

HERPETOFAUNA OF THE CHATTHIN WILDLIFE SANCTUARY, NORTH-CENTRAL MYANMAR WITH PRELIMINARY OBSERVATIONS OF THEIR NATURAL HISTORY

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(with two text-figures)

ABSTRACT.- Sixteen species of amphibians and 34 species of reptiles comprise the herpetofauna of a dry deciduous dipterocarp forest and adjacent farmlands of a wildlife preserve in north-central Myanmar. Numerically, several species of frogs (e.g., *Rana limnocharis*, *Rana rugulosa*, *Microhyla* sp.) are the most abundant components of the Chatthin herpetofauna, and no species of reptile approaches their abundance or density. The area has a strong seasonal shift between wet (monsoon) and dry, and all species show distinct patterns of seasonal activity and associated abundance, no less so for any reptilian species.

KEY WORDS.- Amphibia, Reptilia, natural history, size of adults, Burma, Myanmar.

INTRODUCTION

The Chatthin Wildlife Sanctuary (23° 34.46'N; 95° 44.26'E) is a 268.2 km² nature reserve approximately 160 km north-west of Mandalay, in central Myanmar (Fig. 1). The sanctuary was formed by the British Territorial Government of Burma in 1941 by combining two adjacent forest reserves and unassigned forest (Salter and Sayer, 1983). It was created mainly as a preserve for the thamin or Eld's deer (*Cervus eldi*), but the Japanese supported invasion in 1942, the subsequent war years, and the early years of independence offered little opportunity to protect the thamin or other animal and plant species. Nonetheless, the reserve was recognized locally and received some attention by the Myanmar Forestry Department. When the wildlife division was established within the forestry department in 1986, the division established a station (San Myaung Camp) near the town of Chatthin, and they began a programme of protection and regular patrols.

Chatthin W. S. (ca. 200 m above msl) is mainly a secondary growth indaing forest with several seasonally flooded areas of open grassland (lwin) and a seasonally large lake near the

north-western edge of the W. S. The W. S. also includes three small villages and their associated farmland. The eastern, northern, and western perimeter borders mainly rice paddies, the southern abuts secondary-growth forest. The indaing is deciduous dipterocarp forest dominated by the In (*Dipterocarpus tuberculatus*); about two-thirds of the forest is low indaing with tree tops at 8-10 m, the remainder high indaing reaching 10-15 m. In both, the canopy is open, 30-70%, and the forest floor has a mixture of forbs and grass or mainly grass, never dense beneath the canopy. The shrub layer ranges from sparse to moderate with a variety of other low shrubs and trees and In sprouting from root stocks.

In 1994, the Smithsonian's National Zoological Park/Conservation and Research Center began a collaborative research programme with the Myanmar Nature and Wildlife Conservation Division on the ecology of the thamin. Subsequently, they initiated a bird census programme in late 1995, and in July 1997, we began a herpetofaunal inventory and monitoring program. The programme has three components that

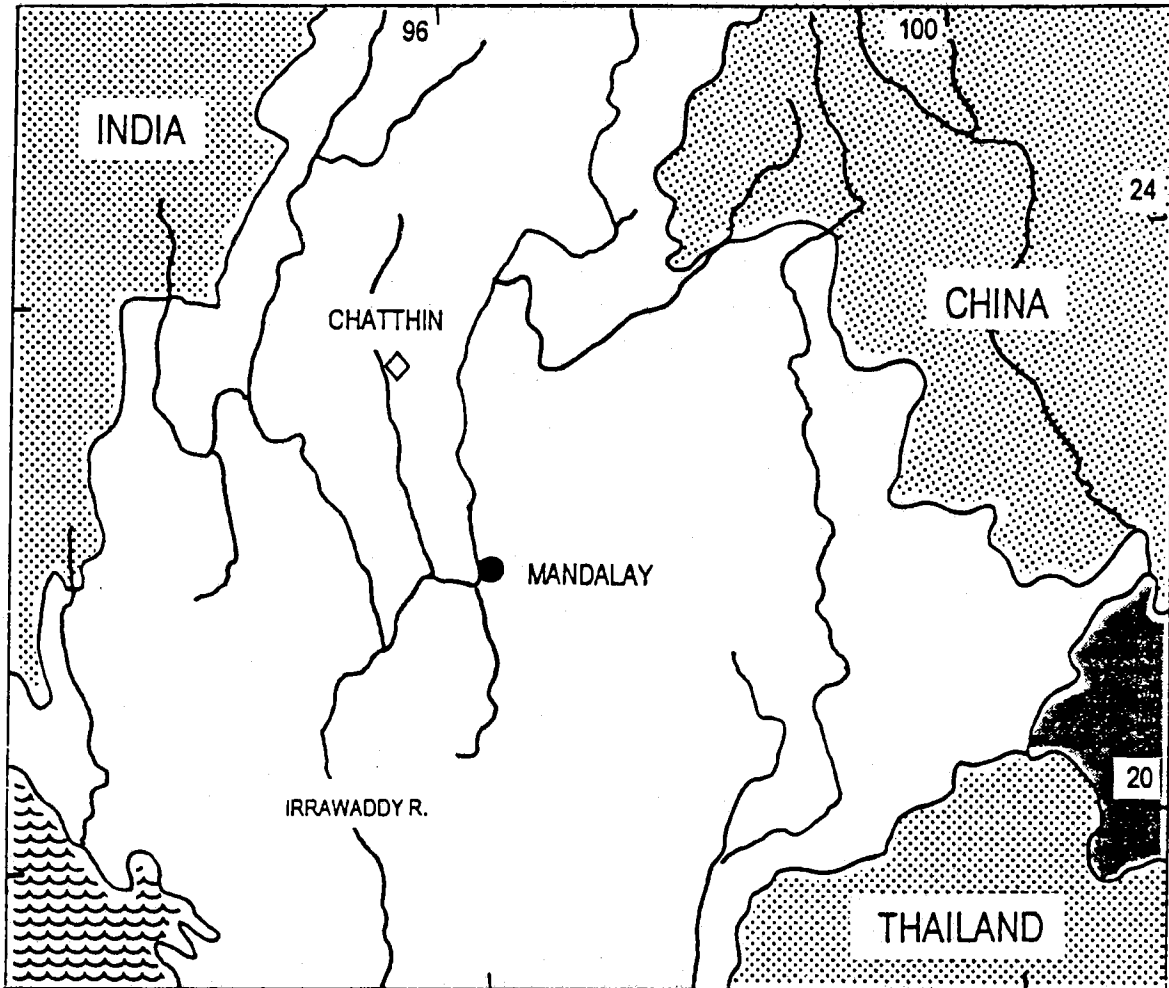


FIGURE 1: Location of the Chatthin Wildlife Sanctuary in north-central Myanmar.

operate weekly or monthly year around. Although we do not yet know all of the amphibians and reptiles of the sanctuary, we believe that it is appropriate to provide a preliminary list of the herpetofauna and some of our observations on their natural history from our first year of monitoring. This goal is important, because aside from Dowling and Jenner's (1987) snake checklist, the most recent published observations on the Myanmar herpetofauna derive from the time of British administration (e.g., Shreve, 1940; Smith, 1940; 1943).

CHATTHIN HERPETOFAUNA

The Chatthin fauna contains at least 16 species of frogs, two turtles, 12 lizards, and 20 snakes (Table 1). The following accounts provide data on adult snout-vent length (SVL, separately for

adult females and males, and sample sizes; unless noted otherwise, all measurements were taken pre-preservation), an estimate of abundance (abundant, common, uncommon, rare), main habitat and microhabitat occurrence, and miscellaneous observations on the biology of the species. Sex and maturity were determined by dissection and examination of gonads in reptiles, examination on gonads and/or presence of functional vocal sacs in frogs. All species reported here are represented by voucher specimens in the Chatthin W.S. Collection (ChWS) and/or National Museum of Natural History, Smithsonian Institution (USNM); see Appendix I.

FROGS

Bufo melanostictus (Bufonidae). 99-113 mm, 74-101 mm SVL, n = 3 females, 2 males. Un-

TABLE 1: Species of amphibians and reptiles occurring in the Chatthin Wildlife Sanctuary and adjacent farmlands. The number in brackets denotes the number of species for each group.

AMPHIBIA	
ANURA [16]	<i>Hemidactylus frenatus</i>
Family Bufonidae [1]	Family Scincidae [5]
<i>Bufo melanostictus</i>	<i>Lygosoma lineolatum</i>
Family Microhylidae [5]	<i>Mabuya dissimilis</i>
<i>Glyphoglossus molossus</i>	<i>Mabuya novemcarinata</i>
<i>Kalophrynus interlineatus</i>	<i>Mabuya quadricarinata</i>
<i>Kaloula pulchra</i>	<i>Sphenomorphus maculatus</i>
<i>Microhyla ornata</i>	Family Varanidae [1]
<i>Microhyla sp</i>	<i>Varanus bengalensis</i>
Family Ranidae [8]	SNAKES [20]
<i>Occidozyga lima</i>	Family Colubridae/Colubrinae [12]
<i>Rana lateralis</i>	<i>Ahaetulla nasuta</i>
<i>Rana limnocharis/large</i>	<i>Boiga multomaculata</i>
<i>Rana limnocharis/small</i>	<i>Boiga ochracea</i>
<i>Rana macrodactyla</i>	<i>Chrysopelea ornata</i>
<i>Rana rugulosa</i>	<i>Dendrelaphis subocularis</i>
<i>Rana tigerina</i>	<i>Elaphe radiata</i>
<i>Tomopterna breviceps</i>	<i>Lycodon aulicus</i>
Family Rhacophoridae [2]	<i>Oligodon cruentatus</i>
<i>Chirixalus nongkhorensis</i>	<i>Oligodon quadrilineatus</i>
<i>Polypedates leucomystax</i>	<i>Oligodon splendidus</i>
	<i>Ptyas mucosus</i>
	<i>Sibynophis collaris</i>
	Colubridae/Natricinae [1]
	<i>Amphiesma stolatum</i>
	Family Cyllindrophiiidae [1]
	<i>Cylindrophis ruffus</i>
	Family Elapidae/Elapinae [2]
	<i>Bungarus fasciatus</i>
	<i>Naja kaouthia</i>
	Family Typhlopidae [1]
	<i>Ramphotyphlops braminus</i>
	Viperidae/Crotalinae [1]
	<i>Trimeresurus erythurus</i>
	Viperidae/Viperinae [1]
	<i>Daboia russelii</i>
	Family Xenopeltidae [1]
	<i>Xenopeltis unicolor</i>
REPTILIA	
TESTUDINES [2]	
Family Testudinidae/Testudininae [1]	
<i>Indotestudo elongata</i>	
Family Trionychidae/Lissemyinae [1]	
<i>Lissemys scutata</i>	
SQUAMATA	
LIZARDS [12]	
Family Agamidae [3]	
<i>Calotes mystaceus</i>	
<i>Calotes versicolor</i>	
<i>Leiolepis peguensis</i>	
Family Gekkonidae [3]	
<i>Gekko gekko</i>	
<i>Hemidactylus bowringii</i>	

common; single individuals found occasionally near camp buildings in forest; no breeding aggregations seen or heard locally.

Chirixalus nongkhorensis (Rhacophoridae). 31-34 mm, 23-31 mm SVL, n = 7, 20. Common;

this treefrog calls from late May through mid October and breeds during the early to middle monsoon (May-August) based on the occurrence of amplexing pairs; males typically call from shrubs and trees, 1-3 m above ground, rarely

calls on ground. It is arboreal, occurring in fence rows and isolated trees in the farmland and forest; diurnal "rain-calls" demonstrate its presence to 6-8 m height in densely foliated trees.

Polypedates leucomastix (Rhacophoridae). 77 mm, 48-60 mm SVL, n = 1, 12. Uncommon; this species breeds with the earliest rains (May-early June) of the monsoon and is seen only sporadically thereafter during the monsoon. Males occasionally call from the ground, but more frequently from shrubs near temporary forest pools, usually < 2 m from ground.

Glyphoglossus molossus (Microhylidae). 86 mm, 63-77 mm SVL, n = 1, 6. Uncommon; juveniles and adults have been found in our forest floor surveys and in breeding aggregations. Body form and the large heel spade suggest a fossorial life-style. Breeding occurs in the early monsoon in deep, temporary forest pools. Males call from a floating posture, usually clustered in the middle of the pool. They are extremely wary and sink with the slightest disturbance. The size disparity between the sexes prevents typical amplexus, and the male is broadly glued to the female's back.

Kalophyrnus interlineatus (Microhylidae). 39-44 mm SVL, n = 4, 0. Rare; this species has been found only as single individuals within the forest on the forest floor.

Kaloula pulchra (Microhylidae). 67 mm, 61-70 mm SVL, n = 1, 3. Uncommon; it is found predominantly in the forest, and all breeding males have been found in forest or forest-edge pools, although it is a known resident of garden and landscaped sites in villages and towns. Breeding occurs in the early monsoon with the males calling in the water at the edge of pools.

Microhyla ornata (Microhylidae). 20-27 mm, 20-25 mm SVL, n = 7, 11. Common; it occurs in forest and farmland. Its breeding season extends from early through mid-monsoon with peak chorusing activity in the latter half of this period. Males call from the ground and typically partially or completely hidden under vegetation.

Microhyla sp. (Microhylidae). 16-18 mm, 14-17 mm SVL, n = 6, 22. Abundant; most specimens derive from breeding choruses which occur in farmland or at forest edge, although a few

individuals have been found in forest litter surveys. Chorus activity begins in early monsoon and continues throughout the monsoon. The tiny males call from land and always beneath vegetation.

Occidozyga lima (Ranidae). 24-40 mm, 22-30 mm SVL, n = 6, 33. Abundant; it occurs in forest and farmland. It is a most common paddy frog and regularly found in ditches and puddles. Although it moves overland, it is seldom far from water. Chorusing and breeding occurs from early to late monsoon. Males call mainly from a floating posture and occasionally sitting on vegetation in the water.

Rana lateralis (Ranidae). 55-64 mm SVL, n = 0, 10. Uncommon; this species has been found only as single individuals within the forest or at forest edge. Adult males have been found most frequently in early monsoon, but we have not found a breeding aggregation or even a single calling male.

Rana limnocharis group. Two species of the *R. limnocharis* group occur. Both species are abundant, and the larger species matches the Thai populations identified as this species. The small species initially were mistaken for juveniles, but calling males are common.

Rana limnocharis/large (Ranidae). 47-67 mm, 39-52 mm SVL, n = 27, 34. Abundant; this species occurs throughout the forest and farmlands, usually associated with water although it is occasionally seen, both during the day and night, foraging 100 m or more from the nearest water. Males call year around when conditions are wet, and even sporadically during the day; although main breeding choruses are nocturnal, usually beginning several hours after sunset and continuing into the early morning. Males call from the water's edge, sitting in the water or on land. *R. limnocharis* is wary and escapes by a series of leaps away from the intruder. This species and *R. rugulosa* are collected by the locals and are sold as "finger-food" at the Chatthin village market.

Rana limnocharis/small (Ranidae). 30-39 mm, 24-29 mm SVL, n = 6, 18. Common; this species is a paddy frog and otherwise has been seen only at the forest edge. Choruses appear

once the monsoon rain have flooded the paddies with persistent water; although an occasional male is heard nearly year around. Males call from land, at the edge of the water to 1 m away.

Rana macrodactyla (Ranidae). Rare; only two juveniles (34.5, 25.2 mm SVL, July & November, respectively) have been captured. The occurrence of these juveniles indicates that breeding occurs near the Sanctuary's headquarters, although we have not seen a breeding aggregation or an adult.

Rana rugulosa (Ranidae). 70-107 mm, 49-54 mm SVL, n = 8, 9. Common; *R. rugulosa* is a wetlands species, always in association with water from the rice paddies of the farmlands to temporary pools in the forest and the flooded grasslands (lwin) within the forest. In small pools of water, this species commonly escapes by hopping out of the water and hiding in the adjacent vegetation or leaf litter. Choruses begin prior to the monsoon rains and continue through the entire monsoon, although reproduction appears to be early to mid-monsoon (May-August) based on the occurrence of gravid females. Males call sitting in the water, either at the edge or in shallow areas.

Rana tigerina (Ranidae). 83 mm SVL, n = 0, 1. Rare; a single adult male was found in the low indaing beneath leaf litter in the late dry season (mid-May). A darkening of the throat over the vocal sac areas suggest it was approaching breeding condition.

Tomopterna breviceps (Ranidae). 53-61 mm, 50-54 mm SVL, n = 5, 9. Common but strongly seasonal; this frog breeds with the first monsoon rains and then largely disappears with only an occasional individual calling to mid-monsoon. The well-developed heel spade denotes at least a semifossorial life-style, and our forest litter surveys indicate that it is a denizen of the forest.

TURTLES

Indotestudo elongata (Testudinidae). Uncommon; this species has long been collected by villagers for food. It is a deciduous forest species. A single juvenile was found in May 1998; all other records derive from carapaces found near villagers. This juvenile (77 mm CL; photo-

graphed and released) was hiding at midday beside a termite mound in the high indaing. It possessed a single growth annulus on each scute suggesting that it was in its second growth season or would soon renew its growth in the forthcoming monsoon.

Lissemys scutata (Trionychidae). Uncommon; we obtained two individuals (100, 102 mm CL/preserved, presumed juveniles) in July 1997. It occurs year around in permanent streams and the deep pools in the forest chaungs (streambeds) that persist through the dry season. Local farmers report that it aestivates in burrows adjacent to chaungs or ponds during the dry season. One of our vouchers was found in a roadside puddle near a monsoon-filled stream; the other was purchased from a local farmer, both in mid-monsoon. This species is also collected by villagers for food.

LIZARDS

Calotes mystaceus (Agamidae). 104-112 mm, 134-158 mm SVL, n = 2, 2 possible males. Uncommon; this species occurs mainly in farmlands and fence rows and is rarely seen in the forest. Although arboreal, one individual was found beneath leaf litter in January, suggesting terrestrial hibernation during the cool-dry season. One of the females had four oviducal eggs, each approximately 18 mm in maximum length.

Calotes versicolor (Agamidae) 63-80 mm SVL, n = 5, 1. Uncommon; although this species is a forest to forest edge and fencerow species, it is not abundant in the forest. Our various census protocols indicate less than one individual per hectare. *C. versicolor* is semiarboreal, appearing to forage on the ground, but usually escaping to and up trees. At night, it is found sleeping on trees and shrubs near the end of the branches and from 1-4 m above the ground. Adult females collected May-August had either mid-vitellogenic follicles or oviducal eggs (4-5; approximately 10-14 mm maximum length). Two juveniles with yolk-sac scars were collected in late July, suggesting a late June to mid-July hatching.

Leiolepis peguensis (Agamidae). Uncommon; we have captured only two individuals

(74.9, 110.7 mm SVL, the larger one is an immature female). *L. peguensis* is largely inactive for about half of the year. It is restricted to elevated, well-drained, open sandy areas in the forest. Individuals live in burrows and are active during the dry season from March through June, "requiring" hot sunny weather. It is most visible when daily temperatures exceed 30°C and is seen outside of its burrows even in midday when temperatures approach 40°C. Most often, it escapes by running to its burrow, but if cutoff from the burrow, it may climb a tree. In the monsoon season, it closes its burrow, presumably for hibernation. We suspect that only one lizard occupies a burrow system, which consists of a "main" entrance and an accessory or escape exit. They have been observed eating plants and animals, including *Brassa* grass and termites.

Gekko gekko (Gekkonidae). 161-162 mm SVL, n = 0, 2. Uncommon; it occurs most frequently as a commensal in buildings but also lives in the forest. Usually, only one individual occurs in a building or a set of adjacent buildings. When two individuals are present, one of them is smaller, perhaps a female and male sharing overlapping territories. *G. gekko*, presumably males, call irregularly throughout the day and night from February into June. This gecko stays high in buildings and trees. It eats large insects, mice, and perhaps other geckos, such as *Hemidactylus frenatus*, although we have observed no chases or captures of smaller geckos. Chatthin individuals move about their "territories" throughout the night. One individual occupied three adjacent buildings and moved among them on an irregular pattern, although it did not change its hunting building during a single foraging night.

Hemidactylus bowringi (Gekkonidae). 43-44 mm, 44-47 mm SVL, n = 3, 2. Uncommon; *H. bowringi* is a forest gecko, most commonly found on the forest floor beneath detritus and also at the base of trees and beneath bark of standing dead trees. Our preliminary observations suggest a seasonal activity pattern, being most active during the monsoon; we saw individuals in July-September and January-February. A gravid female (USNM 520557, 44 mm SVL) collected in the forest more than 1 km from hu-

man buildings appears to be a hybrid between *H. bowringi* and *H. frenatus*.

Hemidactylus frenatus (Gekkonidae). 48-56 mm, 53-57 mm SVL, n = 5, 3. Common; *H. frenatus* is strictly a human commensal, on buildings or vegetation adjacent to buildings. Although principally a nocturnal lizard, it appears and captures insects from 1-2 hr prior to sunset through the night to about 1 hr after sunrise.

Lygosoma lineolatum (Scincidae). 47-52 mm, 46-51 mm SVL, n = 8, 3. Common; this skink is a forest floor inhabitant, occasionally seen foraging above the leaf litter but most frequently found beneath floor litter, seeming exclusively so during the heavy rain periods of the mid-monsoon. Reproductive states show several peculiarities. One specimen is hermaphroditic, possessing testes and a left oviduct. Gravid females occurred only in the late July sample and have either two or three oviducal eggs (7.0-9.3 mm, max. length). The minimum of size of sexually mature females is 47.1 mm SVL, yet three females > 50 were immature.

Mabuya dissimilis (Scincidae). Rare; we have seen only a few individuals of this species and only in July. Both specimens appear immature: the male (49.6 mm SVL/preserved) has moderate-sized testes and small epididymides; the female (72.0 mm SVL) has previtellogenic follicles and unconvoluted oviducts.

Mabuya novemcarinata (Scincidae). 78 mm SVL, n = 0, 1. Rare; a single individual has been collected in the sanctuary in August.

Mabuya quadricarinata (Scincidae). 45-46 mm SVL, n = 0, 2. Rare; we have seen only two individuals. Both were adult males and were captured in early August in the forest.

Sphenomorphus maculatus (Scincidae). 56 mm, 50-51 mm SVL, n = 1, 2. Uncommon; *S. maculatus* is a forest floor species. It has a seasonal activity pattern and is most abundant (= visible) in the dry season, February through mid June, although it has been seen in most months.

Varanus bengalensis (Varanidae). 326 mm SVL/preserved, n = 0, 0, 1 not sexed. Rare; few monitors are seen within the forest.

SNAKES

Ahaetulla nasuta (Colubridae). 295 mm SVL, $n = 0, 1$. Rare; this species has been seen only once near the forest edge in a cluster of trees at 3 m.

Amphiesma stolatum (Colubridae). 340-556 mm SVL, $n = 5, 0$. Common; *A. stolatum* is the most frequently encountered of the Chatthin snakes. It is seen mainly at the forest edge and in the adjacent farmlands; however, it is also seen in the forest, usually near or in open habitats. A gravid female (533 mm SVL, 6 June 1998) bore 10 oviducal eggs, 21-24 mm maximum length.

Boiga multomaculata (Colubridae). 678 mm SVL, $n = 0, 1$. Uncommon; this species is a forest species. All specimens have been found on the ground beneath leaf litter or logs.

Boiga ochracea (Colubridae). 666 mm SVL, $n = 1, 0$. Rare; a single individual was found in the forest beneath leaf litter.

Chrysopelea ornata (Colubridae). 883 mm SVL, $n = 0, 1$. Uncommon; *C. ornata* is a forest species and an exceptional climber. When disturbed on the ground, it moves to the nearest tree and rapidly ascends whether bark is smooth or rough by concertina locomotion that is performed so rapidly that it appears serpentine. In the trees, it is commonly seen at heights > 4 m and does glide from tree to tree or ground when chased.

Dendrelaphis subocularis (Colubridae). 411-426 mm SVL, $n = 0, 2$. Rare, this species lives in the forest. Both individuals have large testes and small epididymides; nonetheless, we assume that they are mature. They are dimorphic; one has a dark grey venter except for a white chin and throat, the other has a white venter from chin to posterior third of trunk then gradually becoming grey.

Elaphe radiata (Colubridae). 1336 mm, 1630 mm SVL, $n = 0, 1, 1$ not sexed. Rare; although this species is likely an inhabitant of farmlands, we have observed it only in the forest.

Lycodon aulicus (Colubridae). 479 mm, 305-324 mm SVL, $n = 1, 3$. Common; this species occurs in forest and forest-edge habitats. It is a terrestrial species, occurring beneath logs and leaf litter. It is likely a crepuscular or nocturnal species as we have captured specimens around

the camp shortly after sunset. Although *L. aulicus* is principally a terrestrial species, it will attempt to avoid capture by climbing trees using concertina locomotion.

Oligodon cruentatus (Colubridae). 305 mm SVL, $n = 0, 1$. Uncommon; three individual were captured in the forest.

Oligodon quadrilineatus (Colubridae). 537 mm SVL, $n = 0, 1$. Uncommon; *O. quadrilineatus* is a forest floor inhabitant and the most abundant ($n = 6$) of the three Chatthin *Oligodon* sp. It was seen in early morning and late afternoon moving on the surface of the litter, and discovered at other times beneath the leaves and logs. A juvenile female (234 mm SVL) regurgitated two lizard eggs (17 mm maximum length, presumably *Calotes mystaceus* eggs).

Oligodon splendidus (Colubridae). 460 mm, 519 mm SVL, $n = 0, 1, 1$ not sexed. Rare; this snake is a forest-floor inhabitant.

Ptyas mucosus (Colubridae). 1651 mm SVL, $n = 0, 0, 1$ not sexed. Rare; we saw a single individual in the forest. This species may be more common in the farmlands surrounding the sanctuary.

Sibynophis collaris (Colubridae). Rare; one juvenile male (161 mm SVL) was captured in the forest.

Cylindrophis ruffus (Cylindrophidae). 270 mm SVL/preserved, $n = 0, 0, 1$ not sexed. Rare; this species was seen only once, several years ago.

Bungarus fasciatus (Elapidae). 1290 mm SVL, $n = 1, 0$. Uncommon; all specimens (two juveniles, one adult) were found in the farmlands and at night.

Naja kaouthia (Elapidae). 945 mm SVL, $n = 1, 0$. Uncommon; all specimens were found in the farmlands, both at day and night

Ramphotyphlops braminus (Typhlopidae). Common; this species is found on the forest floor and beneath floor-debris in the monsoon season. The largest individual captured was 120 mm SVL, but most are less than 90 mm SVL; we have not attempted to determine the size at sexual maturity in our sample.

Daboia russelii (Viperidae). 819-830 mm SVL, $n = 0, 2$. Rare in the forest, uncommon in

the farmlands. This viper becomes active at twilight.

Trimeresurus erythurus (Viperidae). Rare; this snake is a forest species. Two juveniles (390, 400 mm SVL; late November and early December) were found during the cool dry season, one on the forest floor and the other in a shrub at < 1 m above the ground.

Xenopeltis unicolor (Xenopeltidae). Rare; this species seems to require moist forest soils. Both individuals are immature (ca. 400 mm SVL) and were found in forest litter near the kitchen water-overflow at the sanctuary's headquarters.

DISCUSSION

Our inventory of the Chatthin herpetofauna is only one year old, and we certainly have not en-

countered all species that occur in the sanctuary. However, we are using a variety of survey protocols, thus it seems likely that we now have identified the major herpetofaunal components. The species accumulation curve (Fig. 2) shows that our survey efforts are approaching an asymptote and the total Chatthin herpetofauna is likely $60 \pm$ species.

The herpetofauna seems depauperate, although we have no other Burmese sites with which to compare it. The closest locality that has been thoroughly surveyed (Inger and Colwell, 1977) is the Sakaerat forest reserve in north-eastern Thailand ($14^{\circ} 30'N$; $101^{\circ} 55'E$). Although Sakaerat is at a lower latitude, it shares climatic and floral similarities with a strong seasonal rainfall, also an elevation of about 200 m, and an open deciduous dipterocarp forest with

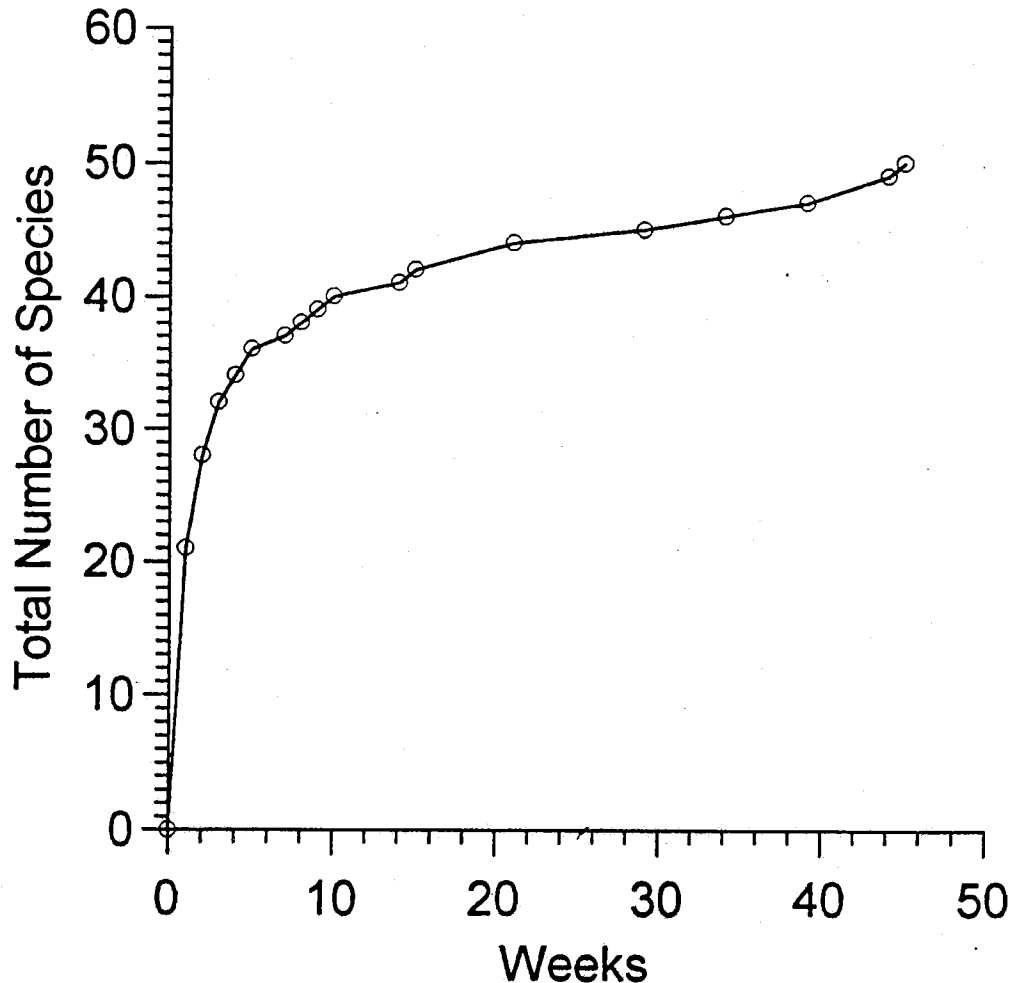


FIGURE 2: Species accumulation curve for the herpetofaunal survey of the Chatthin Wildlife Sanctuary. The survey began on 14 July 1997, and this graph reports our inventory results through 16 June 1998.

adjacent agricultural lands. It also possesses a lowland evergreen forest, but the herpetofauna of that habitat is excluded from the following discussion because no such forest exists near Chatthin. Sakaerat has 24 amphibians (a caecilian, 23 frogs) and 57 reptiles (two turtles, 21 lizards, 35 snakes). With a herpetofauna x 1.5 larger than Chatthin, the impression of a depauperate fauna is supported, but the intensity of sampling at Sakaerat exceeds that performed at Chatthin even though the former sampling occurred only for 11 months.

We are struck more by the similarities of the two faunas than by their differences, considering that the two herpetofaunas are 1,200 km apart and separated by a major mountain range. They share the same species or ecologically-equivalent species. For example, among the frogs, they share ten species (more than half of the known Chatthin anuran fauna); ecological-equivalents would make this number higher. The similarities are at about the same level among the reptiles (e.g., seven shared lizard species and 12 snakes; both more than half the Chatthin faunas). Our ongoing monitoring activities and forest-floor quadrat sampling will allow us to make a more rigorous and statistical comparison of these two faunas in the future.

Such a comparison will also be possible on the relative abundance of the herpetofaunal components. At this time, we are struck by the greater abundance (= visibility) of the anuran fauna in contrast to the reptilian fauna. This abundance is evident in the forest and paddies. The slightest amount of moisture increases the exposed activity of frogs, particularly *Rana limnocharis*, and in the forest, this species is as likely to be observed as any lizard. Indeed, most reptiles are uncommon to rare, and many show a strong seasonality of occurrence. There seems to be an especially low abundance of lizards. Is it possible that the high diversity of birds suppresses lizard abundance by both a competition for insect prey resources and predation of all life stages of lizards? Lizard abundance may also be suppressed by forest-floor fires (P. P. van Dijk, pers. comm.) that occur moderately frequently in these dry dipterocarp forests.

Another comparison of the amphibian fauna is possible with Ma Da, Vietnam, approximately 650 km south-east of Sakaerat. This site is primarily secondary forest with scattered stands (a hectare or less) of primary dipterocarp forest (Tarkhnishvili, 1994). Nineteen species of frog occur at Ma Da. Eight species are shared with Chatthin and 11 species with Sakaerat. This comparison and the one with Sakaerat are, of course, dependent upon the correct identification of the amphibians and species, as well as the assumption that a named taxon in Myanmar is the same as the one in Thailand as in Vietnam. In spite of these potential difficulties, the Chatthin frog fauna shows decreasing similarities with increasing distance even though the structure of the habitat appears similar.

The Thai and Vietnamese frog faunas suggest that the central Myanmar fauna has closer biogeographic affinities with the south-east Asian one than to the Indian fauna. Chanda's (1994) report on the north-east Indian frog fauna lists 54 species. Chatthin shares only five species with this area that is geographically closer than the south-east Asian sites. This lack of shared fauna reinforces Chanda's conclusion that the frog fauna of north-eastern India is largely derived from the Indian subcontinent.

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- species occurring in Chatthin Wildlife Sanctuary. Abbreviation: ChWS, Chatthin Wildlife Sanctuary collection; USNM, National Museum of Natural History, Smithsonian Institution.

AMPHIBIA

Anura. Family Bufonidae, *Bufo melanostictus*, USNM 520316-17. Family Microhylidae, *Glyphoglossus molossus*, USNM 520318-20; *Kalophrynus interlineatus*, USNM 520321; *Kaloula pulchra*, USNM 520322-31; *Microhyla ornata*, USNM 520349-67; *Microhyla* sp, USNM 520333-48. Family Ranidae, *Occidozyga lima*, USNM 520368-82; *Rana lateralis*, USNM 520399-405; *Rana limnocharis*, USNM 520438-50; *Rana limnocharis*/small, USNM 520406-20; *Rana macrodactyla*, USNM 520469; *Rana rugulosa*, USNM 520470-80; *Rana tigerina*, ChWS 34195; *Tomopterna breviceps*, USNM 520490-499. Family Rhacophoridae, *Chirixalus nongkhorensis* USNM 520503-20; *Polypedates leucomystax*, USNM 52035-39.

REPTILIA

Testudines. Family Testudinidae, *Indotestudo elongata* USNM 520645. Family Trionychidae, *Lissemys scutata*, USNM 520643-44.

Squamata/lizards. Family Agamidae, *Calotes mystaceus*, USNM 520540-41; *Calotes versicolor*, USNM 520542-47; *Leiolepis peguensis*, USNM 524046. Family Gekkonidae, *Gekko gecko*, USNM 520548; *Hemidactylus bowringii*, USNM 520551-57; *Hemidactylus frenatus*, USNM 520560-65. Family Scincidae, *Lygosoma lineolatum*, USNM 520566-75; *Mabuya dissimilis*, USNM 520631-14; *Mabuya novemcarinata*, ChWS 34127; *Mabuya quadricarinata*, USNM 520616; *Sphenomorphus maculatus*, USNM 520618-21. Family Varanidae, *Varanus bengalensis*, ChWS 34194.

Squamata/snakes. Family Colubridae, *Ahaetulla nasuta*, ChWS 34147; *Amphiesma stolatum*, USNM 520630-34; *Boiga multomaculata*, USNM 520622; *Boiga ochracea*, USNM 524064; *Chrysopelea ornata*, USNM 520623; *Dendrelaphis subocularis*, USNM 524066; *Elaphe radiata*, USNM 524067; *Lycodon aulicus*, USNM 520627-29; *Oligodon cruentatus*, USNM 524068; *Oligodon quadrilineatus*, USNM 52064-25; *Oligodon splendidus*, USNM 520626; *Ptyas mucosus*, ChWS 34174; *Sibynophis collaris*, ChWS 34154. Family Cyliodromidae, *Cylindrophis ruffus*, ChWS unnumbered. Family Elapidae, *Bungarus fasciatus*, USNM 520635-36; *Naja kaouthia*, USNM 524075. Family Typhlopidae, *Ramphotyphlops braminus*, USNM 520637-42. Family Viperidae, *Daboia russelii*, USNM 524077; *Trimeresurus erythurus*, USNM 524076. Family Xenopeltidae, *Xenopeltis unicolor*, USNM 524062.

APPENDIX I

Representative voucher specimens of the Chatthin herpetofauna. For brevity, we have not listed all specimens examined but provide one or more voucher records for each

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