The Amphibians and Reptiles of Malinau Region, Bulungan Research Forest, East Kalimantan:

Annotated checklist with notes on ecological preferences of the species and local utilization

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Edited by
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Abstract

The amphibians and reptiles of CIFOR's field site in Malinau were investigated for a one month period in June - July 2000, a study which was then continued by two interns from Aberdeen, so that the total length of study was about 72 days. A number of amphibian and reptile species were directly observed in the area during this time. Following that work and interviews with local people, a total of 97 species are noted, and 76 among them are confirmed. This is an ecologically rich area for an exploited forest and researchers found less logging damage than previously believed. Observed impacts only occurred locally around skid trails, logging roads, and in areas where trees have been harvested, though a more intensive study around those sites must be performed. This study indicates that current logging activity has only minimal impact on frog diversity. Although their abundance is relatively low, the present study is unable to link this fact with logging activities because diversity levels are similar to those in undisturbed forests. All streams contain roughly the same species, indicating that the habitat itself is essentially homogenous. Knowledge of the habitat of amphibian species should be explored more deeply for future monitoring of logging activities. The local people used turtles, monitor lizards and pythons as food, but they rarely eat frogs, although they acknowledge that at least six species are known to be edible. Therefore we believe that the reason for the low number of large adults frogs of the genus *Limnonectes* is most probably the result of natural causes and not by human exploitation. Local people are principally familiar with a variety of poisonous snakes, so as to avoid them. The poison from the king cobra was used in the past for the poison darts of blowpipes, but the poison is now seldom used.

A preamble regarding CIFOR's work in Malinau

The Malinau area of East Kalimantan (Borneo) was until recently little known biologically. It was suspected that the rugged and forested landscape, next to the Kayan Mentarang National Park, would have a high value in terms of its plants and animals. A major emphasis for CIFOR's research has been to document this biological wealth. This research has had three major components:

1. Finding out what occurs and where;
2. Assessing to whom it matters and in what way; and
3. Identifying what steps are needed to maintain this biota in the future.

Together, these three strands of information help define priorities that reflect local considerations and can inform a wide range of processes, from the development of reduced impact logging guidelines to international forestry and conservation policy. The account of amphibian and reptile studies reported here provides information relevant to each of these strands by combining an extensive field study with an evaluation of local views and practices, as well as a careful review of what is know about the vulnerability and sensitivity of each species. Using available reference material and knowledge helps provide a body of information that is available to guide management (for a fuller discussion of this philosophy see Sheil and van Heist 2000). It is however, the second aspect – what matters and how priorities are established - that has been so overlooked in earlier environmental science. Therefore, we will briefly introduce this topic.

There is an increasing appreciation of environmental values, including biodiversity, and their role in maintaining human well-being and economic development. Under Article 7 of the Convention on Biological Diversity, for example, signatory countries must assess and monitor their biodiversity. Despite these developments, there is little general guidance - or practical consensus - on how to proceed. The academic approach to surveys has generally been to match very specific methods to very specific questions. However, the most obvious and urgent practical questions have been too broad and multifaceted for such clear resolution. One such question, which we consider here, is 'how can we find out what we should know to make better decisions about tropical forest landscapes?' Following CIFOR's goals, we emphasize biodiversity, forest dependent people and the environment.

Much of the global concern about tropical rainforests derives from fears of major impending extinctions. Considerable efforts have focused on identifying the most important sites for protection or sensitive management. Biodiversity surveys have become a major preoccupation of conservation agencies and are increasingly included in impact assessments. However, the information generated by these efforts remains less influential than many would wish. In many tropical forest countries, the opportunity costs of large-scale conservation are considerable and local people frequently have other priorities. The notion that 'every species must be maintained at all costs' is thus a view irrelevant to many key decision makers.

Local decisions can only balance 'biodiversity' goals with other demands if the values and preferences of local stakeholders, especially forest dependent communities, are addressed. Local decision makers are not the only agents of landscape changes we need to consider: outsider-led interventions can also lead to major changes for local people and the environment. Indeed, from a rural perspective, a town-based official may be viewed as much of an 'outsider' as an overseas funding agency or a foreigner-led research project. For many stakeholders, especially commercial enterprises, such as timber concessionaires and mining companies, their preferences and motivations are relatively clear and easily communicated and understood. But, when rural communities with strong indigenous cultures are considered, their needs and perceptions remain hidden to most outsiders unless a specific effort is made to uncover them.

Is there a solution to this problem? Ideally, detailed knowledge would be gained through intimate personal knowledge, but few decision makers are willing to live for long periods in the communities they will influence. What is needed is a practical method or, indeed, a suite of methods, that can reduce the understanding gap and provide a comprehensible summary of what actually matters locally. Such a approach could also determine what is important, to whom, how much, and why, as well as a means to make these local values and preferences more understandable and relevant to the decision making process.

CIFOR research is thus committed to developing an emerging paradigm in biodiversity research that fits these key objectives. Its goal is to record and assess the biophysical environment while building clear links to the needs and priorities of key stakeholders. For CIFOR, the key stakeholders are often the poor and forest dependent people that are often neglected in national development strategies. Such knowledge helps identify the priorities and needs of local stakeholders, and identifies priorities for both effective interventions and further research.

Douglas Sheil - CIFOR, Bogor, Indonesia.

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Introduction

Amphibians and reptiles are frequently neglected in forestry studies. Their role in the ecosystem is often considered to be of low importance. A consequence of this neglect is that little information about amphibians and reptiles has been recorded from Indonesian forests. To date, in fact, only one report about the herpeto-fauna of the study area of Kalimantan has been published, and that deals with snakes alone (Stejneger 1922).

Much of the Malinau area is covered by a timber concession of the government owned company PT Inhutani II. It, in connection with CIFOR, has experimented with Reduced Impact Logging (RIL) techniques and comparing their impact with that of Conventional Logging (CL) techniques used at present. It was expected that RIL could have a smaller impact than CL on the flora and fauna composition. For this reason, data from various groups of species is badly needed.

Amphibians, in particular, (and some reptiles) are good indicators for assessing forest condition because they are very sensitive to ecological and climatic change. They are abundant in the ecotones and easy to observe, so that a quantitative analysis can be performed. The number of species is limited (about 160 species in Borneo) and a number of guidebook on amphibians are now available. Yet information on species composition of amphibians and reptiles remains scattered and records are frequently made by non-herpetologists (e.g. O'Brien and Fimbel 1999; Rachmatika 2000 (unpublished), a similar survey of birds and fish commissioned by CIFOR). Although amphibians stay in the forest during daylight, they tend to concentrate in riparian areas at night (Inger 1980, Inger and Colwell 1977).

The species composition of amphibians can change very quickly in relation to ecological conditions. Unfortunately, as of yet very few studies have been undertaken in Indonesia (Iskandar 1999a, b; Iskandar and Setyanto 1996, 1999; Iskandar and Colijn 2000; Stuebing, Iskandar and Sabky 1999; Mistar pers. comm.; Liswanto pers. comm.). In North Sumatra, logged forests have been found to have only about 20% of the individuals found in an unlogged forest of the same area (Iskandar 1999a, b). Their abundance is strongly correlated with the amount of forest litter. Logged forests have considerable open areas that allow the litter to be exposed to sunshine, which reduces the rate of litter decomposition. Closed canopy litter is more humid and decomposition proceeds at a much faster rate. Many insects live in decomposing litter but dry litter attracts few insects, making it unattractive as food sources for reptiles and amphibians. There are, however, species with a wider tolerance to ecological conditions, or a preference for open areas, and deforested areas are frequently invaded by these species. A study on this group of species has been considered by CIFOR staff on several occasions and eventually finalised in this work.

Aims of This Study

To prepare an initial checklist of the amphibians and reptiles in the area bordered by the Seturan and Rian Rivers.

To annotate the list, when possible, with information on habitat, life history requirements, and possible vulnerability to harvesting and forest conversion. This includes comprehensive references to published information.

To provide the local names of these species when available.

To identify if any of these species are used by, or valued by the people of Langap, Loreh and Seturan and if so why, in what manner and by whom?

Material and Methods

The methods are a slight modification of those used by Heyer *et al*. (1994). In order to obtain sufficient data, we performed quantitative analysis using quadrats (30 m x width of the river). Each quadrat was assessed for three consecutive nights when possible. Data obtained from quantitative analysis is shown in Tables 1 and 2. In addition, we also cruised the forest to obtain qualitative data on species not found in the riparian area.

The streams were surveyed during daytime and the quadrats were set up at the same time. The river was mapped to sufficient detail so that the nighttime research could be performed without much difficulty. Only streams wider than 5 m but less than 15 m seem suitable. Larger streams or rivers were unsuitable, because the currents were too strong and the water was too deep to allow work at night. In addition streams with stagnant water or intermittent flow were not used because it was very difficult to design plots of equal length and width and, as a result, nearly impossible to accurately assess the abundance. Streams with too many logs were also unsuitable for work at night.

Information was not gathered during nights with heavy rains, because of the risk of being washed away, the danger posed by floating debris, and poor visibility. Tree buttress searches were also performed during the mornings.

For this study the following regions of the Bulungan Research Forest (BRF) have been surveyed:

- A small tributary of the Seturan River, about 45 minutes walk from Seturan base camp. In this stream we set up 17 quadrats. This area is a flat primary rain forest that was to be logged in the year 2001.
- A small tributary of Rian River that was logged in 1996-1997. Only seven plots were set up because of the small stream area.
- A stream behind the Seturan camp consisting of a strip of about 200 m, or about seven quadrats, and the search was then continued onto the banks of Seturan River.
- A stream near Inhutani Camp (Plot 39), consisting of a strip of 11 quadrats.
- A stream at the left side of the road from Seturan camp, a small tributary of Rian River, probably connected with stream from Plot 39. This is outside the logging area and a relatively well-covered gallery primary forest.

In addition, we incorporated the data obtained from two student interns from Aberdeen (Lang and Hubble 2000, 2001 unpublished; Lang 2002 unpublished). Because of the frequent rain, usually a short survey was performed after the heavy rainy night, although this was not performed quantitatively.

Table 1. The increase in number of species during the survey

Species\days	1	2	3	4	5	8	13	14	15	16	17	20	21	22	23	24	70
found	16	18	18	21	24	26	29	32	35	37	40	42	45	48	49	53	76
reported	5	7	8	8	8	8	8	8	8	8	8	8	8	16	18	20	21
total	21	25	26	29	32	34	37	40	43	45	48	50	53	64	67	73	97

Note: Data from Day 25-70 are from Hubble and Lang (pers. comm.)

Table 2. Relative abundance

	Abundance of species per stream				
Species (19 spp.)	**Temalang**	**Rian I**	**Stream 27**	**River 39***	**Rian II***
Ansonia albomaculata	-	-	*-;1*	-	-
Bufo asper	*2;1;-*	*-;8;8*	*2;4;*	+**	+
Pedostibes hosii	1;2;-	-;-;1	-;1	-	-
Leptobrachium abbotti	-	-	-	-	*2*
Leptolalax gracilis	-	-;1;-	-	-	-
Leptolalax pictus	-	-	-;1	-	-
Limnonectes ibanorum	-	-;1;1	1;1;	+	-
Limnonectes kuhlii	3;-;3	4;5;2	-;1	+	+
Limnonectes leporinus	6;5;6	1;7;1	5;1;	+	+
Limnonectes paramacrodon	2;-;1	-	8;3;	-	-
Meristogenys whiteheadi	+	1;-;-	-	-	+
Rana nicobariensis	-	-;2;4	1	-	+
Rana picturata	3;7;4	3;1;1	-;1;	+	+
Rana raniceps	-	-	2	-	-
Polypedates otilophus	-	-	-;1	-	-
Rhacophorus harrissoni	-;1;-	-	-	-	-
Cyrtodactylus malayanus	-	-;-;1	-	-	-
Tropidophorus brookei	-	-	-;1	-	-
Amphiesma sp.	-	-	-	-	1
Number of species	8	10	13	4	9
Duration of work	52; 50; 50	52;47;	60;48	+ 60	+ 120
persons	3	3	4-5	5	5
Specimen/hr/man	0.01	0,3	0.09	-	-
surveyed land surface	2475 m²	960 m²	+ 1500 m²	+ 1200 m²	4000 m²

*) Data not available and will be presented elsewhere. The Stream 27 include a strip of 500 m of the Seturan river.

**) + = present, but no detailed data from the plots.

Results

1. Checklist of Species

Extensive scientific literatures have been compiled by Das (1998) and Iskandar and Colijn (2003). All frog species can be identified using books by Inger (1966), Inger and Stuebing (1989, 1997, 1999), Berry (1975), Iskandar (1998a, b). For reptiles, the two books by de Rooij (1915, 1917) are the only references available that cover the whole region (though they are out of print and 75% out of date). Turtles can be identified using Lim and Das (2000), Moll and Sharma (2000), or Iskandar (2000), which also includes crocodiles. Snakes can be identified using the Stuebing and Inger (1999) guidebook or David and Vogel (1997) for species that occur in Sumatra (and partly in Borneo). Inger and Tan (1996) illustrate some lizards, snakes and frogs that are common in Sabah, but the book is difficult to use as a source of identification. A beautiful and useful book by Manthey and Grossmann (1997), written in German, lists most amphibians and reptiles of Southeast Asia, describing and illustrating about 40% of the known species of Kalimantan. A book by Chanard *et al*. (1999) lists all amphibians and reptiles of Peninsular Malaysia and Thailand, which could be useful. Iskandar and Colijn (2000, 2002) recently published a complete amphibian and snake list of Southeast Asia.

A. Locally reported species

In this section, only species that were not observed directly during this study are discussed. Data on species obtained from direct observation will be discussed in the next section.

AMPHIBIA

People from Langap and Seturan call most frogs *ngu'ang*, while those from Loreh (Merap, Kenyah or Punan and probably Putuk) call all large frogs *sa'ai*. This last name is also used by people in Sabah, Kadazan - Dusun for large edible frogs (Stuebings pers. comm.). Other Punan use the name *pre'eh* for small frogs and *bunong* for medium sized frogs.

ANURA

Bufonidae:

1. *Bufo juxtasper* (jau'i)

A very large plump toad, up to 30 cm in size. Colour: dull-blackish, with or without darker parts. The species frequents running waters such as streams or big rivers. Usually found submerged in the river during daylight. It is not found around Rian or Seturan River, but reported from more remote areas in the forest. The species, as a toad, has poisonous skin and pungent smell. Because of its large size, it is sometimes eaten if it is carefully skinned (avoiding contact between the outer layer of the skin and the flesh).

Megophryidae:

2. *Megophrys nasuta* (ngu'ang)

A toad like species that has smooth skin, as well as a remarkably long and pointed protrusion of skin fold on the upper eyelid and at the tip of the snout. Colour: reddish brown like dead leaves. Call: a single note (kang). During dark moon, its call is repeated once every 30 minutes, but during mating season (full moon period) the intervals are about once every 30 seconds. The species is usually hidden among dead leaves and litter. It does not jump away if disturbed, but hops away if touched. The species only enters the river during breeding season. The species was

not observed nor heard in Seturan and Rian Rivers, but reported from more remote areas.

Ranidae:
3. *Hoplobatrachus rugulosus* (sa'ai Taiwan)
This is a medium sized frog (up to 10 cm) with smooth skin, although the dorsum has numerous, short, elongated ridges. It has brownish or yellowish green colouration with white ventral and small black spots on the gular region. We have no idea how far this species has spread. Matsui (1979) first reported it from Sabah in 1978. The species was brought to North Borneo in order to be ranched, but later escaped in the wild. It is occasionally hunted for food. In East Kalimantan the local people claim that they first observed the species around 1997. It can be concluded that the species needed about 20 years to spread from Northwest Sabah to East Kalimantan. This involves a distance of about 400-700 km depending on the route taken. If the route followed the shoreline then the distance would be 650-700 km. However, because the species is apparently absent from the shoreline area of Tawau, a shorter possible path of dispersal could be from Keningau (where it is abundant) through Sapulut, down to Tanjung Selor (Stuebings pers. comm.): a distance of about 400 km. If this is true, it migrated at a speed of about 20 km per year southwards to East Kalimantan. Unfortunately, we were unable to confirm this finding.

4. *Limnonectes ingeri* (sa'ai)
A very large frog (up to about 15 cm) with smooth skin. Colour: dorsum reddish brown; ventrum: cream and finely spotted with black. Snout rounded, sides of the snout convex, ventral skin slightly granular. Habitat: swampy area. The species has not been seen around Seturan and Rian Rivers, but the local people reported its presence. It is occasionally hunted for food. The species was described from Sabah and found to be present in Kayan Mentarang National Park (Stuebing pers. comm.), hence its occurrence is certainly plausible.

REPTILIA
SQUAMATA
Agamidae:
5. *Draco quinquefasciatus* (takang)
A greenish flying dragon with black and orange banded patangium. The species is known from lowland forest. It is completely absent around human habitation.

Lacertidae:
6. *Takydromus sexlineatus* (kadal ekor panjang)
A very slender lizard with a very long tail (about 3-5 times its body length). It is a relatively small species; the head and body length is about 5-7 cm and the scales are strongly keeled. The body colouration is golden brown or greenish with several white stripes along the back. The species inhabits open areas such as fields and *alang-alang* grassland. It feeds on small insects.

Varanidae:
7. *Varanus rudicollis* (kabok)
A terrestrial or arboreal monitor that is reported to attain about 2 m. The body is completely black or with some reddish hue on the head, the neck has enlarged and strongly keeled scales. The species is usually arboreal and can be found far away from the river. It feeds on birds, small mammals, and some amphibians and reptiles. It is hunted for food when encountered. This species is probably also known as *bucou*, a name that would appear to apply when an animal is still about half of its adult size. Unless it is a wholly new species there are no other candidates. Local people claim that this smaller lizard is different from *Varanus rudicollis*. They claim that their hunting dogs die almost instantly after being bitten by it. This phenomenon is similar to the fact that *V. komodoensis* has a number of virulent microbe species in its mouth that can inflict death on bitten animals. From a literature search, only one other species is known from Borneo, *Varanus heteropholis* (or *Varanus dumerilli heteropholis*), but the colour is greyish-black. It is also eaten after skinning.

OPHIDIA
Acrochordidae:
8. *Acrochordus javanicus* (okat)
This is a very sluggish aquatic snake. Outside the water, it is practically helpless. The skin is very rough, covered with tiny spinose scales. It can attain a size of about 120 cm, and weigh more than one kg. The body colouration is greyish-black with some mottles. The species is considered a pest in fisheries and ponds. Otherwise its skin is highly prized in Java or Sumatra and exploited for golf gloves. The species

is ovoviviparous and can give birth to about 40 siblings in a single clutch. Although it is largish snake, local people do not eat this species.

Colubridae:
9. *Boiga dendrophila*
This species can attain about 2 m in length and is characterized by its distinctive colouration: black with narrow, yellow rings. It lives in trees near the rivers and feeds chiefly on mammals and birds. Although usually found high in the tree, the species descends to the ground at night. It is mildly poisonous and is avoided by local people.

10. *Chrysopelea paradisii*
This "paradise tree snake" is a small mildly poisonous species. It is green with a series of four red scales all along the vertebral region, that makes it one of the most colourful snakes of Borneo. The species usually lives high in the canopy in the primary forest and it is capable of fall-gliding between trees. It feeds chiefly on small lizards, and occasionally on frogs.

11. *Oligodon* spp.
A group of small snakes (more than 50 species worldwide) that coil up their tails when disturbed or molested. They rarely attain more than 40 cm. Although they are harmless, the species have very sharp teeth, used to slit reptile eggs open and eat their contents. Therefore, live specimens could not be kept in a plastic bag. There are numerous similar species of *Oligodon* in Southeast Asia, hence it is difficult to identify the species to specific level. The species is non-poisonous.

Crotalidae:
12. *Trimeresurus albolabris*
A green snake with a red tail, total length about 60 cm. It is characterised by its triangular head with a relatively slender neck. This could also be attributed to *T. albolabris, T. popeiorum, T. sumatranus, T. malcolmi* or *Tropidolaemus wagleri,* though the last three species can attain a much larger size. It is poisonous and can give a nasty bite that can cause painful swelling that lasts for more than a week. It is usually arboreal, but also very often found in the lower levels of the forest canopy. It feeds on small rodents, birds, and lizards. This snake species is one of the few snakes that gives birth.

Cylindrophiidae:
13. *Cylindrophis ruffus*
A small non poisonous snake, famous for having a second "head", because if disturbed, the species flattens its body and raises its red coloured tail to mimic its head. The species has a general size of about 40 cm, and feeds on other snakes. The body is usually blackish with some reddish or white bands. It gives birth to about two siblings.

Elapidae:
14. *Bungarus flaviceps*
The red-headed krait can attain about 2 m. It is actually a rather sluggish species, but it is very poisonous, with a long poison gland that extends into the body cavity much like *Maticora*. The body is black but each scale has some small white dots at the borders, and it has a red tail. It is very similar in colouration to the smaller *Maticora bivirgata* that has red head and tail, with a bluish body instead of black. *Bungarus* is believed to feed on small mammals.

15. *Maticora intestinalis*
This is the smallest species of the poisonous cobra family and it measures at most 30 cm. The underside of the tail is red and the ventral scales are black and red in alternating position. The head is black and has two stripes at the sides, continued as a single stripe onto the vertebral region. Some populations have three stripes on the back. The dorsum is basically black. When molested, it raises its tail mimicking the head much like *Cylindrophis*. Although it is highly poisonous and has the largest venom gland in the world (75% of the body length), its head is so tiny that it prevents it from biting larger species including human beings. It lives underground and feeds on worms and termites.

16. *Ophiophagus hannah*
The king cobra is the largest and amongst the most poisonous terrestrial snakes in the world. The body colouration is usually blackish or brownish. Juveniles have narrow, oblique light bands on the body that disappear with age. In adults, the scales of about one third of the body and the tail are edged with black. It feeds on small mammals and has a particular appetite for other snakes. The species is found in primary rainforest and also in open areas. The female is very aggressive during reproduction

and guards her eggs and newly hatched young. A king cobra mother will chase people aggressively, and is perhaps the most threatening and truly dangerous animal in the Borneo forests.

Pythonidae:
17. *Python curtus* (lepung boot, bongi)
A relatively short plump python. Colour: blackish to orange with some darker orange or reddish brown blotches. Its colouration makes this species very sought after, by both the leather industry and local hunters. The species habitat is semi fossorial (living beneath ground) and during daylight is often found in a rat burrows. It is extremely rare in the forest, but can be very abundant in oil-palm plantations. Compared to the reticulated python, this species is considered aggressive.

Typhlopidae:
18. *Ramphotyphlops braminus*
The species is reported as small species, not longer than 150 mm with diameter usually less than 5 mm, and capable of rapid movement. Colour: blackish, glistening and 'worm-like'. Habitat: burrows into the ground. It is usually found while turning over leaf litter or digging. It is the only snake species in Southeast Asia that is an all female species (i.e. parthenogenic). The species have a very wide distribution in the tropical region, extending from Africa, Asia up to Central America.

CHELONII
Geoemydidae:
19. *Orlitia borneensis*
This is the largest terrapin in Southeast Asia and can measure up to 120 cm (weighing about 100 kg), although it is commonly only about 80 cm. The carapace is uniform black and smooth. The plastron is uniformly cream without any darker area. It feeds on leaves, fruits and large seeds. The species is recently considered to be an endangered species because of excessive exportation to South China from all over Southeast Asia for food. Specimens have been reported from around Long Loreh, and from Malinau, an area with a slight brackish and tidal influence.

Trionychidae:
20. *Pelochelys cantorii* (?) (kerabang)
This is a large soft-shelled turtle. Although it could be *Amyda*, it is more appropriate to link the record to *Pelochelys*, because *Amyda* rarely measures over 1 meter. A photograph of a large specimen supports my supposition (Stuebing pers. comm., the specimen is in the Museum Zoologicum Bogoriense (MZB) collection). It is exploited for food locally and is now considered as rare; IUCN even considers it 'critically endangered'. The taxonomy is unsettled, and it is unclear whether there is one or perhaps even more than three species occurring in Southeast Asia. This species is reported in Long Loreh, but not from Seturan. A previously preserved specimen was obtained from Kutai.

CROCODYLIA
Crocodylidae:
21. *Crocodylus porosus*
Another CIFOR team working in other villages confirmed the occurrence of a crocodile species in the Rian and Seturan Rivers. Two specimens were recorded. A small specimen of about 1 m was been captured in Seturan River several years ago. Another specimen of about 2 m has been sighted recently in Rian River close to Long Loreh when our boat was passing by. It was observed basking at the riverbank and sliding down into the water when the boat approached. Based on the description and habitat - around brackish water - the species identification is relatively certain. The species is hunted for its skin, which is highly valued, despite an older tradition of living peacefully with crocodiles.

B. Species obtained during the survey
AMPHIBIA
ANURA
Bufonidae:
22. *Ansonia albomaculata*
This is a small toad approximately 20 mm in size. It is principally reddish, with a small whitish spot below the eye. Only one specimen was captured, in low-lying vegetation by the camp on the bank of Seturan River, where it was vocalizing. It feeds on small insects. It matches *A. albomaculata*, which was also reported to be present in relatively large rivers, but differs in having light tubercles along the dorso-lateral region. These tubercles were not found on our specimen, thus our identification remains tentative.

23. *Ansonia leptopus*
This species was located in only one site, but is

found all over Borneo. This is a relatively slender toad, about 25-35 mm. As is true for most toads, the skin is covered by numerous large bumps. Under the margin of the lower jaw, we could observe about two rows of black spines. This species is very similar to *A. longidigita* that has four rows of black spines at the lower jaw margin.

24. *Ansonia* sp.
This small toad has an overall blackish body colouration with a white spot at the middle of the shoulder. The skin is covered with small, but pointed, tubercles. This specimen was similar to *A. leptopus*, though *A. leptopus* is larger in size and the body colouration is usually brown, not black. The white shoulder spot is also found in *A. spinulifer*, *A. inthanon* and *A. siamensis* but the skin texture of these species is extremely rough and spiny. The specimen was captured among large stones in the Seturan River.

25. *Bufo asper* (la'ak)
This is a very common toad, found in many riverside habitats (from primary rain forests to the cities with polluted water). The body colouration is usually grayish-brown. Some specimens, especially the juveniles and half-grown specimens, often have black patterns on their backs. Adults can reach a size of more than 12 cm, but are usually less than that. The species was very common and the frequency of occurrence was 3/54 quadrats in Temalang River (Table 3). Up to 4 individuals were found in quadrats VI and VII of Rian River, but the frequency was relatively higher (5/21 quadrats) in Rian River. Apparently the uneven distribution (in several plots only and up to 4 individuals) is related to reproductive behavior (breeding season), and not linked to habitat. Most if not all specimens were found on the riverbank up to 2 m from the waterside, either on the soil (11), on a large trunk (1) and on a

Table 3. Frequency of occurrence

	Frequency of occurrence per plot				
Species (19 spp.)	**Temalang**	**Rian I**	**Stream 27**	**River 39***	**Rian II***
Ansonia albomaculata	-	-	1/14	-	-
Bufo asper	3/54	5/21	2/14	+**	+
Pedostibes hosii	3/54	1/21	1/14	-	-
Leptobrachium abboti	-	-	-	-	+
Leptolalax gracilis	-	1/21	-	-	-
Leptolalax pictus	-	-	1/14	-	-
Limnonectes ibanorum	-	2/21	2/14	+	
Limnonectes kuhlii	4/54	9/21	1/14	+	+
Limnonectes leporinus	13/54	8/21	4/14	+	+
Limnonectes paramacrodon	2/54	-	5/14	-	-
Meristogenys whiteheadi	+	1/21	-	-	+
Rana nicobariensis	-	3/21	1/14	-	+
Rana picturata	11/54	4/21	1/14	+	+
Rana raniceps	-	-	2/14	-	-
Polypedates otilophus	-	-	1/14	-	-
Rhacophorus harrissoni	1/54	-	-	-	-
Cyrtodactylus malayanus	-	1/21	-	-	-
Tropidophorus brookei	-	-	1/14	-	-
Amphiesma sp.	-	-	-	-	+
Total specimens	48	55	37	...	...
Bottom	sand	sand	mud	sand	stone/sand
Duration of work (min)	152	99	108	+ 60	+ 120
Specific forest habitat	primary	logging	logging	logging	gallery

*) Data not available and will be presented elsewhere. The Stream 27 includes a strip of 500 m of the Seturan River.
**) + = present, but no detailed data from the plots.

boulder in the river (1). Near the camp, specimens were found on the riverbank (4), on a boulder or a large stone in the river (2) and on a tree trunk (3).

26. *Bufo divergens* (sa'ai, ngu'ang)
We found only two specimens of this medium sized toad which is usually less than 55 mm. The first one was collected in the forest behind the camp, and the second one came from Long Loreh, collected by the children (and thus has no habitat record). It is brownish to reddish and has a pair of ridges between and behind the eyes. The dorsum has some symmetrical dark markings, similar to some juveniles of *Bufo asper*.

27. *Pedostibes hosii* (sa'ai, ngu'ang)
A yellowish brown to brownish arboreal toad. Males usually measure up to 78 mm, while females can attain a size of 105 mm. Some females are blackish with a few greenish or yellowish spots. A thick bony ridge is present above the ear and connected with the parotoid gland which is rather small. The fingers and toes have truncated tips. The skin is rather smooth for a toad and has few tubercles. The species is not very common. We collected only two specimens in 51 quadrats in the tributary of Temalang River, one in 21 quadrats in Rian I River and one other specimen along the Stream 27 near the camp. All specimens were found on the ground, despite its arboreal habitat.

Megophryidae:
28. *Leptobrachella myobergi*
This species was recorded by the Aberdeen team after I left the locality. It was rare and recorded in only three transect sites. This is a relatively tiny species; adults measure about 15-18 mm and have a reddish brown colour without distinct markings. The species can be easily identified by its practically webless toes and by its small size. The finger and toe tips are essentially conical and pointed.

29. *Leptobrachium abbotti* (sa'ai, ngu'ang)
This litter frog is commonly associated with leaf litter and is rarely captured. Its relatively black colouration blends very well with the background. The species rarely jumps and only hops if disturbed. Because of its secretive habits, the litter frog is usually caught by pitfall traps, but rarely found during night searches. The specimens were collected at the riverbanks of the gallery forest at Rian River. It was suggested that they were moving to the river to breed. They are common from sea level to above 1000 m, though records from other areas in Borneo need verification. Our specimens were collected about 100 km from the type locality, so we can be confident in their taxonomy. There were a lot of specimens from other places that were identified as this species, but as the ventral colouration is either immaculate or covered with small black spots (not heavily blotched as our specimens) it is not clear that they were in fact of the same species. The dorsal colouration of this species varies from completely black to dark-brown with darker or lighter blotching. A detailed analysis is in progress.

30. *Leptolalax gracilis* (sa'ai, ngu'ang)
A single specimen of this tiny frog was found not far from a tributary near the Rian River. Colour: limbs are blackish, although the elbows are white. The dorsum has few bumps and some short, elongated ridges. Members of this genus have a particular venation of the iris that might be of diagnostic value. This characteristic is only evident during daylight and cannot be observed at night, because the pupils are widely dilated.

31. *Leptolalax pictus* (sa'ai, ngu'ang)
A specimen was found in Stream 27. It was caught at the riverbank of a small stream near the camp. It is essentially blackish like *Leptolalax gracilis*, but lacking the diagnostic features commonly associated with that species. Only *L. pictus* has this kind of colouration, but this species has only been recorded at altitudes above 1850 m, so that this species has a more extensive range than previously thought.

Microhylidae:
32. *Chaperina fusca*
This safran frog has a yellow coloured ventrum. When handled, the yellow stain on the ventrum transfers to your hand. It is frequently found in puddles with putrefying plant materials. Only one specimen was found in the survey.

33. *Metaphrynella sundana* (sa'ai, ngu'ang)
This species is about 25-30 mm. It is brownish without distinctive pattern, but the soles have a large tubercle at the base of each finger. It was only recorded at one site and represented by just a single specimen. The species is rarely encountered in

Borneo and is identified by its male call. The species is arboreal and usually found in small water bodies, e.g. in bamboo stumps or tree holes.

34. *Microhyla borneensis*
It is a small, dark brown frog of about 22 mm in size with dark, blurred markings on the dorsum in a form of a double arrowhead. The species is very agile and able to jump over 2 m, and well camouflaged which makes capture difficult. They are not rare.

Ranidae:
35. *Fejervarya cancrivora* (sa'ai, bilang)
A number of specimens were collected from around Long Loreh village. This was commonly in rice fields, and were never encountered in the forest. The species can attain a size of about 12 cm. The body is plump, limbs moderately fleshly, dorsum usually greenish or grayish-green with some darker mottlings. The dorsum skin is usually ornamented with elongated, longitudinally oriented ridges.

36. *Limnonectes finchi* (sa'ai, ngu'ang)
Although this species was only represented by two specimens, we expected it to be more commonly found in the forest because they are known to lay eggs on the ground. It is a brownish species, hardly distinguishable from juveniles of *L. leporinus*. The only reliable characteristic that is easily observed is the reduced toe webbing. The dorsum is moderately ornamented with tubercles, although it still has a relatively smooth appearance. The dorsum is usually dark brown with some blackish mottling, while the gular region (underside the lower jaws) is usually moderately blotched with black. It is a litter frog that lives near riverbanks. Males guard the eggs and bring tadpoles to the water by transporting them on their back. Although common in forest litter, several specimens were observed in the understorey vegetation (>50 cm above the ground).

37. *Limnonectes ibanorum* (sa'ai, ngu'ang)
A plump frog, with a size of up 13.5 cm. It is easily distinguished from the other members of the genus by its few short ridges on the dorsum. The gular region is usually boldly mottled with black. We only collected four specimens, two in Rian River I and two in Stream 27. Local people appreciate this species as edible.

38. *Limnonectes kuhlii* form 2 (sa'ai, ngu'ang)
This is a small brownish species, measuring about 60 mm. The skin is heavily tuberculated on the hind limbs and posterior part of the dorsum, but the underside parts are essentially smooth. It is a member of a very large species complex that includes about 20 morphological forms, extending from China and India up to Borneo and Java. The species is found in very shallow, stagnant to slow moving waters near the riverbanks. This was a relatively common species and was found in every surveyed river.

39. *Limnonectes leporinus* (sa'ai, ngu'ang)
A large sized frog (about 15 cm) with reddish brown to blackish colouration and some mottling on the back. Its limbs are very long and the toe webbing is nearly complete. This is the most common species in the region and is known to be edible by most local people. We collected 31 specimens (mostly juveniles), the majority of which (29) were found in the soil or river-banks up to 2 m from the water border; the other two specimens were perching on a boulder in the river. Its frequency of occurrence is 14 of 51 quadrats in Temalang River tributary; 9 of 21 quadrats in Rian River tributary.

40. *Limnonectes palavanensis* (sa'ai, ngu'ang)
Three specimens have been collected from three different sites, implying that this is not a common species. The species is very similar to *L. finchi* in having reduced webbings and of its size, but this species has a relatively smooth skin and a pair of dorsolateral folds. On the back, between the scapulas, usually there is an inverted V tubercle.

41. *Limnonectes paramacrodon* (sa'ai, ngu'ang)
A medium small species with very smooth skin and uniform reddish brown to dark brown colouration. The tympanums are usually masked with black and the gular is usually heavily dusted with dark pigment. The limbs have reduced webbing much like *L. finchi*. It is easily distinguished from that species by its larger size, smoother dorsum, dusted gular and the presence of a black tympanic mask. This species was particularly abundant in Stream 27, but confined to the muddy section present in several quadrats only. In other streams or rivers, the species was very badly represented.

42. *Meristogenys phaeomerus* (sa'ai, ngu'ang)
This species was found by the Aberdeen team. It is one of the most common species of the genus in Borneo. It is a relatively small frog (males about 30 mm; females about 60-70 mm). The hind limbs are extremely long and slender. Its knees usually extend beyond the level of the insertion of fore limbs. The species has a pair of vocal pouches, situated near the corners of the mouth. Males are usually aggregated near the riverbanks, but the females are difficult to find outside the breeding season.

43. *Meristogenys whiteheadi* (sa'ai, ngu'ang)
This slender species of frog has very long legs, with heels that are strongly overlapping when placed at a right angle to the body. The males have a pair of vocal pouches at the sides of their mouths. The dorsum is smooth, dark coloured and basically featureless. Adults of this genus are very hard to differentiate, and identification is most easily accomplished at the tadpole stage, where differences are most notable.

44. *Rana hosii* (malih)
This is a large forest frog commonly found in low level forest vegetation near riverbanks in primary forest, but it is also abundant in disturbed forest or secondary forest. The male is much smaller than the female. The maximum size of an adult female is about 12 cm, while the male is usually less than 6.5 cm. The dorsum colouration varies from green to brownish or even blue. Some populations, green spotted with dark green or nearly black dorsums. The skin of this frog is poisonous; other frogs that were kept together with it usually died within minutes. The toxin is generally harmless to humans except if it comes in contact with the eyes.

45. *Rana nicobariensis* (sa'ai, ngu'ang)
This is a small slender frog with a narrow and pointed head. The males only measure about 47 mm, females are about 5 mm larger. The sides are usually darker than the dorsal region, the back is usually golden brown with some black mottling or darker regions. Although the species is very common in swampy areas and ditches, it usually requires relatively clear, unpolluted water, and is thus a good indicator of disturbed habitat. *Rana nicobariensis* mates and vocalises year around. Males usually aggregate to make a loud nocturnal chorus, especially when the moon is bright.

46. *Rana picturata* (sa'ai, ngu'ang)
A small, black with numerous reddish spots frog that is always found at the border of a stream. Its colouration is so distinctive. Females are slight bigger compared to the males. Breeding usually occurs in small sidepools all year around. Usually males are easy to collect due to its vocalization and ecological behaviour (always along streams), but females stay in the forest until the breeding period.

47. *Rana raniceps* (sa'ai, ngu'ang)
(=*Rana chalconota raniceps*)
A small frog, similar in size to *Rana nicobariensis* (40 mm), though females are usually slightly larger. It is greenish with red hind limbs. Though its back is green at night, it usually changes to brown during the day. The legs are slender and long; the toes are fully webbed. This species is commonly found in garden areas, but also found in primary forest perching in shrubs or small trees.

48. *Staurois guttatus* (sa'ai, ngu'ang)
A small species of frog, with males measuring about 30-37 mm and females 44-55 mm. It is a beautiful species with dark green spots on a golden dorsum and a jade green ventrum - even its bones have a green pigment. The iris has a blue and red part on the upper side. Iskandar and Colijn (2000) consider that the Bornean and Palawan populations belong to this species while those from other parts of the Philippines belong to *S. natator*. This distinction is based on differences in colouration (dorsum usually uniform), size (females of *S. natator* are smaller compared to *S. guttatus*), egg colouration (white in *S. guttatus*, blackish in *S. natator*) and some morphometrical measurements (Inger 1954, 1966). The species was usually collected perching on branches or leaves in the lower storey of the forest, usually at the riverbanks. According to Diesmos (pers. comm.) the Philippine population assigned to *S. natator* is more likely to be a complex of several species.

49. *Staurois latopalmatus* (sa'ai, ngu'ang)
A medium sized blackish frog with white dots. Its limbs and hands are long; finger and toe tips have very wide expanded disks; snout is extremely short. This species usually lives along rivers with a very swift current, especially those with a stony bank in midrange forest.

50. *Staurois tuberlinguis* (sa'ai, ngu'ang)
Although usually recorded at altitudes above 300 m, we obtained several specimens from three different sample sites below 50 m asl. Similar to *Staurois guttatus* this species has greenish muscles and bones, but it has smaller size and tuberculated skin.

Rhacophoridae:
51. *Nyctixalus pictus* (sa'ai, ngu'ang)
This small red tree frog is covered with small tubercles, each covered with a hair-like structure. The canthal region of the snout is usually armed with a white stripe. Although not very common, the species is always present among collections and usually found in lowland forest.

52. *Polypedates leucomystax* (sa'ai, ngu'ang)
A medium tree frog, with males reaching about 30 mm and females up to 70 mm. They are distinguished by a narrow dark black band at the sides of the head that does not cover the eardrums, and sometimes four fine black stripes on the back. Its skin is essentially smooth, with wide-tipped digits, and a scalp that is co-ossified with the skull. This species is usually found in disturbed areas and rarely in primary forest.

53. *Polypedates macrotis* (sa'ai, ngu'ang)
A medium tree frog, with males reaching 60 mm and females up to about 85 mm. The dorsum is either uniform or marked with a pair of dark bands that cover the eardrums. The skin is essentially smooth, with wide-tipped digits with broad tips. This species is found in both lowland primary forests and disturbed areas, thus its occurrence does not automatically serve as an indicator of forest degradation.

54. *Polypedates otilophus* (sa'ai, ngu'ang)
This is a medium sized tree frog with males reaching 80 mm and females up to 100 mm. The dorsal colouration varies from light brown or grey up to bright yellow. It is distinguished by the presence of a saw edged bony ridge above the ears. The inner sides of the hind limbs have black and white (or yellowish) stripes. This species, like *Polypedates macrotis,* lives in primary forest as well as in disturbed areas, including plantations; it does not do well in captivity.

55. *Rhacophorus harrissoni* (sa'ai, ngu'ang)
This lowland tree frog is rare outside forests. It is greyish, though the sides of its head and the webbing of its digits is dark. Its snout is pointed. It is found in both primary and secondary forest. The species rarely breeds on the ground. The tadpoles are found in tree holes about 1-4 m from the ground. The occurrence of this species in Malinau is the first record outside Sabah and Sarawak.

56. *Rhacophorus nigropalmatus*
The species is well known as Wallace's flying frog. It is relatively large with males measuring about 80-90 mm and females up to 90-100 mm. The overall body colouration is green with white dots and black webbings. Local people describe it as occurring in the forest. It occurs in low elevation primary forest and lives in the canopy, descending only to breed in turbid waters provided by temporary ponds or pig wallow. Single specimen was collected by the Aberdeen team.

57. *Rhacophorus pardalis* (sa'ai, ngu'ang)
This is a medium sized tree frog, with males measuring 55 mm and females up to 70 mm. The overall body colouration is reddish brown with some darker marbling on the back and bright red webbing between its digits. It is a proficient glider, like the Wallace tree frog. Although it can be found in marshes, the species is tightly bound to closed canopy humid forest where it can be extremely abundant along streams. Populations are very scarce in disturbed forests.

GYMNOPHIONA
Ichthyophiidae:
58. *Ichthyophis* sp.
This worm-like amphibian is uniformly dark brown, bluish or blackish with a yellow band at the sides. Its length can reach 25 cm and the body diameter is usually less than 1 cm. It is usually misidentified as a worm or a small eel. The body is extremely slippery and difficult to hold. This group of species is found in damp places near the river. Larvae live exclusively in the river, especially among leaf litter. Juvenile specimens were collected in a shallow part of the river and in leaf litter at the sides of river. Adult specimens were collected in wet sandy soil near the river and on the ground around the Seturan camp after heavy rain. In Malinau, a juvenile

specimen was captured by electrofishing (Rahmatika 1998, unpublished). When squeezed, it emits a soft chirping sound exactly like a *cicak* (house gecko). There is no evidence that these species vocalize except when molested.

REPTILIA
SQUAMATA
Agamidae:
59. *Bronchocela cristatella* (takang)
A very widespread agamid, found throughout the mainland of Southeast Asia and through Indonesia to New Guinea. Its body length is about 10 cm, with a tail that measures nearly twice as long. The overall colouration is green, sometimes with small blue dots oriented in a transverse line to the body and a very small crest on the neck. The species is very common in secondary forest and disturbed areas, including near human habitation, but is not found in cities. The eggs are oval, about 6 mm in length, and usually placed in a hole dug in the soil by females forelimbs. The species feeds on small insects.

60. *Draco cornutus* (takang)
This species is also known as the flying dragon. The colouration is greyish blue and the underside of the patangiums (wings) are spotted with black. The male has an orange dewlap, while the gorge of the females is usually greyish blue. The flying dragon commonly lives in trees; however, somewhat unusually, it is often found in areas close to human habitation, such as gardens or towns. Only two oval eggs about 8 mm in length are laid in a single clutch. The species feeds on ants and termites.

61. *Gonocephalus grandis* (takang, puan - seen only)
The body colouration of the juveniles and young females is brown with bold black blotches. The adult males are uniformly green and have a strongly developed crest on the nape and the vertebral row; the females have no crest. This species is found in the gallery and secondary forests. At night they are often found sleeping in plants overhanging the river, and are much more widely seen than other species of this genus which live high in the canopy. The clutch size is 4-8 eggs, and usually buried in the soil.

Gekkonidae:
62. *Cosymbotus platyurus*
This house gecko is easily recognised by the dark markings on the back while the other two house gecko species (*Hemidactylus frenatus* and *Gehyra mutilata*) are either immaculate or with very fine marks. It is quite common in Long Loreh and also seen in Paya Seturan and Langap, though it was not observed in the camp area. The species is tightly bound to human settlement and has a very wide distribution in the tropical region of Southeast Asia and Australia. At present we have only found this species of house gecko, but it is merely a matter of time before *H. frenatus* and *G. mutilata* will be observed in this area, as they are nearly always reported among human settlements, and are even more common than *Cosymbotus platyurus*.

63. *Cyrtodactylus malayanus*
A slender gecko without enlarged digits, better known as bent-toe gecko. The specimen was relatively small (presumed juvenile). The overall body colouration is greyish brown with several blackish blotches traversing both sides of the dorsum. The specimen was found foraging near the riverbank, but otherwise it is an arboreal species that only occurs in the understorey. Borneo has about a dozen species of the genus of bent-toe geckos. Most bent-toe geckos are generally only present in either primary or secondary forests, but some species might have an exceptionally wider distribution and can be found in plantations.

64. *Gekko smithi* (heard only)
A large forest gecko with a body length of about 16 cm, and tail of more or less similar dimensions. It has a greyish, black body colouration, and the dorsum is usually covered with several transverse white tubercles. It is commonly found on large tree trunks and lays eggs in tree holes. The species is found in both primary forest and secondary forest, but never among human habitations.

Scincidae:
Although this reptilian family is widely found in Indonesia, including Borneo, it is surprising that only few members of this family were observed during this study.
65. *Lipinia quadrivittata* (seen only)
This arboreal skink is only about 7-10 cm long. It is bluish black with three white stripes on the dorsum and a cream coloured tail. Another specific characteristic is that the ear opening is not visibly

evident, and covered by scales and can be located by a shallow depression at the side of the head.

66. *Mabuya rudis* (teliap, belang)
This is a medium large skink species, with a body length of about 15 cm and a tail of similar dimensions. The overall colouration is black with a white stripe on each side of the head and body, situated dorsolaterally. The scales have about three weak keels so that it has the general appearance of a rough-skinned skink. This species is very common in disturbed areas, and was only found in the areas around the camp.

67. *Sphenomorphus sabanus*
This is a medium small sized species of about 60 mm. The dorsum is usually reddish brown and the slender tail is usually dark brown. This skink, like other species, is difficult to identify because of the subtle scale characteristics. This species was only found in the forest.

68. *Tropidophorus brookei* (teliap)
This skink is slightly smaller than *Mabuya rudis* (30 cm, body and tail), and has a compressed tail that serves as a rudder when swimming in the water. It also has very strongly keeled scales. The underlying colouration is greyish-green, with some ill-defined black bars on the back and the tail. This water-bound species is usually found hiding in the leaf litter near the riverbanks. We collected only one specimen.

Varanidae:
69. *Varanus salvator* (aluh, padang - seen only)
This large lizard, commonly known as *biawak*, or water monitor can attain a length of nearly 3 m, although the common size is only about 150 cm. The body colouration is black with transverse rows of yellow spots or blotches. The tail is banded with yellow and black. It was mostly found on the riverbanks and seen traversing logging roads. It feeds on birds, small reptiles, amphibians and small mammals.

OPHIDIA
Colubridae:
70. *Ahaetulla prasina*
This green snake has a slender body and tail. It can reach lengths of about 150 cm. The overall colouration is mat light green with white, cream or yellowish stripes along each side of the ventral scales. The species is arboreal and feeds on lizards, especially agamids but also skinks or tree frogs. It is mildly poisonous, though local children were seen on one occasion playing with this snake at school. A botanist working with CIFOR collected this specimen when working in a forest plot.

71. *Amphiesma* sp.
This specimen was found during the last night, swimming in a small stream. The checker pattern matched *Amphiesma sarawacensis*, but its reddish colouration might apply to other species ;therefore, the specimen needs reidentification.

72. *Boiga cynodon*
A large yellow or cream tree snake with black bands. It is most common in disturbed areas, and commonly feeds on warm-blooded animals such as small birds and mammals.

73. *Boiga jaspidea*
The specimen was found while traversing a logging road. Its colour is brownish with a lot of small elongated black spots, oriented traverse along the back. It is a relatively long (up to 150 cm) and slender snake with a relatively blunt head, much wider than its neck. The species is usually arboreal and lives in vegetation up to about 1.50 m from the ground. It feeds on small lizards and frogs.

74. *Boiga nigriceps*
This is a slender back-fanged snake with a relatively long tail. The head is blackish, but the other parts of the body vary from reddish, brownish to grayish brown with some darker narrow bars on each side of the body. The specimen was found coiled in an arboreal nest on branches hanging over the river. It feeds on small birds, lizards and occasionally on small rodents.

75. *Calamaria bicolor*
It is a very small snake that is rarely longer than 30 cm. The colour of the dorsum is dark brown with a brick-red ventrum. It is non-poisonous and rather common. However, it should be noted that the genus has about 56 species, many known from few records. The species is semi-fossorial and believed to feed on worms or termites. This specimen was collected in a forest plot by a member of the botanist team.

76. *Calamaria* sp. 1
An unclassified species similar to *Calamaria bicolor,* though the colour of the dorsum is grey, with a white/cream ventrum, not brick red and it has a slightly longer body length (40 cm). The species is semi-fossorial and believed to feed on earthworms or termites. It is harmless and rather common. Two specimens were collected in the forest, one when digging for earthworms and the other one in the forest plot by a member of the botanist team.

77. *Dendrelaphis caudolineatus* (seen only)
A very long and slender snake that can attain a length of about 2 m, with a diameter not more than 3 cm. The dorsum is reddish with golden and black stripes or vice versa. It is an arboreal species, capable of climbing vertical tree stems, but can move quickly on the ground. It can be found in various habitats from primary forest to disturbed area such as plantation or human habitations, but is rarely found in the villages. This specimen was observed several times in the camp. The species feeds on lizards and frogs.

78. *Dendrelaphis formosus*
Although it is a relative of the *Dendrelaphis caudolineatus*, its body length is only 1 m. The body is bronze-greenish with some black scales. As the body scales are narrow, and the overlapping area is bluish, it is a very beautiful species when it extends its body. It is a frequently encountered species, as it is commonly seen perching among vegetation at the riverbanks. It feeds on small lizards and frogs.

79. *Elaphe flavolineata*
This is a large snake that can attain a size of about 2 m or more. The body is essentially black with some darker and lighter marks, though the juvenile is distinguished by a bright yellow stripe down the spine. It is a very common species in Java, Sumatra, Borneo and Peninsular Malaysia. The species occurs everywhere: in primary, secondary or disturbed forests, as well as in human habitation and plantations, thus cannot be used as an indicator for habitat degradation. Our specimen was found dead at the side of the street, most probably killed by local people. Though it is a non-poisonous species, local people often mistake it for cobra species. The species feeds on small mammals, birds, frogs and lizards.

80. *Enhydris doriae*
A mildly poisonous, gray snake that seldom leaves the water. The species is a nocturnal forager and feeds chiefly on fish, thus it is considered a fish pest in ponds, and is caught in fishnets (*bubu*). During the day it burrows in the muddy river bottoms. In some areas this species can be abundant, especially in the stagnant or slow moving water of rice fields or ponds.

81. *Gonyosoma oxycephalum*
A large snake measuring more than 150 cm. It is green in colour with a reddish-brown or grayish tail and a slightly lighter green head. While it is an arboreal species, it is often found on the ground. Rachmatika (2000 unpublished) reported this species as an unknown caught in her fish study in the area. It is non-poisonous, and feeds chiefly on frogs and lizards.

82. *Lepturophis albofuscus*
This is a long slender snake that can reach about 2 m long. The colour is dark brown with no mark and white lower parts. This species is easily confused with *Stegonotus borneensis*, but the juveniles of *Lepturophis* have about 35 white or yellow narrow rings around the body.

83. *Oligodon purpurascens*
This is a relatively fat snake of about 60 cm with dull brown colouration and indistinct markings, most notably chevron marks on the head. Like other members of the genus, it typically feeds on reptile eggs. It has sharp teeth, therefore cannot be kept in a plastic sac as it is cut through by its sharp teeth, from which the generic name originates.

84. *Oligodon* sp. 1
This species is previously reported as a *Cylindrophis* (pipe snake), but our present identification shows that it is not a pipe snake. It has an alternate brick-red ventral colouration as in *Cylindrophis* and a relatively long tail. The dorsum colour is reddish brown. The specimen is about 34 cm and its tail is about 8 cm. It was collected from a skid trail.

85. *Psammodynastes pulverulentus*
A small snake of about 40-60 cm, with a reddish brown to blackish colouration. It is often found in leaf litter or in the understorey forest. This species

is one of a few snake species with a wide altitudinal distribution (0-1500 m). It is relatively aggressive with long front fangs, though only mild venom. It feeds on small lizards and occasionally frogs. The species is also one of the few land snakes that gives birth.

86. *Pseudorhabdion collaris*
A small species of about 20 cm long. It is a very discrete snake and usually lived subterranean. This species could be distinguished from the next species by having a single and narrow dark collar. It is not a poisonous species and presumably feeds on larvae of ants and termites.

87. *Pseudorhabdion sarawakensis*
This is a small species that rarely attains more than 40 cm. This species generally has a blackish brown colouration, with a white or reddish collar notable in some species. Our specimen had a dark brown dorsum with a blackish ventrum, and no visible collar. It resembles *Calamaria*, but with a pointed snout and a slender tail. The specimen was found in the leaf litter in the forest by CIFOR plant ecology team. It is not poisonous and feeds on small worms and insect larvae.

88. *Ptyas fuscus* (nawan padek)
This is a very large snake that can attain a size of more than 2 m. This species belongs to a genus that has about a dozen species. The species is a terrestrial but usually found in the forest, and less frequently in open grassy places. It, though relatively rare, could be considered as an indicator for disturbed habitat. It largely feeds on rats and birds but also on frogs and small reptiles.

89. *Rhabdophis conspicillata*
This water snake measures about 40 cm and has a small reddish brown colouration with a distinct white stripe on the side of its head. The body also has irregular checkered marks similar to other *Rhabdophis* species such as *R. chrysargos* or *R. murudensis,* two other species potentially encountered in Borneo. The specimen was evidently a juvenile and was found on the riverbank of the tributary of the Rian River. These species typically live close to water but are not aquatic. They are not poisonous and usually feed on small frogs.

Crotalidae:
90. *Tropidolaemus wagleri* (kelimut pagung)
This is a short thick pit-viper, measuring about 80 cm in length, with a small slender tail. It is green with some dark bands on its back. It is commonly a sluggish species and feeds on birds and arboreal rodents. Local people are afraid of this species. While it is poisonous and its bite can be very painful, no fatalities have ever been reported. Rachmatika (2000 unpublished) also observed this species in the forest behind the camp.

Elapidae:
91. *Maticora bivirgata* (seen only)
This species resembles the red-headed krait with its red head and tail, but it is smaller and has a bluish body colouration. The body is also ornamented with a longitudinal white line. This species usually lives in burrows in the soil or leaf litter. It was observed in a forest close to the river, not far from the camp.

92. *Naja sumatrana* (seen only)
This snake reaches a size of about 1 m, occasionally larger. The body is black with a whitish neck and a bold black band at the base of the neck. The juveniles have bands which disappear with age. The species is found everywhere. Of the two specimens, one was observed in the forest and another one was seen traversing the logging road. They feed on small mammals such as rodents.

Pythonidae:
93. *Python reticulatus* (penganen, lepung)
This well-known species can attain a size of more than 15 m and is claimed to be the longest snake in the world. The largest python in the Seturan area was reported to be about 6 m. It is an arboreal species, but frequently found at the riverbanks during the night. The species usually feeds on amphibians, reptiles, birds and small mammals (rodents) when it is still small, but changes its preference when reaching a size of more than 5 m towards larger mammals. Local people usually eat this species. The fat is used against burns (Loreh, Langap) and also as a traditional medicine for skin diseases.

CHELONII
Geoemydidae:
94. *Heosemys spinosa* (kura-kura duri)
In its adult form this spiny turtle is reddish-brown

with a high domed carapace. The juveniles have spiny margins. All marginal and costal scutes are armed with one to three spines. The more diagnostic characteristic is its yellowish plastron marked with brown lines radiating from the centre of each scute. After it grows up to 20 cm, the spines practically disappear, and the local people recognise it as a different species. Some people claim that this is a semi-aquatic species; however, while we observed that the juveniles lived in the streams, adults were usually found deep in the forest. The spiny turtle feeds on rotten fruits.

95. *Notochelys platynota* (kelep)
A brownish-black species that has six or seven vertebral scutes and a fifth or sixth scute that is much smaller. The plastron is yellow with bold black blotches on each scute. This is one of the two locally well-known species. It is commonly eaten by local people. It was regularly observed at the camp. There is some pressure from hunting.

Trionychidae:
96. *Amyda cartilaginea* (labi-labi)
The soft-shelled turtle is highly prized and considered a delicacy in many parts of the world. The species can attain a size of 110 cm, although a large specimen of 60 cm is the usual adult size. As the team only collected several juvenile specimens, even though the species is reported to be common by the local people and scientists, our identification remains tentative.

Testudinidae:
97. *Manouria emys* (siau – seen only)
The specimen was a juvenile of about 20 cm, but the adults can measure up to 45 cm and weigh about 30 kg. Based on observations and conversations with local people, this species is considered very rare in Malinau. The usual habitat is in hill forest up to about 600 m from sea level - it is rarely seen below 100 m.

2. Number of Species

It was expected that the number of species would increase in relation to the number of surveyed days. The results are shown in Table 1. Prospecting should be considered finished only when the number of species found no longer increases. Yet the graph in Table 1 demonstrates that many more species would be found in the region if the work had continued, as two new records were obtained each day during the survey. A comparative study that was carried out in Nunukan, Maruwai and Kayan Mentarang (not far from the present site) confirms this supposition, as a considerable number of additional species were found in those regions (many of which were locally confirmed) (see Table 4). It is certain that the list will continue to expand since other efforts undertaken in the neighbouring areas are reporting a considerable amount of other species not yet recorded from Malinau. In addition, a comparable number of species recorded from Malinau have not yet been recorded in the neighboring areas (Mistar 2000; Stuebing pers. Comm; Veith pers. comm.). In addition, local information obtained from tribal elders confirms the existence of another 22 species. By combining all this data we can predict that a total of 125 species of amphibians and reptiles are potentially present in this area.

3. Relative Abundance

The general impression we have about the amphibians and reptiles of the Malinau area is that while animal densities are low individuals, it has relatively many species. These results are similar to that performed in Betung Kerihun National Park (1996-1997, obtained during three months work) and also in Nunukan and Maruwai (Mistar 2000, Stuebing pers. comm). However, species in all of these areas are less abundant than those illustrated in research performed in South Kalimantan and North Sumatra-Aceh as well as from Tanah Masa Island (Iskandar 1999a, b; Iskandar and Setyanto 1999; Iskandar and Prasetyo 1996) (see also Table 4).

In an unnamed stream of Rian River where logging was performed in 1995-1996, the relative abundance was about 2.1 specimens per plot (n = 21), but in the unlogged forest in a tributary of Seturan River the relative abundance was only about 0.95 specimen per plot (n = 51). At present, we have no explanation as to why the unlogged area has fewer specimens compared to other rivers affected by logging. Otherwise, the species composition in these areas is more or less the same. The stream behind the camp is very muddy but the abundance is about 5 individuals per plot, but the diversity is very low (3 species) consisting of *Limnonectes paramacrodon, L. leporinus* and *Bufo asper*. At the tributary of Rian River, which is outside the logging area, the species

Table 4. Comparison of species composition in various localities of South and East Kalimantan

No*	Species	Mal	Mar	Nun	Aya
22.	*Ansonia albomaculata*	x	-	-	-
23.	*Ansonia leptopus*	x	x	x	x
	Ansonia longidigita	-	-	x	x
24.	*Ansonia* sp.	x	-	-	-
	Ansonia spinulifer	-	-	x	x
25.	*Bufo asper*	x	x	-	x
26.	*Bufo divergens*	x	x	-	x
1.	*Bufo juxtasper*	(x)	x	x	-
27.	*Pedostibes hosii*	x	x	-	x
	Pelophryne signata	-	x	-	-
28.	*Leptobrachella myobergi*	x	-	x	x
29.	*Leptobrachium abbotti*	x	-	x	x
	Leptobrachium nigrops	-	-	x	-
30.	*Leptolalax gracilis*	x	x	x	x
31.	*Leptolalax pictus*	x	-	-	-
	Megophrys baluensis	-	-	-	x
2.	*Megophrys nasuta*	(x)	-	-	x
32.	*Chaperina fusca*	x	-	x	-
33.	*Metaphrynella sundana*	x	x	-	-
	Microhyla berdmorei	-	-	-	x
34.	*Microhyla borneensis*	x	-	-	-
	Microhyla maculifera	-	-	-	x
	Microhyla perparva	-	-	x	-
	Microhyla petrigena	-	x	-	-
	Kalophrynus subterrestris	-	x	-	-
	Kalophrynus heterochirus	-	x	-	-
	Kalophrynus pleurostigma	-	x	x	-
35.	*Fejervarya cancrivora*	x	-	x	-
	Fejervarya limnocharis	-	-	-	x
3.	*Hoplobatrachus rugulosus*	(x)	-	-	-
	Ingerana baluensis	-	-	x	-
	Limnonectes asperata	-	x	-	-
36.	*Limnonectes finchi*	x	-	-	x
37.	*Limnonectes ibanorum*	x	x	x	-
4.	*Limnonectes ingeri*	(x)	x	-	-
	Limnonectes kuhlii form 1	-	x	-	x
38.	*Limnonectes kuhlii form 2*	x	-	-	-
	Limnonectes laticeps	-	-	-	x
39.	*Limnonectes leporinus*	x	x	x	x
40.	*Limnonectes palavanensis*	x	-	x	-
41.	*Limnonectes paramacrodon*	x	x	-	x
	Limnonectes rhacodus	-	x	-	x
42.	*Meristogenys phaeomerus*	x	-	-	x
	Meristogenys poecillus	-	-	-	x
43.	*Meristogenys whiteheadi*	x	x	-	-
	Occidozyga baluensis	-	-	x	-

No*	Species	Mal	Mar	Nun	Aya
	Occidozyga laevis	-	-	x	-
	Rana baramica	-	x	x	-
	Rana erythraea	-	-	-	x
44.	*Rana hosii*	x	-	x	x
	Rana luctuosa	-	-	-	x
45.	*Rana nicobariensis*	x	-	x	x
46.	*Rana picturata*	x	-	x	x
47.	*Rana raniceps*	x	x	x	x
	Rana signata	-	x	-	-
48.	*Staurois guttatus*	x	x	x	x
49.	*Staurois latopalmatus*	x	-	x	-
50.	*Staurois tuberlinguis*	x	-	x	x
51.	*Nyctixalus pictus*	x	-	-	-
	Polypedates colletti	-	x	-	-
52.	*Polypedates leucomystax*	x	-	x	x
53.	*Polypedates macrotis*	x	x	x	x
54.	*Polypedates otilophus*	x	-	x	-
	Rhacophorus appendiculatus	-	x	-	x
	Rhacophorus gauni	-	-	x	x
55.	*Rhacophorus harrissoni*	x	-	-	-
56.	*Rhacophorus nigropalmatus*	x	x	-	-
57.	*Rhacophorus pardalis*	x	x	x	x
58.	*Ichthyophis* sp.	x	x		x
59.	*Bronchocela cristatella*	x	x	-	x
60.	*Draco cornutus*	x	x	x	-
5.	*Draco quinquefasciatus*	(x)	x	x	-
	Gonocephalus chameleontinus	-	-	x	-
61.	*Gonocephalus grandis*	x	x	x	x
	Gonocephalus liogaster	-	x	-	x
	Phoxophrys borneensis	-	x	-	-
	Aeluroscalabotes felinus	-	x	-	-
62.	*Cosymbotus platyurus*	x	-	-	-
63.	*Cyrtodactylus malayanus*	x	x	x	x
	Cyrtodactylus sp.	-	-	x	x
	Gekko gecko	-	-	-	x
	Gekko monarchus	-	-	x	-
64.	*Gekko smithi*	x	-	-	-
	Hemidactylus frenatus	-	x	x	x
	Ptychozoon rhacophorus	-	x	-	-
6.	*Takydromus sexlineatus*	(x)	x	x	x
	Apterygodon vittatus	-	-	-	x
	Dasia grisea	-	-	-	x
65.	*Lipinia quadrivittata*	x	-	-	-
	Mabuya multifasciata	-	-	x	x
66.	*Mabuya rudis*	x	x	-	x
67.	*Sphenomorphus sabanus*	x	-	-	x
	Tropidophorus beccari	-	x	-	-
68.	*Tropidophorus brookei*	x	-	x	x

No*	Species	Mal	Mar	Nun	Aya
7.	*Varanus rudicollis*	(x)	-	x	-
69.	*Varanus salvator*	x	-	x	-
8.	*Acrochordus javanicus*	(x)	-	-	-
70.	*Ahaetulla prasina*	x	-	x	-
	Amphiesma flavifrons	-	x	-	-
71.	*Amphiesma* sp.	x			
72.	*Boiga cynodon*	x	x	-	-
9.	*Boiga dendrophila*	(x)	-	x	x
73.	*Boiga jaspidea*	x	-	x	-
74.	*Boiga nigriceps*	x	x	-	-
75.	*Calamaria bicolor*	x	-	-	-
76.	*Calamaria* sp. 1	x	-	-	-
10.	*Chrysopelea paradisii*	(x)	x	-	-
77.	*Dendrelaphis caudolineatus*	x	-	-	-
78.	*Dendrelaphis formosus*	x	-	-	x
79.	*Elaphe flavolineata*	x	-	-	-
80.	*Enhydris doriae*	x	-	-	-
81.	*Gonyosoma oxycephalum*	x	-	-	-
82.	*Lepturophis albofuscus*	x	-	-	-
	Oligodon annulifer	-	-	-	x
83.	*Oligodon purpurascens*	x	-	-	-
84.	*Oligodon* sp. 1	x	-	-	-
	Pareas malaccanus	-	-	-	x
85.	*Psammodynastes pulverulentus*	x	-	-	-
86.	*Pseudorhabdion collaris*	x	-	-	-
87.	*Pseudorhabdion sarawakensis*	x	x	-	-
88.	*Ptyas fuscus*	x	-	-	-
	Ptyas korros	-	-	-	x
89.	*Rhabdophis conspicillata*	x	-	-	-
	Rhabdophis subminiatus	-	-	-	x
	Xenodermus javanicus	-	-	x	-
12.	*Trimeresurus albolabris*	(x)	-	-	-
	Trimeresurus borneensis	-	-	-	x
	Trimeresurus sumatranus	-	x	-	-
	Ular sp. 1	-	-	x	-
90.	*Tropidolaemus wagleri*	x	-	-	-
13.	*Cylindrophis ruffus*	(x)	-	-	-
14.	*Bungarus flaviceps*	(x)	-	-	x
91.	*Maticora bivirgata*	x	x	-	-
15.	*Maticora intestinalis*	(x)	-	-	-
92.	*Naja sumatrana*	x	-	-	-
16.	*Ophiophagus hannah*	(x)	-	-	-
17.	*Python curtus*	(x)	-	-	-
93.	*Python reticulatus*	x	x	-	x
18.	*Ramphotyphlops braminus*	(x)	-	-	-
94.	*Heosemys spinosa*	x	x	-	-
95.	*Notochelys platynota*	x	x	-	-
19.	*Orlitia borneensis*	(x)	-	x	-

No*	Species	Mal	Mar	Nun	Aya
96.	*Amyda cartilaginea*	x	-	-	-
	Dogania subplana	-	-	x	x
20.	*Pelochelys cantorii*	(x)	x	-	-
97.	*Manouria emys*	x	-	-	-
21.	*Crocodylus porosus*	(x)	-	x	-
	Total	76(97)	54	52	57
	Average manpower	3/60 days	8/15 days	3/30 days	2/50 days

Note: *These numbers refer to the species description numbers in the text. Data in parenthesis means that the data is only reported or seen, but specimens were not collected. Mal (Malinau), Mar (Maruwai), Nun (Nunukan) and Aya (Aya Yayang Concession) represent areas from East and South Kalimantan. Data from the areas outside Malinau are based on unpublished report of Stuebing (pers. comm.), Mistar and Liswanto (pers. comm), Veith (pers. comm.), and Iskandar and Setyanto (1999).

density was quite high and probably represented the richest area in the Seturan and Rian Rivers. The forest behind the camp was also quite rich in species diversity. Detailed information is given in the entry of each species at the end of this report.

In general, we only captured about 19 species in the designated quadrats, the remaining 32 species were found by chance in the forest, the village, the camp or the logging road. A more comprehensive treatment of all streams will be addressed below.

4. Specificity of Streams

All streams appeared to have more or less the same species. Any differences were not significant and occurred because of the number of single specimen samples found. The number of specimens found was too low to extract any conclusions. The dominant stream-based species were, for the most part, ubiquitously distributed, and differ only in the number of specimens per area. Only one exception is evident. A large population of *Limnonectes paramacrodon* was found in Stream 27 which is defined by its very muddy bottom - otherwise this species was rarely found in other streams. Apparently, the species is tightly associated with this kind of stream. The use of similarity index (i.e. Shannon and Weaver) for these streams will be treated when additional data become available.

5. Age Structure and Sex Ratio

The most striking finding was that most of the *Limnonectes* species collected were either juveniles or young adults. Among 57 specimens, only five were close to maximum size (four *Limnonectes leporinus* and one *L. ibanorum*). We have inquired about the local use of these two species, but apparently the local people only collect them occasionally, so that there is no real collection pressure. The possibility that they were indirectly poisoned by local fishing activities remains unknown. The ecology of the forest and rivers of the associated areas is little damaged, and the use of poison for fishing is not prevalent. One of the possible causes of the skewed age structure of *Limnonectes* species is the drought and forest fires of 1998. During that period, a large part of East Kalimantan's forest was on fire (Iskandar *et al*. 1999, Stuebing *et al*. 1999). Although there was no fires in the study area, not a single land or terrestrial vertebrate species was observed calling or mating during that time. This is particularly important, because amphibians usually breed once a month, all year round. For an organism that is relatively short lived, a six month reproductive abstinence and little or no restocking for the next generation could have proved a significant factor in the skewed nature of this age structure. Iskandar (1998a, b) also reported a similar population decline in Java caused by the volcanic eruption of Mount Galunggung.

The sex ratio of *Rana picturata* is strongly biased in favour of males since practically all specimens that have been collected are males. This phenomenon has been reported previously (Emerson and Inger 1992). However, this skewed sex ratio is more often a result of inflexibility of fixed sample techniques. *Rana* and *Meristogenys* males are commonly found on

riverbanks, but females spend most of their time in the forest and only came to the river to breed. As most sampling was carried out near the river, it is not surprising that males were most widely represented. A similar case was also reported for *Pedostibes hosii* (Inger and Stuebing 1997).

6. Spatial Distribution

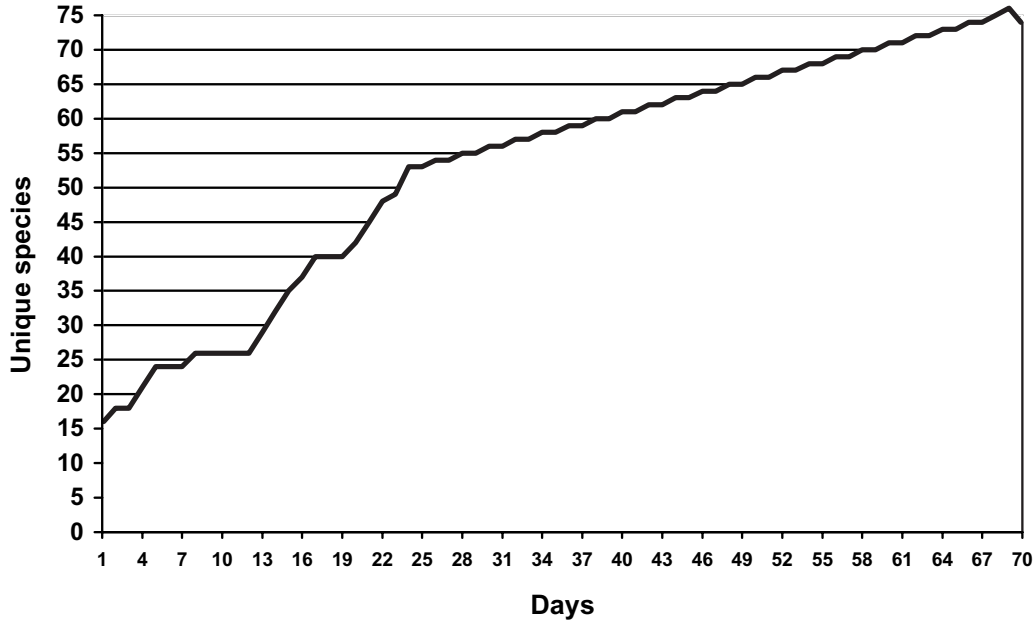
Some species are distinctly arboreal, including: most tree frogs, several toad species and a few ranids and aboreal snakes. As to the horizontal distribution along the river: most *Limnonectes* species are sparsely distributed along the river; *Limnonectes kuhlii* is nearly always found less than 1 m from the water level on a river bank, more often among gravel banks than sandy banks. On the other hand, *Rana picturata* and *Bufo asper* are often found in small groups of up to eight specimens. *R. picturata* is often found among dead branches or fallen trees in the river, while *B. asper* is more often found on large logs or up to 3 m onto steep riverbanks.

7. Local Use

Although a number of amphibians and reptiles are consumed, they are seldom specifically hunted. Local people eat four species of the genus *Limnonectes* (*ibanorum, ingeri, leporinus* and *kuhlii*), *Fejervarya cancrivora* and *Hoplobatrachus rugulosus*. These species are valued by local people, but never sold. According to them, they capture *L. leporinus* using a fish net (*jala*) when the species gather to make their nests on the sandy banks within the river. Other frog species are used as bait for fishing. Other than *Bufo juxtasper*, toads are not eaten or used, as most people know that they are poisonous. Most local people are afraid of snakes, even the small ones, therefore they are reluctant to capture them, except pythons which are eaten. Among lizards species, local people only eat the water monitors (*Varanus* sp.). According to them, there are three species of water monitors in the area though only two have been recorded (*V. salvator*, *V. rudicollis*). Another small blackish monitor is seldom eaten, but we were unable to acquire a specimen, and were unable to determine whether it is *V. heteropholis* or an undescribed species. All species of turtle are consumed locally.

Several species of snake are poisonous*: Tropidolaemus wagleri, Ophiophagus hannah, Bungarus flaviceps* and *Naja sumatrana.* The bite of *T. wagleri* or *T. albolabris* can be very painful and will subsist for about 10 days, but that of *O. hannah, B. flaviceps* and *N. sumatrana* is lethal. The Punan people used to use the poison of *O. hannah* for the tips of their blow darts, however air rifles have long since replaced blow pipes. *Ahaetulla prasina, Chrysopelea paradisii, Boiga dendrophila, B. jaspidea, B. cynodon, B. nigriceps* and *Enhydris doriae* are mildly poisonous but are not deadly.

Figure 1. Graph of increase in number of species during the survey



Conclusions

A total of 97 species have been recorded from this area, although only 76 species are substantiated by specimen, sound, picture or other means, This number representing a considerably high diversity for the area. Two species from the genera *Ansonia* and *Limnonectes* are probably new for science.

The occurrence of a poisonous varanid is biologically interesting. Merap, Punan or Kenyah people all insist that the species is poisonous, and that dogs died very soon after being bitten, thus not likely to be infection related. The species is said to be terrestrial, similar in colour to *Varanus rudicollis*, though much smaller. So far, not a single Asiatic lizard has been claimed as poisonous, but it is now known that microbes which occurs in the mouth of the Komodo dragon (*Varanus komodoensis*) is extremely poisonous. There is apparently a new black varanid found from Sabah that potentially apply to this form.

According to local people an exotic frog has recently been invading the region and could pose a danger to the existence of local species. It is important that this species is clearly identified, for though the local name is linked to *Hoplobatrachus rugulosus*, it is possible that it could be *Rana catesbeiana*, judging from the local descriptions.

Although our data is still preliminary, the species richness suggests that both Reduced Impact and Conventional Logging techniques have minimum impact on the species diversity of amphibians and reptiles in the Malinau Research Forest, but we need more research to confirm this suggestion. It should be noted that that both RIL and CL plots in Malinau still have more or less closed canopy forest. We have made a comparison with other logging areas outside Bulungan (Leuser, North Sumatra) where every large tree has been cut, and the composition of amphibians and reptiles have changed dramatically, because the whole community is essentially changed.

The utilization of amphibians and reptiles by the local people is limited and normally serves as an emergency food. Monitor lizards, turtles and pythons are captured (killed) when found and eaten, otherwise the local people prefer to eat boar or other large mammals.

Our data also suggests that forest fires might have an effect on the overall density of the species. Size distributions suggests that large *Limnonectes* adults are poorly represented despite a very low exploitation for food, and that this might be the result of reduced mating due to the effects of the fire.

We also suggest that forest fire might be responsible for the low abundance of amphibians and reptiles. However, at present we consider that the area is rich in amphibian and reptile species, comparable to other areas in South and East Kalimantan.

Suggestion:
Apparently one of the logging companies (Meranti Jaya) has a collection of snakes from the region. I have had no opportunity to visit this collection though it would be a worthwhile visit, as many of the snakes are potentially found in Malinau as well.

Acknowledgments

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