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Amphibians and Reptiles of Myanmar: Checklists and Keys I. Amphibians, Crocodilians, and Turtles

George R. Zug

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ABSTRACT

Zug, George R. Amphibians and Reptiles of Myanmar: Checklists and Keys. I. Amphibians, Crocodilians, and Turtles. *Smithsonian Contributions to Zoology*, number 653, x + 113 pages, 43 figures, 4 plates, 3 tables, 6 appendixes, 2022. — Myanmar (formerly Burma) has 150 species of formally described amphibians (5 salamanders, 2 caecilians, and 143 frogs) and more than 200 species of reptiles (2 crocodilians, 20 turtles, 100+ lizards, and 100+ snakes). This herpetofauna was never the focus of a countrywide survey and study until recently, from 1997 through 2010. This treatise is the beginning of an overview of this fauna through sets of generic identification keys and checklists for adult amphibians, crocodilians, and turtles of Myanmar. It offers a partial summary of the biological findings of the Myanmar Herpetology Survey from 1997 through 2010, together with rapid assessment surveys during 2014–2017 for Fauna & Flora International's Myanmar Programme and recent herpetological research and surveys of other zoologists.

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Cover images, from left: *Kalophrynus anya* (Figure 2.21), *Clinotarsus penelope* (male and female in amplexus; Figure 2.28), and *Humerana oatesii* (Figure 2.29).

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Preface

Burmese amphibians and reptiles remained largely an unknown herpetofauna relative to our knowledge of the herpetofaunas in the adjacent countries of India, China, and Thailand when Joseph B. Slowinski and I independently began our research in Myanmar in 1997. Joe was searching for a site to study the ecology and behavior of king cobras, and I had begun a collaborative herpetofaunal monitoring study with the Chatthin Wildlife Sanctuary staff. The director of wildlife (U Uga) urged us to begin herpetofaunal surveys throughout Myanmar. The countrywide herpetofaunal survey had its formal beginnings in late 1999 with research support from the U.S. National Science Foundation's Biological Inventory program and the logistic and personnel support of the Myanmar Nature and Wildlife Conservation Division of the Forestry Ministry. The Myanmar Herpetology Survey ran through the summer of 2010. A series of four rapid assessment herpetological surveys (2014–2017) of southern Tanintharyi in proposed national parks was performed by Daniel G. Mulcahy in collaboration with Fauna & Flora International's Myanmar Programme. He subsequently joined a survey of the Zalon area of Sagaing Region in 2019 with the Smithsonian National Museum of Natural History's Biodiversity Survey and Inventory Program (later called the Small Grants Program). A more open policy by the Myanmar government has allowed other zoologists to begin assessments of the herpetofauna; most notably, L. Lee Grismer's group led surveys in the karst areas for *Cyrtodactylus* and other geckos. Sadly, with the return of a military government in late 2020, scholarly research of any sort in Myanmar will again experience a hiatus, most likely for years.

Perhaps I overemphasize the unknown aspect of the Burmese herpetofauna. This overemphasis derives from the absence of, or, rather, the superficial attention to, Burmese populations and species in many studies of Asian amphibians and reptiles. The viewpoint that the Burmese herpetofauna is little or no different from that in adjacent nations has changed as biologists recognize the regional complexities and diversity of the mainland southern Asian faunas and floras. The Myanmar Herpetology Survey was a joint collaboration between the Myanmar Nature and Wildlife Conservation Division, California Academy of Sciences, and Smithsonian Institution; the staffs of all three participated in the fieldwork. The fieldwork provided a wealth of voucher specimens, both preserved whole specimens and tissue samples, which are and have been available to the systematic community to examine the evolutionary and phylogenetic history of Asian amphibians and reptiles since the beginning of our surveys. Fortunately, more researchers have increasingly used these voucher specimens from the California Academy of Science and the National Museum of Natural History in the past decade.

This summary began in the mid-2000s. The first outline draft and a near-final crocodilian and turtle chapter were completed in the summer of 2010. Thereafter, other projects diverted my attention. After finishing another major project in September 2019, I began to work intermittently on the amphibian chapter; then the COVID-19 pandemic and home confinement encouraged me to focus fully on this summary of the Burmese herpeto-

fauna. As I renewed this effort, I recognized that completion of the full project was years away. Would I live long enough to see the project's full completion? Perhaps, but would it not be more useful to serialize the project and publish chapters as they were completed? These two chapters on amphibians and crocodilians and chelonians are the first of the series.

Amphibians and Reptiles of Myanmar: Checklists and Keys

I. Amphibians, Crocodilians, and Turtles

George R. Zug

1. INTRODUCTION

Myanmar (formerly Burma) lies betwixt two distinct floristic and faunistic realms, Indian and Southeast Asian. Although the Burmese flora and fauna contain an admixture of these two realms, it is a factual and conceptual mistake to consider them simply a mixture and interface between these two realms. The flora and fauna are that; however, they are much more as well. The long and complex geologic events creating the current landscape of Myanmar generated many opportunities for dispersal, isolation, and speciation. The diversity and uniqueness of biota reflect the resulting evolution of a distinct Burmese flora and fauna.

GOALS AND ORGANIZATION

The Myanmar Herpetology Survey (MHS) of the amphibians and reptiles of Myanmar, in which I took part, extended from July 1997 to September 2010. We were able to conduct surveys in all political units (seven regions and five states; Figure 1.1A) of Myanmar except Kayah and Kayin; the MHS team's travel and fieldwork were limited in those Myanmar administrative units with no or distant international borders, and we were permitted only in areas considered politically safe, commonly a hundred or more kilometers distant from these borders.

Throughout our survey, our major goal was to document the occurrence of every species of amphibian and reptile found at every site visited, to provide the conservation, educational, and scientific communities and the Myanmar's Ministry of Forestry with a detailed accounting of the geographic distribution of every amphibian and reptile species occurring in Myanmar. These distributional data are summarized in the species accounts of the checklists and the distributional matrices in the appendixes; the detailed locality data for each species, indeed for each individual vouchered, are available at the collections data websites of the California Academy of Sciences (<https://researcharchive.calacademy.org/research/herpetology/catalog/index.asp>) and the National Museum of Natural History, Smithsonian Institution (<https://collections.nmnh.si.edu/search/herps/>).

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FIGURE 1.1. Maps of Myanmar: (A) administrative regions and states and (B) major rivers (west to east: Chindwin, Ayeyarwady, Sittang, Salween) and the arbitrary division of Myanmar for use in reporting the occurrence of species within the species accounts. The locus of mainland Myanmar is Mandalay. The mainland quadrants are as follows: NW, northern Chin, Sagaing; NE, Kachin, northern Mandalay, northern Shan; SW, southern Chin, Rakhine, Magway, western Bago, Ayeyarwady; SE, southern Mandalay, eastern Bago, Yangon, northern Kayin, Kayah. Peninsular Myanmar (southern Kayin, Mon, Tanintharyi) refers to its attenuate shape extending southward from southeastern mainland Myanmar, only the latter quarter of which lies within the Malay Peninsula.

Additionally, I surveyed the holdings of other museums (prior to 2010), and those data are included in the distribution summaries when a specimen's species identification has been verified and its locality represents a state or region not represented by a MHS voucher.

After the MHS fieldwork ended in 2010, no extensive voucher of the Burmese herpetofauna existed until Daniel G. Mulcahy (Smithsonian) joined a Fauna & Flora International rapid assessment survey program (June 2014) in southern Tanintharyi. Although his fieldwork was brief, his annual visits (2014,

2015, 2016, and 2017) added numerous new species records of the Malayan herpetofauna in Myanmar and new Burmese species. Others, notably L. Lee Grismer, Steven G. Platt, Nikolay A. Poyarkov, Gunther Köhler, and their teams, have surveyed broadly, and their discoveries are included herein. This document includes all species described prior to 1 January 2021. I have also included a few species whose presence in Myanmar has not been confirmed but whose present distributions immediately border the country and can be expected to occur in Myanmar.

Distributional data are presented in two ways. Within the species accounts, occurrences are described by their presence in mainland Myanmar and/or peninsular Myanmar (see Figure 1); the political subdivisions (states and/or regions) are included in parentheses. Details of Burmese geography and place-names are examined in Appendix A. For quicker access to species distributions, I created species-political subdivision matrices for each amphibian and reptile group. These latter data derive primarily from the MHS collections housed in the California Academy of Sciences (CAS) and National Museum of Natural History; other museum collection locality records (e.g., Natural History Museum, London, Muséum National d'Histoire Naturelle, Field Museum of Natural History, etc.) are included where they represent localities not vouchered by MHS. The anuran and turtle occurrences are summarized in species $\times$ administrative unit matrices in Appendixes B and C, respectively. A second goal is to provide nonherpetologically trained individuals a means to identify adult Burmese amphibians and reptiles. Originally, I planned to provide identification keys to the species level. As I began their construction and compilation, I discovered that such a task was beyond the scope of my knowledge of Burmese species. Additionally, the rate of discovery and description of Burmese species would make such keys outdated within days of the manuscript's completion and submission for publication. Instead, I offer keys to all known genera occurring in Myanmar as of the end of 2020. The keys are constructed with nonherpetological naturalists and interested laity in mind, emphasizing characteristics of the animals' exteriors, that is, ones that are readily visible with the animal in hand or under close observation. In some instances, the user will need to open the animal's mouth, spread its toes, or use a magnifying glass because not all distinguishing characteristics are readily visible without some form of assistance. I attempted to make each identifying statement an either/or statement. If the specimen in hand does not match all items in a statement, the user should proceed to the next statement. Illustrations of identification characteristics are present within the keys to enhance their utility.

NOMENCLATURE

Classification and Scientific Names

Multiple classifications are available. I have selected those that best reflect the current standard of the herpetological community. My selections and reason for those selections are explained in the first endnote of each chapter.

The synonymies derive from a variety of secondary sources, principally Darrel Frost's "Amphibian Species of the World 6.0, an Online Resource" (ASW) and his earlier productions (<https://amphibiansoftheworld.amnh.org/index.php>); those for crocodilians and turtles are initially from Wermuth and Mertens's *Schildkröten, Krokodile, Brückenechsen* (1961) and subsequently from various editions of *Conservation Biology of Freshwater Turtles and Tortoises* (CBFTT; <https://iucn-tftsg.org/cbftt/>). Those sources are identified in the first endnote of each chapter. Each synonymy contains only the primary synonyms of each taxon. Primary equals the first publication of a new name for a taxon. I usually include *nomen nudum*, *nomen oblitum*, and *nomen dubium* (when there appears to be consensus on a name's assignment to a specific taxon). I have intentionally expanded and spelled out the publication title to assist users in locating the original sources of names. The titles of some sources are too long to conveniently include, and those have been shortened by dropping portions of the title and replacing them with ellipses. The full titles of all publications listed in the synonymies are listed in Appendix E; note that I have not included pagination or publisher information in that bibliographic list. I have checked the majority of citations for the accuracy of page number and type locality of each name. I have checked also the name of each publication, using the online catalogs of the Smithsonian Libraries and Archives and the Library of Congress, title pages of books available in the Biodiversity Heritage Library, and actual copies held in the Division of Amphibians and Reptiles, National Museum of Natural History.

The format of the synonymies follows the standardization established for the Smithsonian Contributions Series by the former Smithsonian Institution Press (and adopted by Smithsonian Institution Scholarly Press). It is concise yet allows full documentation of the publication location of the name and the precision of the type locality. I have not included plate or figure information in a synonymy unless no textual description of the new taxon exists. I cite in quotation marks the type locality as given in the original description whether or not it subsequently has proved incorrect; however, I have not included proposed corrections of or redefinition of type localities within the synonymies. That information and much more nomenclatural and systematic information is available in the "Amphibian Species of the World" website (Frost, 2012, 2020) as well as in the checklists and species accounts in *Conservation Biology of Freshwater Turtles and Tortoises* (Rhodin et al., 2008–2018).

Standard or Vernacular English Names

Owing to the widespread appearance of English names for amphibians and reptiles in the popular and regulatory literature, I have included and propose a single standard English name for each species currently recognized as a valid taxon. My first criterion was to select names frequently encountered in popular and conservation (e.g., the International Union for Conservation of Nature endangered species list) literature, although I have not used those names where they seem inappropriate. For some

genera and species groups, I suggest a standard name and use it as a base name for all members of the group, for example, Narrow-mouthed Frogs for *Microhyla* and Leaf-turtles for *Cyclemys*. I describe the selection philosophies in the first or second endnote of each chapter. In general, I reviewed a variety of published and web sources and selected names that have developed a modest consistency of use; however, I again have not felt obligated to accept previously published names if they do not meet one or more

criteria for use: (1) The standard English name (SEN) is unique. (2) The SEN assists in the identification of the species. (3) The SEN serves to identify a species and its presumptive relatives, for example, Treefrogs for *Hyla*, *Polypedates*, and *Rhacophorus* and Toadfrogs for all Megophryidae (proposed by Halliday and Adler, 2002). (4) The SEN has appeared frequently in past English language publications. The construction of standard names follows the guidelines of Crother (2008).

2. Caecilians, Salamanders, and Frogs¹

KEY TO ADULT CAECILIANS, SALAMANDERS, AND FROGS

1. Body earthworm-like with distinct segments or rings; no fore- or hindlimbs; head blunt and jaw underslung; eyes beneath skin and visible or not as dark pigment spots [Figure 2.1A] caecilians (Gymnophiona)
- 1'. Not as above; fore- and hindlimbs present; skin lacks scales 2
2. Body attenuate with distinct head, neck, trunk, and tail [Figure 2.1B] salamanders (Caudata)
- 2'. Body foreshortened with head joining trunk without visible neck and tail absent [Figure 2.1C] frogs (Anura)

KEY TO CAECILIAN GENERA AND SPECIES*

1. Striped, one or two lateral yellow to cream stripes 2
- 1'. Unicolor dark gray above or nearly so; eye usually not visible or weakly so *Chikila alcocki*
2. Single yellow to cream lateral stripe on side of body from head to base of tail; color above and below light stripe nearly equal medium gray 3
- 2'. Double lateral stripes, light-colored stripe on middle of side of body and bordered below by dark longitudinal stripe; 358 to 366 annuli on body, 2 to 4 on tail *Ichthyophis multicolor*

FIGURE 2.1. General body form of the three orders of Burmese amphibians: (A) caecilian (Gymnophiona), (B) salamander (Caudata, *Tylotriton*), and (C) frog (Anura, generic).

3. Lips with partial cream stripe or same color as remainder of head 4
- 3'. Lateral cream stripe ends before corner of mouth; first cervical groove well-developed dorsally; 320 to 355 annuli on body, 3 to 5 on tail; middorsal light stripe on body *Ichthyophis bannanicus*
4. Lateral cream stripe on lips to middle of eye or slightly beyond; first cervical groove shallow dorsally and often absent middorsally; 270 to 321 annuli on body, 3 to 5 on tail; no middorsal light stripe on body *Ichthyophis supachaii*
- 4'. Lateral cream stripe on lips to middle of eye or slightly beyond; first cervical groove shallow dorsally and often absent middorsally; 358 to 366 annuli on body, 3 to 5 on tail; no middorsal light stripe on body *Ichthyophis kohtaoensis*

*Note: This key and the Key to Anuran Genera are constructed for the identification of subadults and adults from Burmese populations only.

CHECKLIST OF CAECILIANS

GYMNOPHIONA MÜLLER, 1832²

CHIKILIDAE KAMEI, SAN MAURO, GOWER, VON BOCKLAER, SHERRAT, THOMAS, BABU, BOSSUYT, WILKINSON, AND BIJU, 2012

Chikila alcocki Kamei, Gower, Wilkinson, and Biju, 2013 Unicolored Chikila Caecilian

Chikila alcocki Kamei, Gower, Wilkinson, and Biju, 2013, *Zootaxa* 3666: 403 [type locality: "Dhyütere (25.91528 N, 94.10528 E; 78 m asl [above sea level]), New Sendenyu village, Tseminyu subdivision, Kohima district, Nagaland, India"].

DISTRIBUTION. Expected in northwestern Myanmar (Sagaing); presently known from adjacent Northeast India (Arunachal Pradesh, Nagaland).

HABITAT. Fossorial, moist to wet soils adjacent to streams, ponds, and paddies in agricultural areas and edge of secondary forest.

ICHTHYOPHIIDAE TAYLOR, 1968

Ichthyophis bannanicus (Yang, 1984) Banna Striped Caecilian

Ichthyophis bannanica Yang, 1984, *Acta Herpetologica Sinica, Chengdu*, n.s., 3(2): 73 [type locality: "Mengla County, Xishuangbanna, Yunnan, altitude 600 m," China].

DISTRIBUTION. Expected in northeastern Myanmar (Kachin, Shan); presently known from southern China (Guangdong, Guangxi, Yunnan) and montane northern Vietnam.

Ichthyophis kohtaoensis Taylor, 1960 Kohtao Striped Caecilian

Ichthyophis kohtaoensis Taylor, 1960, *University of Kansas Science Bulletin* 40: 110 [type locality: "Koh Tao Island, west side, Gulf of Siam," Thailand].

DISTRIBUTION. Southern peninsular Myanmar (Tanintharyi); presently known from Koh Tao Island and adja-

cent mainland peninsular Thailand and two isolated records in Laos (Champasak Province) and eastern Cambodia (Ta Veng).

HABITAT. Forest floor of wet evergreen forest.

COMMENT. The southern Tanintharyi records were identified by genomic comparison (Mulcahy et al., 2018) to be similar to specimens identified as "*I. cf. kohtaoensis*" in GenBank (Nishikawa et al., 2012); however, these identifications depend upon data from GenBank, and there is no certainty that the GenBank reference specimens were correctly identified originally.

Ichthyophis multicolor Wilkinson, Presswell, Sherratt, Papadopolou, and Gower, 2014 Burmese Tricolored Caecilian

Ichthyophis multicolor Wilkinson, Presswell, Sherratt, Papadopolou, and Gower, 2014, *Zootaxa* 3785: 47 [type locality: "vicinity of Mwe Hauk Village (26°16'39.2"N, 94°45'23.5"E; ca. 10 m asl) Ayeyarwady Region, Myanmar"].

DISTRIBUTION. Southern mainland Myanmar (Ayeyarwady, Bago, Rakhine); Myanmar endemic.

HABITAT. Fossorial, from agricultural fields and secondary forests.

CHECKLIST OF SALAMANDERS

CAUDATA FISCHER VON WALDHEIM, 1813

SALAMANDRIDAE GOLDFUSS, 1820

Tylototriton kachinorum Than Zaw, Paw Lay, Pawangkhanat, Gorin, and Poyarkov, 2018

Kachin Crocodile Newt

Tylototriton kachinorum Than Zaw, Paw Lay, Pawangkhanat, Gorin, and Poyarkov, 2018, *Zoological Research* 40: 161 [type locality: "Ingyin Taung Mountain, Indawgyi Lake area, Mohnyin Township, Kachin State, Myanmar (approximate coordinates N25.09°, E96°; elevation 1000 m a.s.l.)"].

DISTRIBUTION. Northern mainland Myanmar (Kachin); known only from vicinity of the type locality.

HABITAT. Swampy areas without canopy in a montane evergreen forest.

***Tylototriton ngarsuensis* Grismer, Wood, Quah, Myint Kyaw Thura, Espinoza, Grismer, Murdoch, and Lin, 2018**
Ayeyarwady Crocodile Newt

Tylototriton ngarsuensis Grismer, Wood, Quah, Myint Kyaw Thura, Espinoza, Grismer, Murdoch, and Lin, 2018, *Zootaxa* 4500: 562 [type locality: “Baw Hto Chang in Ngar Su Village, Ywangan Township, Taunggyi District, Shan State, Myanmar (21.15364° N, 96.43660°E WGS84) at 1212 m in elevation”].

DISTRIBUTION. Northern mainland Myanmar (Shan); known only from vicinity of the type locality.

HABITAT. Shallow, slow stream amid a degraded gallery forest.

***Tylototriton panwaensis* Grismer, Wood, Quah, Myint Kyaw Thura, Espinoza, and Murdoch, 2019**
Panwa Crocodile Newt

Tylototriton panwaensis Grismer, Wood, Quah, Myint Kyaw Thura, Espinoza, and Murdoch, 2019, *Journal of Natural History* 53: 483 [type locality: “vicinity of Panwa village, Panwa Township, Myitkyina District, Kachin State, Myanmar (25.60425°N, 98.37664°E, WGS84) at 2256 m in elevation”].

DISTRIBUTION. Northern mainland Myanmar (Kachin); known only from the vicinity of the type locality.

HABITAT. All individuals of the type series were found near small ponds and streams.

COMMENT. With the analysis of this new species, the authors also demonstrated the presence of two lineages of *Tylototriton* on the Shan Plateau.

***Tylototriton shanorum* Nishikawa, Matsui, and Rao, 2014**
Shan Crocodile Newt

Tylototriton shanorum Nishikawa, Matsui, and Rao, 2014, *Natural History Bulletin of the Siam Society* 60: 16 [type locality: “Taunggyi Township, Shan State, Myanmar (20°48′28.5″ N, 97°02′45.1″ E, 1457 m asl”)].

DISTRIBUTION. Northern Myanmar (Shan); known only from Taunggyi and Nyaung Shwe townships.

HABITAT. Not given in the description of this species.

***Tylototriton verrucosus* Anderson, 1871**
Crocodile Newt

Tylototriton verrucosus Anderson, 1871, *Proceedings of the Zoological Society of London* 1871: 423. Types: Not designated, but subsequently, Sclater (1892) suggested a series of specimens as syntypes.

DISTRIBUTION. A recently designated neotype is from Yunnan near its border with Myanmar (Kachin), so *T. verrucosus* may be resident in Myanmar, although the ongoing recognition of localized genetic divergence and the description of new species suggest geographic nearness is not an indicator of a broader range (see discussion in Frost 2020, ASW 6.0, accessed 3 Jan. 2020).

KEY TO ANURAN GENERA*

1. Large, globular body and short, stout limbs, body outline is circular in dorsal view, overall nearly spherical 2
- 1'. Body outline is not circular in dorsal view and does not have a spherical habitus 3
2. Head small with large, flattened chin and rounded snout [Figure 2.2A]; dorsal skin of head, trunk, and limbs moist, superficially with smooth appearance but with numerous tiny warty or spiny tubercles *Glyphoglossus*
- 2'. Head distinct and moderate with protruding, bluntly rounded chin and snout; dorsal skin of head, trunk, and limbs moist, superficially appearing smooth but with numerous small warty or spiny tubercles *Uperodon globulosus*
3. Stout body with short forelimbs and stout or slender hindlimbs; skin appears dry and dorsal surface of trunk densely covered with small to large warts, pustules, and/or tubercles; dorsal coloration typically light to dark brown or brownish olive 4
- 3'. Body stout to slender with short to long fore- and hindlimbs; skin appears moist to wet and dorsally smooth and shiny to rough with numerous tiny spines or small, circular tubercles or elongate rugae (short glandular ridges); coloration variable 12
4. Cranial ridges absent or indistinct 5
- 4'. One or more distinct cranial ridges present [Figure 2.3A] 8
5. Tympanum small, indistinct, and mostly covered by glandular skin; parotoid gland large, elongate, length about twice width *Bufo pageoti*
- 5'. Tympanum medium to large from half to nearly equal horizontal diameter of eye 6
6. Tympanum large, its diameter nearly equals diameter of eye; no parotoid glands; dorsal eyelid with row of warts [Figure 2.3B] *Ansonia*
- 6'. Parotoid gland present, small to large 7
7. Tympanum medium-sized, its diameter less than diameter of eye; large parotoid gland elongate or elliptical, length about twice width *Duttaphrynus stuarti*
- 7'. Tympanum large, its diameter nearly equals diameter of eye; small, round parotoid glands [Figure 2.3C] *Ingerophrynus macrotis*

FIGURE 2.2. Diversity of body shape among Burmese frogs, all dorsal views: (A) spherical body of *Glyphoglossus globulosus* (identical in body form to *G. guttulatus*), (B) teardrop shape of *Microhyla*, (C) slender, elongate body of many ranoid frogs, (D) outline of *Kalophrynus*, (E) outline of *Kaloula pulchra*, (F) outline of *Megophrys feae*, (G) outline of *Occidozygia lima*, and (H) treefrog outline of *Polypedates*.

8. Supratympanic (parietal) crests well-developed and often glandular, canthal and supraorbital present, latter commonly flattened; large dermal fold (tarsal fold) on inside of ankle [Figure 2.3D]; hindfeet with well-developed webbing *Phrynoidis asper*
- 8'. Cranial crests present, variably developed; no dermal fold on inside of ankle; hindfeet weakly webbed 9
9. Large and elongate parotoid glands and distinct supratemporal cranial crest 11
- 9'. Parotoid gland modest or absent; cranial crest variously developed 10
10. Weak canthal and no preorbital ridges, supraorbital and parietal ridges forming straight or slightly curved ridge on each side, supratympanic ridge distinct *Ingerophrynus parvus*
- 10'. Low to modest supratympanic ridge; tympanum large, its diameter equals diameter of eye; small, round parotoid glands *Ingerophrynus macrotis*
11. Supratympanic ridge large, but short; no pair of large warts between parotoid glands *Duttaphrynus crocus*
- 11'. Supratympanic ridge large; pair of large warts between large, elongate black parotoid glands [Figure 2.3E] *Duttaphrynus melanostictus*
12. No or slight webbing at the base of the digits of the forefoot 13
- 12'. Forefoot distinctly webbed; webbing between second and third fingers at least to one-half of basal phalanges 43
13. Hindfoot with slight or no basal webbing 14
- 13'. Hindfoot distinctly webbed; webbing reaches at least to joint of basal and second phalanges between third and fourth toes 23
14. Limbs slender and dorsal skin smooth to slightly granular; toes of hindfeet not tightly joined together for basal one-half of foot 15
- 14'. Limbs moderately robust, dorsal skin variable from moist smooth granular to rounded tuberculate 17

FIGURE 2.3. Morphological characteristic of toads (Bufonidae): (A) schematic of cranial crests of toads (supratympanic = parietal crest), (B) dorsolateral view of *Ansonia thinthinae* with row of warts on eyelid, (C) dorsolateral view of anterior third of *Ingerophrynus parvus* and its small, round parotoid gland and paired cranial crest, (D) ventral view of right hind-foot and its tarsal fold of *Phrynoidis asper*, (E) dorsal view of head of *Duttaphrynus melanostictus*, showing large parotoid glands and a pair of warts between them.

15. Digit tips of fore- and hindfeet slightly expanded; basal webbing on hindfeet; pair of moderate metacarpal tubercles on forefoot *Ingerana tenasserimensis*
- 15'. Digit tips of fore- and hindfeet bluntly rounded; no to slight basal webbing on hindfeet; two or more metacarpal tubercles on palm of forefoot 16
16. Dorsal body outline teardrop shaped [Figure 2.2B], width of head at rear of jaw distinctly less than half width of body at middle of abdomen; fingers bluntly rounded or slightly enlarged, usually four or five metacarpal tubercles on palm of forefoot; hindlimbs moderately well-developed, with toe tips rounded or slightly enlarged *Microhyla*
- 16'. Dorsal body outline not teardrop shaped, from oblong cylindrical to stout with head as wide as anterior trunk or wider; variable number of metacarpal tubercles on forefoot 17
17. Dorsal body outline narrow oblong, snout rounded acute [Figure 2.2C]; fore- and hindlimbs of near equal length; maximum width of head slightly smaller or nearly equal to midtrunk width 18
- 17'. Dorsal body outline broad; head also broad, sometimes as broad or broader than shoulders; limb length variable, although forelimbs always shorter than hindlimbs 19
18. Dorsum skin uniformly fine granular; contrastingly brightly colored in black, white, and reddish brown; fore- and hindfeet with bluntly rounded digit tips; hindfoot without webbing; six or more small metacarpal tubercles on palm of forefoot *Micryletta*
- 18'. Dorsum skin lightly tuberculate, small tubercles sparsely spaced; cryptically colored in shades of brown with dark marks; fore- and hindfeet with slightly expanded digit tips of equal size and round; four or five metacarpal tubercles on palm of forefoot *Leptobrachella*

19. Dorsal body outline elongate triangular with pointed snout to broad sacral area [Figure 2.2D]; dorsally trunk with cloak-like covering of fine, closely packed spines ending sharply laterally; fore- and hindfeet stout with short, bluntly rounded digit tips; basal webbing on hindfeet; circular, often ocellus, inguinal spot usually present *Kalophrynus*
- 19'. Dorsal body outline broad elongate to stout; snout pointed to rounded; dorsal trunk surface variable, nearly smooth with scattered tubercles and rugae to many tubercles and folds; digits, particularly of hindfeet, long, digits pointed to bluntly rounded 20
20. Tympanum visible, commonly immediately below supratympanic ridge or fold 22
- 20'. Tympanum hidden beneath glandular skin 21
21. Stout body and limbs; finger and toe tips bluntly rounded; dorsally and laterally trunk with numerous small to medium circular tubercles in longitudinal rows; distinct curved glandular ridge from eye to axilla *Scutigera*
- 21'. Robust body, short, blunt-snouted head, and moderately long, muscular fore- and hindlimbs [Figure 2.2E]; fingers with large squarish digital pads, toes bluntly rounded; dorsal skin leatherlike with scattered low tubercles; large glandular mass covering tympanum *Kaloula*
22. Stout body with head distinctly larger than rear trunk; large, slightly protuberant eyes; iris bicolor, dark bottom half, top half brightly colored red, orange to blue; dorsal skin smooth and shiny; fore and hindlimbs stout and of medium length *Leptobranchium*
- 22'. Body variable from moderate elongate to short and stout; pointed eyelid horn over each eye short to long; some species with distinct dorsal transverse fold at junction of head and trunk [Figure 2.2F]; digits bluntly rounded, usually fore and hind digits long *Megophrys*
23. Dorsal body outline teardrop shaped, width of head at rear of jaw distinctly less than half width of body at middle of abdomen; forefeet not webbed, hindfeet slight to fully webbed 24
- 23'. Dorsal body outline not teardrop shaped, usually elongate; hindfeet distinctly webbed; digit tips various from acute or bluntly rounded to expanded into pads with or without circummarginal grooves 25
24. Eyes protuberant and displaced dorsally; forefeet with long, pointed fingers; hindlimbs large and muscular with big, heavily webbed feet and pointed toe tips [Figure 2.2G] *Occidozyga*
- 24'. Eyes lateral and not protuberant; fore- and hindfeet with normal-length digits, their tips bluntly rounded to slightly expanded; tympanum occasionally hidden in males *Microhyla*
25. Dorsal body outline treefrog shaped [Figure 2.2H], elongate with blunt snout, robust to slender limbs; dorsal skin superficially appearing smooth, granular close up 26
- 25'. Dorsal body outline ranoid shaped [Figure 2.2C], elongate with acute snout, robust to slender limbs; dorsal skin with glandular ridges and often tubercles 27
26. Bright-green dorsum from snout to pelvis bordered by dorsolateral dark-brown stripe narrowly edged in cream above and below extending from snout to inguen; hands and feet brownish cream to orange; fore and hind digit tips moderately expanded with circummarginal grooves *Hyla annectans*
- 26'. Very large, oblong digital pads on tips of forefeet, large but smaller pads on toes; forefoot webbing slight to absent; hindfeet always webbed, usually about half webbed; dorsal skin granular and tuberculate [Figure 2.4B]; size small to large . . . 43
27. Dorsum of trunk roughened with assortment of tubercles or rugae [Figure 2.4C]; digit tips not or only slightly expanded spade shaped 28
- 27'. Dorsum of trunk nearly smooth to closely packed granular; dorsolateral folds present or absent; finger tips various, from not to distinctly expanded, round to oblong 35
28. Ventral abdomen shiny white with fejevarian lines (pair of dark curved pigment marks on ventrolateral sides of abdomen [Figure 2.5A]) 29
- 28'. Ventral abdomen immaculate or with dark markings but without fejevarian lines 30
29. Adults moderate sized (38–54 mm); distinct supratympanic fold extending from eye above tympanum and curving to axilla; digit tips pointed; upper lip with vertical brown bars *Fejevaria*
- 29'. Adults small (≤ 36 mm snout–vent length [SVL]); indistinct supratympanic fold not touching eye and barely extending beyond tympanum; digit tips rounded; upper lip with horizontal white stripe *Minervaria*
30. Short, stout body and limbs; head as broad or slightly broader than long; hindfoot with enlarge and spade-like inner metatarsal tubercle [Figure 2.5B] *Sphaerothera* sp.
- 30'. Body slender to robust, distinctly elongate limbs long, slender to robust; hindfeet with small to moderate inner metatarsal tubercle [Figure 2.5C] 31
31. Moderately stout body with remanent of lateral line (linear series of small, dark glands on side of trunk); hindfeet large and fully webbed; eyes shifted slightly dorsal *Euphyctis*
- 31'. Body shape variable without remanent lateral line 32

FIGURE 2.4. Schematics of dorsal skin morphology in anurans: (A) dorsal outline of frog showing position of skin section, (B) compact granular-tuberculate skin, for example, *Amolops*, (C) multiple rugae, for example, *Hoplobatrachus*, and (D) dorsolateral fold crossing fine granular skin, for example, *Hylarana*.

FIGURE 2.5. Morphological diagnostic features in anuran species: (A) ventral view of a *Fejervarya* frog showing the darkened lines (“fejervaryan lines”) of abdominal muscle attachment, (B) right hindlimb of *Sphaerotheca* sp. with enlarged spade-shaped inner metatarsal tubercle, (C) ventral view of a *Fejervarya* right hindfoot with small outer and larger internal metatarsals, and (D) stylized anterior view of mouth of *Limnonectes* highlighting enlarged mandibular odontoids (fangs).

32. Pair of enlarged mandibular odontoids at front of lower jaw [Figure 2.5D]	33
32'. Front of lower jaw without enlarged odontoid, usually smooth	34
33. Large (>60 mm SVL) and heavy bodied; head never wider than long; dorsal trunk with numerous short, smooth longitudinal folds or rugae [Figure 2.4C]	<i>Hoplobatrachus</i>
33'. Small to large, moderately slender to robust; head as wide or wider than long; dorsal trunk surface from numerous small tubercles to mix of small to moderate-sized tubercles	<i>Limnonectes</i>
34. First finger longer than second finger; tarsal fold present and serrate fold on outer edge of fifth toe; dorsal trunk skin tuberculate	<i>Quasipaa</i>
34'. First finger shorter than second finger; no tarsal fold present or serrate fold on outer edge of fifth toe; dorsal trunk skin not or lightly tuberculate	<i>Nanorana</i>
35. Dorsum of trunk with dorsolateral glandular folds [Figure 2.4D] from back of head to pelvis	36
35'. Dorsum of trunk without dorsolateral glandular folds from back of head to pelvis	42

36. Dorsolateral fold contrasting in color, usually white to yellow, to dorsal color; dorsum shades of green with or without middorsal light stripe; digit tips slightly enlarged and pads round *Hylarana*
- 36'. Dorsolateral fold same color or nearly so to dorsal color; dorsal color variable from cream to dark brown; digit tips slight to greatly expanded and pads round to oblong 37
37. Hindfoot webbing full, extending to at least base of terminal phalanx of fourth toe 40
- 37'. Hindfoot webbing modest to well-developed but not extending to base of penultimate phalanx of fourth toe 38
38. Oblong digit pads, forefoot pads twice the size of hindfoot ones; upper lip white continuous with white lateral stripe extending to axilla but not beyond; dorsal color green *Chalcorana*
- 38'. Digit tips slightly enlarged, pads round, finger and toe pads near equal sized; upper lip white continuous with white stripe that extends to axilla and often beyond 39
39. Dorsally and laterally trunk two-toned, back brown, often with rufous overtones with dark-brown sides; white upper labial stripe often extends beyond axilla to inguen, although trunk portion may be incomplete or replaced by black and white reticulation *Hydrophylax leptoglossa*
- 39'. Dorsally and laterally trunk two-toned, back tan to light brown with uniform green sides; white upper labial stripe usually extends beyond axilla to inguen, rarely incomplete or absent *Humerana*
40. Uniformly colored dorsally in shades of olive brown; digit tips slightly enlarged, fore- and hindfoot ones equal sized and round; breeding males with lateral trunk skin expanded into winglike structures *Pterorana khare*
- 40'. Dorsum not uniformly colored, dorsally lighter (usually brown) than sides; hindlimbs with pattern or brighter colored than dorsum 41
41. Snout strongly acute; side of head (supralabial area) distinctly flared; dorsum uniform brown, sides distinctly darker; upper lip lighter than top of head or with narrow white stripe *Clinotarsus*
- 41'. Snout bluntly acute; side of head vertical, not outwardly flared; dorsum uniform mid brown, sides distinctly darker; side of head from snout through tympanum dark brown bordered below by white stripe on upper lip extending to axilla; both rictal and supra-axillary glands within white stripe *Sylvirana*
42. Dorsally trunk lacks dorsolateral folds but has a sharp coloration break between dorsal and lateral color, dorsum green and sides dark brown; usually white or yellow upper lip with stripe continuing to axilla; limbs long, especially hindlimbs; no forefoot webbing, hindfeet strongly webbed; fore- and hindfeet digits expanded, fore slightly larger than hind *Odorrana*
- 42'. No dorsolateral folds and no coloration break between back and sides; color pattern from unicolor to variegated; lips light but not striped; long limbs with no forefoot webbing, hindfeet webbed to tips; fore- and hindfeet digit expanded, fore slightly larger than hind *Amolops*
43. Mostly small bodied (≤ 45 mm SVL); usually, first and second fingers joined basally [Figure 2.6A] and separated from third and fourth fingers; hindfeet variously webbed; finger and toe tips distinctly expanded into large oblong to circular pads with circummarginal grooves 44
- 43'. Moderate to large bodied (> 42 mm SVL); typical frog forefoot with no fusion of first and second fingers at their base [Figure 2.6B]; hindfeet fully webbed [Figure 2.6D,E]; finger and toe tips distinctly expanded into large oblong to circular pads with circummarginal grooves 51
44. Dorsal skin appearing smooth with a fine granular surface; first and second fingers basally tightly fused for about one-quarter of basal length of digits and offset from third and fourth fingers [Figure 2.6A]; slight webbing on forefoot, full webbing [Figure 2.6D] on hindfoot 45
- 44'. Dorsal skin various, although generally appearing smooth with a fine granular surface; first and second fingers slightly fused basally and offset from third and fourth fingers; forefeet not webbed, hindfeet distinctly webbed 46
45. Dorsal background color usually light shades of yellow to brown; no dorsolateral stripes *Chirixalus*
- 45'. Dorsal background color usually light shades of yellow to brown; dorsolateral yellow, brown-edged stripe from tip of snout to axilla *Rohanixalus*
46. Slender and attenuate body and limbs; reddish background color dorsally with numerous small white spots *Nasutixalus*
- 46'. Stout to moderate robust body and medium-length limbs 47
47. Dorsal skin from snout to sacrum uniformly and densely covered with small round tubercles; background color orangish brown to gold; no webbing on fore- or hindfeet *Gracixalus*
- 47'. Dorsal skin variable, smooth and granular or rough with rugae or irregular sized tubercles 48
48. Dorsal skin smooth; forefoot with fused first and second digits separated from third and fourth; forefoot without webbing, hindfoot barely webbed 49
- 48'. Dorsal skin rough; first and second fingers not basally fused; no forefoot webbing and basal webbing of hindfeet 50

FIGURE 2.6. Hand and foot morphology of rhacophorid frogs: (A) basally fused first and second fingers of *Chirixalus nongkhorensis*, (B) no basal fusion of fingers and no webbing in *Polypedates mutus*, (C) strong webbing of forefoot in *Zhangixalus*, (D) strong webbing in hindfoot of *Chirixalus*, and (E) strong webbing in hindfoot of *Rhacophorus*.

49. Small (12–36 mm SVL); dorsum usually smooth to finely granular and variably colored; forefeet without webbing and fingers without marginal fringe, hindfeet slight to less than one-third webbed *Philautus*
- 49'. Small (10–45 mm SVL); dorsum usually with numerous small tubercles and variably colored dorsally; slight to less than one-third webbed; fingers with narrow fringe on sides *Raorchestes*
50. Small (25–42 mm SVL); dorsal skin rough with numerous pointed tubercles; forearm and hand and ankle and hindfoot with lateral fringe; forefeet without webbing, hindfeet half or less webbed; tympanum visible; no gland on rear of thigh *Kurixalus*
- 50'. Moderate size (42–60 mm); dorsum with longitudinal rows of smooth rugae; forefeet without webbing, hindfeet slight webbing at base and toes with smooth lateral flange; tympanum hidden; femoral gland in middle of rear surface of thigh *Oreolalax*
51. Heel with pointed tarsal projection; forearm and ankle commonly with dermal fold along outer edge; strongly webbed forefeet [as in Figure 2.6C] and hindfeet [Figure 2.6E]; dorsal color usually shades of green, yellow to brown . . . *Rhacophorus*
- 51'. Heel rounded without tarsal projection; forearm and ankle without dermal fold along outer edge 52
52. Dorsal surface of head, body, and limbs densely covered with small to medium-sized tubercles *Leptomantis*
- 52'. Dorsal surface of head, body, and limbs appearing smooth and/or tightly packed small, flat granules 53
53. Forefeet without webbing [Figure 2.6B]; hindfeet at least half webbed; webbing neutral colored *Polypedates*
- 53'. Forefeet usually half webbed, hindfeet with webbing to near or touching digital pads; webbing contrastingly colored *Zhangixalus*

*This key will assist the identification of an adult frog from Myanmar to its proper genus. The specific names for a few taxa are included.

CHECKLIST OF ANURANS

ANURA GRAY, 1825

BUFONIDAE GRAY, 1825

Ansonia kraensis Matsui, Khonsue, and Nabhitabhata, 2005
Kra Stream Toad

Ansonia kraensis Matsui, Khonsue, and Nabhitabhata, 2005, *Zoological Science* 22: 810 [type locality: “Punyaban waterfall (98°52' E, 10°06' N), 113m a.s.l.), Ranong Province, Thailand”].

DISTRIBUTION. Possibly a resident of peninsular Myanmar, although not confirmed; its type locality is in Ranong Province, Thailand, adjacent to Tanintharyi.

HABITAT. Streamside in mountain forests.

COMMENT. *Ansonia kraensis* and *A. thinthinae* are each other's closest genetic relatives, that is, sister species.

Ansonia kyaiktiyoensis Quah, Grismer, Wood, Myint Kyaw Thura, Oaks, and Lin, 2019

Golden Rock Stream Toad

Ansonia kyaiktiyoensis Quah, Grismer, Wood, Myint Kyaw Thura, Oaks, and Lin, 2019, *Zootaxa* 4656: 555 [type locality: “in proximity of a

stream below the Kyaiktiyo Pagoda, Mon State, Myanmar (97.099379 N, 17.478863 E, 1033 m in elevation)"].

DISTRIBUTION. Peninsular Myanmar (Mon), known only from the vicinity of the type locality near the Kyaiktiyo Pagoda.

HABITAT. Streamside in small streams in degraded evergreen forest.

***Ansonia pilokensis* Matsui, Khonsue, and Panha, 2018**
Pilok Stream Toad

Ansonia pilokensis Matsui, Khonsue, and Panha, 2018, *Zoological Science* 35: 41 [type locality: "Pilok Subdistrict, Thong Pha Phum National Park, Kanchanaburi Province, Thailand (14°41'N, 98°24'E, 942 m a.s.l.)"].

DISTRIBUTION. Presently known only from Thong Pha Phum National Park, Kanchanaburi Province, Thailand; possibly occurs in adjacent Myanmar.

HABITAT. Edges of montane streams.

***Ansonia thinthinae* Wilkinson, Sellas, and Vindum, 2012**
Thin Thin's Stream Toad

FIGURES 2.3B, 2.7; PLATE 1A

Ansonia thinthinae Wilkinson, Sellas, and Vindum, 2012, *Zootaxa* 3136: 58 [type locality: "14°41'4.6"N 98°19'59.3"E, Tanintharyi Nature Reserve, Yebyu Township, Dawei District, Tanintharyi Division, Myanmar, ca. 409 m"]].

FIGURE 2.7. Outline portrait of *Ansonia thinthinae*. Tanintharyi Nature Reserve, Myanmar.

DISTRIBUTION. Peninsular Myanmar (Tanintharyi), presently known from two small mountain streams within the Tanintharyi Nature Reserve and populations farther south.

HABITAT. Streamside in small streams in primary evergreen forest.

COMMENTS. This small species was the first *Ansonia* reported from Myanmar. Its streamside habitat appears to be less than a dozen miles from *Ansonia pilokensis* (Matsui et al., 2018) on the Thailand side of the Bilauktaung Mountains, although genetically, it is more similar to *Ansonia kraensis* of the Isthmus of Kra (Wilkinson et al., 2012). Mulcahy's 2014 survey (Mulcahy et al., 2018) revealed a sister population in southern Tanintharyi, and subsequent surveys, in 2016 and 2017, showed it farther south on the mainland and also Myeik Archipelago.

***Bufo pageoti* Bourret, 1937**
Pageot's Mountain Toad

Bufo pageoti Bourret, 1937, *Annexe au Bulletin Générale de l'Instruction Publique, Hanoi* 1937: 9 [type locality: "Fan-Si-Pan (2500 m)," Lao Cai Province, Vietnam].

Bufo burmanus Andersson, 1939 [1938], *Arkiv för Zoologi* 30: 2 [type locality: "Kambaiti," northeastern Myanmar].

DISTRIBUTION. Mountains of northeastern mainland Myanmar (Chin, Magway; above 1,000 m elevation) and eastward through southern Yunnan, China, to mountains of northern Vietnam (Lao Cai, Nghe An, Ha Tinh, and Quang Nam Provinces), 1,900–2,500 m elevation.

HABITAT. Terrestrial, montane forest.

COMMENTS. Frost's (2012, ASW 5.5, accessed 13 Jan. 2012) commentary noted that, based on an earlier molecular study, this toad is not a cladistic member of *Bufo*; Frost also noted that this species may be a member of the *Torrentophryne* group of toads. Chinese herpetologists have so treated it and recognize *Torrentophryne burmanus* as a valid species for the Myanmar and Yunnan populations. Frost (2020, ASW 6.1, accessed 30 Dec. 2020) subsequently listed it as a species of *Duttaphrynus* but without conviction.

***Duttaphrynus crocus* (Wogan, Htun Win, Thin Thin, Kyi Soe Lwin, Awan Khwi Shein, Sai Wunna Kyi, and Hla Tun, 2003)**

Burmese Golden Toad

Bufo crocus Wogan, Htun Win, Thin Thin, Kyi Soe Lwin, Awan Khwi Shein, Sai Wunna Kyi, and Hla Tun, 2003, *Proceedings of the California Academy of Sciences*, ser. 4, 54: 142 [type locality: "Myanmar, Rakhine State, Gwa Township, Rakhine Yoma Elephant Sanctuary, Ye Bya Stream Camp, 17° 41' 47.0" N, 94° 38' 48.7" E., elev. 83 m"]].

DISTRIBUTION. Southwestern mainland Myanmar, known only from two localities below 100 m elevation in Rakhine State.

HABITAT. Terrestrial, primary evergreen forest.

Duttaphrynus himalayanus* (Günther, 1864)*Himalayan Toad**

Bufo melanostictus var. *himalayanus* Günther, 1864, *The Reptiles of British India*: 422 [type locality: “in the Himalayas (in Sikkim and Nepal)”].

Bufo abatus Ahl, 1925, *Zoologischer Anzeiger* 63: 110 [type locality: “Darjeeling,” West Bengal, India].

Bufo cyphosus Ye, 1977, *Acta Zoologica Sinica*: 55: 62. [type locality: “Chayü, Xizang [=Tibet], altitude 1540 m,” China].

DISTRIBUTION. Southern slopes of Himalayas from extreme eastern Pakistan through Nepal and northern India and adjacent China. There are no confirmed *D. himalayanus* vouchers from Myanmar.

HABITAT. Terrestrial, predominantly open habitats created by human activities (Anders, 2002)

Duttaphrynus melanostictus* (Schneider, 1799)*Asian Black-Spined Toad**

FIGURES 2.3E, 2.8

Bufo melanostictus Schneider, 1799, *Historiae amphibiorum naturalis et literariae . . . descriptos nostique sis distinctos*, vol. 1: 216 [type locality: “India orientali”].

DISTRIBUTION. Widespread in Myanmar from Putao in northern Kachin southward to southern tip of Tanintharyi; generally restricted to elevations below 500 m. Elsewhere, southwestern and southern China (including Taiwan and Hainan) throughout

FIGURE 2.8. Portrait of *Duttaphrynus melanostictus*. Chatthin Wildlife Sanctuary, Myanmar.

southern Asia from northern Pakistan and Nepal through India to Sri Lanka, Andaman Island, the Maldives, the Malay Peninsula, Sumatra, Java, Borneo, and Bali, up to 2,000 m in some places; introduced to Sulawesi, Papua New Guinea, and Madagascar.

HABITAT. Terrestrial, ecological tolerant, occurring from village to streamside and open habitats in various tropical forest types.

COMMENTS. *Duttaphrynus melanostictus* is the familiar toad to most Burmese, occurring from city parklands and gardens through agricultural lands into forests.

The presence of *D. melanostictus* as far north as Putao suggests that *D. himalayanus* is absent from Myanmar. *Duttaphrynus himalayanus* has been treated as a subspecies of *D. melanostictus* (Dubois and Ohler, 1999); the Putao toads appear to be typical *D. melanostictus*.

Wogan et al. (2016) demonstrated that genetic diversity of Burmese *D. melanostictus* was much greater than suspected, consisting of three main lineages, exceeding the diversity of Thailand and Indochina populations and separate from those populations. No one has addressed this diversity taxonomically, so the epithet *D. melanostictus* continues to apply to all Southeast Asian populations.

Duttaphrynus stuarti* (Smith, 1929)*Stuart's Toad**

PLATE 1B

Bufo stuarti M. A. Smith, 1929, *Records of the Indian Museum* 31: 78 [type locality: “Putao plain, N.E. Burma, near the Tibetan frontier,” Kachin State, Myanmar].

DISTRIBUTION. Northern mainland Myanmar (Kachin; known only from vicinity of Putao) and isolated localities in northeastern India (Arunachal Pradesh and Meghalaya) and Yunnan, China.

HABITAT. Terrestrial, in secondary forest bamboo thickets, often streamside.

Ingerophrynus macrotis* (Boulenger, 1887)*Flat-Headed Toad**

FIGURE 2.9

Bufo macrotis Boulenger, 1887, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 5: 422 [type locality: “Bhamò; Teinzò, and Me-tan-jà in the Kakhien Hills,” Myanmar; restricted to Teinzò, Kachin State, Myanmar, by lectotype designation].

DISTRIBUTION. Arunachal Pradesh (northeastern India) and northern mainland Myanmar (Kachin, Sagaing; also a single record each from Yangon and Rakhine) throughout much of Thailand through Laos to the central highlands of Vietnam and southwestern Cambodia to the northern Malay Peninsula; also adjacent Yunnan, China.

HABITAT. Terrestrial, predominantly streamside and forest-edge habitats.

COMMENT. Burmese records are summarized by Wogan et al. (2008).

FIGURE 2.9. Portrait of *Ingerophrynus macrotis*. Nakhon Si Thammarat, Thailand.

Ingerophrynus parvus (Boulenger, 1887)

Dwarf Toad

FIGURE 2.3C; PLATE 1C

Bufo parvus Boulenger, 1887, *Annals and Magazine of Natural History*, ser. 5, 19: 346 [type locality: “within a radius of fifty miles from the town of Malacca,” Peninsular Malaysia].

DISTRIBUTION. Southern mainland Myanmar (Yan-gon) and southern peninsular Myanmar (Tanintharyi) through southwestern Thailand, Peninsular Malaysia to Sumatra and western Java; also Northeast India.

HABITAT. Terrestrial, predominantly streamside and forest-edge habitats.

COMMENT. Mulcahy et al. (2018) demonstrated a high genetic diversity between the Tanintharyi population and those of the southern Malay Peninsula.

Leptophryne borbonica (Tschudi, 1838)

Sumatran Slender-Legged Toad

Hysaplesia borbonica Boie in Schlegel, 1826, *Bulletin des sciences naturelles et de géologie*, Paris, ser. 2, 9: 239. *Nomen nudum*.

Hylaplesia borbonica Boie in Schlegel, 1826, *Isis von Oken* 20: 294. *Nomen nudum*.

Hylaplesia borbonica Tschudi, 1838, *Classification der Batrachier*, . . . Abteilung der Reptilien: 70 [type locality: none given].

Bufo jerboa Boulenger, 1890, *Proceedings of the Zoological Society of London* 1890: 328 [type locality: “S.E. Borneo”].

Nectophryne sumatrana Van Kampen, 1910, *Natuurkundig Tijdschrift voor Nederlandsch Indie* 69: 19 [type locality: “Bander Baru liegt im Battak Gebirge, etwa 1000 M. hoch”].

DISTRIBUTION. Southern peninsular Thailand through Malay Peninsula to Sumatra, Java, and Borneo; possibly southern Tanintharyi, but no vouchers as yet from Myanmar.

HABITAT. Along banks of small forest streams.

Phrynoidis asper (Gravenhorst, 1829)

Spiny River Toad

PLATE 1D

Bufo asper Gravenhorst, 1829, *Deliciae Musei Zoologici Vratislaviensis. Fasciculus primus*, . . . *Batrachia*: 58 [type locality: “Java”].

DISTRIBUTION. Peninsular Myanmar (Kayah, Kayin, Mon, Tanintharyi) through western and peninsular Thailand to Sumatra, Borneo, and Java; in Vietnam on the border of Gia Lai and Dac Lac Provinces to the northwest of Plei Tung Than at approximately 700 m; presumably also in intervening Cambodia and Laos.

HABITAT. Terrestrial, forest floor and commonly streamside of small to moderate forest streams.

COMMENTS. Burmese records are summarized by Wogan et al. (2008). Molecular data (Mulcahy et al., 2018) showed high genetic similarity of Tanintharyi population to Borneo populations.

CERATOBATRACHIDAE – ALCALINAE BROWN, SILER, RICHARDS, DIESMOS, AND CANNATELLA, 2015

Alcalus tasanae (Smith, 1921)

Tasan Dwarf Cascadefrog

Rana pullus Smith, 1921, *Journal of the Federated Malay States Museums* 10: 197 [type locality: “Tasan, 25 miles S. W. Chumporn, Peninsular Siam [Thailand]”]. Preoccupied by *Rana gracilis* var. *pulla* Stoliczka, 1870.

Rana tasanae Smith, 1921, *Journal of the Natural History Society of Siam* 4: 193. Replacement name for *Rana pullus* Smith, 1921.

DISTRIBUTION. Southeastern mainland Myanmar (Kayah, Kayin) and southern peninsular Myanmar (Mon, Tanintharyi); western Thailand and central peninsular Thailand.

HABITAT. Terrestrial, adjacent to streams in primary rain forest (International Union for Conservation of Nature Red List of Threatened Species [https://www.iucnredlist.org]; accessed 25 January 2020).

DICROGLOSSIDAE – DICROGLOSSINAE ANDERSON, 1871

Euphlyctis cyanophlyctis (Schneider, 1799)

Northern Skittering Frog

Rana cyanophlyctis Schneider, 1799, *Historiae amphibiorum naturalis et literariae . . . descriptos nostique suis distinctos*, vol. 1: 137 [type locality: “ex India orientali”].

Rana bengalensis Gray, 1830, *Illustrations of Indian Zoology: Chiefly ... Hardwicke*, vol. 1, part 3: pl. 82, fig. 2 [type locality: “Bengal,” India or Bangladesh].

Rana leschenaultia Duméril and Bibron, 1841, *Erpétologie générale, ou, Histoire ... reptiles*, 8: 342 [type locality: “Pondichery” and “Bengale,” India].

Dicroglossus adolfi Günther, 1860, *Proceedings of the Zoological Society of London* 1860: 158 [type locality: “Kulu and Simla, Himalaya (2400–4200 feet above the level of the sea),” India].

Rana cyanophlyctis var. *seistanica* Nikolskii, 1899, *Annuaire du Musée Zoologique de l'Académie Impériale des Sciences de St-Petersbourg* 4: 406 [type locality: Neizar in Seistano, Iran (original in Russian)].

Rana cyanophlyctis variety *fulvus* De Silva, 1958, *Spolia Zeylanica* 28: 158 [type locality: “from brackish water pools on the islands of Karitivu, Leyden and Punkudutivu off Jaffna (N.P.),” Sri Lanka].

Rana cyanophlyctis variety *flavens* De Silva, 1958, *Spolia Zeylanica* 28: 158 [type locality: “Ratnapura, Ceylon,” Sri Lanka].

Euphlyctis cyanophlyctis microspinulata Khan, 1997, *Pakistan Journal of Zoology* 29: 108 [type locality: “side pool of a stream on the southwest of Khuzdar (southeast Kalat Division, Balochistan, Pakistan; lat. 27° 53' N, long. 66° 36' E)"].

DISTRIBUTION. Predominantly an Indian subcontinent species from Afghanistan and Pakistan through all of India, Sri Lanka, and Bangladesh into western mainland Myanmar (Chin, Magway, Mandalay, Rakhine, Sagaing) to the Ayeyarwady River.

HABITAT. Semiaquatic, mainly waterside on slow-moving stream and pond banks of little or no vegetation.

COMMENTS. “Note that Schneider clearly intended to spell the specific name ‘*cyanophlyctis*’, which he does on page 137, and again on page 144. Nevertheless, the current Code of Zoological Nomenclature (1999), Art. 33.3.1, preserves the ‘prevailing usage’, which is clearly ‘*cyanophlyctis*’” (Frost 2020, ASW 6.0, accessed 11 Jan. 2020).

Euphlyctis specimens collected in Myanmar have been assigned to this species without a careful examination of morphology; thus, specific identifications in collections’ databases are questionable.

Euphlyctis ghoshii (Chanda, 1991)

Manipur Skittering Frog

Rana ghoshii Chanda, 1991 [1990], *Hamadryad* 15: 16 [type locality: “Khugairk Reserve Forest, Manipur, India (alt. ca. 925 m)"].

DISTRIBUTION. Known only from the type locality within the Chin Hills of India, thus potentially occurring farther south in Chin State, Myanmar.

HABITAT. Semiaquatic, waterside inhabitant.

Euphlyctis kalasgramensis Howlader, Nair, Gopalan, and

Merilä, 2015

Bangladesh Skittering Frog

Euphlyctis kalasgramensis Howlader, Nair, Gopalan, and Merilä, 2015, *PLoS One* 10(2): 4 [type locality: “Kalasgram (22°45'N, 90°18'E), Barisal, Bangladesh”].

DISTRIBUTION. Occurs widely, although apparently spotty, in Bangladesh. Owing to its presence in Chittagong and Cox’s Bazar, it is likely present in eastern Rakhine State.

HABITAT. Semiaquatic, waterside, as for *E. cyanophlyctis*.

COMMENT. The description of this species may indicate that all previous Burmese records of *E. cyanophlyctis* should be identified as *E. kalasgramensis*.

Fejervarya altilabris (Blyth, 1855), *nomen dubium*

White-Lipped Grassfrog

Rana altilabris Blyth, 1856, *Journal of the Asiatic Society of Bengal* 24: 720 [type locality: “Pegu,” Myanmar].

DISTRIBUTION. If the subsequent designation of type locality as “Schwe-Gyen on the Sitang River, Pegu” (unknown source in Frost 2012, ASW 5.5, accessed 13 Jan. 2012) is correct, the lower Sittang River Valley, Pegu Region, is the “known” distribution.

HABITAT. Unknown.

COMMENTS. The location of the type was not stated and is presumed to have been deposited in the Zoological Society of India collection at Kolkata, but its present whereabouts are unknown. Boulenger (1882) labeled *R. altilabris* a *nomen dubium*, and that is the status recognized here.

Fejervarya kupitzi Köhler, Mogk, Khin Pa Pa Khaing, and

Ni Lar Than, 2019

Alaungdaw Kathapa Grassfrog

Fejervarya kupitzi Köhler, Mogk, Khin Pa Pa Khaing, and Ni Lar Than, 2019, *Vertebrate Zoology* 69: 193 [type locality: “Alaungdaw Kathapa National Park, along road between Thabakesay, Log Cabin Camp, and Payawa Sakhan, Elephant Camp (22.317863°N, 94.479012°E, WGS84), 375 m, Sagaing Division, Myanmar”].

DISTRIBUTION. Disjunct occurrence in the hilly forests of Alaungdaw Kathapa National Park, Sagaing Region, and the western side of Bago Yoma, Bago Region.

HABITAT. Terrestrial, in low montane forest floors, usually near streams.

Fejervarya limnocharis (Gravenhorst, 1829)³

Common Asian Grassfrog

FIGURE 2.10

Rana limnocharis Gravenhorst, 1829, *Deliciae Musei Zoologici Vratislaviensis. Fasciculus primus, ... Batrachia* 1: 42 [type locality: not stated explicitly, but from context Java, Indonesia].

Rana wasi Annandale, 1917, *Memoirs of the Asiatic Society of Bengal* 6: 131 [type locality: “Kuching, Sarawak”].

DISTRIBUTION. Members of this species group are widespread and occur in all political divisions of mainland and peninsular Myanmar, eastward into mainland Southeast Asia and China, and southward into the Sundas and Philippines (fide Köhler et al., 2019).

FIGURE 2.10. Portrait of *Fejervarya limnocharis*. Chatthin Wildlife Sanctuary, Myanmar.

FIGURE 2.11. Portrait of *Fejervarya moodiei*. Mwe Hauk, Myanmar.

HABITAT. Semiaquatic, slow-moving and stationary water with emergent vegetation; common in agricultural areas, especially paddies.

COMMENTS. Owing to the morphological similarity of members of the *Fejervarya limnocharis* species group, that nomen has been applied widely to populations from Pakistan eastward into China and southward through the Sundas and the Philippines. See note 3 for a detailed, yet abbreviated, explanation of the current and past usage.

Mulcahy et al. (2018) identified some Burmese *Fejervarya* frogs as *F. multistriata*. According to Köhler et al. (2019), these frogs are actually *F. limnocharis*, and *F. multistriata* does not occur in Myanmar.

***Fejervarya moodiei* (Taylor, 1920)**

Northern Crab-Eating Grassfrog

FIGURE 2.11; PLATE 1E

Rana moodiei Taylor, 1920, Philippine Journal of Science 16: 234 [type locality: "at Manila, P. I.," Philippines].

DISTRIBUTION. Along coast of Myanmar (Ayeyarwady, Bago, Mon, Rakhine, Tanintharyi, Yangon); also Bangladesh, Thailand (north of the Isthmus of Kra), and the Philippines.

HABITAT. Semiaquatic, coastal marshes and forest, usually at water's edge or in the water.

COMMENTS. In two studies (Kurniawan et al., 2010, 2011), Kurniawan and colleagues examined the genetics, development, and morphology of the Crab-eating Grassfrog from numerous populations in Sumatra, Java, and Sulawesi; several populations in southeastern Thailand; and a single population each in west central Peninsular Malaysia, the Philippines, and Bangladesh. All results suggest the presences of three species in the *cancrivora* complex, and in their 2011 publication, they restricted *Rana cancrivora* Gravenhorst to the Sumatra, Java, and Sulawesi populations and *Rana moodiei* Taylor to populations of Bangladesh, Thailand, and the Philippines. Unfortunately, they did not avail themselves of the MHS samples, and that forces us to assume that Burmese populations are *Fejervarya moodiei*. Using their suggested diagnostic hindfoot traits indicates that the preceding assumption is correct. Subsequently, Yodthong et al. (2019) increased the number of samples of these frogs from Thailand, again not including MHS samples, and demonstrated that *F. moodiei* was the species occurring on the east coast of peninsular Thailand and most likely was the species occurring along the Bay of Bengal coast of Myanmar.

Fejervarya orissaensis (Dutta, 1997)**Indo-Burman Grassfrog**

Limnonectes orissaensis Dutta, 1997, *Hamadryad* 22(1): 2 [type locality: “near a temporary rainwater pool at Sainik School area, Bhubaneswar, Khurda District, Orissa, India”].

DISTRIBUTION. Southern Myanmar (Ayeyarwady, Bago, Mon, Rakhine, Yangon); elsewhere from eastern peninsular India, Bangladesh, to western Thailand.

HABITAT. Semiaquatic to terrestrial, predominantly in distributed habitats, such as paddies and flooded agricultural lands.

COMMENTS. Mulcahy et al. (2018) identified some Tanintharyi *Fejervarya* as likely the same species as “Clade 21, haplo 2” of Kotaki et al. (2010). Köhler et al. (2019) subsequently identified these populations as *F. orissaensis*.

Hoplobatrachus crassus (Jerdon, 1853)**Jerdon’s Bullfrog**

Rana malabarica Kelaart, 1852, *Prodromus faunae zeylanicae*: 191 [type locality: “Trincomalee in paddy field and other marshy grounds,” Sri Lanka]. A junior primary homonym of *Rana malabarica* Tschudi.

Hoplobatrachus crassus Jerdon, 1853, *Proceedings of the Asiatic Society of Bengal* 1853: 66–85 [type locality: “found in a few tanks in Carnatic”].

Hoplobatrachus ceylanicus Peters, 1864, *Monatsberichte der Königlichen Preussischen Akademie der Wissenschaften zu Berlin* 1863: 445–470 [type locality: “Trincomalee, Ceylon (=Trincomalee, Sri Lanka)”].

DISTRIBUTION. Not confirmed for Myanmar, although its presence in adjacent Bangladesh suggests its possible occurrence in Rakhine State; primary distribution is through eastern India to Sri Lanka.

HABITAT. Semiaquatic, mostly temporary and semi-permanent bodies of water.

COMMENT. Alam et al. (2008) demonstrated that *H. crassus* was genetically distinct from *H. rugulosus* and *H. tigerinus*.

Hoplobatrachus litoralis Hasan, Kuramoto, Islam, Alam, Khan, and Sumida, 2012**Coastal Bullfrog**

Hoplobatrachus litoralis Hasan, Kuramoto, Islam, Alam, Khan, and Sumida, 2012, *Zootaxa* 3312: 47 [type locality: “Teknaf, Cox’s Bazar district (20° 52’ N, 92° 18’ E, > 5 m asl.), Bangladesh”].

DISTRIBUTION. Southeastern coast (Cox’s Bazar District) of Bangladesh; apparently also across southern mainland Myanmar from Rakhine State to Mon and northern Tanintharyi.

HABITAT. Not mentioned in description, presumably semiaquatic in marshes.

COMMENT. Mulcahy et al. (2018) demonstrated that one individual each from Yangon and Mon was genetically

distinct from more northern *H. rugulosus* and genetically matched Bangladesh *H. litoralis*

Hoplobatrachus rugulosus (Wiegmann, 1834)**Asian Rugose Bullfrog**

FIGURE 2.12; PLATE 1F

Rana chinensis Osbeck, 1765, *Reise Ostindien China*: 244 [type locality: not given]. *Nomen dubium*, see Comments.

Rana rugulosa Wiegmann, 1834, in Meyen, ed., *Reise um die Erde ... Seehandlungs-Schiffe Prinzess Louise, ... 3 (zoologie)*: 508 [type locality: “Cap Syng-more” = Kap Shui Mun, Lantau Island, Hong Kong, China].

Rana tigrina var. *pantherina* Steindachner, 1867, *Amphibien*, in Steindachner, ed., *Reise der Österreichischen Fregatte ... Zoology*, vol. 1: pl. 1, figs. 14–17 [type locality: “Hongkong”].

Rana burkilli Annandale, 1910, *Records of the Indian Museum* 5: 79 [type locality: “Tavoy” = Dawei, Tanintharyi Region, Myanmar].

DISTRIBUTION. Widely in mainland Myanmar (Bago, Kachin, Magway, Mandalay, Sagaing, Shan); eastward through Thailand and southern China to Taiwan, also southward into the Malay Peninsula.

HABITAT. Semiaquatic, marshes, rice paddies, and similar grass-sedge areas, commonly adjacent to forests.

COMMENTS. *Rana chinensis* Osbeck was proposed without a type specimen or a type locality. Various authors

FIGURE 2.12. Portrait of *Hoplobatrachus rugulosus*. Chatthin Wildlife Sanctuary, Myanmar.

(for names see synonymy in Frost 2012, ASW 5.5, accessed 13 Jan. 2012) have attempted to associate the name with a known species. Because the description is vague and the origin of the specimen is uncertain, the name has no unambiguous species association; hence, it is a *nomen dubium* and not available for nomenclatural assignment.

There are minor, although consistent, morphological and coloration differences between the mainland Myanmar population and the more eastward populations (Schmalz and Zug, 2002). If the peninsular population matches the mainland ones and if it is considered a separate species from those in mainland Southeast Asia, *Rana burkilli* Annandale is available.

***Hoplobatrachus tigerinus* (Daudin, 1802)**

Asian Green and Tan Bullfrog

FIGURE 2.13

Rana tigerina Daudin, 1802, *Histoire naturelle des rainettes, des grenouilles et des crapauds*: 64 [type locality: “du Bengale,” India].

Rana tigrina Merrem, 1820, *Tentamen Systematis Amphibiorum*, 1: 174. Incorrect subsequent spelling.

Rana picta Gravenhorst, 1829, *Deliciae Musei Zoologici Vratislaviensis. Fasciculus primus, . . . Batrachia*: 39 [type locality: not given].

DISTRIBUTION. Widely in mainland Myanmar (Bago, Chin, Kachin, Magway, Mandalay, Rakhine, Sagaing, Shan, Yangon); westward through Bangladesh, Bhutan, Nepal, India to northern Pakistan and northeastern Afghanistan.

HABITAT. Semiaquatic, marshes, rice paddies, and similar grass-sedge areas, commonly adjacent to forests.

COMMENTS. The Convention on International Trade in Endangered Species of Wild Fauna and Flora uses “Indian

FIGURE 2.13. Portrait of *Hoplobatrachus tigerinus*. From Boulenger, (1890:, fig. 132).

Bullfrog” as a standard English name. I prefer a less regional adjective owing to the wider distribution of this taxon outside of both political India and peninsular India. Because “Bullfrog” has become established as a standard for *H. tigerinus*, I recommend using this as part of the English name for all *Hoplobatrachus* species.

Hoplobatrachus tigerinus is definitely a geographically widespread multispecies complex. Hasan et al. (2012) showed two genetic lineages, one in Bangladesh and another in the western Ghats. There appear to be regionally different color pattern morphs, none geographically overlapping in Myanmar.

***Limnonectes bannaensis* Ye, Fei, Xie, and Jiang, 2007**

Banna Broad-Headed Frog

Limnonectes bannaensis Ye, Fei, Xie, and Jiang, 2007, *Zoological Research, Kunming* 28: 546 [type locality: “Jinghong City, Mengla County, Yunnan Province,” China].

DISTRIBUTION. Southern and western Yunnan and Guangxi and immediately adjacent Myanmar (Kachin, Shan), Laos, and Vietnam.

HABITAT. Semiaquatic.

COMMENT. McLeod (2010) demonstrated that *L. bannaensis* is a valid species and two lineages of this taxon occur in Myanmar. Burmese specimens of this species were formerly labeled *L. kuhlii*.

***Limnonectes blythii* (Boulenger, 1920)**

Blyth’s Broad-Headed Frog

PLATE 1G

Rana fusca Blyth, 1856 [1855], *Journal of the Asiatic Society of Bengal* 24: 719 [type locality: “Tenasserim valley,” Myanmar]. Junior homonym of *Rana fusca* Roessel, 1758, and *Rana fusca* Meyer, 1795.

Rana (*Rana*) *macrodon* var. *blythii* Boulenger, 1920, *Records of Indian Museum* 20: 43. Replacement name for *Rana fusca* Blyth, 1855.

DISTRIBUTION. Peninsular Myanmar (Mon, Tanintharyi) and eastern mainland (Kayah); also Yunnan, China, and western and peninsular Thailand.

HABITAT. Semiaquatic, streamside and in streams of evergreen forest.

COMMENT. Molecular evidence (Emerson and Ward, 1998; Chen et al., 2005) demonstrates that “*Rana blythii*” is a polyphyletic complex of species distributed phylogenetically throughout the *Limnonectes grunniens* group. Those data result in *Limnonectes blythii* being a peninsular Myanmar species and the identity of extralimital species being unknown.

***Limnonectes doriae* (Boulenger, 1887)**

Doria’s Broad-Headed Frog

PLATE 1H

Rana doriae Boulenger, 1887, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 5: 482 [type locality: “Thagatà Juwa; Kaw-ka-riet” (=Kokarit, east of Moulmein), Myanmar].

DISTRIBUTION. Southern mainland Myanmar (Bago, Kayah, Rakhine) and peninsular Myanmar (Mon, Tanintharyi) into western and peninsular Thailand and Malaysia; also reported in Northeast India and the Andaman Islands.

HABITAT. Semiaquatic, streamside in primary and secondary forest.

COMMENT. Two localities listed in type description. Kaw-ka-riet fixed by lectotype designation.

Limnonectes hascheanus (Stoliczka, 1870)

Peninsular Broad-Headed Frog

FIGURE 2.14

Polypedates Hascheanus Stoliczka, 1870, *Proceedings of the Asiatic Society of Bengal* 1870: 4 [type locality: “forests of Penang hill,” Malaysia].

DISTRIBUTION. Southern peninsular Myanmar (Tanintharyi); peninsular Thailand, northernmost Malaysia, and an extralimital record from Northeast India.

HABITAT. Semiaquatic and terrestrial, moist forest and streamside in forested areas.

COMMENTS. Inger and Stuart (2010) reported on the systematics of this species and the closely related *L. limborgi* and delimited the ranges of both, thereby rendering doubtful the many identifications in most of the previous literature on this species. See Comment in the *L. limborgi* species account.

FIGURE 2.14. Portrait of *Limnonectes hascheanus*. Myanmar.

Limnonectes jarujini Matsui, Panha, Khonsue, and Kuraishi, 2010

Jarujini Broad-Headed Frog

Limnonectes jarujini Matsui, Panha, Khonsue, and Kuraishi, 2010, *Zootaxa* 2615: 15 [type locality: “near Kaeng Krachan Reservoir, Kaeng Krachan, Phetchaburi Province, Thailand (12° 57' N, 99° 32' E, 400 m a.s.l.)”].

DISTRIBUTION. Presently not confirmed for peninsular Myanmar, although potentially will be found there; known from northwestern to southern (peninsular) Thailand.

HABITAT. Semiaquatic, streams in midmontane forests.

Limnonectes khasianus (Anderson, 1871)

Khasi Broad-Headed Frog

Pyxicephalus khasianus Anderson, 1871, *Journal of the Asiatic Society of Bengal* 40: 23 [type locality: “Khasi Hills,” Meghalaya, India].

Rana laticeps Boulenger, 1882, *Catalogue of the Batrachia Salientia s. Ecaudata* . . . *British Museum*, 2nd ed.: 20 [type locality: “Khassya” (= Khasi Hills, Assam) and “Bengal,” India].

DISTRIBUTION. Widely separated localities in mainland Myanmar (Kachin, Rakhine); elsewhere Northeast India to peninsular Thailand, Malaysia, Sumatra, and Borneo.

HABITAT. Semiaquatic, typically streamside and broadly from small mountain streams in forest to streams in secondary forest.

COMMENT. The recognition of *R. laticeps* Boulenger as a synonym of *Pyxicephalus khasianus* Anderson extended the range of the presumed Khasi endemic widely throughout mainland Southeast Asia and Sundaland.

Limnonectes “kublii” (Tschudi, 1838)

Kuhl’s Broad-Headed Frog

PLATE 11

Rana kublii Schlegel in Tschudi, 1838, *Classification der Batrachier, . . . Abteilung der Reptilien*: 80 [type locality: “Java,” Indonesia].

Rana palmata Kuhl in Tschudi, 1838, *Classification der Batrachier, . . . Abteilung der Reptilien*: 80. Name attributed to Kuhl and provided as a synonym of *Rana kublii* Schlegel.

Rana conspicillata Günther, 1872, *Proceedings of the Zoological Society of London* 1872: 597 [type locality: “Matang,” Sarawak].

Nyctibatrachus sinensis Peters, 1882, *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1882: 146 [type locality: “Mons Lofau (Provincia Canton) . . . Lofau-Gebirge in der Provinz Canton,” Guangdong, China].

Rana paradoxa Mocquard, 1890, *Nouvelles archives du Muséum d’histoire naturelle de Paris*, ser. 3, 2: 148 [type locality: “Kina Balu,” Sabah]. Primary homonym of *Rana paradoxa* Linnaeus, 1758.

DISTRIBUTION. Widely in mainland Myanmar (Aye-yarwady, Bago, Chin, Kachin, Kayin, Mandalay, Sagaing, Shan); Thailand, Peninsular Malaysia; and Borneo.

HABITAT. Semiaquatic, typically streamside and broadly from small mountain streams in forest to streams in secondary forest.

COMMENTS. McLeod (2010) demonstrated that the nominal *Limnonectes kuhlii* is an aggregation of not particularly closely related species, implying that application of this name to any population outside of Java is incorrect. Thai populations were allocated to other species (*Limnonectes jarujini*, *Limnonectes taylori*) by Matsui et al. (2010b), who discussed the results of McLeod (2010) insofar as they applied to the Thai populations. I have retained *L. "kuhlii"* as a Burmese species because many specimens have been identified as this species, although they certainly are not. At the present time, I cannot examine these misidentified specimens and provide a new identification, hence my use of quotation marks around *kuhlii*.

Limnonectes limborgi (Sclater, 1892)

Limborg's Broad-Headed Frog

Rana limborgi Sclater, 1892, *Proceedings of the Zoological Society of London* 1892: 344 [type locality: "Tenasserim," Myanmar].

DISTRIBUTION. Mainland Myanmar (Bago, Kachin, Kayah, Kayin, Mandalay, Sagaing) and peninsular Myanmar (Mon, northern Tanintharyi); elsewhere Yunnan, Laos, northern and peninsular Thailand, highlands of Vietnam, and northeastern Cambodia.

HABITAT. Terrestrial, typically streamside and broadly from small mountain streams in primary forest to streams in secondary forest.

COMMENT. Inger and Stuart (2010) demonstrated with a morphological and molecular analysis that *L. hascheanus* and *L. limborgi* were diagnostically different species, with the latter being the northern member of the pair. Because the holotype of *L. limborgi* was lost, they designated a neotype from Kayin State at the northern end of the British administrative division of Tenasserim.

Limnonectes liui (Yang, 1983)

Liu's Broad-Headed Frog

Platymantis liui Yang, 1983, *Acta Herpetologica Sinica, Chengdu*, n.s., 2(2): 53, 56 [type locality: "Menglung, Mengla County, Yunnan, alt. 550m," China].

DISTRIBUTION. Presently known only from Yunnan, China; may occur in adjacent eastern Kachin.

HABITAT. Terrestrial in moist areas adjacent to forest streams.

Limnonectes longchuanensis Suwannapoom, Yuan, Sullivan, and McLeod in Suwannapoom, Yuan, Chen, Hou, Zhao, Wang, Nguyen, Nguyen, Murphy, Sullivan, McLeod, and Che, 2016
Longchuan Broad-Headed Frog

FIGURE 2.15

Rana longchuanensis Suwannapoom, Yuan, Sullivan, and McLeod in Suwannapoom, Yuan, Chen, Hou, Zhao, Wang, Nguyen, Nguyen, Murphy,

FIGURE 2.15. Portrait of *Limnonectes longchuanensis*. Alaungdaw Kathapa Wildlife Sanctuary, Myanmar.

Sullivan, McLeod, and Che 2016, *Zootaxa* 4093: 191 [type locality: "from Longchuan, Dehong, Yunnan, China (24° 27' 32.40" N, 97° 45' 10.80" E, 1255 m a.s.l.)"].

DISTRIBUTION. Northern Myanmar (Chin, Kachin, Sagaing); adjacent Yunnan, China.

HABITAT. Terrestrial, along hillside streams in evergreen forest.

COMMENT. Burmese specimens of this species were formerly labeled *L. kuhlii*.

Limnonectes macrognathus (Boulenger, 1917)

Big-Mouthed Broad-Headed Frog

Rana macrognathus Boulenger, 1917, *Annals and Magazine of Natural History*, ser. 8, 20: 414 [type locality: "Karin Hills, Upper Burma, 1300 to 1600 feet, and from the district of the Karin Bia-po," Kayah State, Myanmar].

DISTRIBUTION. Scattered occurrence in mainland Myanmar (Kayah, Kayin, Yangon) and southern peninsular Myanmar (Tanintharyi); also northwestern and southern peninsular Thailand to northern Malaysia.

HABITAT. Terrestrial, semiaquatic, in and adjacent to streams in montane forest.

Limnonectes taylori Matsui, Panha, Khonsue, and Kuraishi, 2010
Taylor's Broad-headed Frog

Limnonectes taylori Matsui, Panha, Khonsue, and Kuraishi, 2010, *Zootaxa* 2615: 10 [type locality: "Ban Khun Klang, 1350 m, Doi

Inthanon, Chiang Mai Province, Thailand (18° 31' N, 98° 30' E, 1350 m a.s.l.)"].

DISTRIBUTION. Extreme eastern Myanmar (Shan), northwestern Thailand, and western Laos.

HABITAT. Semiaquatic to aquatic, in ponds and streams of montane forest.

COMMENT. Burmese specimens of this species were formerly labeled *L. kuhlii*.

***Minervarya chiangmaiensis* (Suwannapoom, Yuan, Poyarkov, Yan, Kamtaeja, Murphy, and Che, 2016)**

Chiangmai Dwarf Grassfrog

FIGURE 2.16

Fejervarya chiangmaiensis Suwannapoom, Yuan, Poyarkov, Yan, Kamtaeja, Murphy, and Che, 2016, *Zoological Research* 37: 330 [type locality: "Ban Monjong, Omkoi District, Chiang Mai Province, Thailand (N17°28'16.93", E98°27'28.26", 460 m a.s.l.)"].

DISTRIBUTION. Known only from the vicinity of its type locality in northwestern Thailand and in mainland Myanmar (Ayeyarwady, Bago, Chin, Mandalay, Sagaing).

HABITAT. Moist terrestrial in agricultural habitats, such as paddies.

COMMENTS. The *Minervarya* clade was only recently (Sanchez et al., 2018) elevated from the synonymy of *Fejervarya*.

FIGURE 2.16. Portrait of *Minervarya chiangmaiensis*. Chatthin Wildlife Sanctuary, Myanmar.

Mulcahy et al. (2018) identified specimens from northern Myanmar as likely a new species. Köhler et al. (2019) identified these specimens as *M. chiangmaiensis*.

***Minervarya muangkanensis* (Suwannapoom, Yuan, Jiang, Yan, Gao, and Che, 2017)**

Muangkan Dwarf Grassfrog

Fejervarya muangkanensis Suwannapoom, Yuan, Jiang, Yan, Gao, and Che, 2017 *Zoological Research* 38: 245 [type locality: "Ban Tha Khanun, Thong Pha Phum, Kanchanaburi Province, Thailand (N15°11'52.73", E98°19'29.71"; 712 m a.s.l.)"].

DISTRIBUTION. Broadly, but scattered, in mainland (Ayeyarwady, Bago, Chin, Kachin, Rakhine) and peninsular (Tanintharyi) Myanmar and western Thailand.

HABITAT. Terrestrial, moist areas in agricultural habitats, such as paddies.

COMMENT. Mulcahy et al. (2018) identified some Tanintharyi specimens as likely the same species as "Clade 11, haplotype 3" of Kotaki et al. (2010). Köhler et al. (2019) showed these populations to be *M. muangkanensis*.

***Nanorana andersoni* (Dubois, 1975)**

Anderson's Montane Frog

Rana (Paa) arnoldi Dubois, 1975, *Bulletin du Muséum national d'histoire naturelle*, ser. 3, 324: 1093 [type locality: "Pangnamdim, Nam Tamai Valley, Triangle, nord de la Birmani, 27° 2' N, 97° 54' E, altitude environ 910 m (3000 ft)"].

DISTRIBUTION. Northern Myanmar (Kachin); adjacent northwest India, Tibet, and Yunnan.

HABITAT. Semiaquatic along mountain streams.

COMMENT. Our MHS surveys did not encounter this species.

***Nanorana arnoldi* (Dubois, 1975)**

Arnold's Mountain Frog

Rana (Paa) arnoldi Dubois, 1975, *Bulletin du Muséum nationale d'histoire naturelle, Paris*, ser. 3, *Zoologie* 324: 1101 [type locality: "Pangnamdim, Nam Tamai Valley, Triangle, nord de la Birmanie, 27°42'N, 97°54'E, altitude environ 910 m (3000 ft)"].

DISTRIBUTION. Northern Myanmar (Kachin); eastern Nepal and adjacent India to Xizang and northwestern Yunnan, China.

HABITAT. Wetlands.

COMMENT. Our MHS surveys did not observe this species.

***Nanorana chayensis* (Ye, 1977)**

Chayu Mountain Frog

Rana maculosa chayensis Ye, 1977, *Acta Zoologica Sinica* 23: 58 [type locality: "Chayü, Xiang, alt. 1540 m," Tibet, China].

DISTRIBUTION. Northern Myanmar (Kachin); also Northeast India and adjacent China.

HABITAT. Wetlands.

COMMENT. Our MHS surveys did not observe this species.

Nanorana feae (Boulenger, 1887)

Fei's Mountain Frog

Rana feae Boulenger, 1887, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 5: 418 [type locality: "Kakhien Hills," Myanmar].

DISTRIBUTION. Northern Myanmar (Kachin); Yunnan, China.

HABITAT. Wetlands.

COMMENT. Our MHS surveys did not observe this species.

Nanorana yunnanensis (Anderson, 1879)

Yunnan Mountain Frog

Rana yunnanensis Anderson, 1879, *Anatomical and Zoological Researches: ... Western Yunnan*: 839 [type locality: "Hotha [=Husa], 5,000 feet above the sea," Yunnan, China, fide Dubois, 1987].

Rana phrynoides Boulenger, 1917, *Annals and Magazine of Natural History*, ser. 8, 20: 413 [type locality: "Yunnan at Tongchuan fu," China].

Rana muta Su and Li, 1986, *Acta Herpetologica Sinica, Chendu*, n.s., 5(2): 152 [type locality: "Ninglang County, Yunnan [Province], alt. 2,650 m," China]. Preoccupied by *Rana muta* Laurenti, 1768.

Rana (*Paa*) *liui* Dubois, 1987 [1986], *Alytes* 5: 150. Replacement name for *Rana muta* Su and Li, 1986.

DISTRIBUTION. Northern Myanmar (Kachin); northeastern India and Yunnan, China.

HABITAT. Wetlands.

COMMENTS. The MHS survey vouchered this species at 7,400 ft near the Yunnan border. See nomenclatural discussion in Frost (2020, ASW 6.0, accessed 29 Apr. 2020).

Quasipaa spinosa (David, 1875)

Chinese Spiny Frog

Rana latrans David, 1872 [1871], *Nouvelles archives du Muséum d'histoire naturelle de Paris* 7: 76 [type locality: "torrent des montagnes," Jiangxi Province, China]. A junior homonym.

Rana spinosa David, 1875, *Journal de mon troisième voyage d'exploration dans l'empire Chinois* 2: 253 [type locality: "Ouang-mao-tsae" (=Wangmaozhai), a mountain village in Jiangxi near the Fujian boundary, China].

Nyctibatrachus sinensis Peters, 1882, *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1882: 146 [type locality: "Lofau-Gebirge [= Mt. Luofu], Provinz Canton [actually Guangzhou], China].

Rana duboisreymondi Vogt, 1921, *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1921: 75 [type locality: "chinesischen Bade Kuling auf dem rechten Yangtzeufer bei der Stadt Kin Kinag" = Kuling [=Guling, Lu Shan], right bank of Yangtze River, Kin Kiang [=Jin Jiang, Jiangxi Province], China].

Rana chekiensis Angel and Guibé in Angel, Bertin, and Guibé, 1947 [1946], *Bulletin du Muséum national d'histoire naturelle*, ser. 2, 18: 473 [type locality: not given].

DISTRIBUTION. Expected in northeastern Myanmar (Shan) but not yet vouchered, occurring in adjacent Laos and China.

HABITAT. Streamside in montane streams.

COMMENT. See nomenclatural discussion in Frost (2020, ASW 6.0, accessed 29 Apr. 2020).

Sphaerotheca, unnamed

Myanmar Spade-Foot Frog

FIGURES 2.5B, 2.17; PLATE 1J

DISTRIBUTION. Central and southern mainland Myanmar (Magway, Mandalay, Sagaing, Shan, Yangon); elsewhere from Pakistan and Nepal to Northeast India.

HABITAT. Terrestrial, open forest (primary and secondary) and adjacent agricultural lands.

COMMENTS. Dubois et al. (2001) demonstrated that *Euphlyctis*, *Fejervarya*, *Hoplobatrachus*, *Minervarya*, *Nanophrys*, and *Sphaerotheca* comprised a single clade within Dicroglossidae. Of these six, *Sphaerotheca* appears least like the others in its spadefoot toad habitus. Yet subsequent molecular studies (e.g., Kotaki et al., 2010; Hasan et al., 2014; Sanchez et al., 2018) consistently showed *Sphaerotheca* to be the sister of the "*Fejervarya*" lineage. Deepak et al. (2020) examined the relationships within the Indian subcontinent *Sphaerotheca* and showed that the Burmese species differed genetically from all Indian species and that *S. breviceps*, the name commonly applied to a southeastern Indian species, is not correct for the Burmese

FIGURE 2.17. Portrait of *Sphaerotheca* sp. Chatthin Wildlife Sanctuary, Myanmar.

species. They offered no resolution; hence, the Burmese population of *Sphaerotherca* has no name.

**DICROGLOSSIDAE – OCCIDOZYGINAE FEI,
YE, AND HUANG, 1990**

Ingerana borealis (Annadale, 1912)

Northern Tricklefrog

Micrixalus borealis Annadale, 1912, *Records of the Indian Museum* 8: 10 [type locality: “Rotung (alt. 1,300 ft.) and about 3 miles S. of Yembung,” Arunachal Pradesh, India].

DISTRIBUTION. Western mainland Myanmar (Bago, Chin, Rakhine, Sagaing); elsewhere Bhutan, eastern Nepal, northern and northwestern India, Bangladesh, and Tibet.

HABITAT. Terrestrial, semiaquatic; streamside or amid litter and gravel.

COMMENTS. Closely allied to *Ingerana tenasserimensis* (as *Micrixalus*) according to the original publication. See statement of geographic range, habitat, and conservation status in Stuart (2008). Wogan et al. (2008) provided the first records for Chin and Rakhine States in Myanmar. Prior to 2010, *I. borealis* had been proposed by some workers as a species of *Occidozyga* or *Phrynoglossus*; it is now widely accepted as an *Ingerana*.

Ingerana tenasserimensis (Sclater, 1892)

Burmese Tricklefrog

FIGURE 2.18

Rana tenasserimensis Sclater, 1892, *Proceedings of the Zoological Society of London* 1892: 345 [type locality: “Tenasserim,” Myanmar].

DISTRIBUTION. Southwestern mainland Myanmar (Rakhine, Yangon, Bago) and peninsular Myanmar (Mon, Tanintharyi); also southwestern and peninsular Thailand into adjacent Malaysia.

HABITAT. Terrestrial, semiaquatic; streamside or amid litter and gravel in seepage areas.

COMMENT. The occurrence of *I. tenasserimensis* in Rakhine requires reexamination given its absence in southern Bago, Yangon, and Ayeyarwady Regions and the confirmed presence of *I. borealis* in Rakhine.

Occidozyga lima (Gravenhorst, 1829)

Gray-Green Puddlegfrog

FIGURE 2.19; PLATE 1K

Rana lima Gravenhorst, 1829, *Deliciae Musei Zoologici Vratislaviensis. Fasciculus primus, . . . Batrachia*: 41 [type locality: “Java”]. Original description not seen.

Houlema obscura Gray, 1831, *The Zoological Miscellany*, part 1: 38 [type locality: “China”].

Oxydozyga braccata Tschudi, 1838, *Classification der Batrachier, . . . Abteilung der Reptilien*: 85. *Nomen nudum* attributed to Kuhl.

FIGURE 2.18. Portrait of *Ingerana tenasserimensis*. Dawe, Bago Yoma, Myanmar.

Oxyglossa lima var. *chinensis* Müller, 1878, *Verhandlungen der Naturforschenden Gesellschaft in Basel* 6: 580 [type locality: “Lilong, Prov. Kanton,” China]. *Nomen nudum*.

Osteosternum amoyense Wu, 1929, *Contributions to Biology Lab Science Society, China, Zoology Series* 5: 3 [type locality: “a rice field near campus of the University of Amoy,” Xiamen, Fujian Province, China]. Original description not seen.

Oxyglossus lima chinensis Liu and Hu, 1961, *Chung-kuo wu wei liang ch’i lei*: 222. Status of name uncertain; Liu and Hu ascribed it to Hallowell (1860, *Proceedings of the Academy of Natural Sciences of Philadelphia* 12: 506), although it does not appear in that paper.

DISTRIBUTION. Widespread in mainland Myanmar (Ayeyarwady, Bago, Kachin, Kayin, Magway, Mandalay, Sagaing, Shan, Yangon) and peninsular Myanmar (Mon, Tanintharyi); also from West Bengal, India, through Bangladesh, Myanmar, to Thailand, Laos, Vietnam, southern China, Malaysia, and Java.

HABITAT. Predominantly open habitat, puddles to slow-moving streams, commonly associated with gardening and agricultural activities.

COMMENTS. My and Mulcahy’s present investigations of Burmese *Occidozyga* indicate one widespread *lima* morphotype, and Mulcahy et al. (2018) showed that individuals from Mandalay and Sagaing occupied the same CO1 BIN whereas Tanintharyi specimens had a different BIN. The presently recognized broad Asian occurrence suggests a species complex.

FIGURE 2.19. Portrait of *Occidozyga lima*. Chatthin Wildlife Sanctuary, Myanmar.

Occidozyga sumatrana has a long history of confusion with *O. laevis* (Philippines), which is occasionally listed incorrectly for Myanmar or even confused with *O. lima*. *Occidozyga laevis* occurs from the southern Malay Peninsula into Greater Sunda Islands and possibly to Borneo.

***Occidozyga martensii* (Peters, 1867)**
Hooded Puddlegfrog

PLATE 1L

Phrynoglossus Martensii Peters, 1867, *Monatsberichte der Königlischen Preussischen Akademie der Wissenschaften zu Berlin* 1867: 29 [type locality: “aus Bangkok (Siam)”].

DISTRIBUTION. Mainland Myanmar (Ayeyarwady, Bago, Kachin, Kayin, Mandalay, Rakhine, Shan, Yangon) and peninsular Myanmar (Mon, Tanintharyi); also in Thailand, northern Malaysia, southern China, Laos, and Vietnam.

HABITAT. Terrestrial, mainly in leaf litter in or near water in secondary and primary forests.

COMMENT. Currently, the collections of the MHS and D. G. Mulcahy from Tanintharyi contain three genetic lineages that have distinct morphotypes.

HYLIDAE RAFINESQUE, 1845

***Hyla annectans* (Jerdon, 1870)**
Assam Treefrog

Hyla annectans Jerdon, 1870, *Proceedings of the Asiatic Society of Bengal* 1870: 84 [type locality: “Khasi hills,” Meghalaya, India].

DISTRIBUTION. In mainland Myanmar (Chin, Kachin, Sagaing, Shan); also present in Northeast India (Assam, Manipur, Meghalaya, Nagaland), Yunnan, northern Laos, and Thailand.

HABITAT. Arboreal, semiterrestrial in forests to rural disturbed habitats.

COMMENTS. Frost (2020, ASW 6.0, accessed 9 May 2020) includes the Chinese, northern Thailand, and Vietnamese populations of this treefrog as subspecific members of this taxon. Chinese herpetologists (e.g., Fei et al., 2009) recognize these latter populations as *Hyla gongshanensis*, often as subspecies of *H. gongshanensis*.

MEGOPHRYIDAE – LEPTOBRACHIINAE DUBOIS, 1980

***Leptobrachella fuliginosa* (Matsui, 2006)**

Sooty Toadfrog

Leptolalax fuliginosus Matsui, 2006, *Zoological Science* 23: 825 [type locality: “Pa Lao U, Prachuap Khiri Khan Province, Thailand (12°32’ N, 99°34’ E)”].

DISTRIBUTION. Not presently known from Myanmar; occurs in Thai province (Prachuap Khiri Khan) abutting Tanintharyi.

HABITAT. Terrestrial, near small streams in tropical forest.

***Leptobrachella lateralis* (Anderson, 1871)**

Anderson’s Toadfrog

Ixalus lateralis Anderson, 1871, *Journal of the Asiatic Society of Bengal* 40: 29 [type locality: “unknown”].

DISTRIBUTION. Known with confidence only from the neotype locality in northeastern India (Nagaland). A suggested inhabitant of northern Myanmar, a Kayah voucher in Muséum National d’Histoire Naturelle (Paris).

HABITAT. Terrestrial, likely in forest areas.

COMMENTS. Delorme et al. (2008) suggested that *Leptobrachella lateralis* and *Leptobrachella pelodytoides* are conspecific. Specimens not part of the type series are said to derive from the Bhamò region (Kachin). Our MHS surveys did not confirm the presence of *L. lateralis* in Myanmar.

***Leptobrachella melanoleuca* (Matsui, 2006)**

Black and White Bellied Toadfrog

Leptolalax melanoleucus Matsui, 2006, *Zoological Science* 23: 822 [type locality: “Khlong Saeng Wildlife Sanctuary, Surat Thani Province, Thailand (9° 15’ N, 98° 39’ E)”].

DISTRIBUTION. Not presently known from Myanmar; occurs in peninsular Thailand near border with Myanmar

HABITAT. Terrestrial, near small streams in tropical forest.

Leptobrachella pelodytoides (Boulenger, 1893)**Karin Toadfrog**

Leptobrachium pelodytoides Boulenger, 1893, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 13: 345 [type locality: “Thao” and “District of the Karin Bia-Po,” Myanmar].

DISTRIBUTION. Eastern mainland Myanmar (Kachin, Kayah, possibly Kayin); may occur in adjacent Thailand.

HABITAT. Terrestrial, in and near forest streams.

COMMENTS. There is considerable confusion in the assignment of this name to *Leptobrachella* specimens from areas other than the region of the type locality. See Plate 2A for general appearance of a *Leptobrachella*.

Leptobrachium chapaense (Bourret, 1937)**Chapa Bicolor-Eyed Toadfrog**

Megophrys hasseltii chapaensis Bourret 1937, *Annexe au Bulletin Générale de l'Instruction Publique, Hanoi* 1937: 18 [type locality: “Chapa” (=Sa Pa), Vietnam].

DISTRIBUTION. Southeast mainland Myanmar (Shan, possibly Kayin) and adjacent Thailand through Laos to northern Vietnam and also southern Yunnan, China.

HABITAT. Terrestrial, forest floor, often near small streams.

COMMENTS. In her description of a new species of Burmese *Leptobrachium*, Wogan (2012) evaluated all *Leptobrachium* taxa previously listed as occurring in Myanmar. She demonstrated morphologically and molecularly that only four species occur in Myanmar: *L. chapaense*, *L. huashen*, *L. rakhinensis*, and *L. smithi*. Matsui et al. (2010a) provided molecular evidence that nominal *L. chapaense* is composed of more than one lineage.

Leptobrachium huashen Fei and Ye, 2005**Blue Bicolor-Eyed Toadfrog**

Leptobrachium huashen Fei and Ye in Fei, Ye, Jiang, and Xie, 2005, *An Illustrated Key to Chinese Amphibians*: 69, 253 [type locality: “Xin-minxiang, Jingdong (24° 28' N, 101° 05' E), Yunnan, altitude 2030 m,” China].

DISTRIBUTION. Northern mainland Myanmar (Kachin) and adjacent western, central, and southern Yunnan, China, possibly Northeast India.

Leptobrachium rakhinensis Wogan, 2012**Rakhine Bicolor-Eyed Toadfrog**

Leptobrachium rakhinensis Wogan, 2012, *Zootaxa* 3415: 27 [type locality: “Myanmar, Rakhine State, Gwa Township, Rakhine Elephant Sanctuary [N 17° 42' 14.0" E 94° 38' 54.3"]].

DISTRIBUTION. Southwestern mainland Myanmar (Bago, Rakhine) and in adjacent Bangladesh and Northeast India.

HABITAT. Terrestrial, leaf litter in and adjacent to small forest streams.

COMMENT. Wogan (2012) noted that the morphology of the *Leptobrachium* identified as *L. smithi* from Assam and Meghalaya, India, matches that of *L. rakhinensis*.

Leptobrachium smithi Matsui, Nabhitabhata, and Panha, 1999
Smith's Bicolor-Eyed Toadfrog

FIGURE 2.20; PLATE 2B

Leptobrachium smithi Matsui, Nabhitabhata, and Panha, 1999, *Japanese Journal of Herpetology* 18: 24 [type locality: “Ton Nam Plu Waterfall, Khao Chong, Trang Province, Thailand (7° 34' N, 99° 49' E, alt. 260 m)"].

DISTRIBUTION. Mainland (Ayeyarwady, Kayah, Shan) and peninsular (Mon, Tanintharyi) Myanmar; elsewhere adjacent Thailand and Laos to Peninsular Malaysia; purported isolated populations in Northeast India (Assam, Meghalaya, Mizoram) and southeastern Bangladesh, although these likely are *L. rakhinensis* populations (fide Wogan, 2012).

HABITAT. Terrestrial, near and streamside in forest streams.

COMMENT. This species has been regularly confused with *L. hasseltii*, which does not occur in Myanmar.

Leptobrachium tenasserimense Pawangkhanant, Poyarkov, Duong, Naiduangchan, and Suwannapoom, 2018
Blue-Eyed Toadfrog

Leptobrachium tenasserimense Pawangkhanant, Poyarkov, Duong, Naiduangchan, and Suwannapoom, 2018 *PeerJ* 6: e5584 [type locality: “montane forest of Khao Laem Mt., Suan Phung District, Ratchaburi Province, western Thailand (13°32'50.35"N, 99°12'14.18"E; elevation 715 m a.s.l.)"].

FIGURE 2.20. Portrait of *Leptobrachium smithi*. Dawe, Bago Yoma, Myanmar.

DISTRIBUTION. Known only from a small area of Ratchaburi Province, Thailand; possibly present in adjacent Mon State, Myanmar.

HABITAT. Terrestrial, along small forest streams.

***Oreolalax jingdongensis* Ma, Yang, and Li, 1983**
Jingdong Toothed Toad

Oreolalax jingdongensis Ma, Yang, and Li in Yang, Ma, Li, and Chen, 1983, *Acta Zootaxonomica Sinica* 8: 323 [type locality: “Mt. Ailao, Jingdong, Yunnan, altitude 2400 m, China”].

DISTRIBUTION. Northern Myanmar (Kachin); adjacent Yunnan.

HABITAT. Terrestrial, adjacent to forest streams.

COMMENT. Rahman et al. (2020) reported a specimen from Kachin, confirming the presence of *Oreolalax* clade in Myanmar.

***Scutiger adungensis* Dubois, 1979**
Adung Alpine Toad

Scutiger adungensis Dubois, 1979, *Revue Suisse de Zoologie* 86: 631 [type locality: “la vallée de l’Adung, Birmanie, a la frontière tibéto-birmane, a l’altitude de 12000 pieds (3650 m)”].

DISTRIBUTION. Known only from the type locality in extreme northern Myanmar (Kachin).

HABITAT. Semiaquatic, terrestrial, along mountain streams.

MEGOPHRYIDAE – MEGOPHRYINAE BONAPARTE, 1850

***Megophrys* Kuhl and Van Hasselt, 1822,**
***Isis von Oken*, 10: 475⁴**

***Megophrys ancræ* Mahony, Teeling, and Biju, 2013**
Namdapha Horned Toadfrog

Megophrys ancræ Mahony, Teeling, and Biju, 2013, *Zootaxa* 3722: 145 [type locality: “6th mile (27° 29.833’ N 96° 23.467’ E, 420 m asl.) approx. 3 km from Deban Guest House, Deban, Namdapha National Park and Tiger Reserve, Changlang district, Arunachal Pradesh state, Northeast India”].

DISTRIBUTION. Not known from Myanmar, although present at a single locality in Northeast India adjacent to northernmost Sagaing Region; also reported from Yunnan, China.

HABITAT. Terrestrial, streamside and low on vegetation adjacent to forested mountain streams.

***Megophrys carinense* (Boulenger, 1889)**
Karen Horned Toadfrog

Leptobrachium carinense Boulenger, 1889, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 7: 748 [type locality: “Western slope of Karens Mountains, East of Toungoo, at an altitude of 800 metres and upwards,” Kayin State, Myanmar].

Brachytarsophrys platyparietus Rao and Yang, 1997, *Asiatic Herpetological Research* 7: 106 [type locality: “Duo-Di-He, San-Tai, Da-Yao, Yunnan, China, altitude 2100 meters”].

DISTRIBUTION. Mainland (Ayeyarwady, Bago, Kachin, Kayah, Kayin) and peninsular (Mon, Tanintharyi) Myanmar, adjacent northern Thailand, and widely through southern China (Yunnan to Jiangxi).

HABITAT. Terrestrial, in shrubby areas.

***Megophrys feae* (Boulenger, 1887)**
Fea’s Horned Toadfrog

Megalophrys feae Boulenger, 1887, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 4: 512 [type locality: “East of Bhamò, Kakhien Hills, Burma”].

DISTRIBUTION. Eastern mainland Myanmar (Kachin, Kayah) through northern Thailand to northern Vietnam and adjacent southern China (Yunnan, Sichuan, Guangxi).

HABITAT. Terrestrial, in forest.

***Megophrys feii* Yang, Wang, and Wang, 2018**
Yingjiang Horned Toadfrog

Megophrys feii Yang, Wang, and Wang, 2018, *Zootaxa* 4413: 327 [type locality: “Xiaolangsu Village, Tongbiguan Town, Yingjiang County, Yunnan Province, China (24°30’3.23”N, 97°34’16.75”E, 700 m a.s.l.)”].

DISTRIBUTION. Described from a Yunnan locality within 5 km of the border of Kachin (northeastern Myanmar), thus likely a resident of Kachin.

HABITAT. Terrestrial, in broadleaf montane forest.

***Megophrys glandulosa* Fei, Ye, and Huang, 1990**
White-Lipped Horned Toadfrog

Megophrys glandulosa Fei, Ye, and Huang, 1990, *Key to Chinese Amphibia*: 99 [type locality: Wuliang Shan, Jingdong, Yunnan Province, 1990 m, China; original in Chinese].

DISTRIBUTION. Northern Myanmar (Kachin), Northeast India, and Yunnan, China.

HABITAT. Terrestrial, montane forest.

***Megophrys longipes* (Boulenger, 1886)**
Bigfoot Horned Toadfrog

Megalophrys longipes Boulenger, 1886, *Proceedings of the Zoological Society of London* 1885: 850 [type locality: “mountains of Perak, Straits of Malacca, at a height of 3,300 feet,” Malaysia].

DISTRIBUTION. Mountain ranges of Southern Peninsular Myanmar (Tanintharyi) and adjacent Thailand southward into central Malaysia.

HABITAT. Terrestrial, forests.

COMMENT. Wogan et al. (2008) reported the first occurrence of this Malaysian species in Myanmar on the basis of a

single specimen, supposedly from Tanintharyi, but the specimen is listed in the CAS database as being from Kachin.

***Megophrys parva* (Boulenger, 1893)**

Dwarf Eye-Spined Toadfrog

PLATE 2C

Leptobrachium parvum Boulenger, 1893, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 13: 344 [type locality: “District of Karin Bia-po, Yado,” Kayah State, Myanmar].

DISTRIBUTION. Known with certainty only from Kayah State; other records list it from Magway, Kayin, Shan, Bangladesh, Northeast India, Yunnan, Laos, and Thailand.

HABITAT. Terrestrial, along forest stream.

COMMENTS. Mahony and Ali Reza (2008) suggested that “*Xenophrys parva*” is a species complex.

The CAS collection has specimens identified as *M. parva* from Kachin, Sagaing, and Shan, but these identifications have not been verified. Frost (2020, ASW 6.0, accessed 9 Jul. 2020) suggest that specimens from localities other than the type locality are likely different species.

***Megophrys periosa* Mahony, Kamei, Teeling, and Biju, 2018**

Giant Himalayan Eye-Spined Toadfrog

Megophrys (Xenophrys) periosa Mahony, Kamei, Teeling, and Biju, 2018, *Zootaxa* 4523: 59 [type locality: “Pangin town (28°12′33.96″N, 94°59′10.02″E, 450 m asl.), East Siang district, Arunachal Pradesh state, Northeast India”].

DISTRIBUTION. Northern Myanmar (Kachin); presently known from only Northeast India (Arunachal Pradesh) and adjacent Myanmar.

HABITAT. Terrestrial, along and on boulders in mountain streams of primary and secondary forest.

MICROHYLIDAE – KALOPHRYNINAE MIVART 1869

***Kalophrynus anya* Zug, 2014**

Northern Burmese Sticky Frog

FIGURE 2.21; PLATE 2D

Kalophrynus anya Zug, 2014, *Proceedings of the California Academy of Sciences*, ser. 4, 62(5): 150 [type locality: “Chatthin Wildlife Sanctuary, San Maung Camp (~23°35′57″N, 95°31′13″E) elevation ~200 m, approximately 2 km WNW of Chatthin (town), Sagaing Division, Myanmar”].

DISTRIBUTION. Northern mainland Myanmar (Kachin, Sagaing).

HABITAT. Terrestrial, open dryland forest.

***Kalophrynus interlineatus* (Blyth, 1855)**

Striped Sticky Frog

PLATE 2E

Engystoma? interlineatum Blyth, 1855 [1854], *Journal of the Asiatic Society of Bengal* 23: 732 [type locality: “Pegu,” Myanmar].

FIGURE 2.21. Portrait of *Kalophrynus anya*. Chatthin Wildlife Sanctuary, Myanmar.

DISTRIBUTION. Mainland (Bago) and peninsular (Mon, Tanintharyi) Myanmar; elsewhere northwestern Thailand, Laos, Cambodia, Vietnam, and southern China (Yunnan, Guangxi, Hainan, Guangdong).

HABITAT. Terrestrial, grassland to scrub and deciduous forest.

MICROHYLIDAE – MICROHYLINAE GÜNTHER, 1858

***Glyphoglossus guttulatus* (Blyth, 1856)**

Blotched Burrowing Frog

FIGURE 2.2A

Megalophrys guttulata Blyth, 1856 [1855], *Journal of the Asiatic Society of Bengal* 24: 717 [type locality: “Inhabits Pegu,” Myanmar].

DISTRIBUTION. Eastern mainland Myanmar (Bago, Shan, Yangon); supposedly broadly in mainland Thailand to the Central Highlands of Vietnam.

HABITAT. Terrestrial, forests.

COMMENTS. Blyth (1856: 711) states that Capt. Berdmore’s collection derived from “Schwe Gyen, on the Sittang river, Pegu.” Also, note that Figure 2.2A shows *Glyphoglossus globulosus*, which is identical to *G. guttulatus* in body shape.

***Glyphoglossus molossus* Günther, 1869**

Blunt-Chinned Burrowing Frog

FIGURE 2.22

Glyphoglossus molossus Günther, 1869, *Proceedings of the Zoological Society of London* 1868: 483 [type locality: “Pegu,” Myanmar].

DISTRIBUTION. Mainland Myanmar (Ayeyarwady, Bago, Magway, Mandalay, Sagaing); through most of mainland Thailand, Laos, and Cambodia to southern Vietnam.

FIGURE 2.22. Outline portrait of *Glyphoglossus molossus*. Chatthin Wildlife Sanctuary, Myanmar.

HABITAT. Terrestrial, dry forest to rural agricultural lands.

COMMENTS. Our survey vouchers derive exclusively from the Central Dry Zone. The type locality of the nineteenth century “Pegu” would barely encompass the southern edge of this zone. Shreve’s (1940) report of a voucher from Prome (=Pyay) confirms the Bago Region occurrence, and Parker (1934) cited a report of this species from the “tidal portion of the Irrawaddy Delta,” presumably in the Ayeyarwady Region.

***Kaloula latidisca* Chan, Grismer, and Brown, 2014**
Wide-Disked Painted Frog

PLATE 2F

Kaloula latidisca Chan, Grismer, and Brown, 2014, *Zootaxa* 3900: 574 [type locality: “Gubir, Kedah, Peninsular Malaysia (6°8′24.56″N 100°50′53.58″E, 180 m a.s.l.)”].

DISTRIBUTION. Peninsular Myanmar (Tanintharyi); likely most of southern peninsular Thailand and northern Peninsular Malaysia.

HABITAT. Terrestrial, primary to secondary forests.

COMMENTS. This species is one of several members of the *K. baleata* complex. Other members occur through mainland Southeast Asia (e.g., *K. indochinensis*) and the Sundas to the Philippines. The nominal species, *K. baleata*, resides in Java and Bali.

***Kaloula pulchra* Gray, 1831**
Asian Painted Frog

FIGURE 2.23; PLATE 2G

Kaloula pulchra Gray, 1831, *The Zoological Miscellany*, part 1: 38 [type locality: “China”].

Hylaedactylus bivittatus Cantor, 1847, *Journal of the Asiatic Society of Bengal* 16: 1064 [type locality: “field near Malacca,” Malaysia].

FIGURE 2.23. Portrait of *Kaloula pulchra*. Chatthin Wildlife Sanctuary, Myanmar.

Callula macrodactyla Boulenger, 1887, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 5: 485 [type locality: “Kaw-ka-riet,” Kayin State, Myanmar].

Kaloula pulchra hainana Gressitt, 1938, *Proceedings of the Biological Society of Washington* 51: 127 [type locality: “Kachek, alt. 25 meters, east central Hainan Island, South China Sea (lat. 18° 50′ N., long. 110° 30′ E.),” China].

Kaloula pulchra macrocephala Bourret, 1942, *Les Batraciens de l’Indochine*: 490 [type locality: “Tonkin: ? (pas de localité indiquée),” Vietnam].

Kaloula aureata Nutphund, 2001, *Amphibia Thailand*: 163 [type locality: “Thung Song District, Nakhon Si Thammarat Province,” Thailand].

DISTRIBUTION. Widespread in mainland Myanmar (Ayeyarwady, Bago, Kachin, Kayah, Kayin, Magway, Mandalay, Rakhine, Sagaing, Shan, Yangon) and southern peninsular Myanmar (Mon, Tanintharyi); broadly in tropical Asia from Northeast India and Bangladesh to southern China and Taiwan, southward through mainland Southeast Asia to Singapore and Sumatra.

HABITAT. Principally woodland, secondary forest into urban gardens.

COMMENTS. *Kaloula pulchra* is also present in Borneo, Sulawesi, and the Philippines (Luzon and Palawan); Philippine populations are considered introductions.

Mulcahy et al. (2018) showed considerable genetic variation existed in mainland Southeast Asian *K. pulchra* with possibly three genetic lineages in Myanmar.

***Microhyla berdmorei* (Blyth, 1856)**
Berdmore’s Narrow-Mouthed Frog

FIGURE 2.24; PLATE 2H

Engystoma? Berdmorei Blyth, 1856 [1855], *Journal of the Asiatic Society of Bengal* 24: 720 [type locality: “Pegu,” Myanmar].

FIGURE 2.24. Portrait of *Microhyala bermorei*. Sakaerat, Thailand.

Callula natatrix Cope, 1867, *Journal of the Academy of Natural Sciences of Philadelphia*, ser. 2, 6: 192 [type locality: “near Rangoon, Burmah”].

Microhyala malcolmi Cochran, 1927, *Proceedings of the Biological Society of Washington* 40: 182 [type locality: “Pak Jong, Siam”].

DISTRIBUTION. Mainland Myanmar (Bago, Chin, Magway, Yangon) and southern peninsular Myanmar (Tanintharyi); elsewhere from Northeast India and Bangladesh to Yunnan (China), Thailand, Laos, the Central Highlands of Vietnam, and Cambodia southward through Malaysia into Sumatra and Borneo.

HABITAT. Mainly associated with agricultural lands, usually “weedy” fence rows to secondary forest.

***Microhyala butleri* Boulenger, 1890**

Butler’s Narrow-Mouthed Frog

PLATE 21

Microhyala butleri Boulenger, 1900, *Annals and Magazine of Natural History*, ser. 7, 6: 188 [type locality: “Larut Hills at 4,000 feet,” Perak, Malaysia].

Microhyala boulengeri Vogt, 1913, *Sitzungsberichte der Gesellschaft naturforschender Freunde zu Berlin* 1913: 222 [type locality: “Hainan,” China].

Microhyala latastii Boulenger, 1920, *Annals and Magazine of Natural History*, ser. 9, 6: 107 [type locality: “Saigon, Cochin China,” Vietnam].

Microhyala grahami Stejneger, 1924, *Occasional Papers of the Boston Society of Natural History* 5: 119 [type locality: “Suifu, Province of Szechwan, China”].

Microhyala sowerbyi Stejneger, 1924, *Occasional Papers of the Boston Society of Natural History* 5: 119 [type locality: “Near Yen-ping-fu, Province of Fukien, China”].

Microhyala cantonensis Chen, 1929, *China Journal of Science and Arts, Shanghai* 10: 338 [type locality: “in a pond in the northern part about one mile from Canton city,” Guangzhou Shi, Guangdong, China].

DISTRIBUTION. Mainland Myanmar (Ayeyarwady, Kachin, Kayah, Rakhine, Shan, Yangon) and a northern outlier (Kachin; Poyarkov et al., 2019); eastward through southern China (Yunnan to Zhejiang, including Hainan) to Taiwan and mainland Southeast Asia to Singapore.

HABITAT. Terrestrial, grasslands and paddies, usually in the vicinity of standing water.

***Microhyala fodiens* Poyarkov, Gorin, Than Zaw, Kretova,**

Gogoleva, Pawangkhant, and Che, 2019

Shinmataung Narrow-Mouthed Frog

Microhyala fodiens Poyarkov, Gorin, Than Zaw, Kretova, Gogoleva, Pawangkhant, and Che, 2019, *Zoological Research*, 40(4): 244–276; doi:10.24272/j.issn.2095-8137.2019.044: 11 [type locality: “bank of an artificial pond near a Buddhist pagoda in the small village of Kan Pauk in the vicinity of Shinma Taung Mt., Yesagyo Township, Magway Division, Myanmar (coordinates N21.595°, E95.074°; elevation 232 m a.s.l.)”].

DISTRIBUTION. Central mainland Myanmar (Magway); presently known only from the type locality.

HABITAT. Terrestrial, along the edge of standing water.

***Microhyala heymonsi* Vogt, 1911**

Black-Sided Narrow-Mouthed Frog

Microhyala heymonsi Vogt, 1911, *Sitzungsberichte der Gesellschaft naturforschender Freunde zu Berlin* 1911: 181 [type locality: “Formosa,” Taiwan].

DISTRIBUTION. Mainland Myanmar (Bago, Kachin, Kayah, Shan, Yangon) and southern peninsular Myanmar (Mon, Tanintharyi); northeastern India to southern China (Yunnan to Zhejiang, including Hainan) southward through Thailand, Peninsular Malaysia, and Sumatra; also reported from Andaman and Nicobar Islands.

HABITAT. Terrestrial, principally around standing water in disturbed habitats.

COMMENTS. An early analysis (de Sa and Zug, 2014 unpublished manuscript) showed that Burmese *M. heymonsi* contained several distinct genetic lineages. Poyarkov et al. (2019) noted that there were at least two lineages in Myanmar, and the genetic analysis of Mulcahy et al. (2018) and Gorin et al. (2020) similarly indicated multiple lineages of “*heymonsi*” in Myanmar.

***Microhyala irrawaddy* Poyarkov, Gorin, Than Zaw, Kretova,**

Gogoleva, Pawangkhant, and Che, 2019

Dwarf Ayeyarwady Narrow-Mouthed Frog

Microhyala irrawaddy Poyarkov, Gorin, Than Zaw, Kretova, Gogoleva, Pawangkhant, and Che, 2019, *Zoological Research*, 40(4): 244–276; doi:10.24272/j.issn.2095-8137.2019.044: 19 [type locality: “temporary pond in the Irrawaddy (Ayeyarwady) River Valley, in the suburbs of Pakokku, Pakoku District, Magway Division, Myanmar (coordinates N21.316°, E95.053°; elevation 59 m a.s.l.)”].

DISTRIBUTION. Central mainland Myanmar (Magway); presently known only from two nearby localities in central

Magway but expected to occur widely in the Ayeyarwady valley of the Central Dry Zone.

HABITAT. Terrestrial, along the edge of standing water.

Microhyla mantheyi Das, Yaakob, and Sukumaran, 2007
Manthey's Narrow-Mouth Frog

PLATE 2J

Microhyla mantheyi Das, Yaakob, and Sukumaran, 2007, *Hamadryad* 31: 306 [type locality: "from road between Jemaluang and Kahang (02° 16'N; 103° 52.36'E), Johor, Malaysia"]].

DISTRIBUTION. Peninsular Myanmar (Tanintharyi); Malay Peninsula from southern Thailand to Singapore.

HABITAT. Terrestrial, along the edge of standing water.

Microhyla mukhlesuri Hasan, Islam, Kuramoto, Kurabayashi, and Sumida, 2014
Mukhlesuri's Narrow-Mouthed Frog

FIGURE 2.25; PLATE 2K

Microhyla mukhlesuri Hasan, Islam, Kuramoto, Kurabayashi, and Sumida, 2014, *Zootaxa* 5735: 408 [type locality: "Raozan, Chittagong (23° 35' N 91° 55' E, > 9 m asl), Bangladesh"]].

DISTRIBUTION. Widespread throughout mainland (Ayeyarwady, Bago, Chin, Kachin, Kayah, Magway, Mandalay, Sagaing, Yangon) and peninsular (Mon, Tanintharyi) Myanmar. Broadly from Bangladesh to southern China west of the Red River and southward through mainland Southeast Asia to Singapore.

HABITAT. Terrestrial, from paddies to forest floor of secondary forests.

FIGURE 2.25. Portrait of *Microhyla mukhlesuri*. Chatthin Wildlife Sanctuary, Myanmar.

COMMENTS. Whereas frogs matching the morphology of the *M. ornata* paradigm are common in Myanmar, they represent multiple genetic lineages (fide R. de Sa, University of Richmond, personal communication, November 2011). The preceding observation is proving prescient as these frogs cycle through multiple names from *ornata* to *fissipes* and now to *mukhlesuri*. The *fissipes* clade has at least nine lineages (fide Gorin et al., 2020: fig. 6).

Microhyla pulchra (Hallowell, 1861)
Marbled Narrow-Mouthed Frog

Engystoma pulchrum Hallowell, 1861 [1860], *Proceedings of the Academy of Natural Sciences of Philadelphia* 12: 506 [type locality: "Hong-Kong, China. Common in the brackish water marshes between Hong-Kong and Whampoa [=Huang-Pu], Guangdong, China].

Scaptophryne labyrinthica Fitzinger, 1861 [1860], *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Mathematisch . . .*, Wien 42: 416 [type locality: "Hong Kong," China]. Nomen nudum.

Ranina symmetrica David, 1872 [1871], *Nouvelles archives du Muséum d'histoire naturelle de Paris* 7: 76 [type locality: "les collines voisines du Yantzékiang, et devient abondante vers le Setchuan," China].

Microhyla hainanensis Barbour, 1908, *Bulletin of the Museum of Comparative Zoology* 51: 322 [type locality: "Mt. Wuchi, Central Hainan," China].

Microhyla melli Vogt, 1914, *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1914: 101 [type locality: "Umgebung der Stadt Canton," Guangdong Province, China].

Microhyla major Ahl, 1930, *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1930: 317 [type locality: none given; presumably Yaoshan, Kwangsi (fide Parker, 1934)].

DISTRIBUTION. Central mainland (Sagaing, Magway, Mandalay) and southern peninsular (Tanintharyi) Myanmar; Northeast India, southern China (Yunnan to Hainan), Thailand, Laos, Cambodia, and Vietnam.

HABITAT. Terrestrial, from paddies to forest floor of secondary forests.

COMMENT. It seems likely that Burmese *M. pulchra* represent a separate species from the population of China and Indochina.

Microhyla rubra (Jerdon, 1854)
Red Narrow-Mouthed Frog

Engystoma rubrum Jerdon, 1854 [1853], *Journal of the Asiatic Society of Bengal* 22: 534 [type locality: "in the Carnatic near rivers, in sandy banks"]].

Copea fulva Steindachner, 1864, *Verhandlung der kaiser-königlichen zoologische-botanischen Gesellschaft in Wien* 14: 286 [type locality: "Brasilien"]].

DISTRIBUTION. Southern Central Dry Zone (Magway, Mandalay) of mainland Myanmar; principally southern half of peninsular India.

HABITAT. Terrestrial, presently vouchered only from mixed breeding aggregations of *Microhyla* in standing water of disturbed habitats.

COMMENTS. Type locality footnoted “also Ceylon.” Single specimens have been collected from Sagaing to Tanintharyi and identified as *M. rubra*, but their specific identities have not been confirmed by molecular studies. Likely, Burmese *M. rubra* are misidentification, and true *M. rubra* do not occur in Myanmar.

***Micryletta aishani* Das, Garg, Hamidy, Smith, and Biju, 2019**
Northeast India Paddy Frog

Microhyla aishani Das, Garg, Hamidy, Smith, and Biju, 2019, *PeerJ* 7: e7012 [type locality: “Subhong (24°58′34″N 92°47′45″E, 110 m asl), Cachar district, Assam state, India”].

DISTRIBUTION. Northern Myanmar (Kachin) and Northeast India (Assam, Manipur, Tripura).

HABITAT. Terrestrial, moist to wet areas in agriculturally disturbed habitats.

***Micryletta inornata* (Boulenger, 1890)**
Spotted Paddy Frog

Microhyla inornata Boulenger, 1890, *Proceedings of the Zoological Society of London* 1890: 37 [type locality: “Deli” or “Langahat,” Sumatra, Indonesia].

DISTRIBUTION. Sumatra and peninsular Myanmar (Taninthary).

HABITAT. Terrestrial, not reported but likely moist leaf litter-covered areas in or adjacent to secondary forest.

COMMENTS. Until recently, the species was considered widespread in Myanmar, but *Micryletta* populations had been vouchered only in Kachin (= *M. aishani*) and Tanintharyi (Miller et al., 2021). Alhadi et al. (2019) proposed that this species occurred only in Sumatra; however, molecular analysis of southern Tanintharyi *Micryletta* (Miller et al., 2021) demonstrated its presence on the mainland.

***Micryletta lineata* (Taylor, 1962)**
Striped Paddy Frog

FIGURE 2.26; PLATE 2L

Microhyla inornata lineata Taylor, 1962, *University of Kansas Science Bulletin* 43: 546 [type locality: “10 km. West of Nakhon Si Thammarat,” Thailand].

DISTRIBUTION. Presently confirmed only for Tanintharyi populations and those in adjacent Thailand. Likely also occurs north along the Tanintharyi Mountain range into Mon, Kayin, and Shan, also adjacent provinces in Thailand.

HABITAT. Terrestrial, opened to closed forest, commonly near streams.

COMMENT. Miller et al. (2021) demonstrated the sympatry of *Micryletta inornata* and *M. lineata* in southern Tanintharyi and further showed that the latter was a distinct genetic entity.

FIGURE 2.26. Portrait of *Micryletta lineata*. Tanintharyi Nature Reserve, Myanmar.

***Uperodon globulosus* (Günther, 1864)**
Gray Balloon Frog

Cacopus globulosus Günther, 1864, *The Reptiles of British India*: 416 [type locality: “Russelconda (Madras Presidency)” Orissa, India].

DISTRIBUTION. Widespread in India and Bangladesh; vouchered in adjacent areas (Chin, Sagaing) of Myanmar.

HABITAT. Terrestrial, open forests and agricultural lands with sandy soil.

RANIDAE RAFINESQUE, 1814

***Amolops afghanus* (Günther, 1859)**
Marbled Torrent Frog

Polypedates afghana Günther, 1858, *Archiv für Naturgeschichte* 24: 325 [type locality: “Afghanistan”; in error, see Distribution].

Rana latopalmata Boulenger, 1882, *Catalogue of the Batrachia Salientia s. Ecaudata* . . . *British Museum*, 2nd ed.: 464 [type locality: “Tenas-serim,” Myanmar].

Ixalus argus Annandale, 1912, *Records of the Indian Museum* 8: 16 [type locality: “Upper Renging, Abor country,” Arunachal Pradesh, India].

DISTRIBUTION. Extreme northern Myanmar (Kachin); likely also in adjacent northern Sagaing Region and adjacent India (Arunachal Pradesh, Assam, Nagaland). No *Amolops* species has been verified as occurring in Afghanistan.

HABITAT. Semiaquatic, among the rocks in mountain streams amid forests.

COMMENTS. Dever et al. (2012) identified genetic differences between northern and southern populations of the composite *A. marmoratus*. Because the latter's Afghanistan locality is clearly in error and the itinerary of the collector of the type specimens traversed Nagaland, India, and Kachin State, Myanmar, before traveling into Lower Burma, Dever et al. (2012) accepted Kachin as the likely origin of the lectotype.

***Amolops archotaphus* (Inger and Chan-ard, 1997)
Doi Inthanon Torrent Frog**

Rana archotaphus Inger and Chan-ard, 1997, *Natural History Bulletin of the Siam Society* 45: 66 [type locality: "Dawn Tak Them, Doi Inthanon National Park, Chiang Mai Province, Thailand at 1100 m"].

DISTRIBUTION. Presently known only from the type locality, although anticipated that populations also exist in similar small mountains streams in nearby Myanmar (Kayah).

HABITAT. Semiaquatic, amid rocks in forested mountain streams.

***Amolops bellulus* Liu, Yang, Ferraris, and Matsui, 2000
Gaoligong Torrent Frog**

Amolops bellulus Liu, Yang, Ferraris, and Matsui, 2000, *Copeia* 2000: 536 [type locality: "small stream on west slope of Mt. Gaoligong in Pianma Township, Lushui County, Nujiang Prefecture, Yunnan Province, China, close to the border between Yunnan and Myanmar, 26° 01.9' N, 98° 38.0' E, 1540 m elevation"].

DISTRIBUTION. Presently known only from the type locality, although anticipated that populations also occur in similar small mountains streams in nearby Myanmar (Kachin).

HABITAT. Semiaquatic, amid rocks in forested mountain streams.

***Amolops gerbillus* (Annandale, 1912)
Small-Eared Torrent Frog**

Rana gerbillus Annandale, 1912, *Records of the Indian Museum* 8: 10 [type locality: "Yembung, Abor foot-hills at an altitude of 1,100. ft.," Arunachal Pradesh, India].

DISTRIBUTION. Extreme northern Myanmar (Kachin) on the southern slopes of the Himalayas, adjacent China (Xizang), and broadly in Northeast India.

HABITAT. Semiaquatic, amid rocks in forested mountain streams.

***Amolops indoburmanensis* Dever, Fuiten, Konu, and Wilkinson, 2012
Indoburman Torrent Frog**

Amolops indoburmanensis Dever, Fuiten, Konu, and Wilkinson, 2012, *Copeia* 2012: 70 [type locality: "Myanmar, Chin State, Mintatt

District, Mintatt Township, Twi Rein Village, 21°35'55.4"N, 93°51'59.9"E"].

DISTRIBUTION. Western mainland Myanmar (Chin, Rakhine, Sagaing); presently known from southern half (Chin Hills, Arakan Yoma) of the Indo-Burman Mountain Range, thus expected to occur also in adjacent India (Chin Hills, Manipur and Naga Hills, Nagaland).

HABITAT. Semiaquatic, among rocks and boulders in small to moderate streams in montane forest.

COMMENT. Dever et al. (2012) noted that the molecular phylogenetic analysis of *A. indoburmanensis* revealed three genetically distinct subgroups; hence, two additional cryptic species hide beneath this name.

***Amolops kaulbacki* (Smith, 1940)
Kaulback's Torrent Frog**

Rana kaulbacki Smith, 1940, *Records of the Indian Museum* 42: 472 [type locality: "Pangnamdim," Kachin State, Myanmar].

DISTRIBUTION. Northern Myanmar (Kachin) and Northeast India (Mizoram).

HABITAT. Semiaquatic, among rocks and boulders in small to moderate streams in montane forest.

***Amolops longimanus* (Andersson, 1939)
Long-Fingered Torrent Frog**

Rana longimanus Andersson, 1939 [1938], *Arkiv för Zoologi* 30(23): 4 [type locality: "Kambaiti," Kachin, Myanmar]. Original description not seen.

DISTRIBUTION. Presently known from the type locality in northeastern Myanmar (Kachin) on the Chinese border and in adjacent Yunnan.

HABITAT. Semiaquatic, among rocks and boulders in small to moderate streams in montane forest.

***Amolops mantzorum* (David, 1872)
Moupin Torrent Frog**

Amolops mantzorum David, 1872 [1871], *Nouvelles archives du Muséum d'histoire naturelle de Paris* 7: 95 [type locality: "la Chine occidentale"]. Original description not seen.

Rana (Amolops) jugans Stejneger, 1926, *Proceedings of the Biological Society of Washington* 39: 53 [type locality: "Near Wenchwan, about 100 kilometers northwest of Chengdu, Szechwan, China"].

Staurois kangtingensis Liu, 1950, *Fieldiana. Zoological Memoirs* 2: 349 [type locality: "Kangting [=Kangding City], Sikang [now Sichuan], 8000 feet altitude," China].

DISTRIBUTION. No records for this species in Myanmar, although its presence in adjacent Yunnan, China, suggests that it may occur in Kachin.

HABITAT. Semiaquatic, among rocks and boulders in small to moderate streams in montane forest.

FIGURE 2.27. Portrait of *Amolops marmoratus*. Kyaikhtiyo Wildlife Sanctuary, Myanmar.

Amolops marmoratus (Blyth, 1855)

Marbled Torrent Frog

FIGURE 2.27; PLATE 3A

Polypedates? marmoratus Blyth, 1855, *Journal of the Asiatic Society of Bengal* 24: 187 [type locality: “Schwe Gyne, Pegu” = Shwegyin, Bago Division, Myanmar].

Ixalus kakbierenensis Anderson, 1879 [1878], *Anatomical and Zoological Researches: . . . Western Yunnan*: 845 [type locality: “In field, in the Nam-poung valley, 1,000 feet,” = vicinity of Bhamo, Kachin State, Myanmar].

DISTRIBUTION. Northern mainland Myanmar (Bago, Kachin, Kayah, Kayin Mandalay, Shan) and northern peninsular Myanmar (Mon, Tanintharyi); also in adjacent Thailand and Yunnan.

HABITAT. Semiaquatic, among rocks and boulders in small to moderate streams in montane forest.

Amolops panhai Matsui and Nabhitabhata, 2006

Panha Torrent Frog

PLATE 3B

Amolops panhai Matsui and Nabhitabhata, 2006, *Zoological Science* 23: 728 [type locality: “Pa Lao U, Prachuap Kiri Khan Province, Thailand (99°31'E, 12°33'N)"].

DISTRIBUTION. In Myanmar, known only from a single locality in mid Tanintharyi; broader distribution in peninsular Thailand north of the Isthmus of Kra.

HABITAT. Semiaquatic, among rocks and boulders in small to moderate streams in montane forest.

COMMENT. This species was only recently discovered in the Tenasserim watershed in Myanmar and about 30 km

south of *A. marmoratus* in the Tavoy watershed (Dever et al., 2012).

Amolops putaoensis Gan, Qin, Lwin, Li, Quan, Liu, and Lu, 2020

Putao Torrent Frog

Amolops putaoensis Gan, Qin, Lwin, Li, Quan, Liu, and Lu, 2020, *Zoological Research* 41: 734 [type locality: “small stream of Upper Mali Kha, Putao County, Kachin State, Myanmar (N27°5'48." E97°22'28.7"), 544 m a.s.l."].

DISTRIBUTION. Presently known only from a small area in northern Myanmar (Kachin).

HABITAT. Semiarboreal to semiaquatic, holotype captured on dead tree branch over a fast-flowing stream.

Amolops viridimaculatus (Jiang, 1983)

Green-Spotted Torrent Frog

Staurois viridimaculatus Jiang, 1983, *Acta Herpetologica Sinica*, n.s., 2(3): 71 [type locality: Dahaoping, Tengchung, 1,980 m, Yunnan, China; original in Chinese].

DISTRIBUTION. Northern Myanmar (Kachin); occurs eastward through China (Wuliangshan, Yunnan) to northern Vietnam and westward into India (Nagaland).

HABITAT. Single Burmese individual found in a clump of bamboo (Wogan et al., 2008).

Chalcorana eschatia (Inger, Stuart, and Iskandar, 2009)

Peninsular Copper-Checked Frog

Rana eschatia Inger, Stuart, and Iskandar, 2009, *Zoological Journal of the Linnean Society* 155: 134 [type locality: “Ngao Falls National Park (9°56'98°43'E), Ranong Province, Thailand”].

DISTRIBUTION. Southern peninsular Myanmar (Tanintharyi) and adjacent peninsular Thailand.

HABITAT. Semiarboreal, low in trees and shrubs along streams and open areas in forests.

COMMENT. Wogan et al. (2008) reported three specimens of *Chalcorana chalconota* from Tanintharyi Division. These specimens are *C. eschatia*.

Clinotarsus alticola (Boulenger, 1882)

Northern Pointed-Snout Frog

Hylorana pipiens Jerdon, 1870, *Proceedings of the Asiatic Society of Bengal* 1870: 83 [type locality: “Shillong,” Khasi Hills, Meghalaya, India].

Rana alticola Boulenger, 1882, *Catalogue of the Batrachia Salientia s. Ecaudata . . . British Museum*, 2nd ed.: 62, replacement name for *Hylorana pipiens* Jerdon, 1870, a secondary homonym of *Rana pipiens* Schreber.

DISTRIBUTION. Western mainland Myanmar (Chin, Kachin, Rakhine, Sagaing); distribution extends from northeastern India and northern Bangladesh.

HABITAT. Terrestrial-arboreal, along small streams in evergreen forest.

COMMENTS. *Clinotarsus* occurs in two separate regions of Myanmar, the northwest (Kachin, Sagaing, Chin, Rakhine) and peninsular Myanmar (Mon, Tanintharyi). Genetic analysis of the Tanintharyi population indicates that the latter is related to *C. penelope* (Mulcahy et al., 2018). The northwest sample has not been tested; however, the northwest populations being adjacent to the Indian-Bangladesh *C. alticola* population, we assign those populations to the latter species.

Clinotarsus penelope Grosjean, Bordoloi, Chuaynkern, Chakravarty, and Ohler, 2015

Malay Pointed-Snout Frog

FIGURE 2.28; PLATE 3C

Clinotarsus penelope Grosjean, Bordoloi, Chuaynkern, Chakravarty, and Ohler, 2015, *Zootaxa* 4058: 484 [type locality: “Namtok Raman Forest Park (8°27' N, 98°32' E, WGS 84, about 30 m asl), Phang Nga Province, Thailand”].

DISTRIBUTION. Peninsular Myanmar (Mon, Tanintharyi) and adjacent central peninsular Thailand.

HABITAT. Terrestrial-arboreal along small streams in evergreen forest.

COMMENT. See Comments in *Clinotarsus alticola* account.

FIGURE 2.28. Portrait of *Clinotarsus penelope*, female and male in amplexus. Tanintharyi Nature Reserve, Myanmar.

Humerana humeralis (Boulenger, 1887)

Northern Caped Frog

Rana humeralis Boulenger, 1887, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 5: 420 [type locality: “Bhamò, Teinzò,” Kachin, Myanmar].

DISTRIBUTION. Northern mainland Myanmar (Kachin, Sagaing) through northeastern India and northern Bangladesh to eastern Nepal and eastern Bangladesh.

HABITAT. Semiaquatic to terrestrial, in and adjacent to water.

COMMENTS. The MHS survey did not encounter this species in the several monthlong sorties into the general area of Bhamo to Myitkyina. Because this species appears more common to the west, the original Bhamo specimen may represent a rare outlier. See Comments in *Humerana oatesii* for the Bago specimen reported in Mulcahy et al. (2018).

Humerana oatesii (Boulenger, 1892)

Southern Caped Frog

FIGURE 2.29

Rana oatesii Boulenger, 1892, *Annals and Magazine of Natural History*, ser. 6, 9: 141 [type locality: “near Toungoo,” Bago, Myanmar].

DISTRIBUTION. Southeast Mainland Myanmar (Bago, Yangon).

HABITAT. Semiaquatic to terrestrial, in and adjacent to water.

FIGURE 2.29. Portrait of *Humerana oatesii*. Moyingyi Wildlife Sanctuary, Myanmar.

COMMENTS. Our MHS surveys did not identify any specimens as this species. Subsequently, Mulcahy et al. (2018) identified a specimen from the Moyingyi Wildlife Sanctuary as *Humerana humeralis* by matching it to *H. humeralis* specimens in GenBank, although it did possess “considerable genetic differences.” With these differences and the type locality of *H. humeralis* in Kachin, I propose that the southern Bago specimens of *Humerana* are *H. oatesii*.

***Hydrophylax leptoglossa* Cope, 1868**

Long-Tongued Forestfrog

PLATE 3D

Hylorana leptoglossa Cope, 1868, *Proceedings of the Academy of Natural Sciences of Philadelphia* 20: 140 [type locality: “near Rangoon, Burmah”].

Hylorana granulosa Anderson, 1871, *Journal of the Asiatic Society of Bengal* 40: 23 [type locality: “Pegu” (southern Myanmar) and “Seebaigor, Assam” (=Sibsagar, Assam), India].

DISTRIBUTION. Mainland Myanmar (Ayeyarwady, Bago, Chin, Kachin, Kayin, Kayah, Rakhine, Sagaing, Shan, Yangon) and peninsular Myanmar (Mon, Tanintharyi); from North-east India and Bangladesh eastward through Myanmar into adjacent western Thailand.

HABITAT. Terrestrial to semiaquatic, adjacent to streams and pools in forested habitats.

***Hylarana erythraea* (Schlegel, 1837)**

Red-Eared Copper-Backed Frog

PLATE 3E

Hyla erythraea Schlegel, 1837, *Abbildungen neuer oder unvollständig bekannter Amphibien: . . . Leben entworfen*: 27 [type locality: “Java” and “Sumatra”].

DISTRIBUTION. Mainland (Ayeyarwady, Bago, Kayin, Rakhine, Sagaing, Yangon) and peninsular (Mon, Tanintharyi) Myanmar; eastward into Thailand to Cambodian border, southern China, northern Laos, and southward into the Sundas; Philippine populations may be introduced.

HABITAT. Semiaquatic, marshes, paddies, and edges of other slow-moving waters.

COMMENTS. Ohler and Mallick (2002) examined the status of a group of presumably related striped frogs (*H. erythraea*, *H. macrodactyla*, *H. taipehensis*, and *H. tytleri*). They concluded that *H. tytleri* is the species in northern India and Bangladesh. The “*tytleri*” population of peninsular India likely represents a different species; they did not assign a name to this population. Similarly, *H. taipehensis* of Northeast India also appears to represent a different species from the topotypic population of China and Indochina. No name was given to this Indian population.

Hasan et al. (2019) examined the Bangladesh populations of *Hylarana*, thereby confirming the uniqueness of *H. tytleri* with both molecular and morphological evidence. Their study also

suggested a more limited geographic distribution of *H. erythraea* and a much broader occurrence of *H. taipehensis*.

“*Hylarana*” *lateralis* (Boulenger, 1887)

Kokarit Copper-Backed Frog

PLATE 3G

Rana lateralis Boulenger, 1887, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 5: 483 [type locality: “Kaw-ka-riet” (=Kokarit), east of Moulmein, Kayin, Myanmar].

Rana nigrolineata Liu and Hu, 1960 [1959] *Acta Zootaxonomica Sinica* 11: 516, 530 [type locality: “Meng-yang, Yunnan, 680 meters altitude,” China].

DISTRIBUTION. Mainland Myanmar (Bago, Kachin, Shan, Yangon) and southern peninsular Myanmar (Kayin); also adjacent Thailand and Yunnan, China.

HABITAT. Terrestrial, forest floor.

COMMENT. This species assignment to the genus *Hylarana* is questionable owing to its absence in the list of species in the most recent analyses of the *Hylarana* group of species (Oliver et al., 2015; Chan et al., 2020).

***Hylarana macrodactyla* Günther, 1858**

Long-Toed Copper-Backed Frog

FIGURE 2.30; PLATE 3F

Hylarana macrodactyla Günther, 1858, *Archiv für Naturgeschichte* 24: 323 [type locality: “China,” later given as “Hong Kong” and “China” by Günther, 1859 [1858], *Catalogue of the Batrachian Salientia . . . British Museum*: 72].

FIGURE 2.30. *Hylarana macrodactyla*. Moyingyi Wildlife Sanctuary, Myanmar.

Rana trivittata Hallowell, 1861 [1860], *Proceedings of the Academy of Natural Sciences of Philadelphia* 12: 504 [type locality: "Hong Kong"].

Hylorana subcoerulea Cope 1868, *Proceedings of the Academy of Natural Sciences of Philadelphia* 20: 139 [type locality: "Rangoon, Burmah"].

DISTRIBUTION. Broadly in mainland Myanmar (Ayeyarwady, Bago, Kachin, Kayin, Rakhine, Sagaing, Shan, Yangoon) and peninsular Myanmar (Mon, Tanintharyi); elsewhere in southwestern China (Guangdong, Guangxi, Hainan) and Indochina, including the Malay Peninsula.

HABITAT. Semiaquatic in marshes, paddies, and edges of slow-moving water.

COMMENT. The middorsal stripe is more prominent in most *Hylarana macrodactyla* individuals than depicted in this north central Myanmar individual (Figure 2.30).

"Hylarana" margariana Anderson, 1879

Unknown Copper-Backed Frog

Hylarana margariana Anderson, 1879 [1878], *Anatomical and Zoological Researches: . . . Western Yunnan*: 846 [type locality: "in a hill stream debouching into the Irawady [sic], in the second defile," Myanmar]. Original description not seen.

DISTRIBUTION. Northern Myanmar (Kachin).

HABITAT. Likely semiaquatic-terrestrial along forest streams.

COMMENTS. Our MHS surveys did not find any frogs that match the description of this species. This species assignment to the genus *Hylarana* is questionable owing to its absence in the list of species of the most recent analyses of the *Hylarana* group of species (Oliver et al., 2015; Chan et al., 2020). The Kachin locality identification derives from records of the Natural History Museum, London.

***Hylarana tytleri* Theobald, 1868**

Yellow-Striped Copper-Backed Frog

Hylorana tytleri Theobald, 1868, *Journal of the Asiatic Society of Bengal* 37: 84 [type locality: "Dacca," Bangladesh].

Rana (Rana) bilineata Pillai and Chanda, 1981, *Records of the Zoological Survey of India* 79: 159 [type locality: "Dianadubi forest, Garo Hills (alt. about 400 metres) . . . , about one kilometre from the Ranger's office," Assam, India]. Primary homonym of *Rana bilineata* Shaw, 1802.

Rana (Hylarana) albolineata Dubois, 1987 [1985], *Alytes* 4: 153. Replacement name for *Rana bilineata* Pillai and Chanda, 1981.

DISTRIBUTION. Southern mainland Myanmar (Bago, likely western Rakhine and Chin); predominantly northern India and lowland Nepal and Bangladesh.

HABITAT. Semiaquatic, marshes, paddies, and edges of other slow-moving waters.

COMMENT. See comments on *H. tytleri* in the *H. erythraea* account.

***Odorrana andersonii* (Boulenger, 1882)**

Anderson's Stinky Frog

PLATE 3I

Polypedates yunnanensis Anderson, 1879 [1878], *Anatomical and Zoological Researches: . . . Western Yunnan*: 84 [type locality: "at an elevation of 4,500 feet in the valley of Hotha (= Husa)," Yunnan, China]. Secondary homonym of *Rana yunnanensis* Anderson, 1879.

Rana andersonii Boulenger, 1882, *Catalogue of the Batrachia Salientia s. Ecaudata* . . . *British Museum*, 2nd ed.: 55. Replacement name for *Polypedates yunnanensis* Anderson, 1879.

DISTRIBUTION. Northern Myanmar (Kachin); elsewhere in Northeast India and northern Thailand and western Yunnan, China, south into Vietnam and Laos.

HABITAT. Semiaquatic, terrestrial; mountain streams.

COMMENT. Our MHS surveys did not encounter this species.

***Odorrana cangyuanensis* Yang, 2008**

Cangyuan Stinky Frog

Rana cangyuanensis Yang, 2008, in Yang and Rao, eds., 2008, *Amphibia and Reptilia of Yunnan*, 65 [type locality: original in Chinese, presumably = Cangyuan, Yunnan, China].

DISTRIBUTION. Presumed to occur in northern Myanmar (Kachin); presently known only from Yunnan, China.

HABITAT. Semiaquatic, terrestrial; mountain streams.

***Odorrana chloronota* (Günther, 1876)**

Copper-Cheeked Stinky Frog

PLATE 3H

Polypedates chloronotus Günther, 1876 [1875], *Proceedings of the Zoological Society of London* 1876: 569 [type locality: "Darjeeling," India].

DISTRIBUTION. Mainland Myanmar (Bago, Kachin, Rakhine, Sagaing, Shan); widely in Northeast India through Myanmar into southern China and southern Vietnam.

HABITAT. Semiaquatic, terrestrial; slow-moving streams and swamps.

COMMENT. *Odorrana chloronota* represents several unnamed species (Stuart et al., 2006); the Thailand populations represent at least two species.

***Odorrana hosii* (Boulenger, 1891)**

Hose's Stinky Frog

Rana Hosii Boulenger, 1891, *Annals and Magazine of Natural History*, ser. 6, 8: 290 [type locality: "Borneo, on Mount Dulit," Sarawak, Malaysia].

Rana durheimi Baumann, 1913, *Zoologische Jahrbücher. Abteilung für Systematik* . . . *Tiere* 34: 275 [type locality: "Battak-Gebirge von West-Sumatra . . . aus 800 m Höhe"].

Rana cataracta Smith, 1922, *Journal of the Federated Malay States Museums* 10: 275 [type locality: "Khao Ram, Nakon Sritamarat Hills, Peninsular Siam, at 300 metres elevation"].

DISTRIBUTION. Southern peninsular Myanmar (southern Tanintharyi); southward in peninsular Thailand and Malaysia, also Sumatra, and Borneo.

HABITAT. Semiarboreal, on branches over forest streams.

Odorrana livida (Blyth, 1856)
Green Stinky Frog

FIGURE 2.31

Polypedates lividus Blyth, 1856 [1855], *Journal of the Asiatic Society of Bengal* 24: 718 [type locality: “Tenasserim valley,” Myanmar].

DISTRIBUTION. Widely dispersed localities in mainland Myanmar (Chin, Kachin, Kayah, Mandalay) and peninsular Myanmar (Mon, Tanintharyi); also in northwestern India, Yunnan, and peninsular Thailand.

HABITAT. Semiaquatic, amid rocks and banks of forest streams.

COMMENT. Rujirawan et al. (2018) provided an enhanced morphological description of *O. livida* and its natural history in peninsular Thailand.

Odorrana macrotympana Yang, 2008
Large-Eared Stinky Frog

Rana macrotympana Yang, 2008, in Yang and Rao, eds., 2008, *Amphibia and Reptilia of Yunnan*, 78 [type locality: original in Chinese, presumably =

FIGURE 2.31. Portrait of *Odorrana livida*. Pyin Oo Lwin, Myanmar.

“Yinjiang, Great Yinjiang Lake and its tributaries, Yunnan, China, 300 m elevation”].

DISTRIBUTION. Possibly in northern Myanmar (Kachin); occurring in adjacent Yunnan, China.

HABITAT. Semiaquatic, amid rocks and banks of forest streams.

COMMENT. Because Yinjiang Lake is in the Ayeyarwady drainage system, this frog may also occur in Myanmar.

Odorrana nasica Boulenger, 1903
Long-Snouted Stinky Frog

Rana nasica Boulenger, 1903, *Annals and Magazine of Natural History*, ser. 7, 12: 187 [type locality: “Man-Son Mountains, Tonkin, altitude 3000–4000 ft.,” Vietnam].

DISTRIBUTION. Northern Myanmar (Kachin); present in north and northwestern Thailand to northern Vietnam and adjacent Laos and southern Yunnan.

HABITAT. Semiaquatic, amid rocks and banks of forest streams.

Papurana milleti (Smith, 1921)
Millet’s Forestfrog

PLATE 3J

Rana milleti, Smith, 1921, *Proceedings of the Zoological Society of London* 1921: 431 [type locality: “Dalat . . . from the Langbian peaks, and from Dran,” Lam Dong Province, Vietnam].

DISTRIBUTION. Peninsular Myanmar (Tanintharyi); scattered localities in Thailand, Laos, Cambodia, Vietnam, and Yunnan, China.

HABITAT. Terrestrial-semiaquatic, in and adjacent to forest streams.

Pterorana khare Kiyasetuo and Khare, 1986
Floppy-Sided Frog

Pterorana khare Kiyasetuo and Khare, 1986, *Asian Journal of Exploratory Sciences* 1: 12 [type locality: “Sanuoru river, Kohima, Nagaland (alt. 1,440 m a. s. l.),” Meghalaya, India].

DISTRIBUTION. Western mainland Myanmar (Chin, Sagaing), Bangladesh, and Northeast India.

HABITAT. Aquatic, mountain streams.

COMMENT. The flying and gliding epithets for this species misidentify the function of the lateral skin folds. *Pterorana khare* is a highly aquatic species, and the folds are presumably associated with the male’s increased activity during the breeding season.

Sylvirana cubitalis (Smith, 1917)
Dark-Eared Woodfrog

Rana cubitalis Smith, 1917, *Journal of the Natural History Society of Siam* 2: 277 [type locality: “Doi Nga Chang, N. Siam,” Thailand]

Rana (Sylvirana) nigrotympanica Dubois, 1992, *Bulletin Mensuel de la Société Linnéenne de Lyon* 61: 341 [type locality: “Chine”].

DISTRIBUTION. Scattered throughout Myanmar (Kachin, Mandalay, Shan, Yangon) and eastward into Thailand to Cambodian border, southern China, and northern Laos.

HABITAT. Terrestrial, semiaquatic, streamside of forest streams.

***Sylvirana lacrima* Sheridan and Stuart, 2018**
Chin Woodfrog

PLATE 3K

Sylvirana lacrima Sheridan and Stuart, 2018, *PLoS ONE* 13: 39 [type locality: “Myanmar (Burma), Chin State, Mindat District, Mindat Township, Hteen Chaung village, 21.3868 N, 94.0567 E, 443 m elev.”].

DISTRIBUTION. Central mainland Myanmar (Chin, Mandalay).

HABITAT. Terrestrial, semiaquatic, streamside and forest floors.

***Sylvirana malayana* Sheridan and Stuart, 2018**
Malay Woodfrog

Sylvirana malayana Sheridan and Stuart, 2018, *PLoS ONE* 13: 33 [type locality: “Thailand, Surat Thani Province, Khao Sok National Park, 8.9147 N, 98.5278 E”].

DISTRIBUTION. Peninsular Myanmar (Tanintharyi); southward through central and southern peninsular Thailand into Peninsular Malaysia.

HABITAT. Terrestrial, semiaquatic, streamside of forest floor.

COMMENT. Both *S. malayana* and *S. nigrovittata* occur in southern Tanintharyi, although presently, evidence suggests that they do not occur together.

***Sylvirana nigrovittata* (Blyth, 1856)**
Black-Sided Woodfrog

Limnodytes nigrovittatus Blyth, 1856 [1855], *Journal of the Asiatic Society of Bengal* 24: 718 [type locality: “Tenasserim valley”].

Hylarana (Sylvirana) menglaensis Fei, Ye, and Xie, in Fei, Ye, Jiang, and Xie, 2008, *Acta Zootaxonomica Sinica* 33: 201 [type locality: “Zhushih of Mengla County, Yunnan Province (21.48°N, 101.56°E; alt. 1000 m),” China].

Hylarana (Sylvirana) hekousensis Fei, Ye, and Jiang, in Fei, Ye, Jiang, and Xie, 2008, *Acta Zootaxonomica Sinica* 33: 199 [type locality: “Nanxi of Heko County, Yunnan (22.52°N, 103.98° E; alt. 170 m),” China].

DISTRIBUTION. Mainland Myanmar (Ayeyarwady, Bago, Chin, Kachin, Kayah, Mandalay, Rakhine, Sagaing, Shan) and peninsular Myanmar (Mon, Tanintharyi); also eastward into China, Thailand, Laos, and extreme northwestern Vietnam.

HABITAT. Terrestrial, semiaquatic, streamside and forest floor.

COMMENTS. The type locality is not explicitly stated in Blyth’s (1856) description. The subsequent use of Mergui derives from the locality given in the Natural History Museum’s catalog to specimens donated by Mr. Theobald (see comments by Sheridan and Stuart, 2018:8, on lectotype designation).

***Sylvirana roberti* Sheridan and Stuart, 2018**
Tanintharyi Woodfrog

PLATE 3L

Sylvirana roberti Sheridan and Stuart, 2018, *PLoS ONE* 13: 39 [type locality: “Myanmar (Burma), Tanintharyi State, Dwei District, Yephyu Township, Tanintharyi Nature Reserve, 14.7475 N, 98.2213 E, 73 m elev.”].

DISTRIBUTION. Peninsular Myanmar (Tanintharyi).

HABITAT. Terrestrial, semiaquatic, streamside and forest floor.

RHACOPHORIDAE HOFFMAN, 1932⁵

***Chirixalus doriae* (Boulenger, 1893)**
Doria’s Bushfrog

PLATE 4A

Chirixalus doriae Boulenger, 1893, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 13: 341 [type locality: “District of the Karin Bia-po” and “Thao,” Kayah State, Myanmar].

DISTRIBUTION. Mainland Myanmar (Bago, Kachin, Kayah, Sagaing, Yangon) and peninsular Myanmar (Tanintharyi); from Northeast India and adjacent Bangladesh to northern Thailand, Indochina, and adjacent China.

HABITAT. Terrestrial, semi-arboreal; agricultural landscapes and other human-disturbed habitats.

***Chirixalus nongkhorensis* (Cochran, 1927)**
Nong Khor Bushfrog

FIGURE 2.32

Philautus nongkhorensis Cochran, 1927, *Proceedings of the Biological Society of Washington* 40: 179 [type locality: “at Nong Khor, southeastern Siam”].

Rhacophorus (Chirixalus) striatus Ahl, 1930, *Zoologischer Anzeiger* 87: 229 [type locality: “Carin-Berge, Burma, 900–1000 m hoch,” Kayah State, Myanmar].

DISTRIBUTION. Mainland Myanmar (Kachin, Kayah, Mandalay, Rakhine, Sagaing, Shan); Northeast India through Thailand to Indochina and south in Malay Peninsula.

HABITAT. Terrestrial, semi-arboreal; agricultural landscapes and other human-disturbed habitats.

COMMENT. Within Myanmar, the identification of *C. doriae* and *C. nongkhorensis* is difficult, and dorsal stripes do not always occur in the latter. Thus, the proposed distribution of these two species is tentative.

FIGURE 2.32. Portrait of *Chirixalus nongkhorensis*, female and male in amplexus. Chatthin Wildlife Sanctuary, Myanmar.

Gracixalus carinensis (Boulenger, 1893)

Karin Hills Bushfrog

PLATE 4B

Ixalus carinensis Boulenger, 1893, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 13: 339 [type locality: "Karin Hills, 2900–3500 feet," "Thao," and "District of the Karin Bia-po," Kayah State, Myanmar].

Rhacophorus naso Annandale, 1912, *Records of the Indian Museum* 8: 12 [type locality: "Egar stream between Renging and Rotung," Arunachal Pradesh, India].

DISTRIBUTION. Only from mountainous southeast mainland Myanmar (Kayah); elsewhere adjacent Thailand.

HABITAT. Forest streams in mountains.

COMMENT. Our MHS surveys did not find this frog.

Kurixalus bisacculus (Taylor, 1962)

Taylor's Frill-Limbed Treefrog

Kurixalus bisacculus Taylor, 1962, *University of Kansas Science Bulletin* 43: 494 [type locality: "Phu Kading, Loei Province, at an elevation of 3800 ft.," Thailand].

DISTRIBUTION. Southern peninsular Myanmar (Tanintharyi); also north and north central Thailand. See Comments.

COMMENTS. Presently, three clades are in the *Kurixalus odontotarsus* species group (Yu et al., 2017). The northernmost is *K. naso* (Tibet, Kachin); an unnamed one is distributed in Kachin, Sagaing, and Yunnan, and a third is found in peninsular Thailand and Malaysia. The latter two are often labeled *K. bisacculus*. A large-scale study (Lv et al., 2018) showed current populations of "*bisacculus*" contain at least two major clades, each with numerous lineages.

Kurixalus naso Annandale, 1921

Proboscis Frilled-Limbed Treefrog

Rhacophorus naso Annandale, 1912, *Records of the Indian Museum* 8: 12 [type locality: "Egar stream between Renging and Rotung," Arunachal Pradesh, India].

DISTRIBUTION. Northern Myanmar (Kachin); adjacent Northeast India and Tibet.

HABITAT. Semi-arboreal, terrestrial; montane forest adjacent to streams.

COMMENT. See Comments in the *Kurixalus bisacculus* account.

Kurixalus verrucosus (Boulenger, 1893)

Small Frill-Limbed Treefrog

Rhacophorus verrucosus Boulenger, 1893, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 13: 337 [type locality: "Thao," Kayah State, Myanmar].

DISTRIBUTION. Irregularly in mainland Myanmar (Kachin, Kayah); westward through Laos and Thailand to Vietnam and adjacent southern China.

HABITAT. Semi-arboreal, terrestrial; forests.

Kurixalus yangi Yu, Hui, Rao, and Yang, 2018

Yang's Frill-Limbed Treefrog

Kurixalus yangi Yu, Hui, Rao, and Yang, 2018, *ZooKeys* 770: 216 [type locality: "Nabang (24°46'12.03"N, 97°34'28.03"E 34 m elevation; Fig. 2), Yingjiang County, Dehong Autonomous Prefecture, Yunnan, China"].

DISTRIBUTION. Northern Myanmar (Kachin); immediately adjacent Yunnan.

HABITAT. Semi-arboreal, terrestrial; forests.

Leptomantis cyanopunctatus (Manthey and Steiof, 1998)

Blue-Spotted Bushfrog

Rhacophorus cyanopunctatus Manthey and Steiof, 1998, *Sauria* 20: 37 [type locality: "südlichen Rand des Khao Sok National Parks (ca. 200 m ü NN), Provinz Surat Thani, Distrikt Phanom, Thailand"].

DISTRIBUTION. Peninsular Myanmar (Tanintharyi); adjacent Thailand southward to Borneo.

HABITAT. Arboreal, secondary forest near water courses.

FIGURE 2.33. Portrait of *Nasutixalus jerdonii*. From Günther (1876).

***Nasutixalus jerdonii* Günther, 1876**
Jerdon's Ridge-Nosed Treefrog

FIGURE 2.33

Polypedates jerdonii Günther, 1876, *Proceedings of the Zoological Society of London* 1875: 571 [type locality: "Darjeeling, West Bengal, India"].

DISTRIBUTION. Northern Myanmar (Kachin); North-east India.

HABITAT. Semiarboreal, terrestrial; forests.

COMMENT. Rahman et al. (2020) reported a specimen from Kachin.

***Nasutixalus yingjiangensis* Yang and Chang, 2018**
Yingjiang Ridge-Nosed Treefrog

Nasutixalus yingjiangensis Yang and Chan, 2018, *Zootaxa* 4388: 194 [type locality: "Tongbiguan town, Yingjiang County, Yunnan Province, China (24°37'21.59" N, 97°37'13.29" E, 1610 m above sea level)"].

DISTRIBUTION. Possibly in northern Myanmar (Kachin); adjacent Yunnan.

HABITAT. Semiarboreal, terrestrial; broadleaf montane forests.

COMMENT. Type locality is in the Ayeyarwady watershed.

***Nyctixalus pictus* (Peters, 1871)**
White-Spotted Treefrog

PLATE 4C

Ixalus pictus Peters, 1871, *Monatsberichte der Königlichen Preussischen Akademie der Wissenschaften zu Berlin* 1871: 580 [type locality: "Sarawak"].

Rhacophorus anodon Van Kampen, 1907, *Zoologische Ergebnisse einer reise in Niederländisch Ost-Indien* 4: 400 [type locality: "Schlucket bei Ajer Mantiur (Kaju tanam)," Sumatra].

DISTRIBUTION. Peninsular Myanmar (Tanintharyi); peninsular Thailand southward through Malay Peninsula into Sumatra, Borneo, and Philippines.

HABITAT. Arboreal; evergreen forests.

***Philautus cinerascens* (Stoliczka, 1870)**

Mon Shrubfrog

Ixalus cinerascens Stoliczka, 1870, *Proceedings of the Asiatic Society of Bengal* 1870: 275 [type locality: "Ataran river, east of Moulmein [=Mawla-myne] (Tenasserim Province)," Mon State, Myanmar].

DISTRIBUTION. Known only from type locality in southern Peninsular Myanmar (Mon).

HABITAT. Terrestrial; adjacent to forest streams.

COMMENT. None seen since its description.

***Philautus kempii* (Annandale, 1912)**

Kemp's Shrubfrog

Megalophrys kempii Annandale, 1912, *Records of the Indian Museum* 8: 20 [type locality: "Upper Rotung (2,000 ft.)," Arunachal Pradesh, India].

DISTRIBUTION. Possibly in northern Myanmar (Kachin or Sagaing); from Assam, India, to extreme eastern Tibet.

HABITAT. Semiarboreal, along mountain streams.

***Philautus tyttus* Smith, 1940**

Tyttth Shrubfrog

Philautus tyttus Smith, 1940, *Records of the Indian Museum* 42: 475 [type locality: "Hkamti Plain, N Burma-Tibet frontier," Kachin State, Myanmar].

DISTRIBUTION. Northern Myanmar (Kachin); possibly adjacent Yunnan, China.

HABITAT. Semiarboreal, along mountain streams.

***Polypedates braueri* (Vogt, 1911)**

Upland Treefrog

PLATE 4D

Rhacophorus braueri Vogt, 1911, *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1911: 180 [type locality: "Insel Formosa" (Taiwan)].

DISTRIBUTION. Northern Myanmar (Kachin); through southern China to Taiwan.

HABITAT. Arboreal; usually forested area.

COMMENT. Rahman et al. (2020) reported a specimen from Kachin.

***Polypedates discantus* Rujirawan, Stuart, and Aowphol, 2013**
Malayan Slender Treefrog

Polypedates discantus Rujirawan, Stuart, and Aowphol, 2013, *Zootaxa* 3703: 554 [type locality: “Thung Tam Sao, Hat Yai District, Songkhla Province, Thailand, N06°56′24.9″ E100°15′15.8″, 61 m elevation”].

DISTRIBUTION. Peninsular Myanmar (Tanintharyi); peninsular Thailand and Malaysia.

HABITAT. Arboreal; forested to agricultural areas.

***Polypedates leucomystax* (Gravenhorst, 1829)**
White-Lipped Treefrog or Four-Lined Treefrog

FIGURE 2.34

Hyla leucomystax Gravenhorst, 1829, *Deliciae Musei Zoologici Vratislavensis. Fasciculus primus*, . . . *Batrachia*: 26 [type locality: “Java”].

Hyla sexvirgata Gravenhorst, 1829: 28, *Deliciae Musei Zoologici Vratislavensis. Fasciculus primus*, . . . *Batrachia*: 26 [type locality: “Java”].

Hyla quadrilineata Wiegmann, 1834, *Nova Acta Physico Medica, Academiae Caesarea Leopoldino Carolinae, Halle* 17: 260 [type locality: “Java”].

Polypedates rugosus Duméril and Bibron 1841, *Erpétologie générale, ou, Histoire . . . reptiles* 8: 520 [type locality: “Java . . . Manille (= Manila, Philippines)”].

Polypedates quadrilineatus Günther, 1859 [1858], *Catalogue of the Batrachian Salientia . . . British Museum*: 79 [type locality: not given].

Limnodytes celebensis Fitzinger, 1861 [1860], *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Mathematisch . . . , Wien*: 413 [type locality: “Celebes”]. *Nomen nudum*.

FIGURE 2.34. Portrait of *Polypedates leucomystax*. Chatthin Wildlife Sanctuary, Myanmar.

Rhacophorus maculatus var. *quadrilineata* [sic] Boulenger, 1882, *Catalogue of the Batrachia Salientia s. Ecaudata . . . British Museum*, 2nd ed.: 84.

Hylorana longipes Fischer, 1885, *Archiv für Naturgeschichte* 51: 47 [type locality: “Pagat Distrikt, Batang Alai,” Kalimantan, Borneo-Indonesia].

Hyla wirzi Roux, 1927, *Revue Suisse de Zoologie* 34: 121 [type locality: “Région du lac Sentani, Nouvelle-Guinée hollandaise septentrionale,” Papua, Indonesia].

Rhacophorus kampeni Ahl, 1927, *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1927: 43 [type locality: “Sumatra”].

DISTRIBUTION. Mainland Myanmar (Ayeyarwady, Bago, Chin, Kachin, Kayah, Kayin, Magway, Mandalay, Rakhine, Sagaing, Shan, Yangon) and peninsular Myanmar (Mon, Tanintharyi); southern China and Southeast Asia to western New Guinea and the Philippines.

HABITAT. Arboreal; broadly in disturbed habitats with a shrub or tree border.

COMMENTS. *Polypedates leucomystax* presently represent a species complex with a multitude of undefined species. For example, Orlov et al. (2001) concluded that at least five species were subsumed under *leucomystax* in Vietnam, and similarly, Brown et al. (2010) showed in a phylogeographic study of mtDNA that multiple species existed beneath the *leucomystax* epithet. Aside from the hidden diversity within these frogs, many frogs identified as *P. leucomystax* are misidentified.

***Polypedates maculatus* (Gray, 1830)**
Common Indian Treefrog

Hyla maculata Gray, 1830, *Illustrations of Indian Zoology: Chiefly . . . Hardwicke*, vol. 1, part 3: pl. 82 [type locality: “Bengal,” India, and Bangladesh]. Original description not seen.

Bürgeria maculata Tschudi, 1838, *Classification der Batrachier, . . . Abteilung der Reptilien* 34: 34, 75 [type locality: “Malabar,” India].

Rhacophorus acanthostomus Werner, 1901, *Zoologischer Anzeiger* 24: 98 [type locality: “Ratnapura, Ceylon”].

Rhacophorus maculatus himalayensis Annandale, 1912, *Records of the Indian Museum* 8: 14 [type locality: “The Eastern Himalayas, Assam, western China”].

DISTRIBUTION. Mainland Myanmar (Chin, Magway); widespread in peninsular India from southern Nepal and Bangladesh to Sri Lanka.

HABITAT. Arboreal; broadly in disturbed habitats with a shrub or tree border.

***Polypedates megacephalus* Hallowell, 1861**
Big-Headed Treefrog

Polypedates megacephalus Hallowell, 1861 [1860], *Proceedings of the Academy of Natural Sciences of Philadelphia* 12: 507 [type locality: “Hong-Kong, China”].

Polypedates maculatus var. *unicolor* Müller, 1878, *Verhandlungen der Naturforschenden Gesellschaft in Basel* 6: 585 [type locality: “China”]. *Nomen nudum*.

DISTRIBUTION. Northern mainland Myanmar (Kachin, Shan); Northeast India, southern China, Thailand, Laos, and northern Vietnam.

HABITAT. Arboreal; broadly in disturbed habitats with a shrub or tree border.

Polypedates mutus (Smith, 1940)

Upland Treefrog

Rhacophorus mutus Smith, 1940, *Records of the Indian Museum* 42: 473 [type locality: "Htingnan, Sumpura Bum, Kajiti, N'Gumla, N'Chang Yang," Kachin, Myanmar].

DISTRIBUTION. Mainland (Bago, Kachin, Shan) and peninsular (Tanintharyi) Myanmar; adjacent southern China, northern Laos, northern Thailand, and Vietnam.

HABITAT. Arboreal; broadly in disturbed habitats with a shrub or tree border.

Polypedates teraiensis (Dubois, 1987)

Terai Treefrog

Rhacophorus (*Rhacophorus*) *leucomystax teraiensis* Dubois, 1987 [1986], *Alytes* 5: 81 [type locality: "Belberi, 210 m, Est-Népal"].

DISTRIBUTION. Mainland Myanmar (Bago, Kayah, Sagaing, Yangon) and peninsular Myanmar (Tanintharyi); Nepal and northern India through Bangladesh.

HABITAT. Arboreal; broadly in disturbed habitats with a shrub or tree border.

COMMENTS. This taxon likely occurs across southern mainland Myanmar, that is, Rakhine through to Mon, but difficulties in identification and segregation from *P. leucomystax* have led to its misidentification as the latter species. Specimens from Bago, Sagaing, and Yangon were confirmed as *P. teraiensis* by sequence data (Mulcahy et al., 2018).

Raorchestes andersoni (Ahl, 1927)

Tuberculate Shrubfrog

Ixalus tuberculatus Anderson, 1879, *Anatomical and Zoological Research* 1878: 845 [type locality: "Nampoung [=Nanben River] in the centre of the Kakhien Hills," Yingjiang County, Yunnan, China].

Rhacophorus andersoni Ahl, 1927, *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1927: 36. Replacement name for *Ixalus tuberculatus* Anderson, 1879.

DISTRIBUTION. Presumed northern Myanmar (Kachin); adjacent Northeast India, Tibet, and Yunnan.

HABITAT. Arboreal; forest edges and marshes.

Raorchestes longchuanensis (Yang and Li, 1978)

Longchuan Shrubfrog

Philautus longchuanensis Yang and Li in Yang, Su, and Li, 1978, *Amphibians and Reptiles of Gaoligongshan*: 37 [type locality: "Jangjiang and Longchuan, Yunnan Province, China, 1500–1600 m elevation"].

DISTRIBUTION. Northern mainland Myanmar (Kachin, Sagaing); bordering Yunnan and reported from Vietnam and Bangladesh.

HABITAT. Arboreal; forest edges and mountain streams.

Raorchestes parvulus (Boulenger, 1893)

Dwarf Shrubfrog

Ixalus parvulus Boulenger, 1893, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 13: 342 [type locality: "District of the Karin Bia-po," Kayah State, Myanmar].

DISTRIBUTION. Mainland Myanmar (Bago, Chin, Kachin, Kayah, Rakhine, Sagaing); northern Thailand and Laos to northern Vietnam and in northwestern Malaysia.

HABITAT. Arboreal; forest edges and mountain streams.

Rhacophorus bipunctatus Ahl, 1927

Double-Spotted Orange-Webbed Whipping Treefrog

PLATE 4E

Rhacophorus maculatus Anderson, 1871, *Journal of the Asiatic Society of Bengal* 40: 27 [type locality: "Khasi Hills," India].

Rhacophorus bimaculatus Boulenger, 1882, *Catalogue of the Batrachia Salientia s. Ecaudata* . . . *British Museum*, 2nd ed.: 90. Replacement name for *Rhacophorus maculatus* Anderson, 1871, a secondary homonym of *Hyla maculata* Gray, 1830, when the latter is in *Rhacophorus*.

Rhacophorus bipunctatus Ahl, 1927, *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1927: 46. Replacement name for *Rhacophorus bimaculatus* Boulenger, 1882, a junior secondary homonym of *Leptomantis bimaculata* Peters, 1867 (now = *Rhacophorus bimaculata*).

Rhacophorus htuwini Wilkinson, Thin, Lwin, and Shein, 2005, *Proceedings of the California Academy of Sciences*, ser. 4, 56: 43 [type locality: "Nagmung Township, Au Yin Ga Camp (27° 17' 36.9" N, 97° 51' 45.3" E), Putao District, Kachin State, Myanmar, elevation approximately 878 m"].

DISTRIBUTION. Mainland Myanmar (Chin, Kachin, Kayah, Mandalay, Rakhine, Sagaing, Shan) and peninsular Myanmar (Tanintharyi); Northeast India and adjacent Bangladesh through southern China and adjacent Laos, Thailand, Vietnam, Cambodia, and Peninsular Malaysia.

HABITAT. Arboreal, secondary forest near water courses.

Rhacophorus kio Ohler and Delorme, 2006

Black-Webbed Whipping Treefrog

Rhacophorus kio Ohler and Delorme, 2006, *Comptes Rendus Biologies* 329: 90 [type locality: "Long Nai, Nam Lan Forest Conservation Area, Buon Tai County, Phongsaly Province, Laos"].

DISTRIBUTION. Peninsular Myanmar (Tanintharyi); northern Laos and Thailand to northern Vietnam and adjacent China.

HABITAT. Arboreal, secondary forest near or over water courses.

***Rhacophorus nigropalmatus* Boulenger, 1895**

Wallace's Whipping Treefrog

FIGURE 2.35

Rhacophorus nigropalmatus Boulenger, 1895, *Annals and Magazine of Natural History*, ser. 6, 16: 170 [type locality: "Akar River," Sarawak, Malaysia].

DISTRIBUTION. Peninsular Myanmar (Tanintharyi); peninsular Thailand south through Malay Peninsula to Sumatra and Borneo.

HABITAT. Arboreal, secondary forest near or over water courses.

***Rhacophorus norhayatii* Chan and Grismer, 2010**

Orange-Sided Whipping Treefrog

Rhacophorus norhayatii Chan and Grismer, 2010, *Zootaxa* 2505: 42 [type locality: "Bunker Trail (01°51.759N 103°53.186E; 20 m asl.), Gunung Pantí Bird Sanctuary in the Gunung Pantí forest Reserve, Johor, Peninsular Malaysia"].

FIGURE 2.35. Portrait of *Rhacophorus nigropalmatus*. From Boulenger (1912: fig. 71).

DISTRIBUTION. Peninsular Myanmar (Tanintharyi), southern Thailand, and Peninsular Malaysia.

HABITAT. Arboreal, forest near water.

***Rhacophorus rhodopus* Liu and Hu, 1960**

Red-Webbed Whipping Treefrog

Rhacophorus rhodopus Liu and Hu, 1960, *Acta Zoologica Sinica* (1959) 11: 525 [type locality: "Meng-yang, Yunnan, 680 meters altitude," China].

Rhacophorus namdaphaensis Sarkar and Sanyal, 1985, *Records of the Zoological Survey of India* 81: 290 [type locality: "Namdapha camp (alt. 350 m.), ca. 58 km. from Miao, Tirap district, Arunachal Pradesh, India"].

DISTRIBUTION. Mainland Myanmar (Kachin, Shan); elsewhere Northeast India (Arunachal Pradesh) to northern Thailand, Laos, Vietnam, and southern China (Yunnan, Guangxi, and Hainan).

HABITAT. Arboreal, forest near water.

***Rhacophorus turpes* Smith, 1940**

Htingnan Whipping Treefrog

Rhacophorus turpes Smith, 1940, *Records of the Indian Museum* 42: 474 [type locality: "26° 36' N, 97° 52' E . . . Htingnan," Kachin State, Myanmar].

DISTRIBUTION. Northern Myanmar (Kachin); no records other than that of the type specimen.

HABITAT. Arboreal, forest.

COMMENT. Our MHS surveys did not observe this treefrog.

***Rhacophorus verrucopus* Huang, 1983**

Beibeng Whipping Treefrog

Rhacophorus verrucopus Huang, 1983, *Acta Herpetologica Sinica, Chengdu*, n.s., 2(4): 63 [type locality: "Beibeng, Medo Xian (=Medog County), altitude 850 m," Xizang Autonomous Region (Tibet), China].

DISTRIBUTION. Northern Myanmar (Sagaing) and adjacent Tibet.

HABITAT. Arboreal, evergreen forest.

COMMENT. Our MHS surveys did not observe this treefrog.

***Rohanixalus hansenae* (Cochran, 1927)**

Hansen's Bubble-Nest Frog

Philautus hansenae Cochran, 1927, *Proceedings of the Biological Society of Washington* 40: 179 [type locality: "at Nong Khor, southeastern Siam"].

DISTRIBUTION. Expected in southeastern and peninsular Myanmar; southern and peninsular Thailand.

HABITAT. Semi-arboreal, in disturbed habitats.

COMMENT. Biju et al. (2020) revised the small rhacophorid bushfrogs (*Chirixalus*, *Feihyla*) and assigned some of the species of each to a new genus, *Rohanixalus*.

***Rohanixalus punctatus* (Wilkinson, Htun Win, Thin Thin, Kyi Soe Lwin, Shein, and Hla Tun, 2003)**

Black Spotted Bubble-Nest Frog

Chirixalus punctatus Wilkinson, Htun Win, Thin Thin, Kyi Soe Lwin, A. W. Shein, and Hla Tun, 2003, *Proceedings of the California Academy of Sciences*, ser. 4, 54: 18 [type locality: "Rakhine Yoma Elephant Wildlife Sanctuary Headquarters (17°36'48.8" N, 94°36'50.2" E), Gwa, Gwa Township, Rakhine State, Myanmar"].

DISTRIBUTION. Southwestern Myanmar (Rakhine); known only from the area of the type locality.

HABITAT. Semiarboreal, terrestrial; human-disturbed habitats.

***Rohanixalus vittatus* (Boulenger, 1887)**

Two-Striped Bubble-Nest Frog

PLATE 4F

Ixalus vittatus Boulenger, 1887, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 5: 421 [type locality: "Bhamò," Kachin State, Myanmar].

DISTRIBUTION. Mainland Myanmar (Bago, Kachin, Rakhine, Shan, Yangon) and peninsular Myanmar (Tanintharyi); Northeast India and adjacent Bangladesh through Myanmar to southern China, Thailand, and Indochina.

HABITAT. Semiarboreal, usually in grassy habitats.

***Theloderma asperum* (Ahl, 1927)**

Pied Warty Treefrog

Ixalus asper Boulenger, 1886, *Proceedings of the Zoological Society of London* 1886: 415 ["Hill Garden, Larut, Perak, at an altitude of 3300 feet," Malaysia].

Rhacophorus asperimus Ahl, 1927, *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1927: 32. Replacement name for *Ixalus asper* Boulenger, incorrectly considered to be preoccupied by *Rana aspera* Boulenger, 1882 (= *Mantidactylus aspera*).

DISTRIBUTION. Mainland Myanmar (Kachin, Kayah, Sagaing, Shan); elsewhere Northeast India, adjacent China, Thailand, Laos to Vietnam, northern Malaysia, and Sumatra.

HABITAT. Arboreal, forests near streams and edges of ponds and lakes.

COMMENTS. Our MHS surveys did not find individuals identified to this species in peninsular Myanmar where they would be expected to occur given the type locality. The northern localities listed in the above distribution are likely representatives of an undescribed species.

***Theloderma phrynomerma* (Ahl, 1927)**

Tenasserim Warty Treefrog

Phrynomerma asperum Boulenger, 1893, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 13: 342 [type locality: "Thao," Kayah State, Myanmar]. Secondary homonym of *Ixalus asper* Boulenger, 1886.

Rhacophorus phrynomerma Ahl, 1927, *Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin* 1927: 47. Replacement name for *Phrynomerma asperum* Boulenger, 1893.

DISTRIBUTION. Southeast mainland Myanmar (Kayah) and peninsular Myanmar (Tanintharyi).

HABITAT. Arboreal, forest near streams, apparently favors bamboo clumps.

***Theloderma pyaukkya* Dever, 2017**

Burmese Warty Treefrog

Theloderma pyaukkya Dever, 2017, *Journal of Herpetology* 51: 430 [type locality: "Lwe Aein Stream, Indawgyi Wildlife Sanctuary, Hepu Village, Mohnyin Township, Kachin State, Myanmar, 25.05531°N, 96.24225°E, 266 m"].

DISTRIBUTION. Mainland Myanmar (Chin, Kachin).

HABITAT. Arboreal, forest near streams.

***Zhangixalus burmanus* Andersson, 1939**

Burmese Gliding Treefrog

Polypedates (Rhacophorus) demmysii burmana Andersson, 1939, *Arkiv för Zoologi* 30(32): 1 [type locality: "little village of Kambaiti situation in N. East Burma near the border of China in a highland 2,000 m above sea-level," Myanmar]. Original description not seen.

Rhacophorus taronensis Smith, 1940, *Records of the Indian Museum* 42: 473 [type locality: "27° 38' N, 98° 10'E . . . Patsalamdam," Kachin State, Myanmar].

Rhacophorus gongshanensis Yang and Su, 1984, *Acta Herpetologica Sinica, Chengdu*, n.s., 3(3): 51 [type locality: "Pumansao [=Pumanshao], Baoshan County, Yunnan; altitude 1880 m," China].

DISTRIBUTION. Northern Myanmar (Kachin); southwestern China, northern Laos, and Thailand to northern Vietnam.

HABITAT. Arboreal, vicinity of forest streams and ponds.

***Zhangixalus demmysi* (Blanford, 1881)**

Dennys' Gliding Treefrog

Rhacophorus demmysi Blanford, 1881, *Proceedings of the Zoological Society of London* 1881: 224 [type locality: presumably "China"].

Rhacophorus exiguous Boettger, 1894, *Bericht der Senckenbergischen Naturforschenden Gesellschaft in Frankfurt am Main* 1894: 148 [type locality: "Chinhai bei Ningpo," China].

Rhacophorus albotaeniata Vogt, 1927, *Zoologischer Anzeiger* 69: 287 [type locality: "Südchina"].

Rhacophorus feyi Chen, 1929, *China Journal of Science and Arts, Shanghai* 10: 198 [type locality: "Yaoshan (= Dayao Shan), Kwangsi (= Guangxi Zhuang Autonomous Region)," China].

DISTRIBUTION. Presumably in northern mainland Myanmar; southern China, Laos, and northern Vietnam.

HABITAT. Arboreal, vicinity of forest streams and ponds.

COMMENT. Our MHS survey teams did not encounter this species.

***Zhangixalus feae* Boulenger, 1893**

Fea's Gliding Treefrog

Rhacophorus feae Boulenger, 1893, *Annali del Museo Civico di Storia Naturale di Genova*, ser. 2, 13: 339 [type locality: "Thao," Kayah State, Myanmar].

DISTRIBUTION. Southeast mainland Myanmar (Kayah); southwestern China, northern Laos, and Thailand to northern Vietnam.

HABITAT. Arboreal, secondary forest near water courses

COMMENT. Our MHS surveys did not encounter this species.

***Zhangixalus smaragdinus* (Blyth, 1852)**

Emerald Gliding Treefrog

Polypedates smaragdinus Blyth, 1852, *Journal of the Asiatic Society of Bengal* 21: 355 [type locality: "Naga hills, Asám," India].

Rhacophorus maximus Günther, 1858, *Archiv Naturgeschichte* 24: 325 [type locality: "Nepal," "Afghanistan"].

Rhacophorus gigas Jerdon, 1870, *Proceedings of the Asiatic Society of Bengal* 1870: 84 [type locality: "Sikkim and Khasi Hills," India].

DISTRIBUTION. Northern mainland Myanmar (Kachin, Sagaing); Nepal to Bangladesh, Northeast India, and adjacent China.

HABITAT. Arboreal, vicinity of forest streams and ponds.

COMMENT. A recent survey in the Zalon conservation area reported this species (fide D. G. Mulcahy, personal communication, 2019).

NOTES – AMPHIBIANS

1. Familial classification follows Frost et al. (2006) and Frost's (2012, 2020) subsequent modifications posted in "Amphibian Species of the World, an Online Reference" (ASW); species content of the families, subfamilies, and genera similarly follows this online reference. The preceding checklist was current with the online reference (ASW, version 6.0) as of 30 May 2020. The classification modifications and discussion of Blackburn and Wake (2011) do not alter the content or nomenclature followed in this monograph. Each species account's Comment section in "Amphibian Species of the World" provides a wealth of information on nomenclature, relationships, distributions, and biology. I have not attempted to duplicate that information and regularly borrowed from Frost's comments to highlight a taxonomic or phylogenetic observation.
2. Prior to the MHS, a single species of caecilian occurred in Myanmar, and its name, *Ichthyophis glutinosus*, is no longer appropriate for

any Burmese caecilians. Our survey has demonstrated that Burmese caecilians are more widespread and diverse (Ayeyarwady, Bago, Rakhine, Tanintharyi) than previously suspected. The MHS specimens are under study by D. Gower and M. Wilkinson, and one species was recently described. I provide names for *Ichthyophis* species that occur in adjacent Thailand and China and for another species of the recently recognized chikilids of Northeast India. One or more of these extra-Myanmar species may be the appropriate taxon for one or more of the MHS population vouchers.

3. For most of the twentieth century *Rana limncharis* was the name used for a widespread group of grassfrogs; then briefly, in the 1980s it was *Limnonectes* when they were no longer recognized as members of the family Ranidae, and finally, in the 1990s the name was changed to *Fejervarya*. Whatever the generic name, "limncharis" was widely used to identify any medium-sized Grassfrog captured in Southeast Asia. The shift to *Fejervarya limncharis* began when Iskandar (1998) used *Fejervarya* as a full species for *limncharis* in his field guide to frogs of Java and Bali. This usage was reinforced by Dubois and Ohler's (2000) examination and redescription of type specimens of *Rana limncharis* Gravenhorst. These actions led to the widespread usage of *Fejervarya limncharis* in the literature on tropical Asian frogs.

Subsequently, Dubois et al. (2001) recognized that *Fejervarya* consisted of two lineages: *Minervarya*, a groups of small (<45 mm SVL) frogs predominantly from South Asia, and *Fejervarya*, a group of medium-sized (>42 mm SVL) frogs predominantly from Southeast Asia and the Sundas. The distribution of these two genera and their component species in Myanmar was recently demonstrated by Köhler et al. (2019).

4. The species assignment in and among *Brachytarsophrys*, *Megophrys*, *Xenophrys*, and other proposed genera remains uncertain. Frost (2020, ASW 6.0, accessed 13 May 2020) reviews the usage of *Megophrys* and *Xenophrys* and notes widespread disagreement on what species belong in the various species lineages associated with these two genera. That confusion, that is, the paraphyly of the species associated with either name, is not resolved by the use of *Megophrys*, but nevertheless, *Megophrys* has become the name of common usage. Many, likely most, museum specimens of this complex are incorrectly identified or identified as "sp."

The CAS collection contains more than 200 Burmese specimens of *Megophrys*. Of these specimens, more than half have not been identified, and certainly, some represent new species. Further, the identified species may be incorrectly identified; for example, see the Comment section in the *M. parva* account.

5. Since the beginning of the twentieth century, the number of rhacophorid genera and species has increased significantly. Further, I recognize these Asian treefrogs as a distinct family and one of the five most diverse anuran clades. The systematic and phylogenetic history of this clade is detailed on Frost's "Amphibian Species of the World" web page. I wish to note only two nomenclatural changes that have occurred during the MHS herpetofaunal surveys and subsequent analyses. The small grassland-shrub treefrog was known as *Chiromantis*, and its species are now in *Chirixalus* and *Rohanixalus*. Similarly, the species of *Rhacophorus* currently reside in *Leptomantis*, *Rhacophorus*, and *Zhangixalus*. The recent study by Chen et al. (2020) revealed the diversity and phylogenetic relationships within this family, and Biju et al. (2020) revised the small Bushfrogs.

3. Crocodilians and Turtles

KEY TO CROCODILIANS

1. Head long and narrow, snout length 2.5 to 3 times longer than eye to ear distance [Figure 3.1B]; many teeth protruding from upper and lower jaws when closed *Gavialis gangeticus*
- 1'. Head long and broad, snout length 1.5 to 2 times longer than eye to ear distance [Figure 3.1A]; only fourth mandibular tooth outside the mouth when jaws closed 2
2. Transverse row of four enlarged occipital osteoderms on neck immediately behind head; four to six modest-sized osteoderms in cervical cluster [Figure 3.1C], osteoderms usually in contact *Crocodylus palustris*
- 2'. No enlarged osteoderms immediately behind head, nuchal surface covered with compact rows of scales; typically four to six large osteoderms in cervical cluster [Figure 3.1D], osteoderms often slightly separated *Crocodylus porosus*

FIGURE 3.1. Identification features of crocodilians: (A) head of *Crocodylus palustris*, dorsal view, (B) head of *Gavialis gangeticus*, dorsal view, (C) neck of *Crocodylus palustris*, dorsal view, and (D) neck of *Crocodylus porosus*, dorsal view.

CHECKLIST OF CROCODILES¹

CROCODILIA GMELIN, 1789

CROCODYLIDAE CUVIER, 1807

Crocodylus palustris Lesson, 1831

Mugger Crocodile

Crocodylus palustris Lesson, 1831, *Bulletin des sciences naturelles et de géologie*, Paris 25: 121 [type locality: “les mariais saumâtres; ne va jamais dans le Gange”].

Crocodylus vulgaris var. *indicus* Gray, 1830, *Synopsis Reptilium*; . . . Part 1: *Cataphracta* . . . : 58 [type locality: not given].

Crocodylus bombifrons Gray, 1844, *Catalogue of Turtles, Crocodilians*, . . . *British Museum*: 59 [type locality: “India”].

Champsse brevirostris Werner 1933, *Zoologischer Anzeiger* 102: 100 [type locality: “Afrika”].

Crocodylus palustris kimbula Deraniyagala, 1936, *Spolia Zeylanica* 19(3): 284 [type locality: “low country of Ceylon”].

DISTRIBUTION. Occurrence in Myanmar not confirmed; Pakistan and peninsular India eastward to Assam and Bangladesh.

HABITAT. Freshwater streams and lakes.

COMMENT. In his field guide, Das (2010a) listed *C. palustris* in Myanmar. This record apparently arises from a nineteenth century report of a *C. palustris* from Burma that has not been confirmed (Thorbjarnarson et al., 2006).

Crocodylus porosus Schneider, 1801

Saltwater Crocodile

Crocodylus porosus Schneider, 1801, *Historiae amphibiorum naturalis et literariae, fasciculus secundus* . . . 2: 159 [type locality: not given].

Crocodylus oopholis Schneider, 1801, *Historiae amphibiorum naturalis et literariae, fasciculus secundus* . . . 2: 165 [type locality: not given].

Crocodylus natans Meyer, 1795, *Synopsis reptilium* . . . : 20 [type locality: “Ceylonam”].

Crocodylus biporcatus Cuvier, 1807, *Annales du Muséum d'histoire naturelle*, Paris 10: 48 [type locality: not given].

Oopholis Pondcherrianaus Gray, 1862, *Annals and Magazine of Natural History* 10: 268 [type locality: “Pondichery”].

DISTRIBUTION. Formerly widespread along entire coastline of Myanmar, now more restricted with a self-supporting

population in the Meinmahla Kyun Wildlife Sanctuary and the adjacent reserve forest (Ayeyarwady Division) and in scattered localities in southern coastal Tanintharyi and adjacent Mergui Archipelago; elsewhere Sri Lanka and southern India eastward through Southeast Asia, the Sundas, and New Guinea to Palau and Vanuatu and northern coast of Australia.

HABITAT. Mainly associated with mangrove swamps and estuarine waterways, although occurring upstream of river mouths in fresh water.

COMMENTS. Thorbjarnarson et al. (2006) reviewed the purported records of crocodilians in Myanmar. *Crocodylus palustris*, *C. siamensis*, and *Tomistoma schlegelii* have been variously reported for Burma; however, none of these reports have been confirmed. More recently Platt et al. (2012a, 2014d, 2015) confirmed the presence of *C. porosus* in Tanintharyi.

GAVIALIDAE ADAMS, 1854

Gavialis gangeticus (Gmelin, 1789)

Gharial

Lacerta gangetica Gmelin in Linnaeus, 1789, *Systema Naturae per Regna Tria Naturae*, 13th ed., vol. 1: 1057. [type locality: “Senegal et Ganges”].

DISTRIBUTION. Presumably now extinct in Myanmar as there have been no confirmed sightings of this species in Burmese rivers for the past 50 years; formerly, it was reported from Kolandon River (Rakhine) and Maingtha-Mindung (Upper Burma). Elsewhere, its distribution has shrunk from a widespread occurrence in the Indus River of northern Pakistan and across northern India, including Nepal, in the Ganges, Mahanadi, and Brahmaputra Rivers and into Myanmar.

HABITAT. Small to large river with sand and gravel banks and areas of deep water.

COMMENTS. The Kolandon River and Maingtha-Mindung localities were reported in Wermuth and Merten's (1961) checklist. Thorbjarnarson et al. (2006) reported finding only a single record of the gharial: Shweli River, about 65 km from its confluence with the Ayeyarwady. This record is a 1927 Shan State record on the northwestern edge of the Shan Plateau. This locality was investigated in early 2012 (Win Ko Ko and Platt, 2012), and although no gharials were seen, reports from reliable sources strongly indicated the presence of a small population at that time.

KEY TO TURTLES

1. Forelimbs modified as winglike flippers; all digits fused and indistinct, only one to two claws visible on forefoot [Figure 3.2A] 2
- 1'. Forelimbs not modified as flippers; all digits distinct, even if joined by web, three or more claws visible on forefoot [Figure 3.2B] 5
2. Four pairs of pleural scutes on carapace [Figure 3.2C]; no contact between cervical and first pleural scute 3
- 2'. Five or more pairs of pleural scutes on carapace [Figure 3.2D], number may be different on left and right sides; no contact between cervical and first pleural scutes 4
- 2''. Except for hatchlings, no epidermal scutes on the carapace or plastron; seven longitudinal ridges on carapace *Dermochelys coriacea*

FIGURE 3.2. Morphological diagnostic features of sea turtle species: (A) forelimb, left flipper, of *Caretta*, dorsal view, (B) forelimb of *Morenia ocellata*, ventral view, (C) carapace of *Chelonia mydas*, dorsal view, with the first vertebral scute shaded, and (D) carapace of *Lepidochelys olivacea*, dorsal view. Abbreviations: P1, P2, P4, P5, first, second, fourth, and fifth pleural scutes, respectively; V1, first scute; V5, fifth and final vertebral scute.

3. One pair of prefrontal scales on snout [Figure 3.3A]; lower jaw strongly serrate; upper jaw not hooked in profile; posterior edge of carapace weakly serrate *Chelonia mydas*
- 3'. Two pairs of prefrontal scales on snout [Figure 3.3B]; lower jaw not serrate and spoon shaped; upper jaw strongly hooked in profile; posterior edge of carapace strongly serrate *Eretmochelys imbricata*
4. Bridge with three, uncommonly more, inframarginal scutes [Figure 3.3C]; inframarginal scutes without pores (often difficult to see); prefrontal scales often more and asymmetrical in shape *Caretta caretta*
- 4'. Bridge typically with four or five inframarginal scutes [Figure 3.3D]; each inframarginal scute with pore on its posterior border *Lepidochelys olivacea*
5. Head large, nearly one-quarter size/length of carapace; upper jaw strongly hooked downward at end; tail long, much longer than hindlimb *Platysternon megacephalum*
- 5'. Head moderate to small, less than one-eighth length of carapace; tail short, less than hindlimb length 6
6. Surface of carapace and plastron lacking epidermal scutes; snout protruding and snorkel-like [Figure 3.3E] 7
- 6'. Surface of carapace and plastron with hard, epidermal scutes; snout not elongate and snorkel-like 13
7. Plastron with femoral flaps (lobes) on posterior edge [Figure 3.3E]; carapace with peripheral bones, at least in posterior margin, usually not visible in living individuals 8
- 7'. Plastron without femoral plates (lobes) on posterior edge [Figure 3.3F]; carapace without peripheral bones 9
8. Anterior plastral (epiplastral) callosities large and distinctly elongate (oblong); first peripheral bones two or more times larger than subsequent ones; head green to olive with yellow spots *Lissemys punctata*
- 8'. Anterior plastral (epiplastral) callosities modest sized and circular to shorten obovate [Figure 3.3E]; first peripheral bones small, subequal to subsequent ones; head olive to brown, faded dark postorbital stripe *Lissemys scutata*
9. Seemingly short head protruding from thick gular collar [Figure 3.4A]; eyes far forward and close together, distance between eyes less than maximum diameter of orbit; overall coloration dark brown without midline stripe on carapace *Chitra vandijki*
- 9'. Moderate-sized head, rear half not hidden by gular collar [Figure 3.4B]; snout short or long; eyes on sides of head and broadly separated 10
10. Carapace pattern with four dark-centered ocelli or parts of ocelli, faded or absent in adults; large blunt tubercles on top of neck, especially on posterior half *Nilssonina formosa*
- 10'. Carapace pattern, uniform to variously mottled but without ocelli; no enlarged tubercles on neck 11

FIGURE 3.3. Morphological diagnostic features of turtle species: (A) head of *Chelonia mydas*, dorsal view, (B) head of *Eretmochelys imbricata*, dorsal view, (C) plastral bridge of *Caretta*, ventral view, (D) plastral bridge of *Lepidochelys*, ventral view, (E) plastron of *Lissemys scutata*, ventral view, and (F) plastron of *Amyda ornata*, ventral view, with plastral callosities shaded. Abbreviations: ca, plastral callosity; Ff, femoral flap; Im, inframarginal scute; M, marginal scute; Pf, prefrontal scale.

11. Snout short, shorter than diameter of orbit; head seemingly foreshortened by thick gular collar . . . *Pelochelys cantorii*
- 11'. Snout long, equal to or greater than orbital diameter; head without thick gular collar [Figure 3.4B] 12
12. Five well-developed callosities on plastron, medial one on entoplastron [Figure 3.3F]; large tubercles on front edge of carapace [Figure 3.4B] *Amyda ornata*
- 12'. Four weakly developed callosities, none on entoplastron; small or no tubercles on front edge of carapace *Dogania subplana*
13. Hindlimb columnar and elephant-like [Figure 3.4C]; four claws but no digits visible on hindfoot 25
- 13'. Hindlimb not columnar, dorsoventrally compressed and similar in shape to forelimb [Figure 3.4D]; usually five claws and digits visible on hindfoot 14
14. No bony bridge in adults, carapace and plastron joined by ligamentous joint, hence no axillary or inguinal scutes between carapace and plastron [Figure 3.4E] 15
- 14'. Bony bridge in juveniles and adults, at least on anterior half of plastron-carapace junction; usually anterior axillary and posterior inguinal scutes in bridge area [Figure 3.4F] 17
15. Freely moveable transverse hinge between pectoral-abdominal scutes [Figure 3.4E]; plastron can close shell completely 16
- 15'. Weakly flexible plastral hinge between pectoral-abdominal scutes; plastron cannot close shell completely; plastron entirely dark or with extensive dark-brown markings; crown of head uniformly greenish yellow to light brown . . . *Cyclemys fusca*
- 15''. Weakly flexible plastral hinge; plastron entirely dark or with many dark-brown markings; crown of head speckled with light to mid brown on dark-brown to gray background *Cyclemys oldhamii*
16. Posterior margin of carapace smooth (not serrate); carapace typically domed; head black with bright-yellow stripes on side of head *Cuora amboinensis*
- 16'. Posterior margin of carapace lightly serrate; carapace high but flattened on top with strong vertebral ridge; head brown with dark mottling and few light-colored spots *Cuora mouhotii*
17. Entire triturating (crushing) surface of upper jaw (maxilla) narrow and without median, longitudinal ridge [Figure 3.5A] 18
- 17'. Triturating surface of upper jaw broad, at least posteriorly [Figure 3.5B] and usually with one or two medial longitudinal ridges; ridges typically denticulate 23

FIGURE 3.4. Morphological diagnostic features of turtle species: (A) dorsal outline of *Chitra*, (B) head and neck of *Amyda ornata*, dorsal view (note tubercles on anterior margin of carapace), (C) hindlimb of *Indotestudo elongata*, posteroventral view, (D) hindlimb of *Morenia ocellata*, posteroventral view, (E) plastron and ligamentous connection to carapace of *Cuora amboinensis*, ventral view, (F) carapace-plastron bridge of *Siebenrockiella crassicollis* with axillary and inguinal scutes, ventral view, and (G) carapace-plastron bridge of *Morenia ocellata* lacking axillary and inguinal scutes, ventral view. Abbreviations: A, axillary scute; Ab, abdominal scute; An, anal scute; Fe, femoral scute; G, gular scute; gc, gular collar; Hu, humeral scute; I, inguinal scute; M, marginal scute; Pc, pectoral scute.

18. Carapace smooth or slightly serrate posteriorly; anterior margin of carapace mostly smooth, variously curved 19
- 18'. Carapace strongly serrate posteriorly [Figure 3.5C]; anterior margin of carapace spiny or jagged in juveniles, smoothing in adults *Heosemys spinosa*
19. Carapace lightly to moderately domed, with weak to strong middorsal keel; side of head without stripe or stripes 20
- 19'. Carapace lightly to moderately domed, with weak to strong middorsal keel and lateral keels present or absent; side of head weakly to strongly striped or boldly patterned 21
20. Carapace domed, smoothly convex dorsally; side of head finely mottled in green, yellow, and red in juveniles and young adults, becoming uniform gray in older adults; bridge uniformly yellow *Heosemys grandis*
- 20'. Carapace lightly domed, although flattened middorsally; plastral scute gray; bridge uniformly dark brown to black *Heosemys depressa*
21. Side of head with large red spot behind ear and numerous black and yellow stripes on neck; carapace lightly domed, middorsal ridge faint to absent; plastral scutes with large dark blotches *Trachemys scripta*
- 21'. Side of head with no large red spot; other stripes few and often fragmented; carapace typically with distinct middorsal keel and lateral ones variously developed 22
22. Digits of forefeet only half webbed, those of hindfoot barely webbed; three distinct yellow longitudinal stripes on carapace; uniform yellow plastron *Melanochelys tricarinata*
- 22'. Digits of forefeet and hindfoot fully webbed; carapace uniformly dark; plastron mostly brown to dark gray *Melanochelys trijuga*

FIGURE 3.5. Morphological diagnostic features of turtle species: (A) maxillary trituration surface of *Siebenrockiella crassicolis*, ventral view of skull, (B) broad, ridged maxillary trituration surface of *Batagur batagur*, ventral view of skull, (C) carapace of juvenile *Heosemys spinosa*, dorsal view, (D) carapace of *Geochelone elegans*, posterodorsal view, (E) carapace of *Indotestudo elongata*, lateral view. Abbreviations: M5, M6, M7, M11, 5th, 6th, 7th, and 11th marginal scutes; P2, second pleural scute; Sc, supracaudal scute; ts, trituration surface of upper jaw; V5, fifth vertebral scute.

23. Triturating surface of upper jaw narrower anteriorly and broader posteriorly and without medial ridge [Figure 3.5A]; small black turtle with broad head; light to white area or spot on side of head above tympanum; each plastral scute with broad dark marks on a yellowish background *Siebenrockiella crassicolis*
- 23'. Triturating surface of upper jaw very broad throughout its length, with strong medial ridge; carapace distinctly domed and each pleural scute typically with light-centered ocellus; plastron uniform (immaculate) yellow . . . *Morenia ocellata*
- 23''. Triturating surface of upper jaw moderate to very broad, at least posteriorly; posterior edge of carapace smooth or lightly notched 24
24. Triturating surface of maxilla (upper jaw) usually with one medial ridge, occasionally two ridges; five claws on forefoot; carapace dorsally flattened with middorsal keel and often with spines projecting from posterior edge of first three vertebral scutes *Batagur trivittata*
- 24'. Triturating surface of maxilla (upper jaw) with two medial ridges [Figure 3.5B]; four claws on forefoot; carapace domed and smooth *Batagur baska*²
25. Fifth, sixth, and seventh marginal scutes touch second pleural scute [Figure 3.5E] *Indotestudo elongata*
- 25'. Only fifth and sixth marginal scutes touch second pleural scute 26
26. Supracaudal scute subdivided into two scutes (paired 12th marginals) 27
- 26'. Single supracaudal scute, height and width nearly equal (single 12th marginal) [Figure 3.5D] 28
27. Carapace yellowish brown to brown; posterior marginal scutes strongly serrated; vertebral and pleural scutes concave; pectoral scutes in contact on midline [Figure 3.6A]; one large conical tubercles on thigh *Manouria impressa*
- 27'. Carapace uniformly dark brown, olive, or black; posterior marginal scutes only slightly serrated; vertebral and pleural scutes flat to slightly convex; pectoral scutes not in contact on midline [Figure 3.6B]; several large pointed tubercles on thigh *Manouria emys*

FIGURE 3.6. Morphological diagnostic features of tortoise species: (A) plastron of *Manouria impressa*, ventral view, (B) plastron of *Manouria emys*, ventral view, (C) second pleural scute of *Geochelone platynota*, lateral view, and (D) second pleural scute of *Geochelone elegans*, lateral view. Abbreviations: M, marginal scute, Pc, pectoral scute.

28. Carapace with starlike pattern on scutes, each costal scute with yellow spot dorsally and several yellow stripes radiating downward [Figure 3.6C]; plastral scutes with dark blotches or streaks on edges *Geochelone platynota*
- 28'. Carapace with starlike pattern on scutes, each costal scute with yellow spot dorsally and several yellow stripes radiating downward and others horizontally [Figure 3.6D]; plastral scutes with dark lines radiating inward from one corner *Geochelone elegans*³

CHECKLIST OF TURTLES^{4,5}

TESTUDINES BATSCH, 1788

CHELONIIDAE OPPEL, 1811

Caretta caretta (Linnaeus, 1758)

Loggerhead Seaturtle

Testudo Caretta Linnaeus, 1758, *Systema Naturae per Regna Tria Naturae*, 10th ed., 1: 197 [type locality: "insulas Americanas"].

Testudo marina Garsault, 1764, *Les Figures des plantes et animaux d'usage . . . Médecin*, 5: pl. 675, 6: 418 [type locality: "Isles Antilles"].

Testudo Cephalo Schneider, 1783, *Allgemeine Naturgeschichte der Schildkröten*, . . . *Arten*: 303 [type locality: not given].

Testudo nasicornis Lacépède, 1788, *Histoire naturelle des quadrupèdes ovipares et de serpents*, 1: 103 [type locality: "mers du nouveau Continent, voisins de l'équateur"]. *Nomen rejiciendum*; book rejected by the International Commission on Zoological Nomenclature (ICZN) because its nomenclature is not binominal.

Testudo Caouana Lacépède, 1788, *Histoire naturelle des quadrupèdes ovipares et de serpents*, 1: 103, substitute name for *Testudo caretta* Linnaeus. *Nomen rejiciendum*; book rejected by ICZN because its nomenclature is not consistently binominal.

T. caouana Bonnaterre, 1789, *Tableau encyclopédique . . . nature. Erpétologie*: 20 [type locality: "Les contrées chaudes de l'anciens . . . & Sardaigne & . . . de latitude"].

Testudo lauana Meyer, 1790, *Magazin für Thiergeschichte, Thieranatomie u. Thierarzenkunde*, Göttingen, 1: 82. *Nomen oblitum*.

Caretta nasuta Rafinesque, 1814, *Prodromo di Erpetologia Siciliana* . . . 2(9): 66 [type locality: "Sicilia" = Sicily].

Caretta atra Merrem, 1820, *Tentamen Systematis Amphibiorum*, 1: 17 [type locality: "Insel Ascension"].

Chelonia pelasgorum Valenciennes, in Bory de Saint-Vincent 1833, *Expédition scientifique de Moree . . . vertèbres*: pl. 6 [type locality: "sur la plage sablonneuse entre Arcadia et l'embouchure de la Neda," Greece].

Caouana elongata Gray, 1844, *Catalogue of Tortoises, Crocodilians, . . . British Museum*: 53 [type locality: not given].

Thalassochelys corticata Girard, 1858, *United States Exploring Expedition . . . Vol. 20: Herpetology*: 431 [type locality: "Madeira," Canary Islands].

Caretta gigas Deraniyagala, 1933, *Ceylon Journal of Science* 18: 66 [type locality: not given].

DISTRIBUTION. Potentially nesting (in limited numbers) along the entire coast of Myanmar; however, surveys of current nesting are limited (Ayeyarwady; Thorbjarnarson et al.,

2000; Platt et al., 2015) or unavailable as internal government documents. Worldwide in subtropical and temperate seas.

HABITAT. Hatchlings leave the beaches and spend several years in the open ocean. Postpelagic juveniles live in coastal lagoons and nearshore waters; larger juveniles and adults are neritic, from nearshore and estuarine situations to deeper coastal waters, usually less than 30 m deep. *Caretta caretta* requires wide sandy beaches with a vegetation-free supralittoral area for nesting.

Chelonia mydas (Linnaeus, 1758)

Green Seaturtle

Testudo mydas Linnaeus, 1758, *Systema Naturae per Regna Tria Naturae*, 10th ed., 1: 197 [type locality: “insulam Adscensionis”].

Testudo macropus Walbaum, 1782, *Chelonographia . . . natürlichen Urbildern*: 112 [type locality: not given].

Testudo viridis Schneider, 1783, *Allgemeine Naturgeschichte der Schildkröten, . . . Arten*: 299 [type locality: not given].

Testudo japonica Thunberg, 1787, *Königliga Vetenskaps Academiens Nya Handlingar*(2) 8: 178 [type locality: “Japan”].

Testudo marina vulgaris Lacépède 1788, *Histoire naturelle des quadrupèdes ovipares et de serpents*, 1: 54 [type locality: “contrees equatoriales”]. *Nomen rejiciendum*; book rejected by ICZN because its nomenclature is not consistently binominal.

Testudo viridis-squamosa Lacépède 1788, *Histoire naturelle des quadrupèdes ovipares et de serpents*, 1: 924 [type locality: “grande partie l’Amerique meridionale . . . fleuve des Amazones”]. *Nomen rejiciendum*; book rejected by ICZN because its nomenclature is not binominal.

Testudo macropus Gmelin in Linnaeus, 1789, *Systema Naturae . . . vol. 1*, part 3: 1038 [type locality: not given].

Testudo chloronotus Bechstein, 1800, *Herrn De la Ceped’s Naturgeschichte . . . Schlangen. Erster Band*: 107 [see Comment].

Testudo rugosa Daudin, 1801, *Histoire naturelle, générale et particulière, des reptiles*, 2: 37 [type locality: “la mer des Indes . . . environs trois degrés des îles Maldives”].

Testudo cepediana Daudin, 1801, *Histoire naturelle, générale et particulière, des reptiles*, 2: 50 [type locality: not given].

Chelonia virgata Schweigger, 1812, *Prodromus monographiae Cheloniorum*: 291 [type locality: “mari sub zona torrida”].

Caretta cepedii Merrem, 1820, *Tentamen Systematis Amphibiorum*, 1: 18 [type locality: not given], presumably a substitute for *cepediana* Daudin.

Caretta esculenta Merrem, 1820, *Tentamen Systematis Amphibiorum*, 1: 18 [type locality: “Oceano Atlantico”].

Caretta nasicornis Merrem, 1820, *Tentamen Systematis Amphibiorum*, 1: 18 [type locality: “Meer bei Amerika”].

Caretta thunbergi Merrem, 1820, *Tentamen Systematis Amphibiorum*, 1: 19 [type locality: “Japan”].

Chelonia lachrymata Cuvier, 1829, *Le règne animal distribué d’après son organisation, . . . l’anatomie comparée*, 2nd ed.: 13 [type locality: not given].

Chelonia maculosa Cuvier, 1829, *Le règne animal distribué d’après son organisation, . . . l’anatomie comparée*, 2nd ed.: 13 [type locality: not given].

Chelonia bicarinata Lesson, 1834, *Reptiles*, in Bélanger, *Voyage aux Indes-Orientales par le nord de l’Europe, . . . Zoologie*: 301 [type locality: not given].

Chelonia marmorata Duméril and Bibron, 1835, *Erpétologie générale, ou, Histoire . . . reptiles*, 2: 546 [type locality: “île de l’Ascension”].

Chelonia formosa Girard, 1858, *United States Exploring Expedition . . . Vol. 20: Herpetology*: 456 [type locality: “Feejee Islands”].

Chelonia temuis Girard, 1858, *United States Exploring Expedition . . . Vol. 20: Herpetology*: 459 [type locality: “Honden Island, Paumotu Group (=Tuamotu Islands, South Pacific); Tahiti and Eimo; Rosa Island (=Rose Atoll, American Samoa)”].

Chelonia albiventer Nardo, 1864, *Atti del Reale Istituto Veneto di Scienze, Lettere e Arti* (3) 9: 1420 [type locality: “Adriatico . . . prossimata del Porto di Malamocco,” Italy].

Chelonia agassizii Bocourt, 1868, *Annales des sciences naturelle. Zoologie et biologie animale*, ser. 5, 10: 122 [type locality: “embouchure du Nagualate . . . Pacifique,” Guatemala].

Chelonia lata Philippi, 1887, *Zoologische Garten* 28: 84 [type locality: “Insel Chiloe,” Chile].

Chelonia mydas carrinegra Caldwell, 1962, *Contributions in Science, . . . Los Angeles County* 61: 4 [type locality: “Bahia de Los Angeles, Baja California Norte, Mexico”].

DISTRIBUTION. Potentially nests along the entire coast of Myanmar; current nesting on coast of Ayeyarwady (Thorbjarnarson et al., 2000; Platt et al., 2015), Rakhine (S. Platt et al., 2007), and Tanintharyi (Platt et al., 2015). Worldwide in tropical and subtropical seas.

HABITAT. Hatchlings depart the beaches for open ocean and live pelagically for several years; postpelagic juveniles return to coastal lagoons and nearshore waters; larger juveniles and adults are neritic, from nearshore to deeper coastal waters, usually less than 10 m. They use wide sandy beaches typically with a vegetation-free supralittoral area for nesting.

COMMENT. *Testudo chloronotus* Bechstein, 1800 is commonly listed in synonymies, yet a search of the Smithsonian Libraries and Archives’ copy of Bechstein, 1800, *Herrn De la Ceped’s Naturgeschichte . . . Schlangen. Erster Band* revealed that there is no mention of *Testudo chloronotus*, only *Caretta* between pages 110 and 121 and on plate 1, figure 2.

Eretmochelys imbricata (Linnaeus, 1766)

Hawksbill Seaturtle

Testudo imbricata Linnaeus, 1766, *Systema Naturae per Regna Tria Naturae*, 12th ed., 1: 350 [type locality: “Mari Americano, Asiatico”].

T. nasicornis Bonnatere, 1789, *Tableau encyclopédique . . . nature. Erpétologie*: 21 [type locality: “La Zone torride, les mers du nouveau Continent”].

Chelonia radiata Cuvier, *Le règne animal distribué d’après son organisation, . . . l’anatomie comparée*, 2nd ed.: 14 [type locality: not given].

Chelonia griseam Eschscholtz, 1829, *Zoologischer Atlas, enthalten Abbildungen . . . den Jahren 1823–1826*: 13 [see Comments].

Chelonia pseudo-mydas Lesson, 1834, *Reptiles*, in Bélanger, 1834, *Voyage aux Indes-Orientales par le nord de l’Europe, . . . Zoologie*: 299 [type locality: “De l’Ocean atlantique”].

Chelonia pseudo-caretta Lesson, 1834, *Reptiles*, in Bélanger, 1834, *Voyage aux Indes-Orientales par le nord de l’Europe, . . . Zoologie*: 302 [type locality: “De l’Ocean atlantique”].

Caretta Bissa Rüppell, 1835, *Neue Wirbelthiere zu der Fauna von Abyssinen* gehörig: 4 [type locality: “im rothen Meere”].

Caretta squamosa Girard 1858, *United States Exploring Expedition* ... Vol. 20: *Herpetology*: 442 [type locality: “Sooloo Seas and Indian Ocean”].

Caretta rostrata Girard, 1858, *United States Exploring Expedition* ... Vol. 20: *Herpetology*: 446 [type locality: “Feejee Islands”].

Onchochelys kraussi Gray, 1873, *Proceedings of the Zoological Society of London* 1873: 398 [type locality: “Ocean, French Guiana”].

DISTRIBUTION. Hawksbills potentially occur along the entire coast of Myanmar; however, the only confirmed records are from the Thamihla Kyun Wildlife Sanctuary, Ayeyarwady Region (Platt et al., 2015), the central coast of Rakhine (S. Platt et al., 2007), and Lampi Marine National Park, Tanintharyi Region (Platt et al., 2015). Nesting is likely widespread among the islands of the Tanintharyi coast. Worldwide in tropical seas.

HABITAT. Juveniles to adults are neritic, typically occurring in nearshore areas with natural or artificial reef structures. They regularly nest on small islands with slight or no open beaches in areas of supralittoral scrub to forest.

COMMENTS. The Smithsonian Libraries and Archives’ copy of Eschscholtz’s atlas is a bound volume of five parts. The second through fifth volumes of the *Zoologischer Atlas* have no turtle accounts. The first volume (1829) has a single turtle account (*Chelonia olivacea*) on pages 2 and 3. There is no mention of *Chelonia griseam*. Aside from *Chelonia olivacea*, only *Chelonia cephalo* and *Ch. mydas* are mentioned.

Lepidochelys olivacea (Eschscholtz, 1829)

Olive Ridley Seaturtle

Chelonia olivacea Eschscholtz, 1829, *Zoologischer Atlas, enthalten Abbildungen und Beschreibungen neuer Thier, ... den Jahren 1823–1826. Erstes Heft*: 2 [type locality: not given]

Chelonia Dussumierii Duméril and Bibron, 1835, *Erpétologie générale, ou, Histoire ... reptiles*: 557 [type locality: “les mers de la Chine et sur la côte de Malabar”]. Substitute name for *C. olivacea* Eschscholtz, 1829.

Caouana Ruppellii Gray, 1844, *Catalogue of Tortoises, Crocodilians, ... British Museum*: 53 [type locality: “India?”].

Chelonia subcarinata Gray, 1844, *Catalogue of Tortoises, Crocodilians, ... British Museum*: 53. Ruppell’s manuscript name; *nomen nudum*.

Chelonia polyaspis Bleeker, 1857, *Natuurkundig Tijdschrift voor Nederlandsch Indie* 14: 239 [type locality: “Batavia” = Jakarta].

Chelonia dubia Gray, 1864, *Proceedings of the Zoological Society of London* 1864: 13. *Nomen nudum*.

Cephalochelys oceanica Gray, 1873, *Hand-list of the Specimens of Shield Reptiles in the British Museum*: 91 [type locality: not given]. *Nomen nudum*.

Cephalochelys oceanica Gray, 1873, *Proceedings of the Zoological Society of London* 1873: 408. Gray credited this name to his *Hand-list* (p. 91) and noted that a dealer “said it came from the West coast of America – he believed, Mexico.”

Thalassiochelys [sic] *tarapacana* Philippi, 1887, *Zoologische Garten*: 85 [type locality: “in Iquique,” Chile].

Thalassiochelys controversa Philippi, 1899, *Anales de la Universidad de Chile* 1899: 732 [type locality: “Quinteros,” Chile].

Caretta remivaga Hay, 1908, *Proceedings of the United States National Museum* 1908: 194 [type locality: “Ventosa Bay, Mexico”].

DISTRIBUTION. Nesting (in limited numbers) potentially occurs along the entire coast of Myanmar; however, surveys of current nesting are limited (Ayeyarwady: Thorbjarnarson et al., 2000; Rakhine: Platt et al., 2007) or unavailable as internal government documents. At the beginning of the twentieth century, there were three islands (Thamihla Kyu, Kaingthaung Kyun, Thaungkadun) with large (>100 females) nesting populations along the Patheingyi-Ayeyarwady-Bogale delta. Tropical waters of the eastern Pacific Ocean, northern Indian Ocean, and tropical Atlantic bordering western African and eastern South America.

HABITAT. Marine species; primarily epipelagic during nonreproductive periods, neritic and nearshore during nesting period.

COMMENTS. The nomenclatural history of the Olive Ridley is summarized by Zug et al. (1998). Frazier (2011) suggested the possibility that the abundance of *L. olivacea* has increased along the southeast coast of India (Gulf of Mannar) since the beginning of the twentieth century.

DERMOCHELYIDAE FITZINGER, 1843

Dermochelys coriacea (Vandelli, 1761)

Leatherback Seaturtle

Testudo coriacea sive *mercurii* Rondeletius, 1554, *Libri de piscibus marinis, in quibus verae piscium effigies* ... : ? [type locality: Mediterranean Sea]. Reference not seen.

Testudo coriacea Vandelli, 1761, *Epistola de Holothurio, et Testudine Coriacea and Celebrimum Carolum Linnaeum*: 1 [type locality: unknown]. Reference not seen.

Testudo arcuata Catesby, 1771, *Natural History of Carolina, Florida, and the Bahama Islands*: 40 [type locality: not given].

Testudo lyra Lacépède, 1788, *Histoire naturelle des quadrupèdes ovipares et de serpents* 1: 111. *Nomen rejiciendum*; book rejected by ICZN because its nomenclature is not binominal.

Testudo lyra Bonnaterre, 1789, *Tableau encyclopédique ... nature. Erpétologie*: 22 [type locality: “La Méditerranée, l’Océan ... la Zone torride”].

Testudo marina Wilhelm, 1794, *Unterhalt. Naturgesch., Amphibien*: 133 [type locality: unknown]. Reference not seen.

Testudo tuberculata Schoepf, 1801, *Historia Testudinum Iconibus Illustrata*: 123 or Schoepf, 1782–1801, *Naturgeschichte der Schildkröten* ... : 144 [type locality: not given]. Only to page 136 in *Historia Testudinum*, not in seaturtle section.

Chelonia lutaria Rafinesque, 1814, *Prodromo di Erpetologia Siciliana* ... 2(9): 66 [type locality: “Sicilia” = Sicily].

Sphargis mercurialis Merrem, 1820, *Tentamen Systematis Amphibiorum* 1: 19 [type locality: “Mari mediterraneo et Oceano atlantico”].

Dermochelys atlantica LeSueur, 1829, in Cuvier, *La Règne Animal ... Les Reptiles*: 14. *Nomen nudum*.

Sphargis mercurialis Merrem, 1820, *Tentamen Systematis Amphibiorum*, 1: 19 [type locality: “in Mari mediterraneo et Oceano atlantico”].

Sphargis coriacea var. *schlegelii* Garman, 1884, *Bulletin of the United States National Museum* 1884: 303 [type locality: "Tropical Pacific and Indian Oceans"].

Sphargis angusta Philippi, 1899, *Anales de la Universidad de Chile* 1899: 730 [type locality: "pescado cerca de Tocopilla," Chile].

DISTRIBUTION. Platt et al. (2018a, 2018c) reported nesting in the Lampi Marine National Park, Tanintharyi Region. These sea turtles likely occur in coastal waters of Myanmar as rare vagrants, and likely, a female may come ashore and lay eggs; elsewhere *D. coriacea* occurs broadly in the world's oceans.

HABITAT. Juveniles to adults epipelagic and migratory. They typically require wide sandy beaches with a vegetation-free supralittoral area for nesting with a deepwater approach to nesting beach.

COMMENT. I also found miscellaneous reports of Myanmar occurrence in general books, but none provided precise locality records.

EMYDIDAE RAFINESQUE, 1815

Trachemys scripta (Thunberg in Schoepf, 1792)

Testudo scripta Thunberg in Schoepf, 1792, *Historia Testudinum Iconibus Illustrata*: 16 [type locality: not given]. *Nomen conservandum*.

Testudo serrata Daudin, 1802, *Histoire naturelle, générale et particulière, des reptiles*, 2: 148 [type locality: "de la Caroline"].

Emys Serrata (non Daudin, 1802) Gray, 1831 [1830], *A Synopsis . . . Class Reptilia Appendix in Griffith & Others, Animal Kingdom . . . Cuvier*, . . . 9: 75 [type locality: "North America"].

Emys vittata Gray, 1830, *Synopsis Reptilium*; . . . Part 1: *Cataphracta* . . . : 28 [type locality: "in America Boreali" = North America].

Trachemys scripta elegans (Wied, 1839)

Red-Eared Slider

Emys elegans Wied-Neuwied, 1839, *Reise in das innere Nord-America in den Jahren 1832 bis 1834*: 213 [type locality: "Fox River in New Harmony," Indiana]. Reference not seen.

Emys Holbrookii Gray, 1844, *Catalogue of Tortoises, Crocodilians, . . . British Museum*: 23 [type locality: "N. America. Louisiana"].

Emys sanguinolenta Gray, 1856 [1855], *Catalogue of Shield Reptiles in the Collection of the British Museum*: 26. Manuscript name; *nomen nudum*.

Trachemys lineata Gray, 1873, *Hand-list of the Specimens of Shield Reptiles in the British Museum*: 45 [type locality: "N. America"]. Another *nomen lineata* listed in *Hand-list* as 1873 Ann. Mag. Nat. Hist.

DISTRIBUTION. The red-eared slider is a recent arrival in Myanmar and currently has been reported from temple ponds in Yangon (Platt et al., 2000), the Myeik area (Kyi Thar Khaing and Khin War War, 2018), and possibly elsewhere. It is a native of the Mississippi River drainage of south central North America, occurring naturally from northern Indiana to the Gulf of Mexico. Owing to its popularity as a pet store animal, it now

occurs in all states of the United States except Alaska and widely through Europe, Asia, and elsewhere.

HABITAT. A variety of freshwater habits from ponds and canals to backwater habitats of large rivers.

COMMENT. Presently, all reports are derived from pagoda ponds. Successful population growth in those situations seems unlikely owing to predation on the eggs and hatchlings by the house crow on land and catfish in the water (Platt et al., 2000, 2018c).

GEOEMYDIDAE THEOBALD, 1868

Batagur affinis (Cantor, 1847)

Southern River Terrapin

Tetraonyx affinis Cantor, 1847, *Journal of the Asiatic Society of Bengal* 15: 6 [type locality: "Sea off Pinang"].

Batagur baska ranongensis Nutaphand, 1979, *The Turtles of Thailand*: 181 [type locality: "mouth of rivers in Ranong Province," Thailand].

DISTRIBUTION. There are no confirmed records that this species currently lives in southern peninsular Myanmar; this species was the coastal species of Indochina and Thailand and is now extinct throughout much of its range, surviving only in isolated populations of Peninsular Malaysia, Cambodia, and perhaps Sumatra.

HABITAT. Coastal estuarine habitats.

COMMENTS. *Batagur affinis* was recently resurrected (Praschag et al., 2007) from the synonymy of *B. baska*. Presently, three widely separated populations survive in estuaries of the Gulf of Thailand. In general, they have shorter and blunter heads than *B. baska*; heads are usually lighter brown and not black, and the nostril area is never bluish.

The possibility of *B. affinis* in southern Myanmar is doubtful. According to Moll et al. (2015: 6), "The isolated and now extirpated population of river terrapins from the southern Myanmar-Thailand border on the northwestern shore of the Malay Peninsula . . . is most likely attributable to the Northern River Terrapin, *B. baska*."

Batagur baska (Gray, 1830)

Northern River Terrapin

Emys baska Gray, 1830, *Illustrations of Indian Zoology: Chiefly . . . Hardwicke*, vol. 1: pl. 75 [type locality: not given].

Emys Batagur Gray, 1831 [1830], *A Synopsis . . . Class Reptilia Appendix in Griffith & Others, Animal Kingdom . . . Cuvier*, . . . 9: 9 [type locality: not given].

Trionyx (Tetraonyx) Cuvieri Gray, 1831 [1830], *A Synopsis . . . Class Reptilia Appendix in Griffith & Others, Animal Kingdom . . . Cuvier*, . . . 9: 19 [type locality: not given].

Trionyx longicollis Lesson, 1834, *Reptiles*, in Bélanger, 1834, *Voyage Indio-Orientale, Zoologie*: 297 [type locality: "le fleuve de l'Irravady au Pégou," Myanmar].

Tetraonyx lessonii Duméril and Bibron 1841, *Erpétologie générale, ou, Histoire . . . reptiles*, 2: 558 [type locality: "Bengale . . . le fleuve d'Irrayaddy, au Pégou"].

DISTRIBUTION. Previously widespread in estuaries of Myanmar from northwestern Rakhine to southern Tanintharyi. Exceptionally large populations were reported in the Ayeyarwady Delta prior to the late nineteenth century; these populations are now extinct, and the extirpation of *B. baska* from the entire Burmese coastline seems likely, although Kalyar et al. (2007) offered some hope that a small population may persist along the central Rakhine coast. The last known nesting beach in Tanintharyi was destroyed prior to 2012 (Platt et al., 2018c). Similarly, formerly widespread in estuaries from north-eastern India and Bangladesh, possibly to the extreme northwestern coast of peninsular Thailand.

HABITAT. Coastal estuarine habitats.

COMMENTS. The former concept of *B. baska* recognized all populations of the estuarine *Batagur* from India to Southeast Asia (Thailand, Cambodia, Malaysia, and Sumatra) as single species. Prashchag et al. (2007, 2009) demonstrated that two, perhaps three, species occur within this wider distribution.

Platt et al. (2019) provided the most current data on the status of *B. baska* in Myanmar and stated that only a single very old individual survives in a pagoda pond. Moll et al. (2009) provided a detailed account of this species.

Batagur trivittata (Duméril and Bibron, 1835)

Burmese Roofed Turtle

Emys Trivittata Duméril and Bibron, 1835, *Erpétologie générale, ou, Histoire . . . reptiles*, 2: 331 [type locality: “Bengale,” in error].

Kachuga peguensis Gray, 1869, *Proceedings of the Zoological Society of London* 1869: 200 [type locality: “India”].

Kachuga trilineata Gray, 1869, *Proceedings of the Zoological Society of London* 1869: 200 [type locality: “India”].

Kachuga fusca Gray, 1870, *Supplement to the Catalogue of Shield Reptiles . . . Part 1: Testudinata (Tortoises)*: 56 [type locality: “India”].

Batagur iravadica Anderson, 1879, *Anatomical and Zoological Researches: . . . Western Yunnan*: 736 [type locality: “Pegu and from Bhamô in Upper Burma”].

DISTRIBUTION. Formerly in Ayeyarwady, Chindwin, Sittaung, and Thanlwin (Salween) river drainage systems from mouths to upper reaches of these rivers. Now extirpated from most of its former range but survives in residual populations in the upper Chindwin River (Sagaing) and Dokhtawady River (Mandalay; Platt et al., 2005, 2017a, 2018c).

HABITAT. Rivers with areas of deep pools.

COMMENTS. Prashchag et al. (2007) showed that this species was in the *Batagur* clade.⁶ Since 2007, conservationists have been attempting to reestablish populations in the Chindwin River (Platt, 2015), and these actions appear to have been successful in small areas of the river.

Cuora amboinensis (Riche in Daudin, 1802)

Testudo melanocephala Van-Ernest in Daudin, 1801, *Histoire naturelle, générale et particulière, des reptiles*, 2: 128 [type locality: “Moluccas”]. *Nomen oblitum*.

Testudo amboinensis Riche in Daudin, 1801 [1802], *Histoire naturelle, générale et particulière, des reptiles*, 2: 309 [type locality: “Amboina”].

Cuora amboinensis kamaroma Rummler and Fritz, 1991

Southeast Asian Boxturtle

Cuora amboinensis kamaroma Rummler and Fritz, 1991, *Salamandra* 27: 17 [type locality: “50 km north of Bangkok, Thailand”].

Cuora amboinensis lineata McCord and Philippen, 1998, *Reptile Hobbyist*, March 1998: 51 [type locality: “Myitkyina, Kachin Province, Myanmar (Burma)”].

DISTRIBUTION. From northeastern India through Bangladesh and Myanmar (Kachin, Rakhine, Sagaing, Tanintharyi) into southern Southeast Asia, Malayan Peninsula; also occurs in Nicobar Islands, Borneo, and Philippines (Sulu and Palawan Island groups).

HABITAT. Preference for slow-moving or stationary water, from paddies, marshes, borders of ponds and lakes, swamps to small streams.

COMMENTS. The MHS teams did not observe this species. The Rakhine and Tanintharyi localities reported above derive from localities mapped on the species’ distribution in Schoppe and Das (2011: fig. 4) and Platt et al. (2018c). The Museum of Zoology, Senckenberg Dresden has specimens from Yunnan Province, China; considering the distribution of other specimens, these specimens are likely market/trade specimens.

Cuora amboinensis lineata was described by McCord and Philippen (1998) from pet trade specimens obtained in Myitkyina, Kachin Province. Whether the vicinity of the Ayeyarwady River and its tributaries in Kachin is the true origin remains questionable. The distinctiveness of this subspecies was questioned soon after its description; however, in 2016, Ernst et al. (2016) demonstrated that its primary features of differentiation from other populations of *C. amboinensis* were not unique to the Kachin population; therefore, *C. a. lineata* is a synonym of *C. a. kamaroma*.

Cuora mouhotii (Gray, 1862)

Northern Keeled Boxturtle

Cyclemys Mouhotii Gray, 1862, *Annals and Magazine of Natural History*, ser. 3, 10: 157 [type locality: “Lao Mountains”].

Cuora galbinfrons serrata Iverson and McCord, 1992, *Proceedings of the Biological Society of Washington* 105: 434 [type locality: “100 km east of Tungfang at Tainhfen in central Hainan Island, China”]. Captive generated hybrid.

DISTRIBUTION. From northern India (Assam) through western mainland Myanmar (Chin, Rakhine, Sagaing), northern Laos, central and northern Vietnam, and adjacent China to Hainan Island.

HABITAT. Terrestrial to semiaquatic in and adjacent to upland forest streams (Das et al., 2016).

COMMENTS. In a study recognizing the distinctiveness of the central Vietnam population of *Pyxidea mouhotii*, Fritz

(1997) restricted the type locality of *P. mouhotii* Gray to northern Laos (Laung Prabang); hence, the distribution of the nominate subspecies became Laos, adjacent China, and Vietnam. Fritz also noted the distinctiveness of the Assam and northern Burmese populations but did not name this taxon. *Pyxidea mouhotii* became *Cuora mouhotii* when molecular phylogenies (Honda et al., 2002; Spink and Shaffer, 2007) demonstrated that *mouhotii* was a member of the *Cuora* clade.

Our MHS teams did not observe this species in Myanmar. S. G. Platt and the Myanmar Wildlife Conservation Society teams have only recently (Platt et al., 2013) reported this species in the Naga Hills. They noted that the Naga people consider it poisonous, especially the juveniles, and hence harvest them rarely. Their continual persistence in northwestern Sagaing was confirmed by the WCS team (Platt et al., 2018c).

***Cyclemys fusca* Fritz, Guiching, Auer, Sommer, Wink, and Hundsdörfer, 2008**

Northern Brown-Bellied Leaf Turtle

Cyclemys fusca Fritz, Guiching, Auer, Sommer, Wink, and Hundsdörfer, 2008, *Zoologica Scripta* 37: 383 [type locality: “Kachin State, Myanmar”].

DISTRIBUTION. Northern and western Myanmar (Ayeyarwady, Chin, Kachin, Sagaing, Shan) and possibly adjacent India and Laos.

HABITAT. Terrestrial to semiaquatic in and adjacent to streams in lowland and upland forests.

COMMENTS. See Comments in *C. oldhamii* account. Recent surveys (Platt et al., 2013) on the upper Chindwin River and in Naga Hills indicate a modest abundance in this area, although subjected to moderate harvesting. The Platt team also confirmed its presence along the central Rakhine coast (S. Platt et al., 2007), in Natma Taung National Park, Chin State (S. Platt et al., 2012c), the Ayeyarwady Region (Platt et al., 2018c), and southern Tanintharyi (Platt et al. 2015, 2018c).

***Cyclemys oldhamii* Gray, 1863**

Southeastern Brown-Bellied Leaf Turtle

PLATE 4G

Cyclemys oldhamii Gray, 1863, *Proceedings of the Zoological Society of London* 1863: 178 [type locality: “Mergui . . .; Siam . . .”].

Cyclemys dhor shanensis Annandale, 1918, *Records of the Indian Museum* 1918: 67 [type locality: “Fort Stedman on the Inlé Lake, altitude 3,000 feet,” Shan State, Myanmar].

Geoemyda tcheponensis Bourret, 1939, *Annexe au Bulletin Générale de l’Instruction Publique, Hanoi* 1939: 7 [type locality: “la Haute Sé-Bang-Hien (centre de la Chaîne annamique)”].

Cyclemys tiamanensis Kou in Matsui et al., eds., *Current Herpetology in East Asia* . . ., 1989: 193 [type locality: “Nanliang, Mengla County, Xishuangbanna of Yunnan Province, alt. 620 m,” China].

DISTRIBUTION. Southern mainland (Bago, Shan) and southern peninsular (Tanintharyi) Myanmar; southwestern

China, Laos, central and northern Thailand, northern Vietnam, and northern Cambodia.

HABITAT. Terrestrial to semiaquatic in and adjacent to streams in lowland and upland forests.

COMMENTS. For many decades, most specimens of the widespread *Cyclemys* were simply labeled as *C. dentata*.⁷ The nomenclatural segregation of *Cyclemys* populations and the designation of a lectotype (Fritz et al., 1997) from Mergui (=Myeik, Tanintharyi Region) for *Cyclemys oldhamii* Gray establish this taxon as a Burmese turtle. Platt et al. (2018c) noted that the *Cyclemys* from the Bago Yoma have a different color pattern than *C. oldhamii* from elsewhere, so the taxonomic status of that population is ambiguous.

***Heosemys annandalii* (Boulenger, 1903)**

Yellow-Headed Forest Turtle

Cyclemys annandalii Boulenger in Annandale and Robinson, 1903, *Fascicula Malayia Zoology History*, ser. 4, 16: 284 [type locality: “Kampong Jalor” = Yala, Yala Province, Thailand].

DISTRIBUTION. Of questionable occurrence in Myanmar.

COMMENTS. Van Dijk et al. (2011) report the presence of this species in Myanmar as questionable. Our survey did not observe this species; similarly, none of S. Platt’s turtle-specific surveys discovered this species.

***Heosemys depressa* (Anderson, 1875)**

Arakan Forest Turtle

Geoemyda depressa Anderson, 1875, *Annals and Magazine of Natural History*, ser. 4, 16: 284 [type locality: “Arakan” = Rakhine, Myanmar].

G. Arkana Theobald, 1876, *Descriptive Catalogue of the Reptiles of British India* [type locality: “Akyab.” = Sittwe, Rakhine State, Myanmar].

DISTRIBUTION. Southwestern Myanmar (Chin, Rakhine) and adjacent Chittagong Hills of adjacent Bangladesh (fide Platt et al., 2018c).

HABITAT. Terrestrial in a variety of forest habitats from seasonal and evergreen forest to bamboo thickets.

COMMENT. S. Platt et al. (2014b) recently documented this species in the Kyauk Pan Taung Wildlife Sanctuary in the southern Chin Hills, although it appears to be absent in Natma Taung National Park (S. Platt et al., 2012c), which lacks the species’ preferred habitat of bamboo thickets and appears altitudinally too high for this lowland species.

***Heosemys grandis* (Gray, 1860)**

Asian Giant Pond Turtle

Geoemyda grandis Gray, 1860, *Annals and Magazine of Natural History*, ser. 3, 6: 218 [type locality: “Cambojia”].

DISTRIBUTION. Mainland Myanmar (Kayin, Kayah) and peninsular Myanmar (Mon, Tanintharyi); southern Thailand to southern Vietnam and Peninsular Malaysia.

HABITAT. Semiaquatic to aquatic in marshes, swamps, and streams in forested habitats.

COMMENTS. Platt et al. (2012) listed this species from Ayeyarwady, Bago, Kachin, Kayin, Mandalay, Mon, Sagaing, and Tanintharyi; these locations now represent areas from which the species has been eradicated. The Kachin record derives from Iversen's (1992:126) map, and likely, it is a geographically mislabeled specimen or a market specimen carried from its collection site. The Sagaing occurrence also shares the same explanation.

***Heosemys spinosa* (Gray, 1830)**

Spiny Forest Turtle

Emys spinosae Gray, 1830, *Illustrations of Indian Zoology: Chiefly . . . Hardwicke*, vol. 1: pl. 77, figs. 1, 2 [type locality: not given].

Emys Spinosa Gray, 1831 [1830], *A Synopsis . . . Class Reptilia Appendix in Griffith & Others, Animal Kingdom . . . Cuvier*, . . . 9: 8. Correction of ending and gives "Penang" as locality.

DISTRIBUTION. Southern peninsular Myanmar (Tanintharyi); adjacent Thailand through Malay Peninsula to Sumatra and Borneo and into southern Philippine Islands.

HABITAT. Semiaquatic to aquatic in streams of forested habitats.

COMMENT. Platt et al. (2014) provided documentary evidence of this species' present occurrence in extreme southern Tanintharyi.

***Malayemys macrocephala* (Schlegel and Müller, 1845)**

Malayan Snail-Eating Turtle

Geoclemys macrocephala Gray, 1859, *Proceedings of the Zoological Society of London* 1859(27): 479 [type locality: "Siam"].

DISTRIBUTION. Southeastern mainland Myanmar (Kayah, Kayin) and peninsular Myanmar (Mon, Tanintharyi); adjacent central Thailand southward into northeastern Peninsular Malaysia.

HABITAT. Semiaquatic to aquatic in ponds and streams with soft bottoms and aquatic vegetation.

COMMENTS. Platt et al. (2014) provided documentary evidence of this species' present occurrence in extreme southern Tanintharyi. The other records derive from Platt et al.'s (2012) photographic guide. The origin of these records is not specified, and they require verification. A comprehensive discussion of this species is provided by Dawson et al. (2018).

***Melanochelys tricarinata* (Blyth, 1855)**

Three-Ridged Black Turtle

Geoemyda tricarinata Blyth, 1855, *Proceedings of the Asiatic Society of Bengal* 24: 714 [type locality: "Central India (Chaibassa)," India].

Chaibassia theobaldi Anderson, 1879, *Anatomical and Zoological Researches: . . . Western Yunnan*: 718 [type locality: not given].

Nicoria tricarinata sivalensis Lydekker, 1889, *Catalogue of the Fossil Reptilia . . . Part 3: Chelonia*: 100 [type locality: "Pliocene of the Siwalik Hills"].

DISTRIBUTION. No confirmed records for Myanmar; northern India and Nepal and southeastern Bangladesh.

HABITAT. Terrestrial in upland forests.

COMMENTS. With the exception of several distant outliers, *M. tricarinata* occurs in the Himalayan foothills. If the southeastern Bangladesh and eastern Mizoram populations are natural, *M. tricarinata* might also have populations in adjacent Rakhine and Chin States, Myanmar.

***Melanochelys trijuga* (Schweiger, 1812)**

Emys trijuga Schweiger, 1812, *Königsberger Archiv für Naturwissenschaft und Mathematik* 1: 310 [type locality: "insula Java"].

Emys belangeri Lesson, *Reptiles*, in Bélanger, 1834, *Voyage aux Indes-Orientales par le nord de l'Europe*, . . . *Zoologie*: 291 [type locality: "dans les eaux douces du Bengale et du Carnate," India].

Emys trijuga var. *maderaspatana* Anderson, 1879, *Anatomical and Zoological Researches: . . . Western Yunnan*: 729 [type locality: "Madras," India].

Clemmys hydraspica Lydekker, 1885, *Palaeontologia Indica, Memoirs of the Geological Survey of India* 10(iii): 172 [type locality: "Siwaliks of the Jhelam district of the Punjab," India/Pakistan].

Clemmys theobaldi Lydekker, 1885, *Palaeontologia Indica, Memoirs of the Geological Survey of India* 10(iii): 173 [type locality: "Siwaliks, Jhand in the Punjab" (late Pliocene [Tatrot Formation] or early Pleistocene [Pinjor Formation]), India/Pakistan].

Geoemyda trijuga plumbea Annandale, 1915, *Records of the Indian Museum* 11: 192 [type locality: "Coorg on the east side of the Western Ghats"].

***Melanochelys trijuga edeniana* Theobald, 1876**

Burmese Black Turtle

Melanochelys edeniana Theobald, 1876, *Descriptive Catalogue of the Reptiles of British India*: 12. [type locality: "Arakan, Pegu, and Tenasserim," Myanmar].

Emys trijuga var. *burmana* Anderson, 1879, *Anatomical and Zoological Researches: . . . Western Yunnan*: 723 [type locality: "Bhamô, . . . Moulmein and from Khyouk-Phyoo in Arracan," Myanmar].

Geoemyda trijuga wiroti Reimann in Nutaphand, 1979, *The Turtles of Thailand*: 177 [type locality: "Thai-Burmese border area (Tak and Mae Hong Son Provinces)," Thailand].

DISTRIBUTION. A curiously disjunct pattern with few and scattered records from coastal Rakhine, Ayeyarwady River valley in Kachin, upper Chindwin River in Sagaing, middle Sittang River (Bago), and near the mouth of the Salween River (Mon, Kayah) and adjacent Thailand.

HABITAT. Slow-moving water habitats, ponds to lakes, with submergent vegetation and edged with emergent vegetation.

COMMENTS. The preceding distribution records with the exception of the Chindwin record are all pre-1992 (Iversen, 1992). Platt et al. (2012) also listed Magway and Shan in their photographic guide. The Chindwin record (Platt et al., 2013, 2018b) is based on a plastron from a relatively recently

butchered individual. This species may be more abundant than the single record suggests owing to its strong odor and the villagers' reluctance to consume it.

***Morenia ocellata* (Duméril and Bibron, 1835)**

Burmese Eyed Turtle

PLATE 4H

Emys ocellata Duméril and Bibron, 1835, *Erpétologie générale, ou, Histoire . . . reptiles*, 2: 2–39 [type locality: “Bengal” (in error)].

Emys berdmorei Blyth, 1859, *Journal of the Asiatic Society of Bengal* 27: 281 [type locality: “Sitaung Valley?, Pegu, Burma”].

DISTRIBUTION. Mainland Myanmar (Ayeyarwady, Bago, Kachin, Rakhine, Sagaing, Yangon) and peninsular Myanmar (Mon, Tanintharyi).

HABITAT. Slow-moving or stationary water from paddies to marshes, small streams to backwaters of river, seemingly requires heavily vegetated margins and/or emergent vegetation.

COMMENTS. K. Platt et al. (2012: 25) said, “Throughout [Myanmar] except at high elevations.” These data conflict with a more limited distribution shown by Das (2010b) and listed above in the Distribution section. Platt et al. (2005) provided evidence that *M. ocellata* might occur in the Ayeyarwady floodplain just north of Mandalay.

***Siebenrockiella crassicolis* (Gray, 1831)**

Black Marshturtle

Emys Crassicolis Gray, 1831 [1830], *A Synopsis . . . Class Reptilia Appendix in Griffith & Others, Animal Kingdom . . . Cuvier, . . .* 9: 8 [type locality: “Sumatra”].

Emys nigra Blyth, 1856 [1855], *Journal of the Asiatic Society of Bengal* 24: 713 [type locality: “valley of the Tenasserim” = Tanintharyi, Myanmar].

Pangshura cochinchinensis Tirant, 1884, *Excursions et Reconnaissances* 8(19): 15 [type locality: not given].

DISTRIBUTION. Southern peninsular Myanmar (Tanintharyi); central and peninsular Thailand to northern Malaysia, Singapore, Sumatra, and Borneo.

HABITAT. Slow-moving or stationary water from paddies to marshes and small streams, prefers vegetated margins and/or emergent vegetation.

COMMENTS. Win Maung and Win Ko Ko (2002) listed this species from Kayin, Mon, and Tanintharyi. K. Platt et al. (2012) give only Tanintharyi. Kyi Thar Khaing and Khin War War (2018) showed this species to be the second most abundant turtle found in the villages of the Myeik area. Our MHS teams never encountered this species.

Theobald (1876:10) gives a synonymy listing the specific nomen of *crassilabris* twice and attributing the name to Gray in “P. Z. S., 1869, p.197.” This information is incorrect. The name used by Gray is *crassicolis*. Here and elsewhere in citing publication dates, I have used the publisher's date on the title page of the volume for the Asiatic Society's proceedings of the preceding year.

PLATYSTERNIDAE GRAY, 1869

***Platysternon megacephalum* Gray, 1831**

Platysternon megacephalum Gray, 1831, *Proceedings of the Zoological Society of London* 1831: 107 [type locality: “Chinâ”].

***Platysternon megacephalum peguense* Gray, 1870**

Burmese Big-Headed Turtle

Platysternon peguense Gray, 1870, *Supplement to the Catalogue of Shield Reptiles . . . Part 1: Testudinata (Tortoises)*: 70 [type locality: “Pegu”].

Platysternon megacephalum vogeli Wermuth, 1969, *Aquarien- und Terrarienzeitschrift* 22(12): 374 [“Provinz Chiang Mai, Nordwest-Thailand”].

DISTRIBUTION. Southeastern mainland Myanmar (Bago, Kayah, Kayin, Mon, and southeast Shan).

HABITAT. Rocky streams of upland forests.

COMMENTS. Win Maung and Win Ko Ko (2002) listed this species from Bago, Kayah, Kayin, Mon, Rakhine, Shan, and Tanintharyi. K. Platt et al. (2012) excluded Rakhine and Tanintharyi from their list. Our MHS teams found *P. megacephalum* only in northern Mon.

TESTUDINIDAE BATSCH, 1788

***Geochelone platynota* (Blyth, 1863)**

Burmese Star Tortoise

PLATE 4I

Testudo platynota Blyth, 1864 [1863], *Journal of the Asiatic Society of Bengal* 32: 83 [type locality: not given].

DISTRIBUTION. Formerly Central Dry Zone of mainland Myanmar (Magway, Mandalay, Sagaing), but now extinct in the wild (Platt et al., 2012, 2017b; Platt and Win Ko Ko, 2010), although successful reintroduction has been made in Magway and Mandalay, also proposed for Sagaing.

HABITAT. Dry mesic to arid habitats, usually with moderate to thick ground cover.

COMMENTS. S. Platt et al. (2012b: 057.6) stated, “It is unlikely that viable wild populations of *G. platynota* remain in Myanmar.” The extirpation of this species was the result of commercial collectors targeting known populations in the 1990s and 2000s and decimating the last few viable populations. A 2012–2013 survey of the upper Chindwin River (Platt et al., 2013) revealed a single butchered specimen from this previously unreported area of occurrence. In the December 2014 Turtle Survival Alliance blog and subsequent report, Platt (2015) reported on the first successful reassurance colony reproduction and the reintroduction of these tortoises into the wild; also see Platt et al. (2017b) for additional details on captive propagation. Platt et al. (2018b) examined the past distribution in Myanmar's central dry zone.

Blyth's specimens were purchased, presumably in a market in Yangon. He (Blyth, 1864: 83) noted that the carapaces were

commonly used for dispensing cooking oil in Rangoon markets and also stated, “[They] would appear to be very common in lower Pegu,” thereby stating that he did not know the origins of his specimens.

***Indotestudo elongata* (Blyth, 1863)**

Elongated Tortoise

PLATE 4J

Testudo elongata Blyth, 1853, *Journal of the Asiatic Society of Bengal* 22: 639 [type locality: “Arakan,” Rakhine State, Myanmar].

Testudo parallelus Annandale, 1913, *Records of the Indian Museum* 9: 76 [type locality: “Chaibassa Singhbhum district, Chota Nagpur,” India].

DISTRIBUTION. Widespread, although spottily distributed throughout mainland Myanmar (Bago, Chin, Kachin, Kayah, Magway, Mandalay, Rakhine, Sagaing) and peninsular Myanmar (Mon, Tanintharyi); elsewhere in northern India to Bangladesh and Thailand, Indochina to northernmost Peninsular Malaysia.

HABITAT. Variety of forested habitats from seasonal deciduous to evergreen.

COMMENTS. Win Maung and Win Ko Ko (2002) listed this species from Bago, Kachin, Kayin, Kayah, Mon, and Yangon. The localities listed in the Distribution section derive from Ihlow et al.’s (2016) map.

***Manouria emys* (Schlegel and Müller, 1840 or 1844)**

Testudo emys Schlegel and Müller in Temminck, 1839, *Verhandelingen over de natuurlijke geschiedenis der Nederlandsche Oost Indie*, Zool. Pt 2. Reptilia: 34, pl. 4 [type locality: “Sumatra”].

Manouria fusca Gray, 1854, *Proceedings of the Zoological Society of London* 1852: 134 [type locality: “Singapore”].

Teleopus luxatus Le Conte, 1854, *Proceedings of the Academy of Natural Sciences of Philadelphia* 1854: 187 [type locality: “Java”].

Testudo (Scapia) falconeri Gray, 1869, *Proceedings of the Zoological Society of London* 1869: 169 [type locality: “India?”]. *Nomen dubium*.

***Manouria emys phayrei* (Blyth, 1853)**

Northern Brown Tortoise

Testudo phayrei Blyth, 1853, *Journal of the Asiatic Society of Bengal* 22: 639 [type locality: “Arakan, Tenasserim Provinces,” Myanmar].

Geochelone nutapundi Reimann in Nutaphand, 1979, *The Turtles of Thailand*: 193 [type locality: “Northern Thailand (Tak Province) and western Central Region (Kanchanaburi Province); Assam, Burma”].

DISTRIBUTION. Southern mainland Myanmar (Chin, Kayin, Rakhine) and peninsular Myanmar (Mon, Tanintharyi).

HABITAT. Evergreen forests.

COMMENTS. K. Platt et al. (2012) gave Chin, Kayin, Mon, Rakhine, and Tanintharyi for the distribution of this species. S. G. Platt and the WCS teams (Platt et al., 2001, 2018b, 2018c) reported finding this tortoise only in Magway and Rakhine during their surveys in the 2000s. Stanford et al. (2015)

showed only Kachin, Mon, Rakhine, and Tanintharyi on their distribution map. The Kachin record likely derives from a market specimen. MHS survey teams did not encounter this species.

***Manouria impressa* (Günther, 1882)**

Impressed Tortoise

Geoemyda impressa Günther, 1882, *Proceedings of the Zoological Society of London* 1882: 343 [type locality: “Siam”].

Geoemyda latinuchalis Vaillant, 1894, *Bulletin de la Société philomathique de Paris*, ser. 8, 10: 68 [type locality: “dans la rivière Noire,” Tonkin = northern Vietnam].

Testudo pseudemys Boulenger in Annandale and Robinson, 1903, *Fasciculi Malayenses. Anthropological and Zoological Results . . .*, part 1: 144 [type locality: “Batang Padang district, South Perak,” Malaysia].

DISTRIBUTION. Mainland Myanmar (Kachin, Magway, Rakhine); elsewhere, this tortoise may persist in southern Yunnan, Laos, Vietnam, Thailand, and Peninsular Malaysia.

HABITAT. Evergreen forests.

COMMENTS. K. Platt et al. (2012) gave Kachin, Kayah, Rakhine, and Shan for the distribution of this tortoise. The Turtle Taxonomy Working Group (2017:146) *M. impressa* map shows a single western Kachin record (presumably Saw Htun and Platt, 2016) and several records in the Rakhine Hills of Magway and southeastern Rakhine as distant outliers of the Thailand population. Our MHS teams did not observe this species.

TRIONYCHIDAE – CYCLANORBINAE LYDEKKER, 1889

***Lissemys punctata* (Bonnaterre, 1789)**

Testudo punctata Lacépède, 1788, *Histoire naturelle des quadrupèdes ovipares et de serpents*, 171. *Nomen rejiciendum*; book rejected by ICZN because its nomenclature is not binominal.

T. Punctata Bonnaterre, 1789, *Tableau encyclopédique . . . nature. Erpétologie*: 30 [type locality: “Les grandes Indes”].

Emyda dura Anderson, 1867, *Journal of the Linnean Society of London, Zoology* 12: 514 [type locality: not given, Ganges River by implication].

***Lissemys punctata andersoni* Webb, 1980**

Indo-Gangetic Flapshell

Lissemys punctata andersoni Webb, 1980, *Bulletin du Muséum national d'histoire naturelle*, ser. 4, 2A: 554 [type locality: “Belbari, Terai, south-eastern Nepal, elevation 210 m”].

DISTRIBUTION. Southwestern coastal mainland Myanmar (Rakhine) and westward in adjacent Bangladesh, northern India, and Nepal to Indus River in Pakistan.

HABITAT. Slow-moving or stationary water from paddies to marshes, small streams to backwaters of river, presumably with preference for soft-bottom habitats.

COMMENTS. Our MHS teams did not observe this species. Win Maung and Win Ko Ko (2002) listed this flapshell as occurring broadly throughout Myanmar. Such a wide distribution

for this taxon is unlikely. Webb's (1982: fig. 1) distribution map shows two Burmese records in the northern half of Rakhine State. Webb's localities do not match those of Iverson (1992), likely plotting errors. The localities of both authors indicated coastal localities. This observation agrees with their abundance in brackish lagoons of the Sunderbans (Bhupathy et al., 2014). Platt et al. (2018c) confirmed their presence in eastern coastal Rakhine.

***Lissemys scutata* (Peters, 1868)**

Burmese Flapshell

PLATE 4L

Emyda scutata Peters, 1868, *Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin* 1868: 449 [type locality: "Pegu"].

Emyda fuscomaculata Gray, 1873, *Annals and Magazine of Natural History*, ser. 4, 11: 308 [type locality: not given].

DISTRIBUTION. Widespread in floodplains of all three major river systems of mainland Myanmar (Bago, Kachin, Mandalay, Sagaing, Yangon) and northernmost peninsular Myanmar (Mon).

HABITAT. Slow-moving or stationary water from paddies to marshes, small streams to backwaters of river, presumably with preference for soft-bottom habitats.

COMMENT. Thirakhupt and van Dijk (1994:218, fig. 5) reported a *L. scutata* from the upper reaches of the Hai Tinoi River, which drains into the Salween River near its mouth.

TRIONYCHIDAE – TRIONYCHINAE LYDEKKER, 1889⁸

***Amyda ornata* (Gray, 1861)**

Asiatic Ornate Softshell

Trionyx ornatus Gray, 1861, *Proceedings of the Zoological Society of London* 1861: 41 [type locality: "Camboja"].

Trionyx Phayrei Theobald, 1868, *Journal of the Linnean Society of London, Zoology* 10: 18 [type locality: "in fluminibus montium Arakanensium, prope Basein," Myanmar].

Trionyx ephippium Theobald, 1876 [1875], *Proceedings of the Asiatic Society of Bengal* 1875: 177 [type locality: "Tenasserim," Myanmar].

Trionyx nakornsritthamarajensis Nutaphand, 1979, *The Turtles of Thailand*: 209 [type locality: "central part of southern Thailand (Nakorn Si Thammaraj Province)"].

Trionyx cartilagineus nakorn Nutaphand, 1979, *The Turtles of Thailand*: 8; name substitution for *Trionyx nakornsritthamarajensis*.

DISTRIBUTION. Formerly widespread in main and peninsular Myanmar, recent records from Kachin, Mandalay, Rakhine, Sagaing, and Tanintharyi; elsewhere in Asia from Bangladesh to Thailand, Laos, and Cambodia.

HABITAT. Medium to large bodies of water from lakes to rivers, typically freshwater habitats although reported from low brackish estuarine areas.

COMMENTS. *Amyda cartilaginea* was recognized as a species complex by Fritz et al. (2014); Auliya et al. (2016)

suggested otherwise. The complex has been shown to include two species (a concept that began to gain acceptance in 2017): *Amyda cartilaginea* is represented by the Sundas islands populations; *A. ornata* is a mainland species. The Myanmar and immediately adjacent Thai species represent the subspecies *Amyda ornata phayrei*.

***Chitra vandijki* McCord and Pritchard, 2003**

Burmese Narrow-Headed Softshell

Chitra vandijki McCord and Pritchard, 2003 [2002], *Hamadryad* 27: 39 [type locality: "Ayeyarwady River system, northeastern Myanmar"].

DISTRIBUTION. Mainland Myanmar in Ayeyarwady River and larger tributaries in Kachin, northern Chindwin River, Sagaing, possibly Salween River, Bago, and Sittaung River, Mon.

HABITAT. Rivers with deep pools.

COMMENTS. The original description proposed the entire Ayeyarwady River Basin, although the authors had only specimens purchased in Ruili, Yunnan Province, China. Subsequently, Fritz and Havas (2007) added the Salween River of Myanmar and adjacent Thailand. Vouchers, whether specimens or photographs, are rare, and the actual occurrence of this soft-shell now is likely more limited, hence the preceding restrictive distribution.

Platt and Kalyar (2004) mentioned a verbal report of a specimen taken by a local fisherman in Sittaung River and believed that a population may persist in this river. S. Platt et al. (2014c) provided a full review of this species. More recently, Platt et al. (2020) provided details on nesting and hatchlings.

***Dogania subplana* (Geoffroy Saint-Hilaire, 1809)**

Hillstream Softshell

PLATE 4K

Trionyx subplanus Geoffroy Saint-Hilaire, 1809, *Annales du Muséum d'histoire naturelle, Paris* 14: 11, pl. 5, fig. 2 [type locality: "Patrie Inconnue"].

Trionyx frenatus Gray, 1856 [1855], *Catalogue of Shield Reptiles in the Collection of the British Museum*: 67 [type locality: "Singapore"].

Dogania guentheri Gray, 1862, *Proceedings of the Zoological Society of London* 1862: 265 [type locality: "India, - - ?"].

Trionyx? dillwynii Gray, 1873, *Annals and Magazine of Natural History*, ser. 4, 11: 306 [type locality: "Borneo"].

Trionyx vertebralis Strauch, 1890, *Mémoires de l'Académie Impériale des Sciences de Saint-Petersbourg*, ser. 7, 38(2): 113 [type locality: "aus dem flusse im aequatorialen West-Africa"].

Trionyx pecki Bartlett, 1895, *Sarawak Gazette* 1895: 30 [type locality: "Borneo"].

DISTRIBUTION. Peninsular Myanmar (Mon, Tanintharyi); adjacent peninsular Thailand and Malaysia into Indonesia (Sumatra, Java, Borneo).

HABITAT. Upland streams in forested areas (S. Platt et al., 2014a).

Nilssonina formosa (Gray, 1869)
Burmese Peacock Softshell

Trionyx formosus Gray, 1869, *Proceedings of the Zoological Society of London* 1869: 217 [type locality: “Pegu”].

Trionyx? peguensis Gray, 1870, *Supplement to the Catalogue of Shield Reptiles . . . Part 1: Testudinata (Tortoises)*: 99 [type locality: “Pegu”].

Trionyx grayii Theobald, 1876 [1875], *Proceedings of the Asiatic Society of Bengal* 44: 176 [type locality: “Irawadi valley,” Myanmar].

DISTRIBUTION. Presumed to occur broadly in Myanmar (Ayeyarwady, Bago, Kachin, Kayah, Kayin, Magway, Mandalay, Mon, Sagaing, Shan, Tanintharyi).

HABITAT. Small to large streams and lakes in lowland sites.

COMMENTS. Platt et al. (2005) had records from 2000 and 2001 surveys of its presence in Kachin, Mandalay, and Sagaing. K. Platt et al. (2012) provided a listing of its occurrence in most area of Myanmar; the areas listed in the Distribution section are from their species account. Additional details on biology and distribution in the upper Ayeyarwady are present in Platt et al. (2017c); and details on hatchlings are given by Platt et al. (2016).

Pelochelys cantorii Gray 1864
Asian Giant Softshell

Pelochelys cantorii Gray, 1864, *Proceedings of the Zoological Society of London* 1864: 90 [type locality: “Malacca, marine,” Malaysia].

Pelochelys cumingii Gray, 1864, *Proceedings of the Zoological Society of London* 1864: 90 [type locality: “Phillipines”].

Pelochelys Poljakowii Strauch, 1890, *Mémoires de l'Académie Impériale des Sciences de Saint-Petersbourg*, ser. 7, 38(2): 118 [type locality: “Fushun, Liaoning Province, China”].

DISTRIBUTION. Presumably entire coastline in estuaries and bays from Rakhine to Tanintharyi; however, there is only a single verified record for westernmost Rakhine (Das, 2008). Total range extends along the coast from southern India through Southeast Asia to southern China and southward through the Greater Sundas and Borneo.

HABITAT. Large freshwater streams with deep pools and backwaters, often well inland; it also lives in estuarine habitats.

COMMENT. S. G. Platt (Wildlife Conservation Society, personal communication, 15 December 2020) noted that there are no verified records of *P. cantorii* in Myanmar.

NOTES – CROCODILES AND TURTLES

1. Crocodilian classification follows Zug et al. (2001); synonymies derive from Wermuth and Mertens (1961). There are no records of *Crocodylus siamensis* for Myanmar, but a 24 April 2001 Wildlife Conservation Society news release confirmed the occurrence of a small population in Thailand's Kaeng Krachan National Park adjacent to northern Tanintharyi. Subsequently, its absence in Myanmar was confirmed by

Platt et al. (2002), who noted that the Tanintharyi Mountains are a strong barrier to dispersal into Myanmar.

2. *Batagur affinis* is not included in the key owing to the likelihood of its absence in peninsular Myanmar. I note that there is disagreement on past occurrence of *B. affinis* on the west coast of peninsular Myanmar, and here I follow Moll et al.'s (2009) comment on it likely to have been *B. baska*.
3. *Geochelone elegans* does not occur naturally in Myanmar; however, as a widely marketed turtle, it may appear in marketplaces, pagodas, or as “household pets.”
4. Testudine classification is based on Fritz and Havas (2007), and subsequent updates and corrections are from the sequential issues of the *Turtles of the World: Annotated Checklist and Atlas of Taxonomy, Synonymy, etc.* Some seaturtle synonymies relied on the species accounts from the *Catalogue of American Amphibians and Reptiles*. I attempted to confirm type localities in the synonymies. I indicate by “not seen” those citations for which I could not examine a copy of the book or article.
5. Distributional and biological data for Burmese turtles derive largely from the published articles and reports of Steven G. Platt (Wildlife Conservation Society), Kalyar Platt (Turtle Survival Alliance, Myanmar Program), and their colleagues, all supported by the preceding two conservation programs. These data add currency to the turtle distribution as S. G. Platt's surveys began in 1999 with the first article (Platt et al., 2000) appearing as a review on the exploitation of turtles in Myanmar. I supplemented S. G. Platt's records with those reported in the photographic guide to Burmese turtle book of K. Platt et al. (2012) and recent (i.e., 2010 onward) accounts in Rhodin et al.'s (2008–2018) *Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group*. Our MHS surveys did not emphasize a search for turtles, and the vouchers that we obtained derive from butchered carcasses or the occasional purchase of a turtle that clearly was headed for a local market that was locally and recently captured by a resident of the immediate area of our survey.
In addition, I relied on the habitat notes of the 2012 photographic guide and the Platts' and their associates' observations during their turtle-specific surveys; other habitat information derived from Ernst and Barbour (1989).
6. Molecular evidence (Praschag et al., 2007, 2009) has shown that the taxa included in the genera *Batagur*, *Callagur*, and *Kachuga* are members of a single clade. Additionally, they share a set of unique morphological features. Praschag and colleagues include most former *Kachuga* species in a single monophyletic genus, *Batagur*, although the Indian *smithii*, *tecta*, and *tentoria* remain in *Kachuga* and *Hardella* is monotypic *H. thurjii* (*Hardella thurjii* records for the Ayeyarwady-Bago area [Win Maung and Win Ko Ko, 2002], Myanmar, are considered incorrectly labeled [geographically] specimens). Their study also demonstrated that the Sundarbans (and likely the Burmese) *B. baska* are genetically distinct from *B. baska*, although they did not provide a name for this population. If Sundarban and Burmese populations are a single phylogenetic lineage, the name *Trionyx longicollis* Lesson is available.
7. Even though it seemed evident that multiple species existed within the genus *Cyclemys*, Fritz et al. (2008) were able, only in 2008, to resolve diversification and relationships with a combined molecular and morphological study. This study demonstrated that the pan-Asian *dentata* was a complex of seven species and phenetically consisted of a yellow (light) and a dark plastron group. Both Burmese species have dark plastrons, although they are not each other's closest relatives.
8. I am following the standard name protocol for Trionychidae adopted in the standard names protocol (Crother, 2008) with the exclusion of “turtle” from the name. If turtle is added, I then advocate that the prefix become a true adjective as “flapshelled” or “softshelled.”

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Plates

PLATE 1

(OPPOSITE)

- A. *Ansonia thinthinae*.
- B. *Duttaphrynus stuarti*.
- C. *Ingerophrynus parvus*.
- D. *Phrynoidis asper*.
- E. *Fejervarya moodiei*.
- F. *Hoplobatrachus rugulosus*.
- G. *Limnonectes blythii* juvenile.
- H. *Limnonectes doriae*.
- I. *Limnonectes* cf. *kubli* complex.
- J. *Sphaerotheca* sp.
- K. *Occidozyga lima*.
- L. *Occidozyga martensii*.

PLATE 2

(OPPOSITE)

- A. *Leptobrachella* sp.
- B. *Leptobrachium smithi*.
- C. *Megophrys parva*.
- D. *Kalophrynus anya*.
- E. *Kalophrynus interlineatus*.
- F. *Kaloula latidisca*.
- G. *Kaloula pulchra*, defensive posture.
- H. *Microhyla berdmorei*.
- I. *Microhyla butleri*.
- J. *Microhyla mantheyi*.
- K. *Microhyla mukblesuri*.
- L. *Micryletta lineata*.

PLATE 3

(OPPOSITE)

- A. *Amolops marmoratus*.
- B. *Amolops panhai*.
- C. *Clinotarsus penelope*.
- D. *Hydrophylax leptoglossa*.
- E. *Hylarana erythraea*.
- F. *Hylarana macrodactyla*.
- G. "*Hylarana*" *lateralis*.
- H. *Odorrana chloronota*.
- I. *Odorrana andersonii*.
- J. *Papurana milleti*.
- K. *Sylvirana lacrima*.
- L. *Sylvirana roberti*.

PLATE 4

(OPPOSITE)

- A. *Chirixalus doriae*.
- B. *Gracixalus carinensis*.
- C. *Nyctixalus pictus*.
- D. *Polypedates braueri*.
- E. *Rhacophorus bipunctatus*.
- F. *Rohanixalus vittatus*.
- G. *Cyclenys oldhamii*.
- H. *Morenia ocellata*.
- I. *Geochelone platynota*.
- J. *Indotestudo elongata*.
- K. *Dogania subplana*.
- L. *Lissemys scutata*.

Appendix A:

Comments on Burmese Geography and Geographic Names

Myanmar is the current political name for the country bounded on the west by Bangladesh (Chittagong Division) and India (states of Arunachal Pradesh, Nagaland, Manipur, and Mizoram), to the north and northeast by China (provinces of Xizang/Zizhiou [Tibet] and Yunnan), to the east by Laos (Bokeo Province) and Thailand (provinces [changwat] of Chiang Rai, Chiang Mai, Mae Hong Son, Tak, Kanchanaburi, Ratchaburi, Phetchaburi, Prachuap Khiri Khan, Chumphon, and Ranong), and to the south and southwest by the Indian Ocean (Bay of Bengal and Andaman Sea). Myanmar is not a new name for this region, although it is new in current geographic usage, proposed as the official country name in 1989 by the ruling party. The name derives from Myanma, a fourteenth century or earlier name for a smaller area centered on the Ayeyarwady River delta and extending upriver for about 100 km.

I use Myanmar and Burma interchangeably for this geographic region, “Myanmar” when referring specifically to the political-governmental entity and “Burmese” as the adjective and noun for both the geographic and political entity. I am not a linguist nor competent in transliterating Burmese script and sounds into English words. I have generally adopted the place-name spelling proposed on current (1998–2018) Myanmar government maps and travel ones produced by commercial publishers (e.g., Nelly, Peripplus). Unfortunately, there is a lack of consistency within all maps, both in spelling (choice of letters, e.g., Chatthin versus Zwaththin) and composition (e.g., Nat Ma Taung versus Natma Taung versus Natmataung). Previously, I attempted consistency by connecting multiple syllables names that are variously spelt with hyphens. This protocol is not a common one and has been abandoned. Herein I attempt to use the place-name most frequently used or seen in Burmese documents.

The administrative and political subdivisions of Myanmar are states and region. The states are ethnic areas formalized by the British in the Panglong Agreement in 1947 as they prepared to return the land and its administration to the people of colonial Burma. This agreement formed the basis of the 1947 constitution of independent Burma. Presently, the states have a limited degree of autonomy from the central government, and the populations of each state are predominantly a distinct ethnic group from the Burmans of central and south central Myanmar. The latter is the most populous ethnic group and the group currently in political power. These administrative units are (north to south, east to west) are the states of Kachin, Shan, Chin, Rakhine, Kayah, Kayin, and Mon and regions of Sagaing, Mandalay, Magway, Bago, Yangon, Ayeyarwady, and Tanintharyi (see Figure 1.1A). The capital city, Naypyidaw, is a new city whose construction began in 2002

and was completed in 2012. Governmental offices began to shift from Yangon as their office buildings were completed. Naypyidaw lies within the Naypyidaw Union Territory, a moderately large (~7 million km²) area carved from the southern Mandalay Region. Our herpetofaunal surveys did not directly include this area, so the composition of its fauna can be considered part of the Mandalay Region herpetofauna.

GEOGRAPHICAL DESCRIPTORS IN SPECIES SYNONYMIES

I have attempt consistency in the distribution sections of the species accounts by standardizing my geographic terminology. I report only the region or state of occurrence; these records derive largely, although not exclusively, from the voucher collected by the Myanmar Herpetology Survey teams. In addition to the consistent use of the preceding political units, I have arbitrarily divided the country into mainland Myanmar and peninsular Myanmar. Mainland Myanmar (Figure 1.1B) is the area north of the Bay of Bengal and the Andaman Sea and is bordered by all five adjacent Asian nations. Peninsular Myanmar is peninsular only in that it is the southern elongate projection from main Myanmar and arbitrarily begins at the Sittaung River delta; it encompasses Mon State, the southern half of Kayin (Karen) State, and the Tanintharyi Region and is bordered to the east by Thailand and to the west by the Andaman Sea. Mainland Myanmar is further divided into north and south Myanmar by a latitudinal line through Mandalay and divided into east and west by a longitudinal line through Mandalay. North peninsular Myanmar is north of 13°N (just north of Palaw), and south peninsular Myanmar is south of 13°N. Additionally, topographic features serve as regional identifiers. Some common ones are the Ayeyarwady Delta, Bago Yoma, Central Dry Zone, Chin Hills, Mount Popa, Rakhine Yoma, and Shan Plateau.

I include occurrence data for those species that occur beyond the borders of Burma. This information is not precise and is abbreviated and lists only country names and “province” names where a species is limited to only a small area of the adjacent country. The data derive largely from secondary literature sources and have not been confirmed other than ensuring that there is agreement between two such sources. These extra-Myanmar occurrences include a variety of geographic names that encompass a part of a political entity or a combination of political units. The most common ones are peninsular India, northern India (area directly north of peninsular India), Northeast India (states east of West Bengal), Indochina (Laos, Cambodia, and Vietnam), the Malay Peninsula or Malaya (peninsular Thailand and adjacent Malaysia southward to Singapore), Southeast Asia (Thailand, Indochina, and Malaya), Peninsular Malaysia (usually includes Singapore occurrences), Greater Sunda Islands (Sumatra, Java, Borneo, Sulawesi, and their associate islets), Lesser Sunda Islands (Bali eastward to Wallace’s Line), and Sundas or Sunda Islands (both Greater and Lesser Sunda Islands). Because of its larger and varied landscape, China is treated variously: China (state name) for a single occurrence; regional subdivision(s), then

southwestern China (Yunnan and Guangxi) or southern China (Yunnan to Guangdong or Fujian) for multiple-state occurrences.

HISTORICAL GEOGRAPHICAL DESCRIPTORS IN SPECIES SYNONYMIES

A perusal of the twentieth century and earlier literature on history, travel, flora, and fauna of Myanmar uncovers a wealth of geographic terms that seem self-explanatory, but many are *not* or are now obscure locations. The following discussion offers definition of a few of these terms that may be helpful to other naturalists studying the biota of Myanmar.

Lower Burma and Upper Burma appeared formally in the mid-1800s in association with the British annexation of entire region of present-day Myanmar. Although simplistic, this explanation is useful for general discussions of herpetological exploration from the 1860s onward; however, the precolonial (1825 and earlier) history consists of multiple political regions as one ethnic group or another vied for supremacy over other groups, and central Myanmar, the primary home of the Burmans, was often militarily dominant and, even then, recognized as Upper Burma centered first on Bagan (Pagan) and then Ava (Mandalay). Lower Burma was the lower reaches of the Ayeyarwady (Irawadi, Irawady) River approximately from 50 km north of Pyay (Prome, Pyi) southward. Lower Burma, even before the First Anglo-Burmese War of 1824–1825, was divided into Arakan, Pegu, Martaban, and Tenasserim. For biological exploration, however, the regional/political units used by the British naturalists must be examined closely and delimited here because they have been widely misapplied.

Pegu is not the Bago Region! Pegu was used widely by British naturalists as the origin of many type specimens of the Burmese biota. For the past several decades, systematic herpetologists and likely other biologists have equated Pegu to Pegu Province and its modern equivalent, Bago Department. The Pegu of the nineteenth century was a much larger administrative area than twentieth century Pegu Department. Similarly, Tenasserim is not Tanintharyi. Most late nineteenth century atlases show these Pegu and Tenasserim as labels but not with boundary lines. Fortunately, these areas are outlined in a map from Phayre’s (1883) history of Burma (Figure A.1). The accuracy and reliability of this map were recognized only when I became aware that Sir Arthur P. Phayre was Captain Arthur Phayre, the first British commissioner of Pegu, who in 1852 moved the border between British administered Pegu and the Kingdom of Burma 50 miles (~80.5 km) northward to ensure that the extensive teak forest of the Toungoo area was administered by the British (SarDesai, 1994). Phayre’s map shows and labels three “administrative areas” for lower Burma: Pegu, Martaban, and Tenasserim. A subsequent map by Fea (1896) showing his routes during his biological collecting activities does not depict Martaban. Presumably, the administrative unit that was Martaban (the area between the Sittang and Salween [Thanlwin] Rivers) was merged into Tenasserim. There appear to be only two species with type localities of “Martaban,” *Lygosoma lineolatum* (Stolizcka) and

FIGURE A.1. Maps of late nineteenth century southern mainland Burma: (A) Phayre's (1883) Burma and (B) Debes's (1905) *Neuer Handatlas über alle Teile der Erde*.

Homalopsis semizonata Blyth, both of which subsequently had the type locality “corrected” to Mottama. These type localities will be examined further within the species account of each of these two reptiles. Many more herps have Pegu or Tenasserim as type localities, and where possible, these type localities need to be defined precisely, and that will require detailed morphological and molecular analyses.

A brief history of Burma is useful for an understanding of Burma’s geography, especially because natural history exploration began only when the British established trading stations and formal administration centers. Trading centers (often called factories) were variously established by the Portuguese, French, and others, but apparently, none of these foreign residents had any interest in natural history, and no Burmese amphibians or reptiles were described until British colonization.

A treaty signed at the end of the First Anglo-Burmese War (1824–1826) ceded Assam, Arakan, the coast of Tenasserim, and a portion of Martaban east of the Salween River to the British government. The British rebuilt the town of Moulmein (now Mawlamyaing), and it became the administrative headquarters and chief port of Tenasserim (Figure A.1). Natural history exploration and documentation began shortly thereafter. Small collections of natural history specimens were sent to Calcutta and the Asiatic Society of Bengal, which was founded as a natural history and geological specimen depository and locus for promulgation of anthropological, biological, and geological discoveries. With the arrival of Edward Blyth in 1840, its journal (*Proceedings of the Asiatic Society of Bengal*) became an important publication outlet for the notification of specimens collected in Burma. Many of the specimens had their origin labeled as Pegu or Tenasserim, occasionally with more precise locality data.

The latter specimens do not present a problem, but those with only the administrative name of Pegu or Tenasserim do. For the past 50 years or more, systematic herpetologists and likely other biologists have equated Pegu to Pegu Province and its modern equivalent, Bago Department (formerly Bago Division). As noted above, the Pegu of the nineteenth century was a much larger administrative area than the twentieth century Pegu/Bago administrative unit, although the modern Bago administrative

unit does encompass a major portion of the colonial Pegu. An example of nonequivalency is *Trionyx phayrei* Theobald, whose type locality is “in fluminibus montium Arakanensium, prope Basein” [mountain streams of the Arakan, Bassein District]. That type locality now lies within Ayeyarwady Department.

A few comments on Phayre’s map (Figure A.1) will assist with comparison of mid-nineteenth century Lower Burma regions and the present-day one. The Arakan was the region south of the spine of Arakan (=Rakhine) and extended from east of Chittagong to the mouth of the Bassein (Patheingyi) River. The basin of this river to the Sittaung River was Pegu. The northern border was roughly at 19°30’N. This boundary also appears to have been the northern border of Martaban. Martaban lay between the Sittaung and Bilin Rivers. Tenasserim lay to the east of the latter river to the Siam border (crest of the Dawna and Tenasserim mountain ranges and southward to Kathaung River). At the end of the First Anglo-Burmese War, Burma ceded the Arakan and Tenasserim to the British. Commercial interest of the East India Company apparently drove the British 1852 invasion and defeat of the Burmese, resulting in the “peace offering” of Pegu and that region’s expansion northward to 19°30’N to ensure that the British had control of the teak forest in the Toungoo area. The 1885 war gave the British control of all of Burma.

The preceding synopsis demonstrates that Pegu is not equivalent to Bago Department (formerly Pegu Division) and that Tanintharyi Department similarly is not equivalent to Tenasserim. Tanintharyi is the southern portion of Tenasserim and less than half its area. Presently, Ayeyarwady, Yangon, Bago, and the southern quarter of Magway Department occupy the area of eighteenth century Pegu. Martaban and Tenasserim have a different history, a history that I have not fully traced. On the basis of Fea’s travelogue and route maps (Fea, 1896; also see Likhitrakarn et al., 2017: table 1 for list of Fea’s collecting localities with geocoordinates), Martaban no longer existed during his biological surveys of 1885–1889 as most of the area is labeled Tenasserim on his maps. Thus, Tenasserim encompassed parts of present-day Kayah, Mon, and Tanintharyi. The present-day borders of these administrative units were formalized subsequent to Myanmar’s independence from Great Britain.

Appendix B: Occurrence Matrix for Amphibians of Myanmar

TABLE B1. Occurrence matrix for amphibians of Myanmar. The matrix displays the presence of amphibian species vouchered from the 14 administrative units of Myanmar and the main countries bordering Myanmar. The order of presentation matches the order of presentation in the text. Symbols: bullet (•), presence; dash (—), no record; question mark (?), possibly present but no recent record.

Family and genus	Species	NE India	Bangladesh	Kachin	Sagaing	Chin	Mandalay	Shan	Rakhine	Magway	Bago	Kayah	Ayeyarwady	Yangon	Mon	Kayin	Tanintharyi	Yunnan and Laos	Thailand
Chikilidae																			
<i>Chikila</i>	<i>alcocki</i>	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ichthyophiidae																			
<i>Ichthyophis</i>	<i>bannanicus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
	<i>kohtaoensis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	•
	<i>multicolor</i>	—	—	—	—	—	—	—	•	—	•	—	•	—	—	—	—	—	—
Salamandridae																			
<i>Tylototriton</i>	<i>kachinorum</i>	—	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>ngarsuensis</i>	—	—	—	—	—	—	•	—	—	—	—	—	—	—	—	—	—	—
	<i>panwaensis</i>	—	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>shanorum</i>	—	—	—	—	—	—	•	—	—	—	—	—	—	—	—	—	—	—
	<i>verrucosus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
Bufonidae																			
<i>Ansonia</i>	<i>kraensis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•
	<i>kyaukseensis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	—	—	—
	<i>pilokensis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•
	<i>thinthinae</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	—
<i>Bufo</i>	<i>pageoti</i>	—	—	—	—	•	—	—	—	•	—	—	—	—	—	—	—	—	—
<i>Duttaphrynus</i>	<i>crocus</i>	—	—	—	—	—	—	—	•	—	—	—	—	—	—	—	—	—	—
	<i>himalayanus</i>	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
	<i>melanostictus</i>	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	<i>stuarti</i>	•	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ingerophrynus</i>	<i>macrotis</i>	•	—	•	•	—	—	—	•	—	—	—	—	•	—	—	—	—	•
	<i>parvus</i>	•	—	—	—	—	—	—	—	—	—	—	—	•	—	—	•	—	•
<i>Leptophryne</i>	<i>borbonica</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•
<i>Phrynoidis</i>	<i>asper</i>	—	—	—	—	—	—	—	—	—	—	•	—	—	•	•	•	—	•
Ceratobatrachidae																			
<i>Alcalus</i>	<i>tasanae</i>	—	—	—	—	—	—	—	—	—	—	•	—	—	—	•	•	—	•
Dicroglossidae																			
<i>Euphlyctis</i>	<i>cyanophlyctis</i>	—	•	—	•	•	•	—	•	•	—	—	—	—	—	—	—	—	—
	<i>goshi</i>	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>kalasgramensis</i>	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Fejervarya</i>	<i>kupitzi</i>	—	—	—	•	—	—	—	—	—	•	—	—	—	—	—	—	—	—
	<i>limnocharis</i>	—	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	<i>moodiei</i>	—	•	—	—	—	—	—	•	—	•	—	•	•	•	—	•	—	•
	<i>orissaensis</i>	—	•	—	—	—	—	—	•	—	•	—	•	•	•	—	—	—	•
<i>Hoplobatrachus</i>	<i>crassus</i>	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>litoralis</i>	—	•	—	—	—	—	—	?	—	—	—	?	•	•	—	?	—	?
	<i>rugulosus</i>	—	—	•	•	—	•	•	?	•	•	—	—	—	•	—	•	—	•
	<i>tigerinus</i>	•	•	•	•	•	•	•	•	•	•	—	—	—	—	—	—	—	—

TABLE B1. (Continued.)

Family and genus	Species	NE India	Bangladesh	Kachin	Sagaing	Chin	Mandalay	Shan	Rakhine	Magway	Bago	Kayah	Ayeyarwady	Yangon	Mon	Kayin	Tanintharyi	Yunnan and Laos	Thailand
	<i>parva</i>	?	?	—	—	—	—	?	—	?	—	•	—	—	—	—	—	?	?
	<i>periosa</i>	•	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>wuliangshanensis</i>	•	—	?	?	—	—	—	—	—	—	—	—	—	—	—	—	•	—
<i>Oreolalax</i>	<i>jingdongensis</i>	—	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
<i>Scutiger</i>	<i>adungensis</i>	—	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Microhylidae																			
<i>Glyphoglossus</i>	<i>guttulatus</i>	—	—	—	—	—	—	•	—	—	•	—	—	•	—	—	—	—	•
	<i>molossus</i>	—	—	—	•	—	•	—	—	•	•	—	•	—	—	—	—	•	•
<i>Kalophrynus</i>	<i>anya</i>	—	—	•	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>interlineatus</i>	—	—	—	—	—	—	—	—	—	•	—	—	—	•	—	•	•	•
<i>Kaloula</i>	<i>latidisca</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	•
	<i>pulchra</i>	•	•	•	•	—	•	•	•	•	•	•	•	•	•	•	•	•	•
<i>Microhyla</i>	<i>berdmorei</i>	•	•	—	—	•	—	—	—	•	•	—	—	•	—	—	•	•	•
	<i>butleri</i>	—	—	•	—	—	—	•	•	—	—	•	•	•	—	—	—	•	•
	<i>fodiens</i>	—	—	—	—	—	—	—	—	•	—	—	—	—	—	—	—	—	—
	<i>heymonsi</i>	—	—	•	—	—	—	•	—	—	•	•	—	•	•	—	•	•	•
	<i>irrawaddy</i>	—	—	—	—	—	—	—	—	•	—	—	—	—	—	—	—	—	—
	<i>mantheyi</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	•
	<i>mukhlesuri</i>	—	•	•	•	•	•	—	—	•	•	•	•	•	•	•	•	•	•
	<i>pulchra</i>	—	—	—	•	—	•	—	—	•	—	—	—	—	—	—	•	•	•
	<i>rubra</i>	—	—	—	—	—	•	—	—	•	—	—	—	—	—	—	—	—	—
<i>Micryletta</i>	<i>aishani</i>	•	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>inornata</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	—
	<i>lineata</i>	—	—	—	—	—	—	•	—	—	—	—	—	—	•	•	•	—	•
<i>Uperodon</i>	<i>globulosus</i>	•	•	—	•	•	—	—	—	—	—	—	—	—	—	—	—	—	—
Ranidae																			
<i>Amolops</i>	<i>afghanus</i>	•	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>archotaphus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•
	<i>bellulus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
	<i>gerbillus</i>	•	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>indoburmanensis</i>	—	—	•	•	•	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>kaulbacki</i>	•	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>longimanus</i>	—	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
	<i>mantzorum</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
	<i>marmoratus</i>	—	—	•	—	—	•	•	—	—	•	—	•	—	•	•	•	•	•
	<i>panhai</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	•
	<i>putaoensis</i>	—	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>viridimaculatus</i>	—	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
<i>Chalcorana</i>	<i>eschatia</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	•
<i>Clinotarsus</i>	<i>alticola</i>	•	•	•	•	•	—	—	•	—	—	—	—	—	•	—	•	—	—
	<i>penelope</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	•	—	•
<i>Humerana</i>	<i>humeralis</i>	•	•	•	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>oatesii</i>	—	—	—	—	—	—	—	—	—	•	—	—	•	—	—	—	—	—

TABLE B1. (Continued.)

Family and genus	Species	NE India	Bangladesh	Kachin	Sagaing	Chin	Mandalay	Shan	Rakhine	Magway	Bago	Kayah	Ayeyarwady	Yangon	Mon	Kayin	Tanintharyi	Yunnan and Laos	Thailand
<i>Hydrophylax</i>	<i>leptoglossa</i>	•	•	•	•	•	—	•	•	—	•	•	•	•	•	•	•	—	•
<i>Hylarana</i>	<i>erythraea</i>	—	—	—	•	—	—	—	•	—	•	—	•	•	•	•	—	•	•
	“lateralis”	—	—	•	—	—	—	•	—	—	•	—	—	•	—	•	—	•	•
	<i>macroductyla</i>	—	—	•	•	—	—	•	•	—	•	—	•	•	•	•	•	•	•
	<i>margariana</i>	—	—	?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>tytleri</i>	•	•	—	—	?	—	—	?	—	•	—	—	—	—	—	—	—	—
<i>Odorrana</i>	<i>andersonii</i>	•	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	•	•
	<i>cangyuanensis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
	<i>chloronota</i>	•	—	•	•	—	—	•	•	—	•	—	—	—	—	—	—	•	—
	<i>hosii</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	•	•
	<i>livida</i>	•	—	•	—	•	•	—	—	—	—	—	—	—	•	—	•	—	•
	<i>macrotympa</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
	<i>nasica</i>	—	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	•	•
<i>Papurana</i>	<i>milleti</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	•	•
<i>Pterorana</i>	<i>khare</i>	•	—	—	•	•	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Sylvirana</i>	<i>cubitalis</i>	—	—	•	—	—	•	•	—	—	—	—	—	•	—	—	—	•	•
	<i>lacrima</i>	—	—	—	—	•	•	—	—	—	—	—	—	—	—	—	—	—	—
	<i>malayana</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	•
	<i>nigrovittata</i>	—	—	•	•	•	•	•	•	—	•	•	•	—	•	—	•	•	•
	<i>roberti</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	—
Rhacophoridae																			
<i>Chirixalus</i>	<i>doriae</i>	•	•	•	•	—	—	—	—	—	•	•	—	•	—	—	•	•	•
	<i>nongkhorensis</i>	•	—	•	•	—	•	•	•	—	—	•	—	—	—	—	—	—	•
<i>Gracixalus</i>	<i>carinensis</i>	—	—	—	—	—	—	—	—	—	—	•	—	—	—	—	—	—	•
<i>Kurixalus</i>	<i>bisacculus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	•
	<i>naso</i>	•	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>verrucosus</i>	—	—	•	—	—	—	—	—	—	—	•	—	—	—	—	—	•	•
	<i>yangi</i>	—	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
<i>Leptomantis</i>	<i>cyanopunctatus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	•
<i>Nasutixalus</i>	<i>jerdonii</i>	•	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>yingjiangensis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
<i>Nyctixalus</i>	<i>pictus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	•
<i>Philautus</i>	<i>cinerascens</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	—	—	—
	<i>kempii</i>	•	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>tytthus</i>	—	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	?	—
<i>Polypedates</i>	<i>braueri</i>	—	—	•	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—
	<i>discantus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	•	—	•
	<i>leucomystax</i>	—	—	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	<i>maculatus</i>	—	•	—	—	•	—	—	—	•	—	—	—	—	—	—	—	—	—
	<i>megacephalus</i>	•	—	•	—	—	—	•	—	—	—	—	—	—	—	—	—	•	•
	<i>mutus</i>	—	—	•	—	—	—	•	—	—	•	—	—	—	—	—	—	•	•
	<i>teraiensis</i>	•	•	—	•	—	—	—	—	—	•	•	—	•	—	—	—	—	—

TABLE B1. (Continued.)

[illegible]

Appendix C:
Occurrence Matrix
for Crocodilians and Turtles
of Myanmar

TABLE C1. Occurrence matrix for crocodilians and turtles of Myanmar. The matrix displays the presence of crocodilian and turtle species confirmed for the 14 administrative units of Myanmar since 1990 and likely still present in 2020. Symbols: bullet (•), presence; dash (—), no record; question mark (?), possibly present but no recent record; exclamation mark (!), now extinct.

Family and genus	Species	Kachin	Sagaing	Chin	Mandalay	Shan	Rakhine	Magway	Bago	Kayah	Ayeyarwady	Yangon	Mon	Kayin	Tanintharyi
Crocodylia															
Crocodylidae															
<i>Crocodylus</i>	<i>palustris</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>porosus</i>	—	—	—	—	—	!	—	—	—	•	—	!	—	•
Gavialidae															
<i>Gavialis</i>	<i>gangeticus</i>	—	—	—	—	•	!	—	—	—	—	—	—	—	—
Testudines															
Cheloniidae															
<i>Caretta</i>	<i>caretta</i>	—	—	—	—	—	?	—	—	—	•	?	?	—	?
<i>Chelonia</i>	<i>mydas</i>	—	—	—	—	—	•	—	—	—	•	?	?	—	•
<i>Eretmochelys</i>	<i>imbricata</i>	—	—	—	—	—	•	—	—	—	•	?	?	—	•
<i>Lepidochelys</i>	<i>olivacea</i>	—	—	—	—	—	•	—	—	—	•	?	?	—	?
Dermochelyidae															
<i>Dermochelys</i>	<i>coriacea</i>	—	—	—	—	—	?	—	—	—	?	?	—	—	•
Emydidae															
<i>Trachemys</i>	<i>scripta</i>	—	—	—	—	—	—	—	—	—	—	•	—	—	•
Geoemydidae															
<i>Batagur</i>	<i>affinis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>baska</i>	—	—	—	—	—	!	—	—	—	!	—	—	—	!
	<i>trivittata</i>	—	•	—	•	—	—	—	?	—	—	—	?	—	—
<i>Cuora</i>	<i>amboinensis</i>	•	•	—	—	—	•	—	—	—	—	—	—	—	•
	<i>mouhotii</i>	—	•	•	—	—	•	—	—	—	—	—	—	—	—
<i>Cyclemys</i>	<i>fusca</i>	•	•	•	—	•	•	—	—	—	•	—	—	—	—
	<i>oldhamii</i>	—	—	—	—	•	—	—	•	—	—	—	—	—	•
<i>Heosemys</i>	<i>depressa</i>	—	—	•	—	—	•	—	—	—	—	—	—	—	—
	<i>grandis</i>	?	!	—	!	—	—	—	•	•	•	—	•	•	•
	<i>spinosa</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	•
<i>Malayemys</i>	<i>macrocephala</i>	—	—	—	—	—	—	—	—	•	—	—	•	•	•
<i>Melanochelys</i>	<i>tricarinata</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	<i>trijuga</i>	•	•	—	—	—	•	—	•	•	—	—	•	—	—
<i>Morenia</i>	<i>ocellata</i>	•	•	—	?	—	•	—	•	—	•	•	•	—	•
<i>Siebenrockiella</i>	<i>crassicolis</i>	—	—	—	—	—	—	—	—	—	—	—	—	—	•
Platysternidae															
<i>Platysternon</i>	<i>megacephalum</i>	—	—	—	—	•	—	—	•	•	—	—	•	•	—
Testudinidae															
<i>Geochelone</i>	<i>platynota</i>	—	•	—	•	—	—	•	!	—	—	—	—	—	—
<i>Indotestudo</i>	<i>elongata</i>	•	•	•	•	—	•	•	•	•	—	—	•	—	•
<i>Manouria</i>	<i>emys</i>	—	—	•	—	—	•	—	—	—	—	—	•	•	•
	<i>impressa</i>	•	—	—	—	—	•	•	—	—	—	—	—	—	—

TABLE C1. (Continued.)

Family and genus	Species	Kachin	Sagaing	Chin	Mandalay	Shan	Rakhine	Magway	Bago	Kayah	Ayeyarwady	Yangon	Mon	Kayin	Tanintharyi
Trionychidae															
<i>Lissemys</i>	<i>punctata</i>	—	—	—	—	—	•	—	—	—	—	—	—	—	—
	<i>scutata</i>	•	•	—	•	—	—	—	•	—	—	•	•	—	—
<i>Amyda</i>	<i>ornata</i>	•	•	—	•	—	•	—	—	—	—	—	—	—	•
<i>Chitra</i>	<i>vandijki</i>	•	•	—	—	—	—	—	?	—	—	—	?	—	—
<i>Dogania</i>	<i>subplana</i>	—	—	—	—	—	—	—	—	—	—	—	•	?	•
<i>Nilssonia</i>	<i>formosa</i>	•	•	—	•	•	—	•	•	•	•	—	•	•	•
<i>Pelochelys</i>	<i>cantorii</i>	—	—	—	—	—	•	—	—	—	?	?	?	—	?

Appendix D:
Species of Amphibians
and Turtles with Type
Localities in Myanmar

TABLE D1. Species of amphibians and turtles with type localities in Myanmar. The precise locality of each species is available in the checklist synonymies; only the Myanmar regional administrative unit is listed below. The original name is given in parentheses if different from the currently recognized name.

Taxon	Myanmar locality	Taxon	Myanmar locality
Amphibia: Caudata			
Salamandridae		<i>Amolops longimanus</i>	Kachin
<i>Tylototriton kachinorum</i>	Kachin	<i>Amolops marmoratus</i>	Bago
<i>Tylototriton ngarsuensis</i>	Shan	<i>Humerana humeralis</i>	Kachin
<i>Tylototriton panwaensis</i>	Kachin	<i>Humerana oatesii</i>	Bago
<i>Tylototriton shanorum</i>	Kachin	<i>Hydrophylax leptoglossa</i>	Yangon
Amphibia: Gymnophiona		" <i>Hylarana</i> " <i>lateralis</i>	Kayin
Ichthyophiidae		<i>Hylarana macrodactyla</i> (<i>Hylarana subcoerulea</i>)	Yangon
<i>Ichthyophis multicolor</i>	Ayeyarwady	" <i>Hylarana</i> " <i>margariana</i>	unknown
Amphibia: Anura		<i>Nanorana andersoni</i>	Kachin
Bufo		<i>Odorrana livida</i>	Tenasserim
<i>Ansonia kyaiktiyoensis</i>	Mon	<i>Sylvirana lacrima</i>	Chin
<i>Ansonia thinthinae</i>	Tanintharyi	<i>Sylvirana nigrovittata</i>	Tanintharyi
<i>Duttaphrynus crocus</i>	Rakhine	<i>Sylvirana roberti</i>	Tanintharyi
<i>Duttaphrynus stuarti</i>	Kachin	Rhacophoridae	
<i>Ingerophrynus macrotis</i>	Kachin	<i>Chirixalus doriae</i>	Kayah
Dicroglossidae		<i>Gracixalus carinensis</i>	Kayah
<i>Fejervarya altilabris</i>	"Pegu"	<i>Kurixalus verrucosus</i>	Kayah
<i>Fejervarya kupitzi</i>	Sagaing	<i>Philautus cinerascens</i>	Mon
<i>Hoplobatrachus rugulosus</i> (<i>Rana burkilli</i>)	Tanintharyi	<i>Philautus tyttus</i>	Kachin
<i>Limnonectes blythii</i>	Tanintharyi	<i>Polypedates mutus</i> (<i>Rhacophorus mutus</i>)	Kachin
<i>Limnonectes doria</i>	Kayin	<i>Raorchestes parvulus</i> (<i>Ixalus parvulus</i>)	Kayah
<i>Limnonectes limborgi</i>	"Tenasserim"	<i>Rhacophorus bipunctatus</i> (<i>Rhacophorus htunwini</i>)	Kachin
<i>Limnonectes macrognathus</i>	Kayah	<i>Rhacophorus feae</i>	Kayah
<i>Nanorana arnoldi</i>	Kachin	<i>Rhacophorus turpes</i>	Kachin
<i>Nanorana chayuensis</i>	Kachin	<i>Rohanixalus punctatus</i>	Rakhine
<i>Nanorana feae</i>	Kachin	<i>Rohanixalus vittatus</i>	Kachin
<i>Ingerana tenasserimensis</i> (<i>Rana tenasserimensis</i>)	"Tenasserim"	<i>Theloderma phrynoderma</i> (<i>Phrynoderma asperum</i>)	Kayah
Megophryidae		<i>Theloderma pyaukkya</i>	Kachin
<i>Leptobrachella pelodytoides</i>	Kayah	<i>Zhangixalus burmanus</i>	Kachin
<i>Leptobrachium rakhinensis</i>	Rakhine	(<i>Polypedates</i> (<i>Rhacophorus</i>) <i>dennysii burmana</i>)	
<i>Megophrys carinense</i> (<i>Leptobrachium carinense</i>)	Kayah	<i>Zhangixalus burmanus</i> (<i>Rhacophorus taronensis</i>)	Kachin
<i>Megophrys feae</i> (<i>Megalophrys feae</i>)	Kachin	<i>Zhangixalus feae</i> (<i>Rhacophorus feae</i>)	Kayah
<i>Megophrys parva</i> (<i>Leptobrachium parva</i>)	Kayah	Reptilia: Testudines	
<i>Scutiger adungensis</i>	Kachin	Geoemydidae	
Microhylidae		<i>Batagur baska</i>	
<i>Kalophrynus anya</i>	Sagaing	(<i>Tetraonyx lessonii</i>)	Pegu
<i>Glyphoglossus guttulatus</i>	"Pegu"	(<i>Trionyx longicollis</i>)	Pegu
<i>Glyphoglossus molossus</i>	"Pegu"	<i>Batagur trivittata</i> (<i>Batagur iravadica</i>)	Pegu, Kachin
<i>Kaloula pulchra</i> (<i>Callula macrodactyla</i>)	Kayin	<i>Cuora amboinensis kamaroma</i>	Kachin
<i>Microhyla berdmorei</i> (<i>Engystoma? Berdmorei</i>)	"Pegu"	(<i>Cuora amboinensis lineata</i>)	
<i>Microhyla fodiens</i>	Magway	<i>Cyclemys fusca</i>	Kachin
<i>Microhyla irrawaddy</i>	Magway	<i>Cyclemys oldhamii</i>	Tanintharyi
Ranidae		<i>Cyclemys oldhamii</i> (<i>Cyclemys dhor shanensis</i>)	Shan
<i>Amolops indoburmanensis</i>	Chin	<i>Heosemys depressa</i> (<i>Geoemyda Arkana</i>)	Rakhine
<i>Amolops kaulbacki</i>	Kachin	<i>Melanochelys trijuga edeniana</i>	Rakhine, Pegu,
		(<i>Melanochelys edeniana</i>)	Tenasserim

TABLE D1. (Continued.)

Taxon	Myanmar locality	Taxon	Myanmar locality
<i>Melanochelys trijuga edeniana</i> (<i>Emys trijuga</i> var. <i>burmana</i>)	Kachin, Tanintharyi, Rakhine	Trionychidae <i>Amyda ornata</i> (<i>Trionyx Phayrei</i>)	Rakhine
<i>Morenia ocellata</i> (<i>Emys berdmorei</i>)	Tanintharyi	(<i>Trionyx ephippium</i>)	Tenasserim
<i>Siebenrockiella crassicollis</i> (<i>Emys nigra</i>)	Tanintharyi	<i>Chitra vandijki</i>	Kachin
Platysternidae		<i>Lissemys scutata</i>	Pegu
<i>Platysternon megacephalum</i> (<i>Platysternon peguense</i>)	Pegu	<i>Nilssonia formosa</i> (<i>Trionyx?</i> <i>peguensis</i>)	Pegu
Testudinidae		(<i>Trionyx grayii</i>)	Irawadi Valley
<i>Indotestudo elongata</i>	Rakhine		
<i>Manouria emys phayrei</i>	Tenasserim		

Appendix E:

Literature and Abbreviations Cited in Synonymies

The following list contains full titles of all serials and books cited in the synonymies. Some titles are exceptionally long; these I abbreviated in the main text. For these abbreviated titles, the full titles follow the corresponding abbreviated ones in the list below and are enclosed in brackets. Note that none of the works cited in synonymies are included in the References section. The abbreviation “SIL” indicates the citation is from the Smithsonian Libraries catalog. The note “not seen” indicates that I did not personally see this source.

SERIALS

For serials without volume numbers, the date is used as volume number only when actual publication date is subsequent to the date listed on the volume.

Acta Herpetologica Sinica, Chengdu, new series

Acta Zoologica Sinica

Acta Zootaxonomica Sinica

Anales de la Universidad de Chile

Annales des sciences naturelle. Zoologie et biologie animale

Annales du Muséum d'histoire naturelle, Paris

Annali del Museo Civico di Storia Naturale di Genova, series 2

Annals and Magazine of Natural History

Annals of the Lyceum of Natural History of New York

Annexe au Bulletin Générale de l'Instruction Publique, Hanoi

Annuaire du Musée Zoologique de l'Académie Impériale des Science de St-Petersbourg

Aquarien- und Terrarien-Zeitschrift Arkiv för Zoologi

Archiv für Naturgeschichte

Atti del Reale Istituto Veneto di Scienze, Lettere e Arti

Bericht der Senckenbergischen Naturforschenden Gesellschaft in Frankfurt am Main

Bulletin de la Société philomathique de Paris

Bulletin des Sciences naturelles et de géologie, Paris

Bulletin du Muséum national d'histoire naturelle

Bulletin Mensuel de la Société Linnéenne de Lyon

Bulletin of the Museum of Comparative Zoology

Bulletin of the United States National Museum
China Journal of Science and Arts, Shanghai [published 1923–1926, volumes 1–5; SIL]
Comptes Rendus Biologies [2000 onward]
Contributions in Science, . . . Los Angeles County
 [= *Contributions in Science, Natural History Museum of Los Angeles County*]
Contributions to Biology Lab Science Society, China, Zoology Series [not seen]
Hamadryad
Isis von Oken [published in 35 volumes from 1820 through 1848]
Japanese Journal of Herpetology
Journal and Proceedings of the Asiatic Society of Bengal
Journal de mon troisième voyage d'exploration dans l'empire Chinois
Journal of the Academy of Natural Sciences of Philadelphia
Journal of the Asiatic Society of Bengal
Journal of the Linnean Society of London, Zoology
Journal of the Natural History Society of Siam
Königsberger Archiv für Naturwissenschaftliche und Mathematik [see Schweiger, 1812]
Königliga Vetenskaps Academiens Nya Handlingar
Mémoires de l'Académie Impériale des Sciences de Saint-Petersbourg
 [= *Mémoires de l'Académie Impériale des Sciences de Saint-Petersbourg*, 7e série, *Sciences Mathématiques, Physiques et Naturelles. Seconde Partie: Sciences Naturelles*]
Memoirs of the Asiatic Society of Bengal
Monatsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin
Natural History Bulletin of the Siam Society
Natuurkundig Tijdschrift voor Nederlandsch Indie
Nouvelles Archives du Muséum d'histoire naturelle de Paris
Occasional Papers of the Boston Society of Natural History
Pakistan Journal of Zoology
Palaontologia Indica, Memoirs of the Geological Survey of India
Philippine Journal of Science
Proceedings of the Asiatic Society of Bengal
Proceedings of the Biological Society of Washington
Proceedings of the California Academy of Sciences
Proceedings of the New England Zoological Club
Proceedings of the United States National Museum
Proceedings of the Zoological Society of London
Records of the Indian Museum
Records of the Zoological Survey of India
Revue Suisse de Zoologie
Sitzungsberichte der Gesellschaft Naturforschender Freunde zu Berlin
Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Mathematisch . . . , Wien
 [= *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften. Mathematisch-Naturwissenschaftliche Classe, Abteilung 1, Mineralogie, Botanik, Zoologie, Anatomie, Geologie und Paläontologie*; published in Vienna 1861–1871]

Spolia Zeylanica
University of Kansas Science Bulletin
Verhandlung der kaiser-königlichen zoologische-botanischen Gesellschaft in Wien
Verhandlungen der Naturforschenden Gesellschaft in Basel
ZooKeys
Zoologica Scripta
Zoological Journal of the Linnean Society
Zoological Science
Zoologische Ergebnisse einer reise in Niederländisch Ost-Indien
Zoologische Garten
Zoologische Jahrbücher. Abteilung für Systematik . . . Tiere
 [= *Zoologische Jahrbücher. Abteilung für Systematik, Geographie und Biologie der Tiere*, 1887–1926; *Zoologische Jahrbücher. Abteilung für Systematik, Ökologie und Geographie der Tiere*, 1928/1929–1994/1995]
Zoologischer Anzeiger
Zootaxa

BOOKS

Anderson, 1878, *Anatomical and Zoological Researches: . . . Western Yunnan*
 [= Anderson, 1878, *Anatomical and Zoological Researches: Comprising an Account of the Zoological Results of the Two Expeditions to Western Yunnan in 1868 and 1875; and a Monograph of the Two Cetacean Genera, Platanista and Orcella*]
 Annandale and Robinson, 1903, *Fasciculi Malayenses. Anthropological and Zoological Results . . .*
 [= Annandale and Robinson, 1903–1904, *Fasciculi Malayenses. Anthropological and Zoological Results of an Expedition to Perak and the Siamese Malay States, 1901–1902*; published in two or three parts, presumably zoological section was first and published in 1903]
 Boddaert, 1770, *Brief van de kraakbeenige schilpad. Epistolade de testudine cartilaginea*
 Bonnaterre, 1789, *Tableau encyclopédique . . . nature. Erpétologie*
 [= Bonnaterre, 1789, *Tableau encyclopédique et méthodique des trois règnes de la nature: Dédié et présenté à M. Necker, ministre d'État, & directeur général des Finances. Erpétologie*]
 Bory de Saint Vincent, 1833, *Expedition scientifique de Moree . . . vertebres*
 [= Bory de Saint Vincent, 1833, *Expedition scientifique de Moree. Section des sciences physiques*, Volume 3, Section 1: *Des animaux vertebres*]
 Boulenger, 1882, *Catalogue of the Batrachia Salientia s. Ecaudata . . . British Museum*, 2nd ed.
 [= Boulenger, 1882, *Catalogue of the Batrachia Salientia s. Ecaudata in the Collection of the British Museum*, 2nd edition]
 Boulenger, 1885, *Catalogue of the Lizards . . . Volume 2: Iguaniidae, . . . Amphisbaenidae*, 2nd ed.

- [= Boulenger, 1885, *Catalogue of the Lizards in the British Museum (Natural History)*. Volume 2: Iguanidae, Xenosauridae, Zonuridae, Anguidae, Anniellidae, Helodermatidae, Varanidae, Xantusidae, Teiidae, Amphisbaenidae, 2nd edition]
- Boulenger, 1887, *Catalogue of the Lizards* . . . Volume 3: *Lacertidae*, . . . *Chamaeleonidae*, 2nd ed.
- [= Boulenger, 1887, *Catalogue of the Lizards in the British Museum (Natural History)*. Volume 3: *Lacertidae*, *Gerrhosauridae*, *Scincidae*, *Anelytropidae*, *Dibamidae*, *Chamaeleonidae*, 2nd edition]
- Boulenger, 1890, *Reptilia and Batrachia. The Fauna of British India, Including Ceylon and Burma*
- Boulenger, 1893, *Catalogue of the Snakes* . . . Volume 1: *Containing* . . . *Typhlopidae* . . . *Colubridae Aglyphae*
- [= Boulenger, 1893, *Catalogue of the Snakes in the British Museum (Natural History)*. Volume 1: *Containing the Families Typhlopidae, Glauconidae, Boidae, Ilysiidae, Uropeltidae, Xenopeltidae, and Colubridae Aglyphae*]
- Boulenger, 1894, *Catalogue of the Snakes* . . . Volume 2: *Containing Conclusion* . . . *Colubridae Aglyphae*
- [= Boulenger, 1894, *Catalogue of the Snakes in the British Museum (Natural History)*. Volume 2: *Containing the Conclusion of the Colubridae Aglyphae*]
- Boulenger, 1896, *Catalogue of the Snakes* . . . Volume 3: *Containing the Colubridae (Opisthoglyphae . . . Viperidae)*
- [= Boulenger, 1896, *Catalogue of the Snakes in the British Museum (Natural History)*. Volume 3: *Containing the Colubridae (Opisthoglyphae, Proteroglyphae), Amblycephalidae, and Viperidae*]
- Bourret, 1942, *Les Batrachiens de l'Indochine*
- Cantor, 1847, *Catalogue of Reptiles* . . . *Malayan Peninsula and Islands* . . .
- [= Cantor, 1847, *Catalogue of Reptiles Inhabiting the Malayan Peninsula and Islands, Collected or Observed*]
- Catesby, 1771, *Natural History of Carolina, Florida, and the Bahama Islands*
- CBFTT Checklist, 2009, 2012 [*Conservation Biology of Freshwater Turtles and Tortoises*; also, sequential lists from 2007, 2008, 2010.]
- [= Turtle Taxonomy Working Group, 2009, "Turtles of the World: Annotated Checklist of Taxonomy and Synonymy, 2009 Update, with Conservation Status Summary". *Chelonian Research Monographs* 5]
- [= Turtle Taxonomy Working Group, 2012, *Turtles of the World, 2012 Update: Annotated Checklist of Taxonomy, Synonymy, Distribution, and Conservation Status*. *Chelonian Research Monographs* 5]
- Cuvier, 1829, *Le règne animal distribué d'après son organisation, . . . l'anatomie comparée*, 2nd ed.
- [= Cuvier, 1829, *Le règne animal distribué d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'introduction à l'anatomie comparée*, 2nd edition]
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Appendix F:

Sources of Illustrations

The following information is arranged sequentially by appearance in the text. The illustrator or publication is identified for each image.

FIGURES

- 1.1. A, B: Modifications by G. R. Zug. Base maps derived from <https://d-maps.com> (accessed 12 July 2020): (A) birmanie28.ai; (B) birmanie22.ai.
- 2.1. A, B: Ted R. Kahn;
C: Molly Dwyer Griffin.
- 2.2. A, F, G: Catalina Montalvo;
B, C, H: Molly Dwyer Griffin;
D, E: Ted R. Kahn.
- 2.3. A, B, D: Catalina Montalvo;
C, E: Ted R. Kahn.
- 2.4. A: Molly Dwyer Griffin;
B–D: Catalina Montalvo.
- 2.5. A, B, D: Catalina Montalvo;
C: Molly Dwyer Griffin.
- 2.6. A–E: Molly Dwyer Griffin.
- 2.7. Ted R. Kahn.
- 2.8–2.12. Molly Dwyer Griffin.
- 2.13. Boulenger, 1890, fig. 132.
- 2.14–2.25. Molly Dwyer Griffin.
- 2.26. Catalina Montalvo.
- 2.27. Molly Dwyer Griffin.
- 2.28. Catalina Montalvo.
- 2.29–2.31. Molly Dwyer Griffin.
- 2.32. Catalina Montalvo.
- 2.33. Günther, 1876.
- 2.34. Molly Dwyer Griffin.
- 2.35. Boulenger, 1912, fig. 71.
- 3.1. A–D: Ted R. Kahn after figures in Wermuth and Mertens (1961).

- 3.2–3.6. Elénore Dixon-Roche.
 A.1. A: Phayre (1883), inset map;
 B: excerpt of Südost-Asien map from Debes (1905).

PLATES

1. A, C, D, H, I:	J. V. Vindum;	2. A, C, H, K:	Hla Tun;
B, L:	Hla Tun;	B, D, G, I:	G. R. Zug;
E:	gift from ornithologist (name lost);	E, F:	D. G. Mulcahy;
F, J, K:	G. R. Zug;	J, L:	J. V. Vindum.
G:	D. G. Mulcahy.	3. A, C, D, L:	D. G. Mulcahy;
		B, I, J:	J. V. Vindum;
		E, F, H, K:	Hla Tun;
		G:	G. R. Zug.
		4. A–F:	Hla Tun;
		G:	J. V. Vindum;
		H–L:	G. R. Zug.

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