

Field Guide to the Frogs of the Lower Kinabatangan Region, Sabah



**Graeme Gillespie, Eddie Ahmad, Sarah Scriven
and Amanda Shia**

2021

Photograph credits:

Graeme Gillespie, Eddie Ahmad, Sarah Scriven, Rob Colgan, Alice Evans or taken directly from:

www.frogsofborneo.com

www.wildlifeimages.com.au

www.frogweb.org

www.wildborneo.com.my

Cover photo: Harlequin Tree Frog, *Rhacophorus pardalis*

Table of Contents

Introduction	4
Frog morphology	5
Key to the Frogs of the Lower Kinabatangan Region.....	7
Family Bufonidae	11
<i>Ingerophrynus divergens</i> , Crested Toad	11
Family Dicroglossidae	12
<i>Fejervarya cancrivora</i> , Mangrove Frog.....	12
<i>Fejervarya limnocharis</i> , Grass Frog.....	13
<i>Limnonectes finchi</i> , Rough Guardian Frog	14
<i>Limnonectes ingeri</i> , Greater Swamp Frog.....	15
<i>Limnnectes kuhlii</i> , Kuhl’s Creek Frog.....	16
<i>Limnonectes leporinus</i> , Giant River Frog	17
<i>Limnonectes malesianus</i> , Peat Swamp Frog.....	18
<i>Limnonectes paramacrodon</i> , Lesser Swamp Frog	19
<i>Occidozyga baluensis</i> , Seep Frog	20
<i>Occidozyga sumatrana</i> , Yellow-bellied Puddle Frog	21
Family Megophryidae	22
<i>Leptotalax fritinniens</i> , Twittering Slender Litter Frog	22
<i>Megophrys nasuta</i> , Bornean Horned Frog.....	23
Family Microhylidae.....	24
<i>Chaperina fusca</i> , Saffron-bellied Frog	24
<i>Kalophrynus meizon</i> , Rufous-sided Sticky Frog	25
<i>Kalophrynus</i> sp. nov., Lost Frog	26
<i>Kaloula baleata</i> , Brown Bull Frog	27
<i>Metraphrynella sundana</i> , Tree Hole Frog.....	28
<i>Microhyla borneensis</i> , Lesser Bornean Narrow-mouthed Frog.....	29

<i>Microhyla perparva</i> , Least Narrow-mouthed Frog.....	30
Family Ranidae.....	31
<i>Chalcorana megalonesa</i> , White-lipped Stream Frog.....	31
<i>Chalcorana raniceps</i> , Jade-backed Stream Frog.....	32
<i>Hylarana erythraea</i> , Green Paddy Frog.....	33
<i>Indosylvirana nicobariensis</i> , Cricket Frog.....	34
<i>Pulchrana glandulosa</i> , Rough-sided Frog.....	35
Family Rhacophoridae.....	36
<i>Chiromantis inexpectatus</i> , Pizza Frog.....	36
<i>Kurixalus chaseni</i> , Fringed Tree Frog.....	37
<i>Leptomantis rufipes</i> , Red-legged Tree Frog.....	38
<i>Nyctixalus pictus</i> , Cinnamon Frog.....	39
<i>Philautus tectus</i> , Covert Bush Frog.....	40
<i>Polypedates colletti</i> , Collett's Tree Frog.....	41
<i>Polypedates leucomystax</i> , Four-lined Tree Frog.....	42
<i>Polypedates macrotis</i> , Dark-eared Tree Frog.....	43
<i>Polypedates otlophus</i> , File-eared Tree Frog.....	44
<i>Rhacophorus harrissoni</i> , Brown Tree Frog.....	45
<i>Rhacophorus nigropalmatus</i> , Wallace's Flying Frog.....	46
<i>Rhacophorus pardalis</i> , Harlequin Tree Frog.....	47
<i>Zhangixalus dulitensis</i> , Jade Tree Frog.....	48
Habitat Associations.....	49
Glossary and Abbreviations.....	51
References.....	52

Introduction

This guide describes the frog fauna of the Lower Kinabatangan region in Sabah, East Malaysia. The region encompasses the flood plain and associated low hills along the lower Kinabatangan River. The area is mostly flat and low (10–20 m asl), poorly drained and subject to periodic flooding. Vegetation is classified as extreme lowland forest, which now comprises a mosaic of secondary forest with varying levels of disturbance, and oil palm plantations. There are scattered low mudstone hills at *ca.* 40 – 50 m asl and several karstified limestone outcrops at *ca.* 100 asl. Due to their poor accessibility, some of these outcrops support the only remnants of primary rainforest in the region.

The Lower Kinabatangan Wildlife Sanctuary has been extensively surveyed for frogs (Gillespie et al. 2012; Scriven et al. 2018), and on-going monitoring by HUTAN continues to build knowledge of patterns of frogs diversity. To date 39 frog taxa have been recorded in this region, but this number may increase with more research. A diverse range of species is present, spanning six families: Bufonidae, Dicroglossidae, Microhylidae, Megophryidae, Ranidae and Rhacophoridae. At least two taxa are not yet formally described, which may be endemic to the region. Species range in their ecology from terrestrial to fully arboreal. Most species reproduce in ephemeral puddles or swamps. However, there are several obligate stream-breeding species present, two species that reproduce exclusively in tree hollows (*Metaphrynella sundana* and *Rhacophorus harrissoni*) and *Philautus* species, which have direct development. Most species are restricted to, or strongly associated with, forest habitats, many of which have suffered substantial range contractions due to forest clearance and degradation (Gillespie et al. 2012; Scriven et al. 2018). There is also a distinct guild of non-forest species that occurs in oil palm plantations and other human modified habitats.

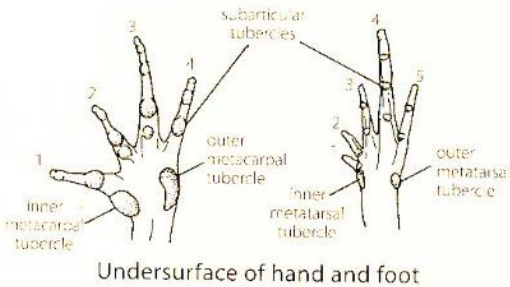
The purpose of this guide is to enable accurate field identification of these species, and differentiation of any additional species detection in the Lower Kinabatangan. Information has been compiled from Gillespie *et al.* 2012; Scriven *et al.* 2018; Inger et al. 2017, the Frogs of Borneo website (www.frogsofborneo.com), and from our own field observations in the Lower Kinabatangan region and Borneo generally.

Frog morphology

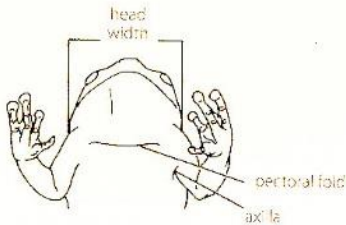
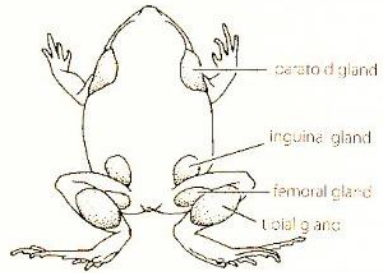
Descriptions and terms in the following diagrams are used in the identification key and species descriptions. A glossary of other terms used in this booklet is also provided at the back.

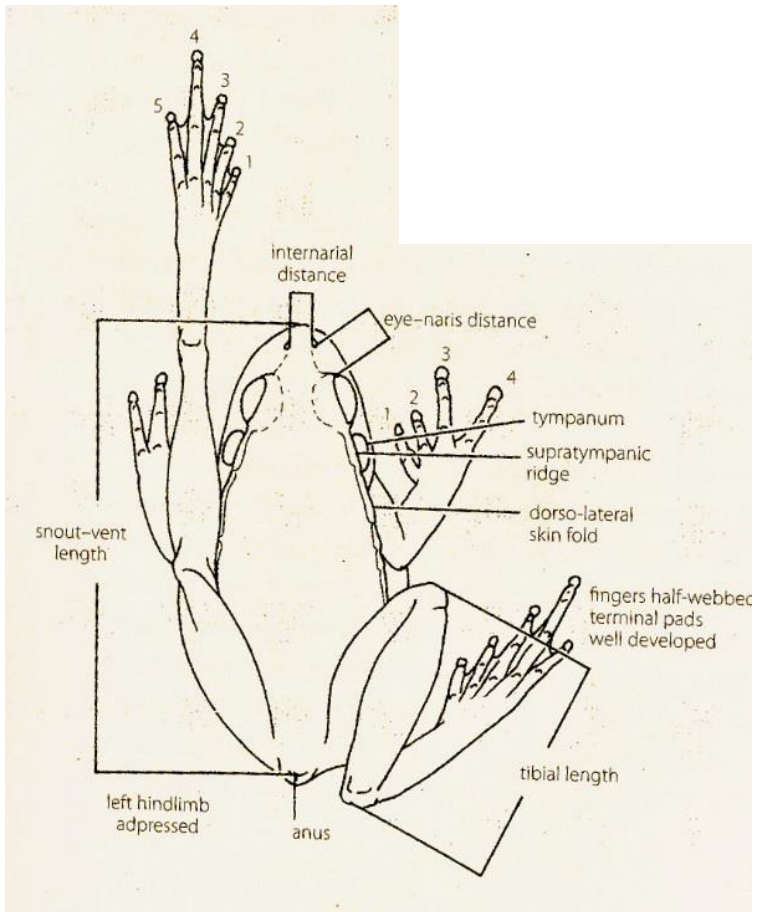


Degrees of webbing on foot, dorsal view



Undersurface of hand and foot





Key to the Frogs of the Lower Kinabatangan Region

1. Conspicuous webbing on hand, at least between two outer finger	2
No webbing between outer fingers	7
2. Webbing red	3
Webbing not red	4
3. Forearm with flap of skin along outer edge	<i>Rhacophorus pardalis</i>
Forearm with no flap of skin	<i>Leptomantis rufipes</i>
4. Outer leg with a wavy-edge fringe of skin	<i>Kurixalus chaseni</i> ¹
Outer edge of leg otherwise	5
5. Dorsal colour predominantly green	6
Skin not as above	<i>Rhacophorus harrissoni</i>
6. Translucent jade coloured skin; red webbing.....	<i>Zhangixalus dulitensis</i>
Skin not as above; yellow and black webbing	<i>Rhacophorus nigropalmatus</i>
7. Pupil vertical	8
Pupil not vertical	9
8. Conspicuous projection of skin from top of each eyelid	<i>Megophrys nasuta</i>
No skin projection	<i>Leptolalax fritinniens</i>
9. Tympanum visible	16
Tympanum not visible	10
10. A large conspicuous 'wart' or gland (parotoid gland) behind the eye in shoulder area, as large, or larger, than then eye	<i>Ingerophrynus divergens</i>
No large gland behind the eye	11
11. Underside of foot with a prominent ridge/flange at the base of the foot	<i>Kaloula baleata</i>
Underside of foot not as above.....	12

1. The webbing between the fingers in *K. chaseni* is not conspicuous; there is often only a very small amount, usually dark brown in colour.

12. First finger missing	<i>Microhyla perpava</i>	
First finger present (four fingers)		13
13. The outer three toes are half webbed; snout-vent length (SVL) < 20mm	<i>Microhyla borneensis</i>	
Webbing otherwise.....		14
14. Toes fully webbed to base of tips.....		15
Webbing otherwise	<i>Occidozyga baluensis</i>	
15. Yellow colour on abdomen or undersides of thighs	<i>Occidozyga laevis</i>	
Abdomen white; may be dark spots on undersides of legs... <i>Limnonectes kuhlii</i>		
16. Distinctly pointed snout; sharp colour change between back and sides of body and head; outermost toe and finger very short.....		17
Shape, colour and digits otherwise		18
17. Side of body orange; back paler; black spot(s) present on side of the body in front of hind leg	<i>Kalophrynus meizon</i>	
Colouration otherwise	<i>Kalophrynus sp. nov.</i>	
18. Back cinnamon-coloured or red, speckled with white; a white spot on the upper eyelid	<i>Nyctixalus pictus</i>	
Colouration not as above.....		19
19. Underside of fingers with enlarged pads, broader than the finger tips	<i>Metraphrynella sundana</i> ²	
Fingers with no such pads.....		20
20. Belly golden yellow with black network.....	<i>Chaperina fusca</i>	
Belly not as above.....		21
21. Body green with distinct raised light yellowish stripe down each side of the back	<i>Hylarana erythraea</i>	
Colouration otherwise.....		22

2. It is often very difficult to see the tympanum of *M. sundana*

22. White upper lip; white ridge extending behind ear.....	23
No white upper lip.....	25
23. Body at least partly green; finger pads at least twice as wide as fingers.....	24
Not green; finger pads only slightly wider than fingers <i>Indosylvirana nicobariensis</i>	
24. Back, flanks and sides of snout green; snout-vent length (SVL) 28-42mm.....	<i>Chalcorana raniceps</i> ³
Back usually light brown, usually with a few brown spots; distinct dark band from nostril to eye; SVL 33-66mm.....	<i>Chalcorana megalonesa</i> ^{3,4}
25 Fourth toe (the longest) webbed to at least base of penultimate phalange...	26
Fourth toe with at least two joints free of full web.....	27
26. A dark stripe between eye and nostril on side of snout; top and side of snout form a sharp angle.....	<i>Limnonectes leporinus</i>
No dark stripe on side of snout; a rounded surface formed by top and side of snout.....	<i>Limnonectes ingeri</i>
27. Tips of toes widened into rounded pads or discs.....	31
Tips of toes not widened into distinct pads.....	28
28. A series of short ridges on the back.....	29
A few rounded rough areas or back smooth.....	30
29. Three joints of the fourth toe (the longest) with no webbing, frequently with a light stripe down the back.....	<i>Fejervarya limnocharis</i>
Only one or two joints of fourth toe without webbing, no stripe.....	<i>Fejervarya cancrivora</i>

3. These species are poorly resolved. Further taxonomic work is required. It is possible that only one species occurs in the LKWS.

4. Some individuals have green backs but retain dark a band between nostril and eye.

30. Usually a dark streak from eye to nostril on side of snout; usually entire tympanum covered by large dark marking; head narrow
*Limnonectes paramacrodon*
 No dark streak from eye to nostril; usually about half of tympanum covered by dark pigment; head wide.....*Limnonectes malesianus*
31. Tips of fingers only slightly wider than fingers; inverted V-shaped ridge usually on back between the shoulders.....*Limnonectes finchi*
 Tips of fingers significantly wider than fingers; no such ridge.....32
32. Conspicuous saw-edged bony ridge above the tympanum.
*Polypedates otilophus*
 No such ridge.....33
33. Tympanum covered by dark band extending along shoulder to armpit.
*Polypedates macrotis*
 Pattern otherwise.....34
34. Sides with enlarged skin glands, producing a rough or pebbled surface.
 *Pulchrana glandulosa*
 Sides of skin not as above.....35
35. Snout sharply pointed; distinct hour-glass pattern on back.....
*Polypedates colletti*
 Snout not pointed.....36
36. Snout-vent length > 35mm.....*Polypedates leucomystax*
 Snout-vent length < 35mm.....37
37. Skin smooth or finely granular; distinct cream or yellow dorso-lateral band, bordered above by a darker band, from nostril, passing under eye and ear drum and over the forearm.....*Chiromantis inexpectatus*
 Skin pattern otherwise.....38
38. Skin green with dark bands or blotches on back and limbs.....*Philautus tectus*
 Skin colour otherwise.....*Philautus* sp.⁶

6. Many *Philautus* species are difficult to identify without recording their advertisement call or genetic analyses.

Family Bufonidae

Ingerophrynus divergens, Crested Toad



Description:

Males: 28-43mm, Females: 36-55mm.

Medium-sized frog with numerous spiny, keratinized warts.

A distinct paratoid gland is present behind the eye, which is longer than wide and usually followed by a row of less distinct warts.

The snout is narrow and projects beyond the mouth. There are raised crests between the eyes.

The tympanum is visible.

None of the toes are fully webbed.

The general colour is mottled brown to reddish brown, often with dark chevron markings on the back.

Many individuals possess a thin, white stripe running down the back.

Habitat and Behaviour:

Found on the forest floor amongst leaf litter. Adults breed in small, shallow streams or in pools where males usually form noisy calling groups.

Call: A querulous, raspy, rising trill.

Family Dicroglossidae

Fejervarya cancrivora, Mangrove Frog



Size: Males: 51-70mm, Females: 53-82mm.

A medium to large frog, with a long snout and muscular hind limbs.

The back and sides have raised bumps and ridges.

The tympanum is conspicuous.

The toes are more than half-webbed, but the tips are free from webbing and are not swollen.

The general colour is mottled brown to grey on the back and legs.

Across the top of the legs there are several dark markings and there is a dark bar across the top of the head, between the eyes.

The underside of the head varies from pure white to white with dark mottling.

Habitat and Behaviour:

Found commonly within disturbed habitats, including oil palm plantations; but also found within mangroves, small slow streams and swamps.

Call: A, raspy call, repeated several times, sometimes described as a “dododododok ...dododok.”

Fejervarya limnocharis, Grass Frog



Size: Males: 32-50mm, Females: 49-58mm.

A small frog, with a narrow head and an oval shaped body. The general colour is rusty brown to brownish grey, with dark blotches along the back, dark bars on lips and limbs; the underside is light grey-cream colour. Most individuals (but not all) have a thick light stripe along the middle of the back. The skin is covered with a series of ridges down the back and sides. There is usually a distinctive U- or W-shaped marking across the shoulders.

The tympanum is conspicuous and is positioned under a prominent fold of skin which runs from the back of the eye. Toes are less than half webbed.

Similar species: Distinguished from *L. cancrivora* by three joints of fourth toe free of webbing. Distinguished from *L. finchi* by absence of expanded rounded finger and toe tips.

Habitat and Behaviour

Found commonly within disturbed habitats, including oil palm plantations, forest edges and open clearings. Groups of males usually gather in large groups around standing water and chorus.

Call: A raspy chirp, which is rapidly repeating.

Limnonectes finchi, Rough Guardian Frog



Size: Males: 32-39mm, Females: 39-4 mm.

A small, stocky frog with long hind limbs and thick thighs.

The back has a V/W-shaped ridge in the middle, with several short ridges and bumps running down the sides.

The tympanum is visible.

Toes are partially webbed and lightly swollen at the tips.

The colour is brown to dark brown often with dark markings along the arms and legs. The underside is white, often with a yellowish tinge.

There is a dark bar across the top of the eyes, and the chin and throat are darkly mottled.

Some individuals have been found with a light stripe running down the back.

Similar species: Distinguished from *F. limnocharis* by presence of round toe tips that are broader than the toes.

Habitat and Behaviour:

Lives on the forest floor on most forest types, has also been found within edge habitats and on occasions within oil palm plantations.

Call: A short trill.

Limnonectes ingeri, Greater Swamp Frog



Size: Males: 75-132mm, Females: 70-127mm.

A large, heavy-bodied frog with a broad head and muscular limbs. The skin is normally smooth, but some scattered bumps and short ridges may be present. The colour is variable, from reddish brown to tan. Some individuals have been found with a thin, light stripe running down the back.

The tympanum is distinct. Toe and fingertips are slightly swollen. Toes are fully webbed, except the fourth (longest) toe on which the webbing ceases just before the joint of the toe-tip.

Similar species: Distinguished from *L. leporinus* by the absence of a dark stripe running from the nostril to the eye.

Distinguished from *L. malesianus* by the absence of a dark streak below the supratympanic ridge; ear drum only partially dark brown on the posterior edge; tubercles on upper eyelid are only small and rounded.

Habitat and Behaviour:

Lives on the forest floor in most forest types, has also been found within oil palm plantations. Typically associated with slow flowing streams.

Call: Males have no vocal sacs and are not known to call.

Limnectes kuhlii, Kuhl's Creek Frog



Size: Males 44-57mm females 51-67mm.

A short stocky frog with short thick legs. The eyes are distinctly upward facing rather than side-facing.

The ear drum is not visible. Toes are fully webbed. Toe tips are slightly swollen. The skin on the back and sides and limbs is covered in small, rounded bumps. The hind legs may be covered in rough warts.

The upper surfaces are dark grey to black with indistinct dark blotches. The chin and throat are heavily spotted, while the rest of the underside is usually white.

Similar species: Superficially similar to *Occidozyga sumatrana* but can be distinguished by more rounded digits and absence of yellow on undersides. *Limnectes kuhlii* also has a more squat and rounded body.

Habitat and Behaviour:

A highly aquatic species associated with moderate-flowing rocky streams. Rarely found more than 1m from stream banks.

Call: Variable between regions; not recorded in the Kinabatangan area.

Limnonectes leporinus, Giant River Frog



Size: Males: 90-175mm, Females: 85-125mm.

A large frog with a long tapered snout and powerful hind limbs. The top and sides of the snout meet at a sharp angle. The tympanum is distinct. The toes are fully webbed and slightly swollen at the tips. The back of smaller individuals is often covered in short ridges and bumps that are less apparent in larger individuals. The upper eyelid has small irregular, bumps.

The colour varies from reddish brown to brown with dark markings. The underside is white with grey mottling in the chin and throat. There is always a characteristic dark streak on the side of the snout between the eye and the nostril. There is often a W-shaped mark between the shoulders, particularly on smaller individuals.

Similar species: Distinguished from *L. ingeri* by the presence of a dark stripe running from the nostril to the eye.

Distinguished from *L. malesianus* by fourth (longest) toe being completely webbed.

Habitat and Behaviour: This species is associated with streams in both primary and disturbed forest. It has been found in oil palm plantations.

Call: Unknown.

Limnonectes malesianus, Peat Swamp Frog



Size: Males: 70-150mm, Females: 75-95mm.

A large, stout frog with a broad head and thick, muscular limbs. The skin is smooth, with some low bumps on the back and sides. The tympanum is distinct. The toes are three-fourths webbed and slightly swollen at the tips. The colour is usually reddish brown but some individuals can be a dark chocolate brown. There are usually wide black bars which run across the lips. Most individuals have a fine, white line which runs from the snout down the back, similar lines are often seen running down the legs. The throat and chest have dark mottling, whilst the underside of the thighs are very dark.

Similar species: Distinguished from *L. ingeri* by the presence of a dark streak below the supratympanic ridge which includes the ear drum; tubercles on upper eyelid are large and pointed.

Distinguished from *L. leporinus* by lacking full webbing amongst toes; webbing on fourth toe extends to the distal subarticular tubercle, continued to tip as a narrow fringe.

Habitat and Behaviour: Occurs in a wide range of lowland habitats including oil palm plantations. Associated with slow streams and swamps.

Call: Unknown.

Limnonectes paramacrodon, Lesser Swamp Frog



Size: Males: 60-75mm, Females: 55-66mm.

A medium to stocky frog, with long muscular hind limbs. The snout ends in a rounded point. The tympanum is visible. All toes, except the fourth (the longest) are almost fully webbed and are distinctly swollen at the tips.

The colour is greyish to reddish brown and the upper surface is roughly pebbled with some small lumps on the back. The rear half of the belly and the underside of the legs is yellow.

Similar species: Distinguished from other *Limnonectes* species by the presence of a dark brown, diamond shaped spot (that almost appears as a mask) that covers the entire tympanum.

Habitat and Behaviour:

This species is usually found along clay and gravel banks of streams. Occurs in forest and plantations

Call: Unknown.

Occidozyga baluensis, Seep Frog



Size: Males: 15-25mm, Females: 25-35mm.

A small, stocky frog with short, hind limbs. The skin on the back is fairly smooth, often with some faint wrinkles and low bumps. There is also often a short ridge just behind the eyes. The middle of the back has a weak U-shaped ridge.

The tympanum is not visible. The toes are about three-quarter webbed.

The colouring can be variable but most individuals have a lighter tan or clay coloured head, whilst the rear of the back is dark brown. The limbs are usually tan with dark crossbars. The underside is cream with brown spots.

Similar species: Distinguished from *L. kuhlii* and *O. sumatrana* by incomplete webbing between toes. *Occidozyga sumatrana* often has a lemon yellow colour on its abdomen and underside of legs.

Habitat and Behaviour:

Often found where water seeps from a slope into a flat area. Occurs in lowland forests and non-forest habitats.

Call: A series of low-pitched raspy notes.

Occidozyga sumatrana, Yellow-bellied Puddle Frog



Size: Males: 21-31mm; Females: 35-48mm.

A small, squat frog with short, fat hind legs. The snout is moderately pointed. The tympanum is not visible. All toes are fully webbed and rounded at the tips. The colouring is usually dark grey-brown; some individuals also have a light streak running down the back. The underside of the head is light grey, with speckled brown spots. The underside of the belly and thighs is usually tinged yellow; however, the belly of juveniles is usually cream -white.

Similar species: Distinguished from *L. kuhlii* and *O. baluensis* by complete webbing between toes. *Occidozyga baluensis* lacks lemon yellow colour on its abdomen and underside of legs.

The distance between the eyes of *O. sumatrana* is the same or narrower than the width of the eyelid compared to *L. kuhlii*.

Habitat and Behaviour:

Found on the forest floor, often submerged in small water bodies, including muddy puddles and small streams.

Call: Unknown.

Family Megophryidae

Leptolalax fritinniens, Twittering Slender Litter Frog



Size: Males: 32-34mm; Females: 45-48mm.

A medium-sized frog with a rounded snout and skinny limbs. The dorsum is finely shagreened or granular, with a few scattered tubercles.

Digits are long and slender with small rounded discs only marginally wider than the toes and fingers. Toes have basal webbing.

The Ear is very distinct and the supratympanic ridge is distinctly angled.

Light brown to greyish brown above with dark markings on the head and back. Underside is white with dark spots.

Pupil is vertical.

Similar species: Other species of *Leptolalax*, but currently this is the only species recorded in the Lower Kinabatangan region.

Habitat and Behaviour:

Usually found perched on low vegetation near small streams, in which it breeds.

Call: A high-pitched twittering call consisting of a long series of pulsed notes with declining frequency.

Megophys nasuta, Bornean Horned Frog



Size: Males: 70-105mm; Females: 90-125mm.

A large, stocky frog with distinctive projections on its head. A wide, pointed, triangular projection from the upper edge of the eyelid, and a similarly pointed projection from the tip of the snout. Two distinct skin folds along either side of the middle of the back, and another dorso-lateral skinfold from the behind the eye to the groin.

Colour variable but usually variable comprising light, greyish or reddish brown. Underside marbled.

Pupil is vertical.

Habitat and Behaviour:

Usually found amongst leaf litter near forest streams, in which it breeds. Often hides under leaf litter.

Call: A very loud “honk.”

Family Microhylidae

Chaperina fusca, Saffron-bellied Frog



Size: Males: 18-21mm, Females: 20-24mm.

A very small frog with disproportionately long legs.

The tympanum is just visible. The toes have no webbing. Tips of the toes and the fingers are slightly widened.

A small spine projects from the elbow and heel.

The colouration is grey, greenish black on the back, whilst the underside is distinctively black with a network of bright yellow spots. The limbs are yellow or cream with dark bars.

Habitat and Behaviour:

Found on the forest floor, primarily in the leaf litter but occasionally on low vegetation or crevices in trees. Also found in gardens.

Call: A short, insect-like buzz.

Kalophrynus meizon, Rufous-sided Sticky Frog

(formerly *K. pleurostigma*)



Size: Males: 37-50mm, Females: 35-57mm.

A highly distinctive small to medium sized, stocky frog, with a triangular head and pointed snout.

Females have a finely pebbled upper surface, whilst males have many small spines. The tympanum is distinct.

The outermost toe and finger are short, toes also have little webbing.

The general colour varies from light to dark brown on the back and rusty oranges on the sides. A white line runs diagonally from the snout to the groin and there is always a conspicuous black spot in front of each hind leg.

Some individuals have an X-shaped marking across the back.

Habitat and Behaviour:

A forest species. Usually found within the leaf litter or under wood or rock crevices. Typically sits facing out of crevices.

Exudes a sticky, glue-like mucus when handled.

Call: Probably a sharp repetitive chirp.

Kalophrynus sp. nov., Lost Frog



Description: Similar body shape to *Kalophrynus meizon*. Small to medium sized, stocky frog, with a triangular head, pointed snout and distinct tympanum.

A single individual found at Gomantong had a distinctly rough upper surface with numerous conical projections or spines.

Differs from *Kalophrynus meizon* in having a uniform dark grey/olive-green back; a distinct dorsolateral line comprising a series of white lumps, and a pale cream-yellow flanks and belly and sides of body and head. Scattered small pale spines present on the upper edge of the mouth.

Similar species: *Kalophrynus meizon*, which has different coloration.

Habitat and Behaviour:

Presumed to be a forest species and may be restricted to limestone outcrops.

Exudes a sticky, glue-like mucus when handled.

Call: Unknown

Kaloula baleata, Brown Bull Frog



Size: Males: 50-61mm, Females: 55-66mm.

A squat, round frog with short, thick hind limbs and a blunt snout. The skin is often granular, with scattered lumps.

The tympanum is not visible.

The tips of the fingers are widened and blunt. Toes have only slight webbing and are blunt at the tips. The sole of the foot has a pair of flanges at the base of the toes.

The general colour varies from chocolate to dark brown and there is often a lighter band across the head. There are usually bright yellow marks at the base of the front and hind limbs.

Habitat and Behaviour:

Occurs in undisturbed forest as well as human-modified habitats and forest edges. Also recorded from oil palm plantations. The species burrows in litter and soft soil and also shelters in tree hollows.

Breeds in large ponds or pools that fill with water during the wet season.

Usually inflates when handled.

Call: A loud sharp, honk.

Metraphrynella sundana, Tree Hole Frog



Size: Males: 19-26mm, Females: 23-29mm.

A tiny, stocky frog with a pointed snout. The backs and top of the legs are covered in minute bumps.

The tympanum is hidden by a curved fold extending from the eye in front of the foreleg.

The feet are fleshy and the toes are about half webbed. The tips of the fingers are widened and the underside of each finger has a thickened, fleshy pad at the base.

The colour varies from grey to light brown, some individuals have a large dark brown mark running down the back. The tops of the fingers are usually yellow.

Habitat and Behaviour:

Males call from water-containing holes in small trees, usually between 1-3m above the ground.

Call: A single piping note at regular intervals. The pitch of the call varies, depending on the dimensions of the tree hole.

Microhyla borneensis, Lesser Bornean Narrow-mouthed Frog



Size: Males: 17-18mm, Females: 19-26mm.

A very small frog with long hind limbs. The snout is slightly pointed and projects in front of the mouth. The tympanum is not visible.

Four fingers are evident but the first finger can be reduced to a stub in males. Tips of toes are slightly widened. Three outer toes are about half webbed.

Body varies from grey to brown above, with a wide, dark brown or purple, mark down the middle of the back. This mark alternates in width, extending laterally to the flanks. Ventral surface faintly speckled with patches of tiny dark brown to black dots

Similar species: *M. perpava*, which has three fingers.

Habitat and Behaviour:

Adults live on the forest floor within the leaf litter and breed in small pools.

Call: A series of sharp rasping pulses with two short pulse groups (1-2 pulses), followed by one long pulse group (5-9 pulses).

Microhyla perparva, Least Narrow-mouthed Frog



Size: Males: 10-12mm, females: 13-15mm.

A tiny frog with long hind limbs. The snout is slightly pointed and projects in front of the mouth.

The skin is smooth.

The tympanum is not visible.

Only three fingers are evident.

The general colour varies from grey to brown. There is often a small dark brown mark running down the centre of the back.

The underside of the throat is dusky brown, but the belly is completely white.

Similar species: *M. borneensis*, which has four fingers.

Habitat and Behaviour:

Adults live on the forest floor within the leaf litter and breed at rain pools within the forest floor.

Call: Unknown.

Family Ranidae

Chalcorana megalonesa, White-lipped Stream Frog

(formerly genus *Hylarana*)



Size: Males: 33-48mm, females 45-66mm.

A small to medium-sized frog with a distinctly pointed snout. The tympanum is distinct and large, almost equal in size to the eye. The legs are moderately long and the toes are fully webbed, except fourth (longest) toe. The tips of fingers and toes are greatly expanded, forming round pads.

The skin on the back is finely pebbled, with a distinct dorso-lateral ridge or fold from behind the eye to the groin. The sides of the head and body are usually green to olive. The back is brown with scattered dark brown spots, although some individuals in the Lower Kinabatangan have green backs. A white strip extends along the upper lip under the tympanum to above the arm. A dark stripe extends along the canthus from the snout, encompassing the nostril to the eye.

Similar Species: *Chalcorana raniceps* is morphologically similar, and no single diagnostic feature reliably distinguishes these species. Further taxonomic work is needed to resolve them. *Chalcorana raniceps* males are smaller than most *C. megalonesa*, and always have a green back, flanks and upper limb surfaces.

Habitat and Behaviour: Occurs in forest where it is typically found perched on low vegetation near streams.

Call: A soft staccato series of clicking notes similar to *H. raniceps*.

Chalcorana raniceps, Jade-backed Stream Frog

(formerly genus *Hylarana*)



Size: Males: 28-34mm, females: 33-42mm.

A small to medium-sized frog with a distinctly pointed snout. The tympanum is distinct and large, almost equal in size to the eye. The legs are moderately long and the toes are fully webbed, except fourth (longest) toe. The tips of fingers and toes are greatly expanded, forming round pads.

The skin on the back is finely pebbled, with a distinct dorso-lateral ridge or fold from behind the eye to the groin. The back is green, and somewhat lighter green on the sides and upper surfaces of the limbs. A white strip extends along the upper lip under the tympanum to above the arm. There is a dark stripe along the canthus from the snout, encompassing the nostril to the eye.

Similar Species: *Chalcorana megalonesa* is morphologically similar, and no single diagnostic feature reliably distinguishes these species. Further taxonomic work is needed to resolve them. *Chalcorana raniceps* males are smaller than most *C. megalonesa*, and always have a green back, flanks and upper limb surfaces.

Habitat and Behaviour: Occurs in forest where it is typically found perched on low vegetation near swamps, rather than streams.

Call: A soft staccato series of clicking notes similar to *H. megalonesa*.

Hylarana erythraea, Green Paddy Frog



Size: Males: 32-45mm, females: 48-75mm.

A medium sized frog with long hind limbs and a tapered snout. The tympanum is very distinct. Skin is smooth with wide ridge on either side of the back from the eye to the groin.

The toes are about half webbed, with the fourth (longest) toe free from webbing near the tip. Toes of fingers are expanded slightly and rounded.

The dorsal body colour is bright to dark green on the top of the head and upper body, with a wide cream or whitish dorso-lateral stripe extending from the eye to the groin. Upper lip white, extending as a stripe below the ear and over the arm. Upper surfaces of limbs light brown or green, with fine dark flecks. Underside is white with occasional dark mottling towards the flanks.

Similar Species: *Hylarana megalonesa* and *C. raniceps* are smaller and have distinctly slender digits with conspicuously expanded tips.

Habitat and Behaviour: A terrestrial species, usually found around ponds and swamps in non-forest areas, such as farms and urban ponds. Common in oil palm plantations in the Lower Kinabatangan region, and occasionally found within forest edges.

Indosylvirana nicobariensis, Cricket Frog

(formerly genus *Hylarana*)



Size: Males: 37-47mm, females: 47-53mm.

A small-medium sized frog with a long, narrow, distinctly pointed head. The tympanum is distinct and large, almost equal in size to the eye. The legs are long and slender. The toes are extremely long with only slightly expanded tips. Toes are about half webbed, with fourth (longest) toe extending far beyond webbing.

The skin on the back is finely pebbled, with a distinct dorso-lateral ridge or fold from behind the eye to the groin. The back is brown with dark brown spots whilst the underside is dirty white with grey mottling. The sides of the body and limbs are mottled brown, sometimes forming broken cross-bars on the limbs. A white strip extends along the upper lip under the tympanum to above the arm. A dark stripe extends along the canthus from the snout, encompassing the nostril, and expanding to encompass the eyes and tympanum, fading behind the tympanum.

Similar Species: Similar body shape to *C. megalonesa* and *C. raniceps*, but *A. nicobariensis* has much narrower toe pads and less webbing.

Habitat and Behaviour: Strongly associated with disturbed habitats, such as gardens, farms, plantations and roadsides, where it calls from vegetation near ponds, marshes and ditches. Can also be found in forested areas where there are openings in the canopy.

Call: Several, up to ten sharp “kek” notes in rapid succession.

Pulchrana glandulosa, Rough-sided Frog

(formerly genus *Hylarana*)



Size: Males: 58-93mm, females: 65-84mm.

A medium-large sized frog with a broad head and prominent eyes.

The skin is covered in raised, round bumps that are especially prominent along the sides of the body.

The tympanum is large and very distinct.

The toes are about half webbed and both the tips of the toes and fingers have thickened, slightly triangular pads.

There is a short ridge of skin which runs back from the upper eyelid and ends above the tympanum.

The colour is generally brown with dark brown-back spots. The sides are lighter with brown blotches. The underside is usually white with some brown spots.

Habitat and Behaviour:

A terrestrial species found on the ground or perched on low logs throughout lowland forest and oil palm plantations.

Call: A loud resonant sequence of “whak” or “yap.”

Family Rhacophoridae

Chiromantis inexpectatus, Pizza Frog



Size: Males: 22-24mm, females: larger but no measurements

A very small tree frog with a rounded snout. The tympanum is relatively indistinct and less than half the eye diameter. Toes are about half webbed; webbing does not reach the discs. Fingers have, at most, only basal webbing. Finger and toe tips are slightly expanded into rounded disc pads.

The dorsum is covered in small pits, giving it a slightly granular appearance. No skin flaps are present along the forearm or tarsus, and heel lacks appendage.

Dorsal colour varies from reddish-brown mottling to pale yellow or cream with darker spots, similarly on upper surfaces of limbs. Ventral surface is white. A pale cream or yellow stripe extends from the snout along the canthus, under the nostril and under eye, through the tympanum to above the forelimb. Flanks are opaque cream or yellowish.

Similar Species: Distinctive from other species in the lower Kinabatangan. This taxon has been assigned to *Chiromantis inspectatus*, the only species of this genus known from Borneo. However, *C. inspectatus* was only described from montane habitat, has more webbing between the fingers and some differences in colour pattern.

Habitat and Behaviour: An arboreal species restricted to semi-inundated and inundated ultra-low rainforest on the Kinabatangan flood plain. Males descend from the canopy after rain to call from on top of leaves at least 1.5m above the water.

Call: A distinctive, sharp single intermittent “tick.”

Kurixalus chaseni, Fringed Tree Frog

(formerly *K. appendiculatus*)



Size: Males: 30-37mm, females: 42-50mm.

A small to medium-sized tree frog with a triangular head. Males have an almost conical tip to the snout, whilst females have an enlarged conical projection. The tympanum is distinct, and about half the diameter of the eye. The toes are about three-fourths webbed. The two outer fingers are partially webbed.

Dorsal skin is covered in many irregular small bumps, which tend to be larger on the sides. The outer edges of the forearms and legs have a characteristic wavy-edged fringe of skin. The upper surfaces are grey green to brown, often with variable mottled markings. The underside is usually white, sometimes with a yellow tinge. Some individuals have pinkish tinge on the front of the thigh.

Habitat and Behaviour:

Common in forest, including highly disturbed forest. Rarely found in plantations or non-forested areas. Males aggregate on vegetation above ephemeral forest pools to call.

Call: This species has a complex combination of calls, but often comprises a short to long series of soft raspy “chrick-chrick” notes, followed by one or more drawn-out “dang” notes.

Leptomantis rufipes, Red-legged Tree Frog



Size: Males 33-39mm, females 48-50mm.

A tree frog with a triangular, pointed head. The toes are fully webbed to the pads; the outer fingers are extensively webbed but to the pads. The skin on the back is smooth, while the belly is coarsely granular. No skin flaps or fringes on the limbs.

The upper surfaces are tan to reddish brown with a few brown spots or cross-markings. The sides of the head are paler cream or light tan. The webbing on the hands and feet is orange-red. The underside of the body is pale yellowish.

Similar species: Superficially similar to *R. pardalis*, from which it can be distinguished by the absence of skin flaps or fringes on limbs. *Leptomantis rufipes* also has a distinct pointed snout with a narrow pale line along the canthus from the snout tip to the eye, both of which are absent in *R. pardalis*.

Habitat and Behaviour: Rarely encountered in the Lower Kinabatangan region. Predominantly restricted to primary forest, but may also persist in some moderately disturbed forest areas. Males call from vegetation around small pools after heavy rain.

Call: Two short clicks, often followed by a short much lower trill.

Nyctixalus pictus, Cinnamon Frog



Size: Males: 30-33mm, females: 31-34mm.

A small frog with a pointed snout and long hind limbs. The skin of the upper surface is rough, with many small, spiny bumps. The tympanum is visible and slightly smaller than the eye. The toes are about half webbed, but the fingers lack webbing. The tips of both the fingers and toes are expanded into rounded pads.

All upper surfaces and sides are cinnamon brown in colour. Some individuals can also be red or orange. Small glossy white spots are scattered all over the upper side of this species which form a broken line from the eyelid to the snout. The upper half of the iris is also white, whilst the lower half is brown.

Habitat and Behaviour:

Associated with primary and secondary forest. Adults are usually found on small shrubs and trees, 1-3m above ground.

Call: A series of 5-20 soft, bird-like whistled notes. Pitch and repetition of the notes rise towards the end of the call.

Philautus tectus, Covert Bush Frog



Size: Males 20-24mm, females 24-28mm.

A small frog with large head, and large bulging eyes. The tympanum is distinct and about 30% of the eye diameter. The snout is elliptical in dorsal view and truncate in profile. The canthus rostralis is sharply curved and the lores are deeply concave. The legs are relatively long and digits all end in a widened disk. The toes are about two thirds webbed and fingers lack webbing. The supratympanic fold is distinct and moderately thick.

The back and upper surfaces of limbs are finely pebbled with broadly scattered large granular tubercles. A V-shaped or triangular arrangement of tubercles is present from the posterior edge of the eyes to the scapular.

Dorsal surfaces of limbs are covered in a variable pattern of dark or light green/yellow and brown or black blotches, sometimes forming dark bars on the limbs. A pale mid-dorsal stripe from the snout to the cloaca may be present.

Similar species: *Philautus* species are relatively cryptic. They can be hard to identify and their taxonomy requires further resolution. Whilst *P. tectus* has been reliably identified in the Lower Kinabatangan region, other *Philautus* specimens have also been reported in the region that have not yet been identified.

Habitat and Behaviour:

Occurs in undisturbed and moderately disturbed forest. Mostly found in karst areas, where it has been found perched on leaves 1-3m above the ground.

Call: A short chirping consisting of a single or doubled pulsed “eek.”

Polypedates colletti, Collett's Tree Frog



Size: Males 44-52mm, Females 59-77mm.

A medium-sized (males) to large (females) tree frog with a triangular head and a distinctly pointed snout. The skin is smooth, except for a fold over the tympanum. The tympanum is visible and is about 80% of the diameter of the eye. The toes are about half webbed; both the toes and fingers are widened into distinct pads at the tips.

The colour is highly variable from light tan to pinkish brown. There is usually a conspicuous mark on the back in the shape of an hour-glass or 'X'. The sides have scattered brown spots, whilst the limbs have crossbars.

Similar species: Distinguished from *Polypedates leucomystax* and *P. macrotis* by its distinctive pointed snout, and absence of dark wide stripe from the back of the eye to the mid-flanks, encompassing the tympanum.

Habitat and Behaviour:

Found throughout forest habitats. Often seen perched on the side of limbs. Breeds in small forest pools.

Call: A series of harsh crackling notes, often preceded by numerous low-pitched, broad band notes.

Polypedates leucomystax, Four-lined Tree Frog



Size: Males 44-52mm, females 59-77mm.

A small to medium-sized tree frog with a slender body and long, slender hind limbs. The sides of the snout are sharp but the tip is blunt. The skin is smooth, except for a curved fold over the tympanum. The tympanum is visible and is about 80% of the diameter of the eye. The toes are about half webbed; both the toes and fingers are widened into distinct pads at the tips.

The colour is highly variable from light tan to dark tan on the head, back and legs. Dark markings on legs usually form cross bars. Individuals often have four narrow dark longitudinal dorsal stripes, while others have scattered dark spots.

Similar species: Distinguished from *Polypedates colletti* and *P. macrotis* by absence of distinctly pointed snout, and absence of dark wide stripe from the back of the eye to the mid-flanks, encompassing the tympanum.

Habitat and Behaviour:

Found throughout all human-modified environments, including gardens, plantations and urban areas. Occurs in highly disturbed forest and the edges of mature forest, such as along roads. Males call in small groups around ponds, perched on vegetation, logs or rocks.

Call: A low pitched nasal “quack” or squelch. Sometimes sounds like someone passing wind.

Polypedates macrotis, Dark-eared Tree Frog



Size: Males 45-57mm, females 66-85mm.

A medium to large-sized tree frog with large, prominent eyes and a triangular head. The tympanum is very distinct. Limbs are long and slender and the toes are almost fully webbed, with the exception of the fourth (longest) toe. The skin is generally smooth, though some individuals may have some small bumps on the back.

The colour varies from light tan to dark brown and there is a characteristic dark brown band running over the tympanum and down the flanks, usually ending before the groin, or breaking up into a series of dark blotches. The underside of the head is mottled brown, whilst the belly is white. There is often a narrow, white ridge of skin running along the outer edge of the forearm.

Similar species: Distinguished from *Polypedates colletti* and *P. leucomystax* by absence of distinctly pointed snout, and presence of distinct dark wide stripe from the back of the eye to the mid-flanks, encompassing the tympanum.

Habitat and Behaviour:

Occurs in disturbed forest, forest edges, and oil palm plantations. Calling males aggregate to call in vegetation over pools and ditches.

Call: A long drawn out chuckle, with the first note louder than the rest.

Polypedates otilophus, File-eared Tree Frog



Size: Males 64-80mm, females 82-97mm.

A large tree frog with a triangular head and a protruding, sharp point at the angle of the jaw. There is a distinctive saw-edged ridge over the tympanum, which is visible. The skin is smooth, except for pointed projections on each elbow and heel. The toes are only half webbed.

Colouration varies from cream, light tan to yellow, with thin dark lines running down the head and back, which merge with black lines in the groin area. The undersides of the thighs are marked with eight to twelve bold black bars on a white background, which often extend over the dorsal surface of the limbs as well. The underside of the body is usually dirty white.

Habitat and Behaviour:

Occurs in disturbed forest, forest edges, and oil palm plantations. Calling males aggregate to call in vegetation over pools and ditches.

Call: A series of slurred, rasping notes, followed by several loud “chucks.”

Rhacophorus harrissoni, Brown Tree Frog



Size: Males 50-56m, Females 60-70m.

A medium sized tree frog with a pointed, sharp-edged snout. The skin of the back is smooth or finely pebbled, and belly is coarsely pebbled. The tympanum is visible and almost the size of the eye. The toes are fully webbed and the three outer fingers are also webbed to the pads, which are distinctly widened. There are no ridges or flaps of skin on the limbs.

Dorsal colour is reddish brown to clay brown. The back is plain or with scattered dark blotches. Some individuals have a dark transverse bar between the eye sockets. Hind limbs can often have dark crossbars or scattered blotches. The side of the head is paler than the top of the head, separated by a narrow pale canthal ridge line. Upper lips sometimes have white spots or dark mottling. The webbing is usually dark brown to dark grey, but some individuals have red markings on top of the webbing. The flanks and hidden surface of the legs are usually greenish-yellow.

Similar species: Superficially similar to some *Polypedates* species; however, it is easily distinguished by the presence of webbing between the fingers.

Habitat and Behaviour:

Occurs in lowland primary and secondary forest with only moderate disturbance. Uncommon in the Lower Kinabatangan region. This species breeds in tree hollows or cavities formed by fusing buttresses.

Call: A single short wooden “clack.”

Rhacophorus nigropalmatus, Wallace's Flying Frog



Size: Males 79-89mm, females 89-100mm.

A large frog with almost rounded snout and very large hands and feet. Fingers and toes are fully webbed. The tympanum is large and visible but not very distinct. The skin of the body is very finely pebbled with no projections or ridges. The forearm has a wide smooth-edged flap of skin that extends to the edge of the out finger. The heel has a wide, rounded flap of skin that continues onto the outer edge of the foot.

All upper surfaces are emerald green, sometimes with a few glossy white spots on the back. The underside is white, becoming yellowish on the chest and belly. The sides of the body and legs are bright yellow. The webbing of the hands and feet is black, with yellow longitudinal lines becoming wide to the outer webbing edges.

Habitat and Behaviour: Associated with lowland primary and secondary forests, where it spends most of its time in the upper canopy. Frogs descend to breed in turbid pools, including animal wallows, after heavy rains.

Call: A low-voiced trill, sounding like a soft tapping of wood; often commencing with a single detached note.

Rhacophorus pardalis, Harlequin Tree Frog



Size: Males 39-55 m, females 55-71mm.

A medium sized to large tree frog with a rounded snout. The toes and three outer fingers are fully webbed to the pads. The skin on the back is smooth, while the belly is coarsely pebbled. A wide smooth-edged skin flap runs along the outer edge of the forearm and hand. The heel has a round flap of skin.

The upper surfaces are tan to reddish brown, with dark markings sometimes forming an X in the middle of the back. Many individuals have several white spots on the back. In some cases these can be extensive. Some individuals have yellow or blue spots on the back and upper surfaces of the legs. The lower sides are mottled orange and yellow and an orange network on the belly. The webbing on the hands and feet is orange-red.

Similar species: Superficially similar to *L. rufipes*, from which it can be distinguished by the presence of the skin flap on the outer edge of the forearm and hand. *Leptomantis rufipes* also has a distinct pointed snout with a narrow pale line along the canthus from the snout tip to the eye.

Habitat and Behaviour: Found in a wide range of forest habitats, including extensively disturbed forest and forest edges. Males call from vegetation around ponds, marshes, ditches and non-flowing side pools of streams.

Call: A brief raspy chuckle.

Zhangixalus dulitensis, Jade Tree Frog



Size: Males 33-40mm, females 49-50mm.

A small tree frog with a sharply pointed snout and a slender body. The tympanum is visible, but not distinctive. The skin on the back is smooth. The toes are fully webbed and the fingers are almost fully webbed, except for the fourth toe. There is a narrow white-edged ridge of skin along the outer edge of the forearm and lower leg. A ridge of skins also projects above the cloaca. The heel has a small conical or round flap of skin.

Dorsal colouration is a distinctive pale jade green, sometimes with tiny brown dots. The flanks and eye sockets may have a yellow sheen. The upper eyelid and a narrow line along the canthus are reddish-brown or purple. The top of the web between the outer toes is red.

The underside is transparent and the turquoise bones can be seen from beneath.

Habitat and Behaviour:

Occurs in lowland primary and secondary forest with only moderate disturbance. Males form large breeding groups around ponds that form after heavy rain, where they call from over-hanging leaves.

Call: A short, weak cricket-like trill.

Habitat Associations

Several distinct broad distinctive habitat types occur in the Lower Kinabatangan area: (i) dry rainforest forest – rarely inundated during the wet season; (ii) wet forest – regularly inundated during the wet season, including permanent swamps; (iii), limestone karst hilly outcrops; (iv) riparian forest – stream banks, comprising the large Kinabatangan River, smaller muddy tributaries, and stony streams draining limestone hilly outcrops; (v) non-forest – open (treeless) grassland and gardens, and open marshy areas; and (vi) oil palm plantations. These habitat types have been used previously to describe the occurrence of frog species in the area (Gillespie et al. 2012; Scriven et al. 2018).

Species	Dry forest	Wet forest	Limestone karst	Riparian forest	Non-forest	Plantation
<i>Ingerophrynus divergens</i>	*			*		
<i>Fejervarya cancrivora</i>				*	*	*
<i>Fejervarya limnocharis</i>	*	*		*	*	*
<i>Limnonectes finchi</i>	*	*		*		*
<i>Limnonectes ingeri</i>	*	*		*		*
<i>Limnnectes kuhlii</i>			*	*		
<i>Limnonectes leporinus</i>		*		*		*
<i>Limnonectes malesianus</i>				*		
<i>Limnonectes paramacrodon</i>				*		
<i>Occidozyga baluensis</i>		*				
<i>Occidozyga sumatrana</i>	*	*		*		
<i>Leptolalax fritinniens</i>				*		
<i>Megophrys nasuta</i>			*	*		
<i>Chaperina fusca</i>	*	*		*		
<i>Kalophrynus meizon</i>	*	*				
<i>Kalophrynus sp. nov.</i>			*			

Species	Dry forest	Wet forest	Limestone karst	Riparian forest	Non-forest	Plantation
<i>Kaloula baleata</i>	*	*	*	*	*	*
<i>Metraphrynella sundana</i>	*	*	*	*		
<i>Microhyla borneensis</i>	*	*		*		
<i>Microhyla perpava</i>	*	*		*		
<i>Chalcorana megalonesa</i>		*		*	*	*
<i>Chalcorana raniceps</i>		*		*	*	*
<i>Hylarana erythraea</i>					*	*
<i>Indosylvirana nicobariensis</i>		*		*	*	*
<i>Pulchrana glandulosa</i>	*	*		*		*
<i>Chiromantis inexpectatus</i>		*				
<i>Kurixalus chaseni</i>	*	*		*		*
<i>Leptomantis rufipes</i>						
<i>Nyctixalus pictus</i>	*		*			
<i>Philautus tectus</i>			*			
<i>Polypedates colletti</i>	*	*	*	*		
<i>Polypedates leucomystax</i>	*	*			*	*
<i>Polypedates macrotis</i>	*	*	*	*	*	*
<i>Polypedates otilophus</i>	*	*			*	
<i>Rhacophorus harrissoni</i>	*		*	*		
<i>Rhacophorus nigropalmatus</i>	*	*				
<i>Rhacophorus pardalis</i>	*	*		*	*	
<i>Zhangixalus dulitensis</i>	*	*		*	*	

Glossary and Abbreviations

Anterior	Towards the front
Appendage	Projecting part of body, with a distinct appearance or function
Canthus	Outer or inner corner of the eye, where the upper and lower lids meet.
Canthus rostralis	Canthal ridge line between the canthus and the nostril
Chevron	V-shaped line or stripe
Cloaca	Posterior vent at the end of the body for excretion and reproductive products
Dorsal/dorsum	Upper side or back
Flank	Side of the body
Karst	Limestone rock outcrop
Keratinized	A hard material made from the protein keratin
Lores	The side surface of the head between the eye and nostril
Penultimate	Second last before the end
Paratoid gland	A swollen glandular region on the head usually commencing behind the eye, sometimes extending onto the back
Phalange	One of the bones in a finger or toe
Posterior	Towards the rear
Querulous	Complaining in a rather petulant or whining manner
Semi-inundated	Partly filled with water, or filled with water only some of the time
SVL	Snout-vent length
Subarticular tubercle	Small rounded projection, lying below the joints, especially between the phalanges of the digits.
Supratympanic ridge	Raised ridge of skin or bone above the ear
Translucent	Allowing light to pass through, semi-transparent
Truncate	Shortened
Tubercle	Small rounded projection from the body
Tympanum	Ear
Ventral	Underside

References

Gillespie, G. R., Ahmad, E., Evans, A., Ancrenaz, M. Goossens, B. and Scroggie, M. 2012. Relative value of secondary forests and non-forest habitats for amphibians in Borneo. *Biological Conservation* 152: 136-144.

Scriven, S., Gillespie, G.R., and Goossens, B. 2018. Edge effects of oil palm plantations on tropical anuran communities in Borneo. *Biological Conservation*. 220: 37-49.

Inger, R.F., Stuebing, R.B., Grafe, T.U. and Dehling, J.M. 2017. A Field Guide to the Frogs of Borneo, 3rd Edition. Natural History Publications, Kota Kinabalu.