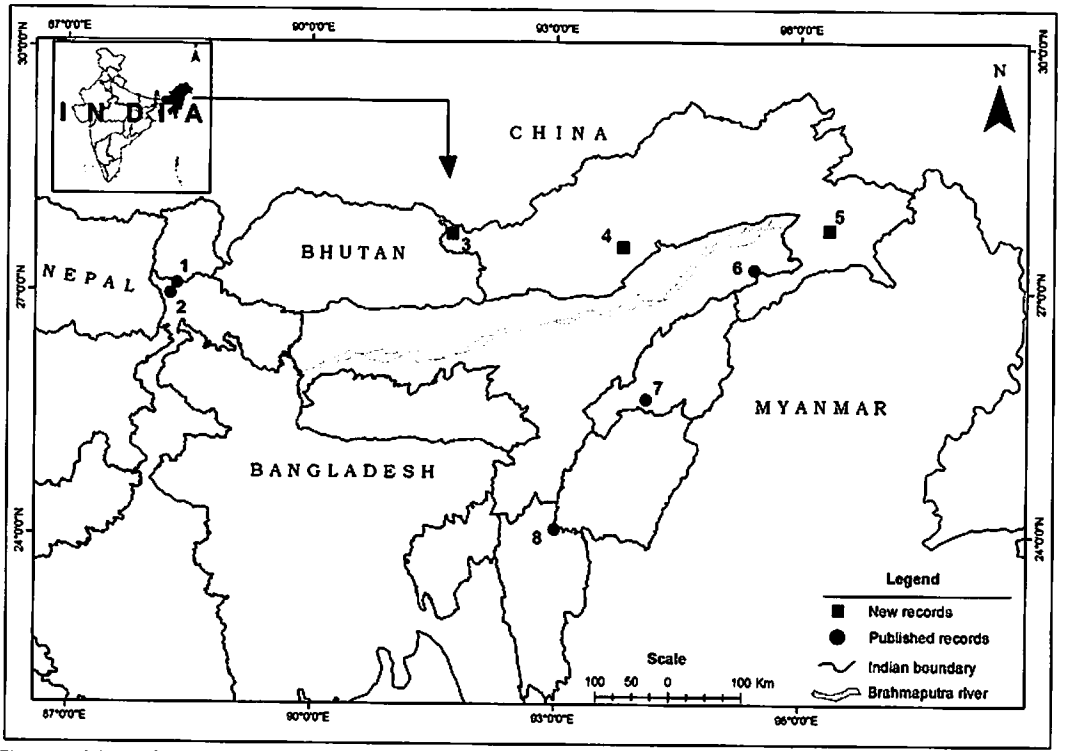

Figure 1. Map of northeast India showing the distribution of *Dinodon septentrionalis*. 1: Darjeeling, Northern West Bengal; 2: Phubsering, Northern West Bengal; 3: Zimithang, Arunachal Pradesh; 4: Ziro, Arunachal Pradesh; 5: Kahare, Arunachal Pradesh; 6: Namsang, Assam; 7: Kohima, Nagaland; 8: Bhumtilong, Mizoram.

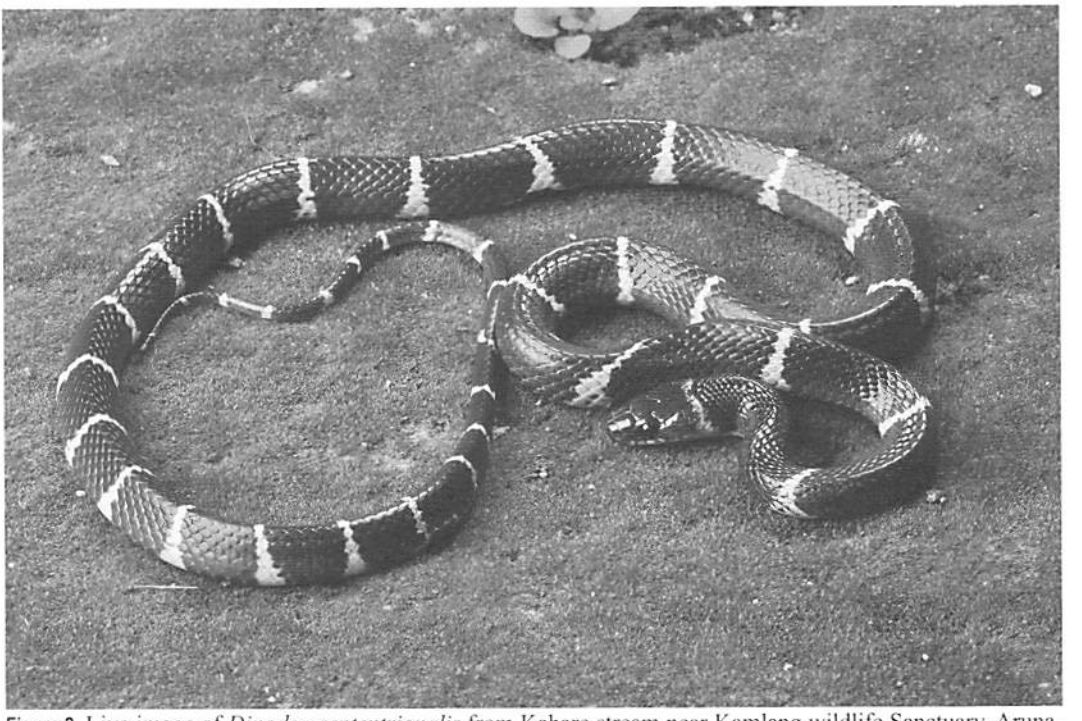

Figure 2. Live image of *Dinodon septentrionalis* from Kahare stream near Kamlang wildlife Sanctuary, Arunachal Pradesh (IISERP S005).

1444 m. Our record of the species from Zimithang at an elevation of 2100 m is the highest elevational record for the species so far.

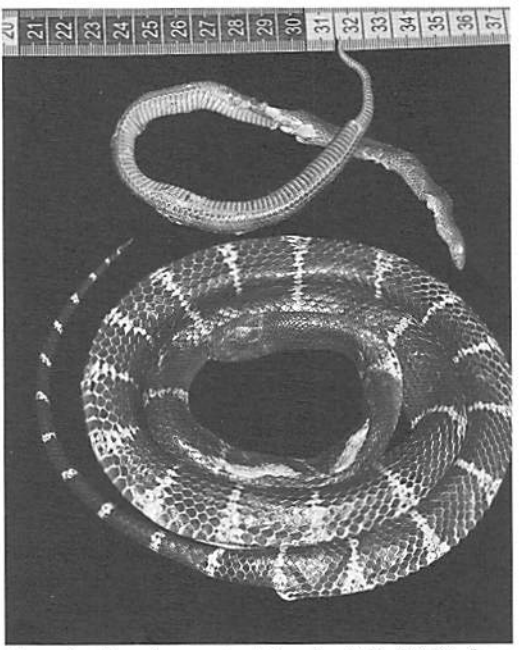

Figure 3. *Dinodon septentrionalis* (AD S072) from Ziro, Arunachal Pradesh with its freshly ingested prey *Trachischium tenuiceps*.

We also made a novel observation on the diet of the species. On dissecting the stomach of the specimen from Ziro (AD S072, SVL: 755 mm; TL: 183 mm; Fig. 3), we found a freshly devoured *Trachischium tenuiceps* (Ventrals: 140, Subcaudals: 29 Anal: 2, Preocular: 1/1, Postocular: 2/2, loreal present). Total length of the prey was 341 mm (SVL 298 mm; TL: 43 mm), which constituted 36.6% of predator's body length. Earlier dietary records include a lizard of the genus *Lygosoma* (Wall 1909a). Our observation reports the first record of a snake in the diet of *Dinodon septentrionalis*.

The specimens examined so far exhibit variation in the number of dorsal white bars, which ranges between 35–43 (average bands 39.16, N=5). However, a specimen registered as ZMH (Zoological Museum, Hamburg) R05369 from the Karen Mountains, Myanmar depicted in Hallermann (2002) has 73 white bars on the body and tail. We have not examined this specimen.

Although Siler *et al.* (2013) placed *Dinodon* in the synonymy of *Lycodon* using multilocus phylogeny, we prefer to follow Smith (1943), who distinguished between *Dinodon* and *Lycodon* primarily using the shape of the maxil-

lary bone: strongly arched and bent inwards anteriorly, with 3 to 6 anterior teeth increasing in size, fang-like, and separated by a toothless interspace from the rest 7 to 15 in number, the last two of which are larger than the others in *Lycodon* versus maxillary bone extending beyond the palatine, bent inwards but not arched, or only slightly so, with 5–7 anterior teeth increasing in size, fang-like, and separated, or not by a toothless space from the rest, 5 or 6 in number, the last 2 or 3 of which are larger than the others in *Dinodon*). It may be noted that Siler *et al.* (2013) only used 2 species of *Dinodon* (*rufozonatum* and *semicarinatum*) in their study, neither of which is currently known from India. Thus we maintain the validity of the genus *Dinodon* for Indian species (*Dinodon gammiei*, *D. septentrionalis*) pending further study.

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Natural history notes on *Elachistodon westermanni* Reinhardt, 1863

The Indian Egg-eating Snake *Elachistodon westermanni* Reinhardt, 1863 is the only species in the monotypic genus *Elachistodon* Reinhardt, 1863. Sparse distribution records and an elusive nature make it one of the least studied Indian snake species. It is currently known from sixteen sites spread across Bangladesh, India and Nepal. I here take the opportunity to report a new locality, which extends the distribution of the species to the south and also provide notes on the behavior and captive feeding of *E. westermanni*.

On 12 October 2014, at 2100 hrs, a live specimen of *Elachistodon westermanni* was rescued by J. Srinivas from a residence in Patancheru, Medak District, Telangana (17°30'16"N, 78°17'18"E; 556 m a.s.l.). The specimen had entered the fenced perimeter of the house from an adjacent dry thorny scrub patch. The current record of *E. westermanni* is the southernmost known for the species (Fig. 1), extending the range ca. 400 km south-east from Buldana, Maharastra (Narayanan 2012), the previous southernmost record. The closest documented record of the species at Wardha, Maharastra (Captain *et al.* 2005) ca. 360 km north of Patancheru shares a similar dry Deccan thorn scrub-forest habitat. From the current and previous documented records, we can infer that the distribution of *E. westermanni* is restricted to dry and moist mixed deciduous, dry grasslands and tropical & sub-tropical moist broadleaf ecoregions. Our current knowledge of the geographic distribution of the species suggests that it is widely distributed. The apparent rarity of the species may well be the result of difficulty of detection.

Because *E. westermanni* is seldom encountered, morphological and behavioural data were recorded from the specimen in captivity. Ventral counts were made according to Dowling (1951). Dorsal scale rows were counted one head-length behind the head, at mid-body and at one head length anterior to the vent. Body length measurements were taken with a non-stretchable thread to the nearest mm. Other measurements were taken with a digital caliper to the nearest 0.1 mm. The specimen was sexed using a 1.25 mm diameter sexing probe. High-resolution digital images were used to describe coloration and pholidosis (except dorsal scale rows which were counted on the live snake).

The specimen (Fig. 2) was an adult female measuring 790 mm in total length (687 mm SVL plus 103 mm tail length) and having the following characteristics: head distinct from neck, slightly elongated with head length measuring 23.1 mm, maximum head width 8.3 mm and maximum head depth 6.7 mm; rounded snout; large protruding eyes measuring 3.0 mm in diameter, with vertically elliptical pupils; body moderately elongated, laterally compressed

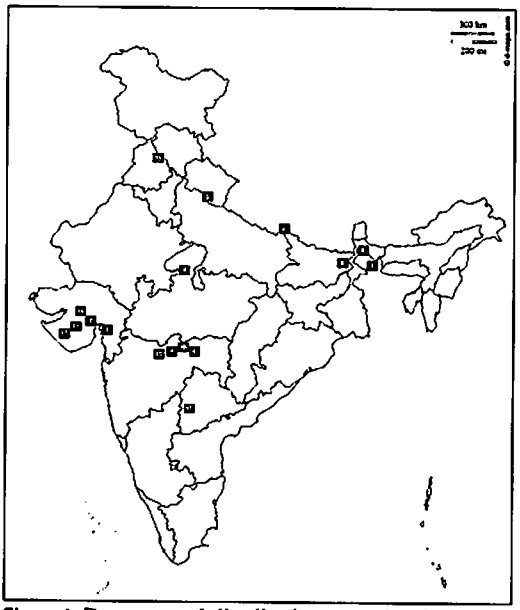

Figure 1. Documented distribution records of *Elachistodon westermanni* from the Indian sub-continent –1. Rangpur, Bangladesh (Reinhardt 1863) (Type locality); 2.Purnea, Bihar, India (Blanford 1875); 3.Jalpaiguri, West Bengal , India (Wall1913); 4. Chitwan, Nepal (Fleming & Fleming 1974); 5.Corbett National Park, Uttarakhand, India (Sharma 2003); 6.Wardha, Maharashtra, India (Captain *et al.*, 2005); 7.Bhavnagar, Gujarat, India (Vyas 2006); 8.Surat, Gujarat, India (Vyas 2006); 9.Amrawati, Maharashtra, India (Nande & Deshmukh 2007); 10.Akola, Maharashtra, India (Dangde 2008); 11.Junagadh, Gujarat, India (Vyas 2010); 12.Buldana, Maharashtra, India (Narayanan 2012); 13.Amreli, Gujarat, India (Vyas 2013); 14.Surendranagar, Gujarat India (Vyas 2013); 15.Hoshiarpur district, Punjab, India (Sharma 2014); 16.Shivpuri, Madhya Pradesh, India (Sharma 2014); 17.Patancheru, Telangana, India (this paper).

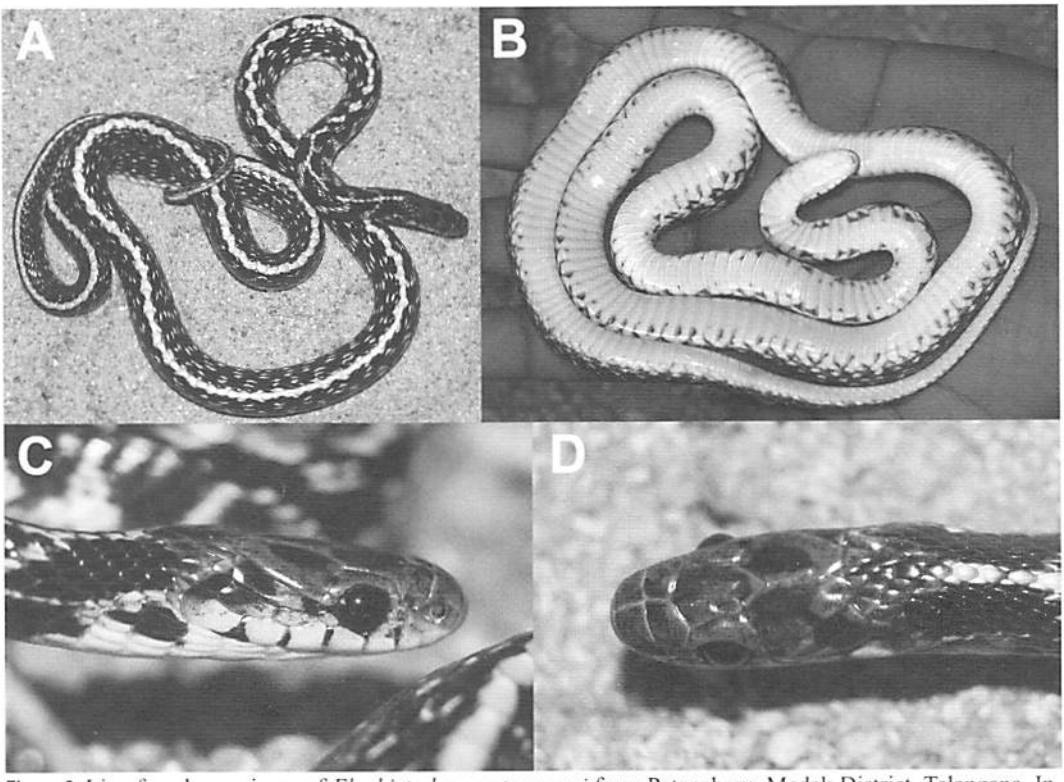

Figure 2. Live female specimen of *Elachistodon westermanni* from Patancheru, Medak District, Telangana, India. **A.** Dorsal view of the entire body **B.** Ventral view of the entire body **C.** Lateral view of the head **D.** Dorsal view of head.

with spine subtly arched outward giving a triangular appearance; tail short and prehensile; scales smooth and lustrous. Internasals as large as prefrontals; supralabials 7, with 3rd and 4th in contact with the eye; preoculars 2, postoculars2; loreal absent; temporals 2+3; dorsal scales in 21:15:15 rows; vertebral scales larger than the adjacent dorsal scales. Ventral scales 217; anal scale entire; subcaudals 52, paired (excluding the terminal scale). Dorsum dark brown with single yellow vertebral stripe from neck to tail tip, discontinuous at the anterior body. Off-white streaks, perpendicular to vertebral scales conspicuous on the anterior body but reduced to speckles of decreasing prominence towards the posterior end. Ventral scales glossy off-white. Many of the anterior ventrals have dark brown triangular patches at their outer edges. Head tan with dark brown patches on parietals, frontal, prefrontals and temporals. Dark brown streaks separate supralabials 2 to 7.

The specimen was terrestrial but showed remarkable dexterity in scaling vegetation. On one occasion, it was able to raise more than half the body length without any other support while reaching out towards other branches. When provoked, it raised the anterior portion of the body, forming 'S' shaped coils as a defensive strategy. It was active exclusively nocturnally. During the day it rested under crevices on land. Its scales appear acutely receptive to vibrations or touch; the specimen was startled, backing off in a sudden jolt, when it accidentally came in contact with a fallen leaf or other obstructions.

Two eggs of a Blue Rock Pigeon (*Columba livia*), measuring 35 mm x 27 mm, were presented to the specimen. After being tongue-flicked, the first egg was swallowed entirely and pushed inward towards the cervical region. After a pause of three minutes, the snake, in a swift motion, threw its vertebral column at the cervical region in a downward thrust to crack open the egg (Fig. 3A). Rapid vertical contractions followed lasting 1 to 2 seconds, to expel the contents of the egg. This was immediately followed by a series of quick horizontal contractions, lasting ca. 2 seconds, which pushed the discharged egg contents further towards the

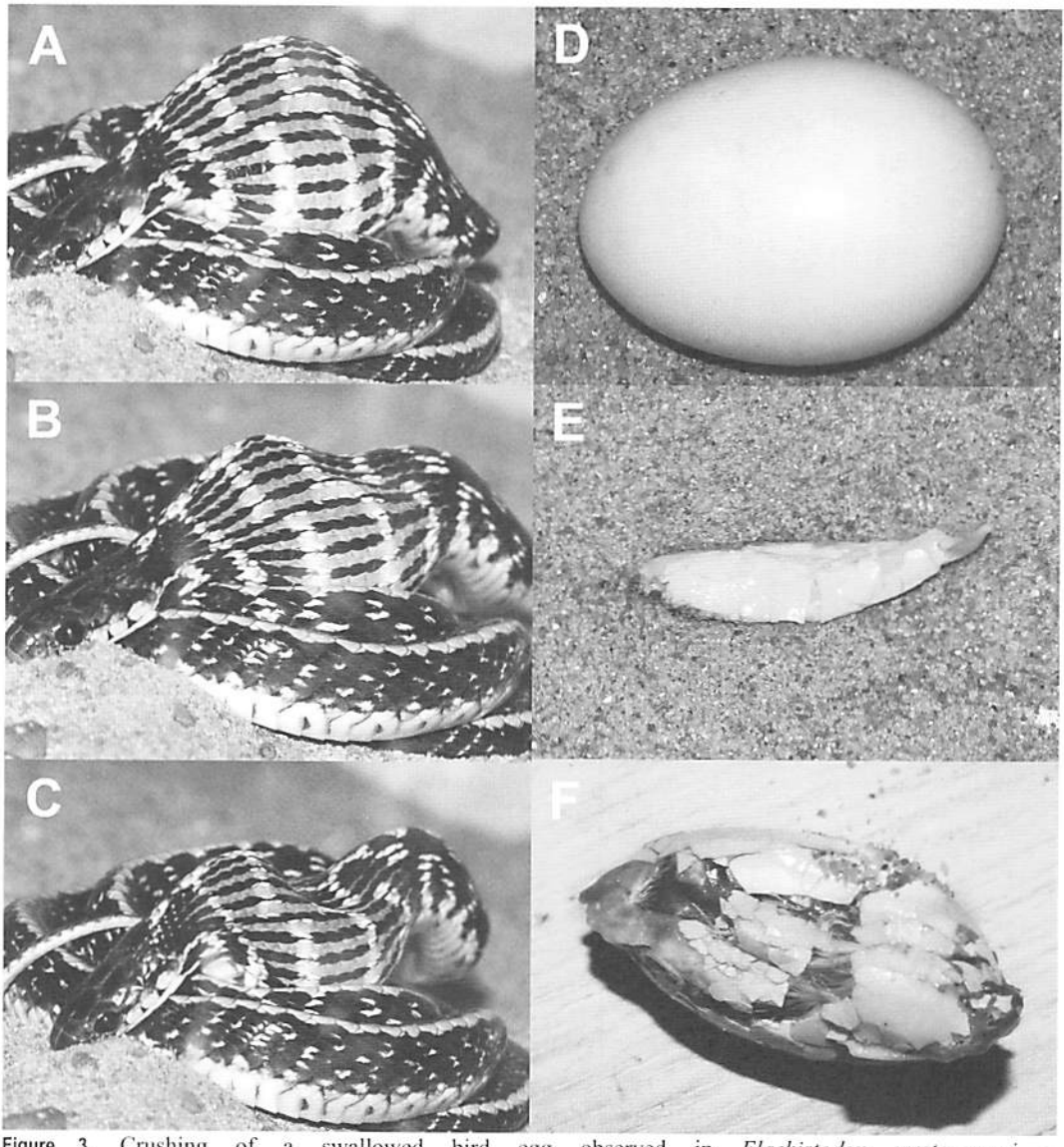

Figure 3. Crushing of a swallowed bird egg observed in *Elachistodon westermanni* – **A.** swallowed egg resting in the cervical region **B.** Initiation of the egg crushing process by the vertebral column **C.** Egg crushed by the downward thrust of the vertebral column. D. Intact egg before inhestionby *E. westermanni.* **E.** Elongated disc-like remnants of the regurgitated egg shell. The shell fragments are held together by the egg membrane **F.** Regurgitated egg containing a fully-formed chick.

stomach. Subtle peristaltic movements of the oesophagus continued until the contents had reached the stomach.

Vertical and horizontal contractions at the cervical region were repeated thirty times, to ingest all the content of the egg, except the shell, which was later regurgitated (Figs. 3B–C). The process of egg consumption, from initial ingestion until the regurgitation of the egg shell, lasted 56 minutes. The regurgitated egg shell was crushed and folded inward along a median line. The fragmented pieces of the shell were still attached to the egg membrane. Further examination revealed that the egg membrane was torn only at two sites at the posterior end of the egg towards the stomach. I speculate that the snake uses the sharp edges of the vertebral projections to slice open the egg membrane. Flat and blunt side of the projections probably aided in crushing of the hard egg shell and squeezing the contents out. Out of ten regurgitated eggs shells examined, egg membranes of seven were torn

open at only two sites, while the other three had been torn at three sites – two small circular gashes and one adjacent longitudinal tear running more than half the length of the egg. Das (2002) suggested that the secretions from the Harderian glands helped adhesion of the egg shell to the internal tissue of the oesophagus. However, freshly regurgitated eggs (Fig. 3E) were slippery and no sticky secretions were found. The regurgitated shells were, however, thoroughly wetted, probably to avoid shell fragments from getting stuck to the oesophageal wall.

Eggs with embryonic development were rejected. Such eggs, when washed thoroughly in water were ingested by the snake, but subsequently regurgitated (Fig. 3F), suggesting the specimen's inability to successfully take solid prey. Based on the above it is extremely probable that the snake uses its olfactory ability to choose eggs without embryonic growth. Smaller eggs of Red-vented Bulbul (*Pycnonotus cafer*) (20.6 ± 0.08 mm x 15.97 ± 0.13 mm) presented to the snake, were crushed and consumed entirely, including the shell. I speculate that the thin egg membrane of *P. cafer* was not able to hold the shell fragments together, which would otherwise aid in channeling the contents out of the egg. Defecation on the following day contained a powdery mass, creamy-white in appearance indicating the total breakdown of the calciferous shells by the snake's digestive fluids.

Gans & Williams (1954) noted the scarcity of knowledge on the genus *Elachistodon*. This situation still remains much the same. There is much to learn about this elusive species by maintaining it in captivity, as sightings are few and far apart. Extensive field surveys should also be made to document the extent of geographic range of the species in the sub-continent.

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