

## **5. The Relative Abundance of Frogs at Breeding Ponds in a Coorg Coffee Estate, Southern Karnataka.**

**Daniel Bennett and Katie Hampson**

The amphibian communities of the Western Ghats are noted for their high species richness and levels of endemism. However forest clearance has presumably reduced the available habitat for frog communities, prompting fears that some species might be endangered. However, few studies have been conducted to estimate the proportion of amphibian species in forest communities that are unable to survive in disturbed habitats. This study examined the community composition of amphibians around breeding sites in a coffee plantation bordering Nagarhole National Park, in order to determine habitat requirements and relative abundance of the member species.

### **Methods**

Habitats at each site were assessed by eye, and classified according to vegetation and ground moisture. Total area of each habitat around each pond was estimated and each habitat type allocated a proportion of 43 quadrats according to the relative abundance of that habitat around the pond. Quadrats were placed at random in each microhabitat over at least five evenings and numbers and species of amphibians in each quadrat recorded. The total numbers of individuals found in each search was calculated and the overall mean numbers per species used to calculate diversity. The mean numbers for each species were multiplied by a mean mass in g (calculated from a sample of live adult males from the same area.) to allow diversity to be calculated by biomass. Simpson reciprocal and Shannon-Weiner diversity indices were calculated. Species identifications were confirmed by Dr I Das from specimens deposited at the Zoological Survey of India, Calcutta. It was not possible to combine data from land quadrats and water transects so they are treated separately. Descriptions of sites are given in chapter 4 of this report. Data generated was combined with observational data from elsewhere on the estate in order to classify amphibians species by overall abundance and habitat preference..

## Results

Diversity measurements at all sites and by both methods are given in Table 1. Generally, evenness and diversity increased when biomass data were used.

	SITE NO.	1	2	3	4	5	6
BY NUMBERS	RICHNESS	12	10	9	7	3	5
	SIMPSON	1.825	3.596	3.906	4.224	2.4	2.016
	RECIPROCAL SW	1.488	2.334	2.323	2.376	1.369	1.338
BY BIOMASS	EVENNESS	2.81	5.04	5	5.19	2.58	2.53
	SIMPSON	5.818	2.355	4.656	6.235	2.206	2.777
	RECIPROCAL SW	2.846	1.825	2.508	2.691	1.2	1.709
	EVENNESS	7.19	3.54	5.69	6.46	2.3	3.27

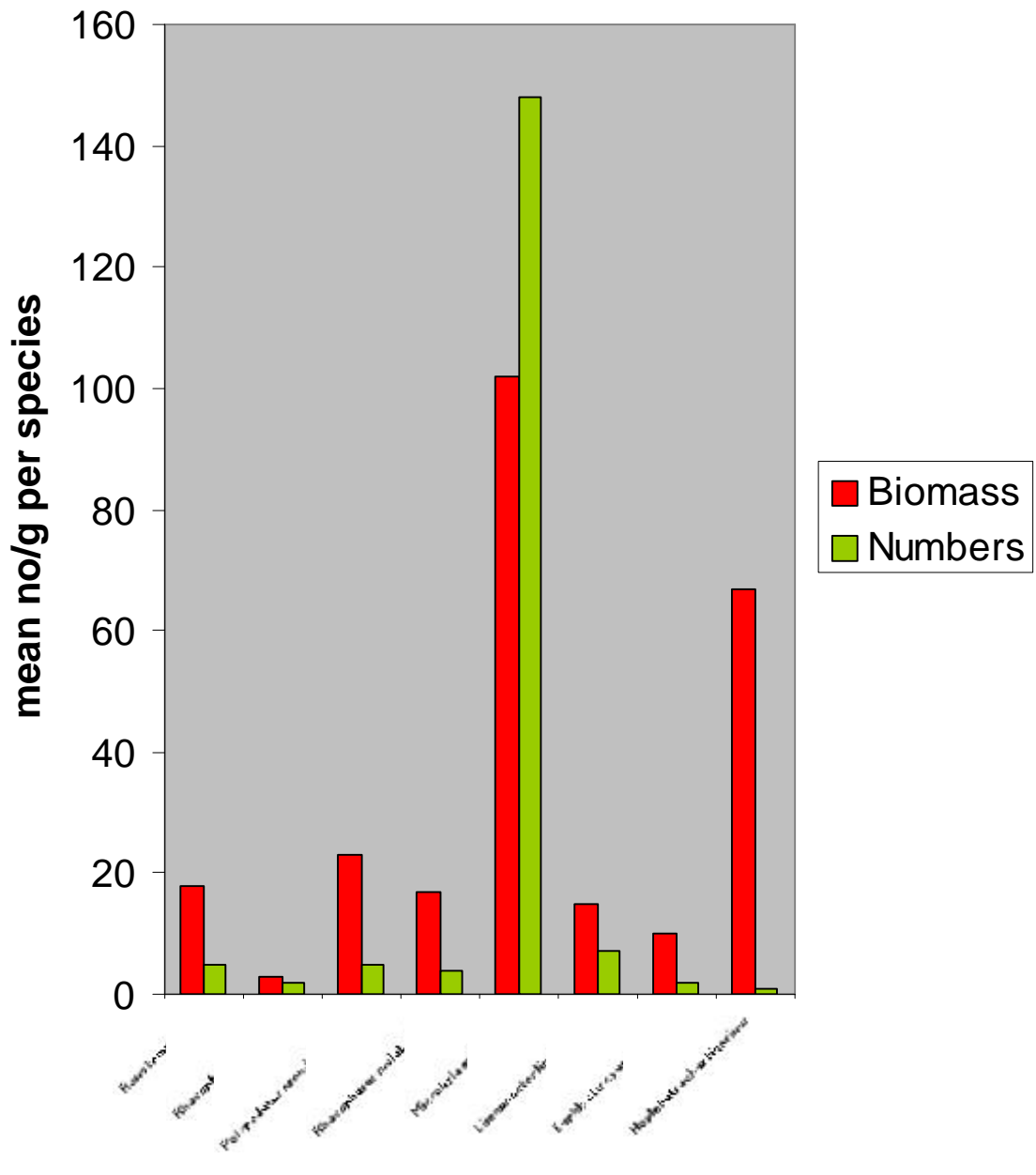
Table 5.1 Diversity measurements for anuran communities.

In total 12 species of amphibians were recorded, representing about 55% of the species known to occur on the estate. Species richness at sites varied from 3-12. Richness increased with the amount of shoreline at sites, and with the number of microhabitats recognised. In the figures below "striped frog/ranid" is *Indirana* sp., and "white spot frog" is *Nyctobatrachus* sp.

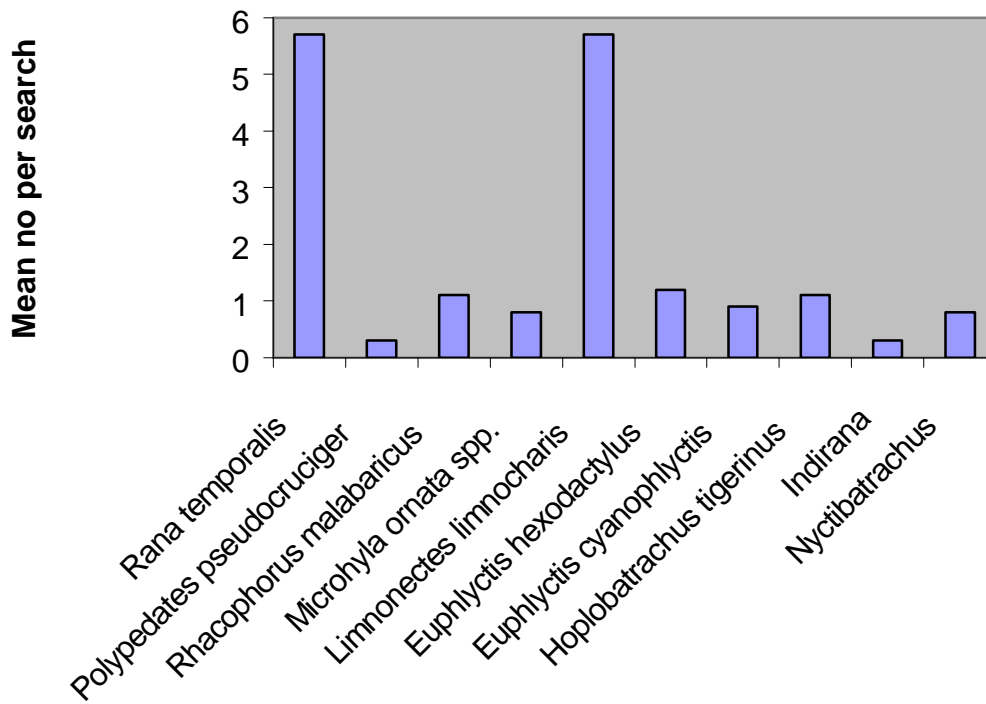
At the most speciose and best studied site (1) *Microhyla* frogs were more abundant than all other species combined, the result of dense aggregations on the ground. As a result the site is ranked lowest for diversity. When biomass rather than number of individuals is considered, abundance of *H. tigrinus* equals that of *Microhyla* and the site was the most diverse and had the highest evenness. At site 2 two species (*R. temporalis* and *L. limnocharis*) outnumbered all others. These species are characteristic of edges of ponds. By biomass *H. tigrinus* was more abundant than all other species combined. At site 3 *Limnonectes* frogs were most abundant by both numbers and biomass, although *P. pseudocruciger* and *H. tigrinus* were almost equally common when biomass is considered. At site 4 only the larger form of *Microhyla rubra* was found (see Chapter 7). Although numbers of individuals varied between species, six species were present at approximately equal biomasses. Quadrats at site 5 yielded only three species. *Limnonectes* and *Indirana* were approximately equally common by numbers and biomass. The yellow-thighed *Philautus* was rare. At site 6 *Nyctobatrachus* was the commonest species by both numbers and biomass. At all sites species found on the ground tended to be more abundant than treefrogs.

Species composition in the water was different. *E. cyanophlyctus* was common at four sites. At two of the three sites where it occurred *E. hexodactylus* was commonest frog in the water. Neither of these species were present on land. *Nyctobatrachus* was the most abundant species in the water at site 6. *Limnonectes* frogs were found in the water at five of six sites, but were only abundant where *Euphlyctus* species were absent.

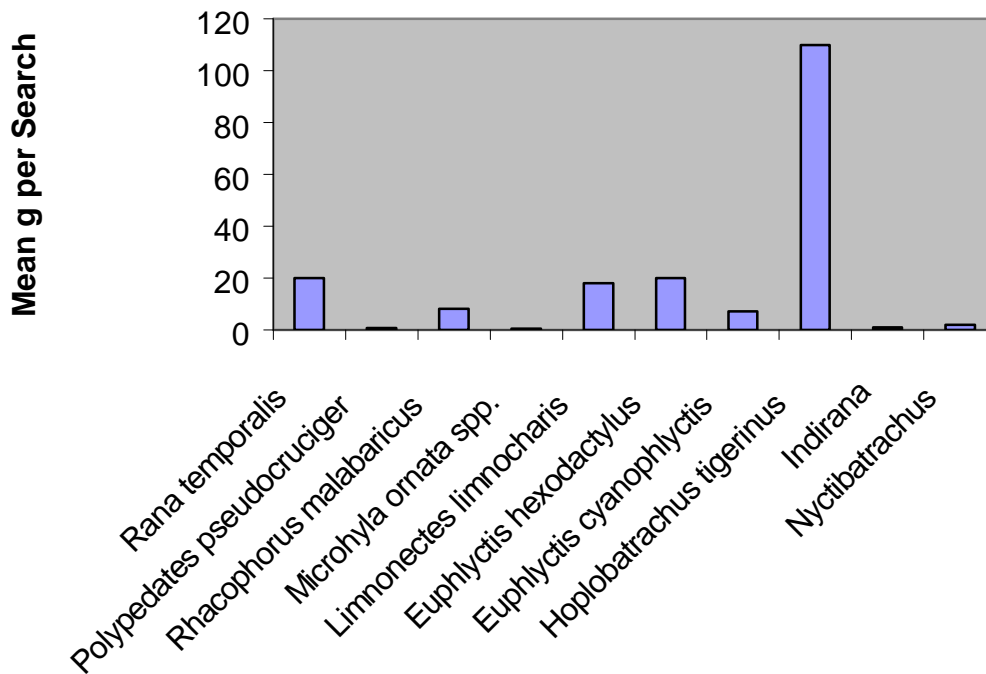
## Diversity of anurans around Lake 1



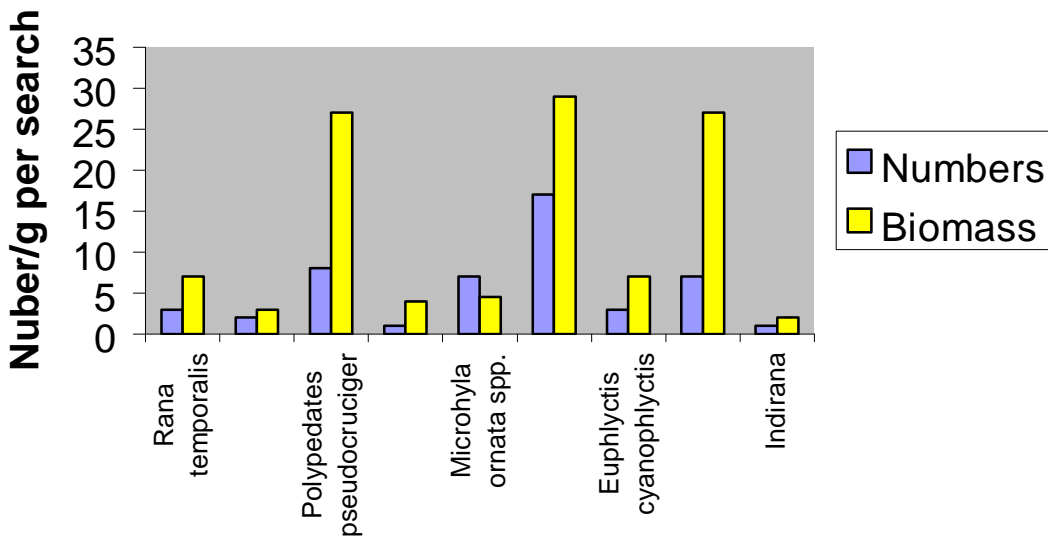
## Diversity of anurans around Site 2



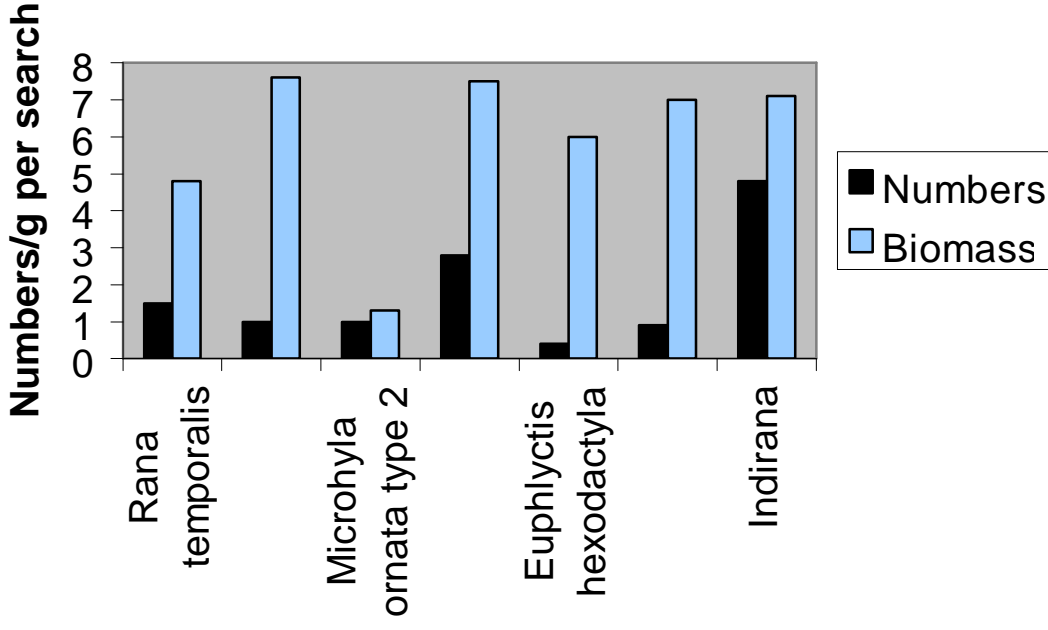
## Biomass of anurans around Site 2



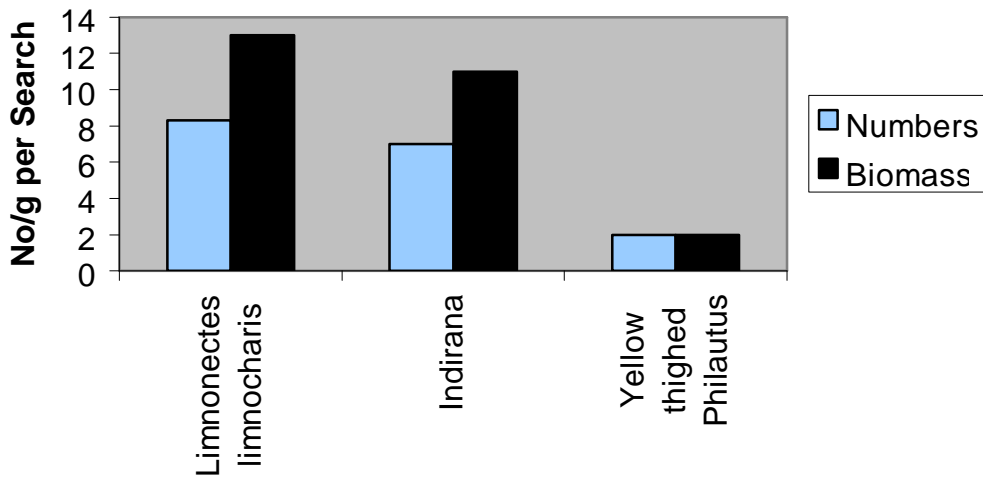
### Diversity of anurans at Site 3



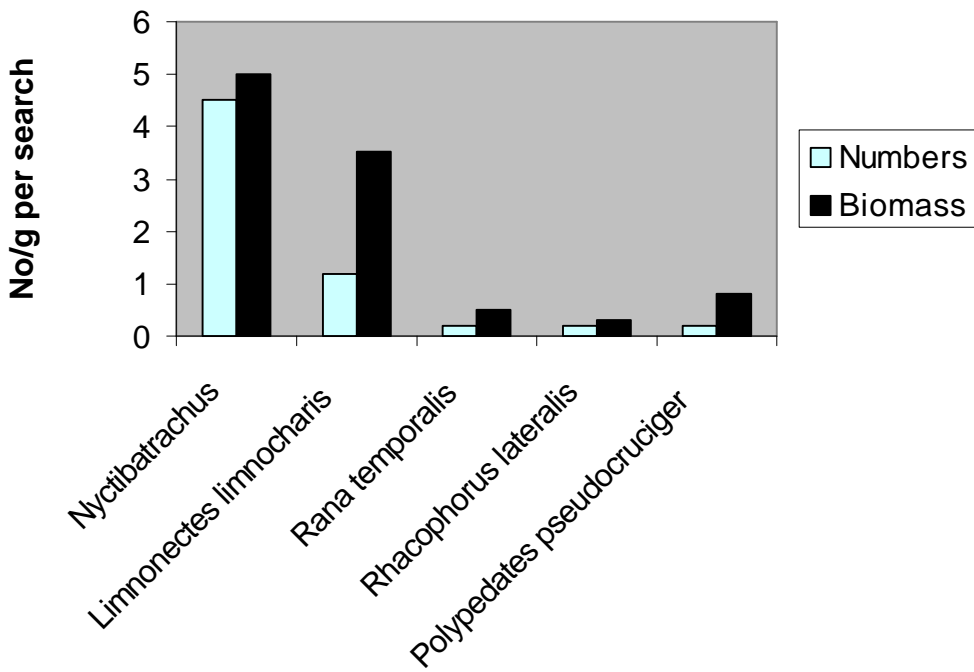
### Anuran Diversity at Site 4

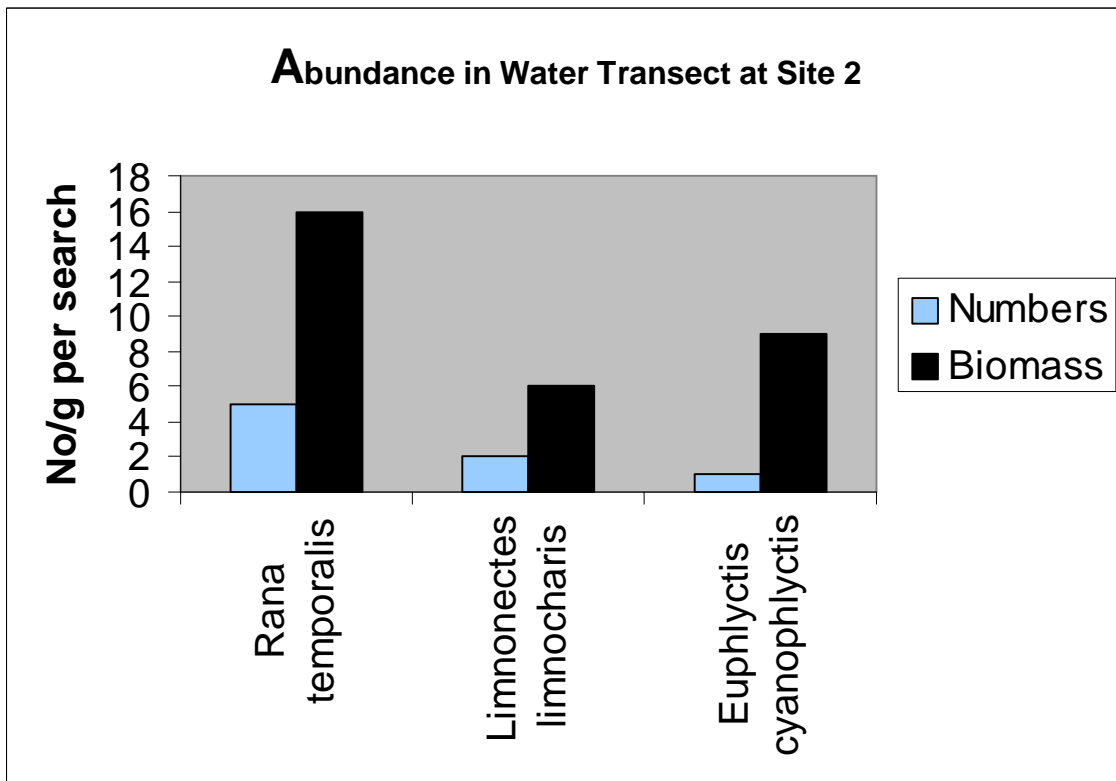
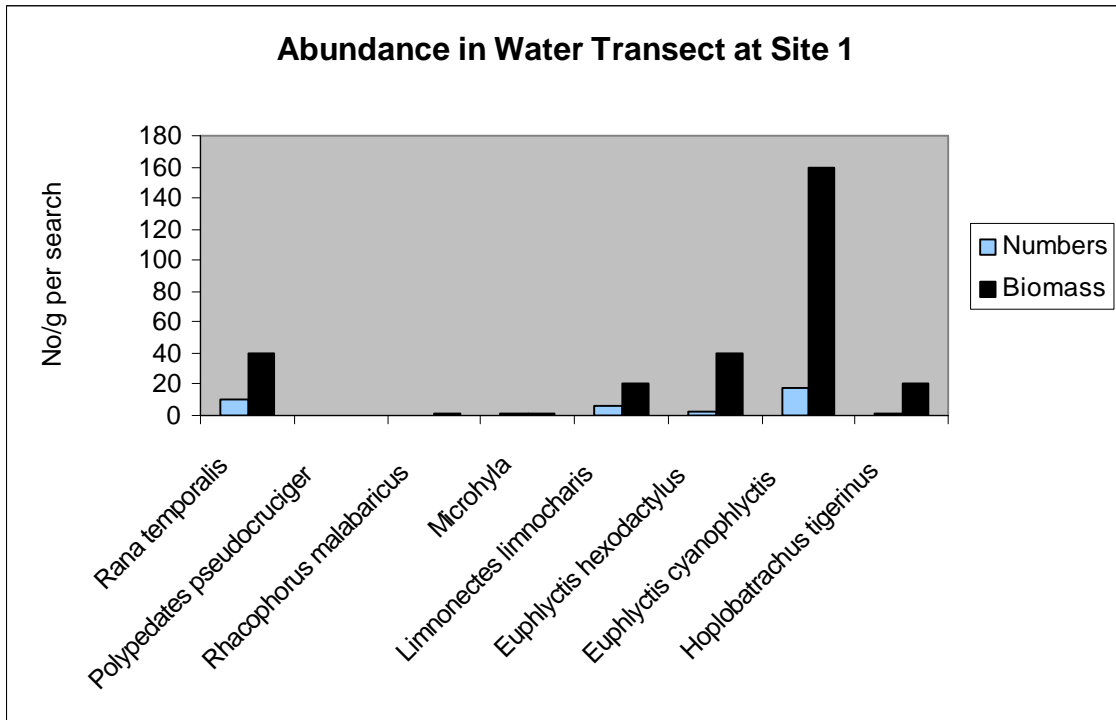


### Anuran Diversity at Site 5

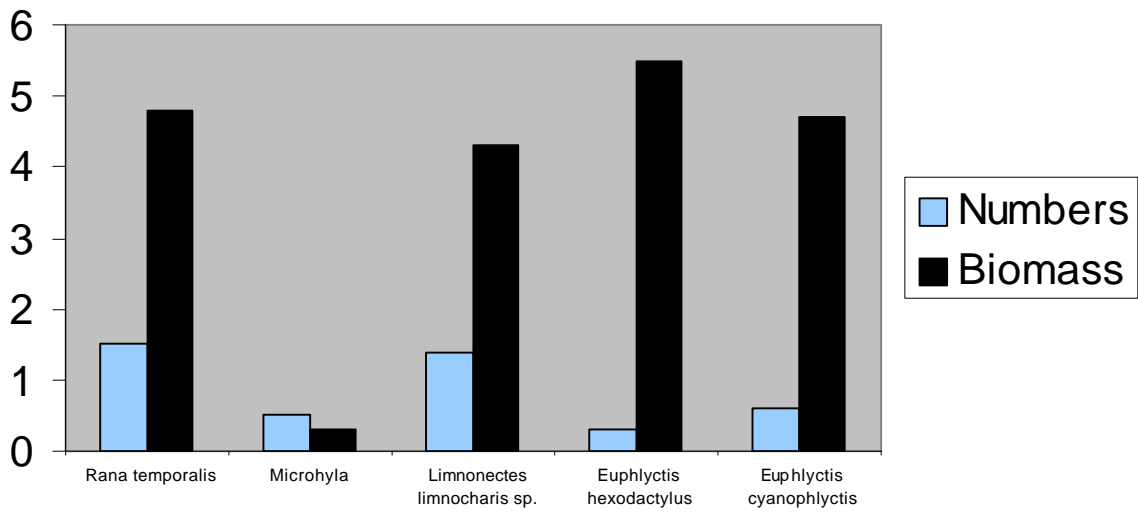


### Anuran Diversity at Site 6

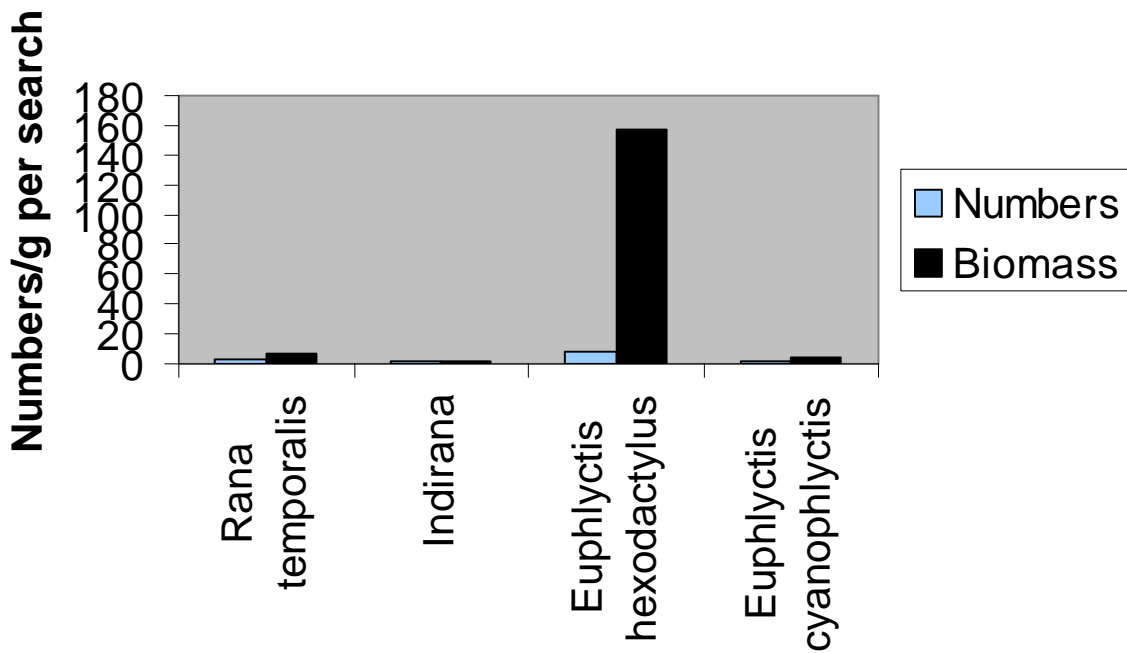


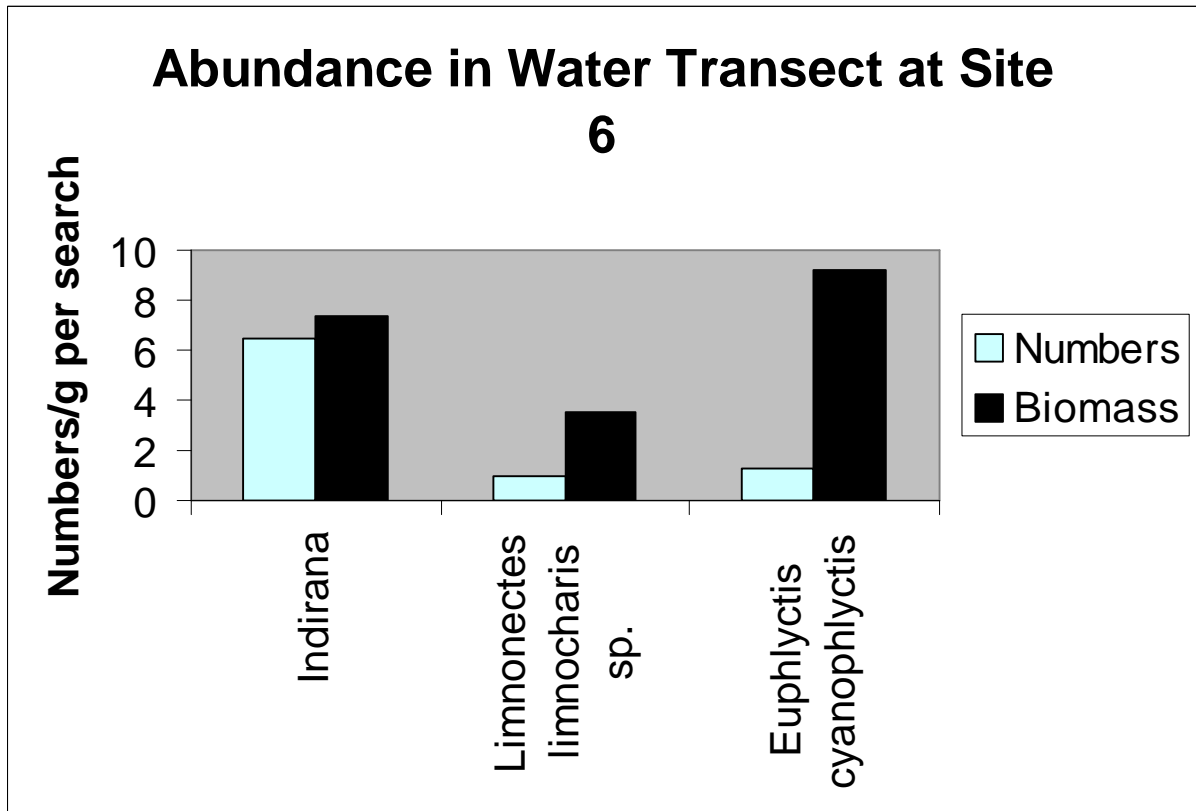
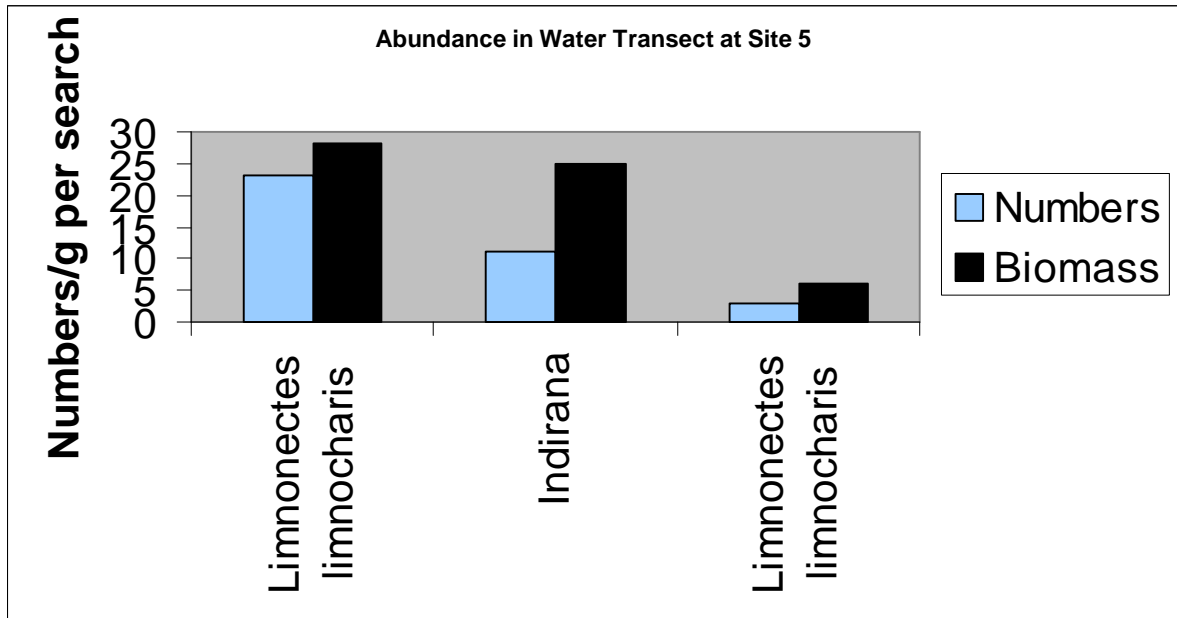


### Abundance in water transect at Site 3



### Abundance in Water Transect at Site 4





**Discussion**

Different water bodies on the estate harboured very different amphibian communities, both in terms of species composition and relative abundance. Richness and diversity may be higher at Lackunda than other estates in the area because it borders Nagarhole National Park to the east and may contain forest species that cannot normally survive in agricultural areas.

The amphibians detected during pond site surveys represent only a fraction of the species that occur at Lackunda. Away from breeding sites amphibian densities were too low to generate measurements of relative abundance. With the exception of caecilians it is possible to categorise emmber species according to their overall abundance during the study. This is based on the work presented above, elsewhere in this report and our casual observations. The rareness rank refers to the abundance of the species at Lackunda, based on our encounter rate, the effort put into finding individuals and the likelihood of individuals being encountered.

The rarest species are small-bodied *Philautus* species that call from vegetation away from breeding assemblages. Other species that are rare at Lackunda are common elsewhere in the Western Ghats.

#### Sources of error

There are a multitude of sources of error in our attempts to describe frog diversity at Lackunda. However the study represents six weeks of high effort investigation involving at least seven people in two teams per night, using a wide variety of methods over a small area. As a result the data set is relatively robust and complete.

The use of otherwise of communal breeding areas, the accessibility of habitats, variations in abundance due to climatic conditions or timing of reproduction, use and character of advertisement calls and the presence of extremely rarespecies are all important sources of error. The small escape-proof quadrat method used to assess abundance and habitat use around breeding sites is repeatable and we anticipate it will prove a robust method in all open habitats. In habitats with cluttered vegetation conuting individuals frogs degenerates into a rather random event. Searching even 1m<sup>2</sup>. of open ground for frogs requires considerable effort, curcsory inspection invariable results in some individuals being missed and our experience suggests it is not possible to search large areas efficiently for non-calling individuals. Transects set randomly through the estate proved too time consuming and produced little data on relative abundance because sample sizes were small. Conducting all searches in a standardized way that would permit replication would have resulted in a lower species count and prohibited other aspects of the study through time constraints.

	<b>Status</b>	<b>Habitats</b>	<b>Rareness rank</b>
<i>Microhyla rubra 1</i>	CW	B F H?	21
<i>Microhyla rubra 2</i>	CW	B F H?	22
<i>Mircohyla ornata</i>	RN	B F H?	4
<i>Ramanella triangularis</i>	RN	E	6
<i>Kaloula taprobanica</i>	RN	E	5
<i>Bufo melanostictus</i>	RW	F G	9
<i>Rana temporalis</i>	CW	C	13
<i>Rana curtipes</i>	CR	E F	17
<i>Limnonectes limnocharis I</i>	CW	A B H	18
<i>L. limnocharis spp.</i>	CW	A B H	20
<i>Indirana (striped frog)</i>	CW	B H?	19
<i>Hoplobatrachus tigerinus</i>	RW	B D	12
<i>Euphlyctis cyanophlyctis</i>	CW	A G	16
<i>E. hexodactylus</i>	RW	A	10

<i>Nannobatrachus</i>	CN	D	11
<i>Rhacophorus mala baricus</i>	CW	C	14
<i>Rhacophorus lateralis</i>	RW	C	7
<i>Polypedates pseudocruciger</i>	CW	C	15
<i>Gold Philautus</i>	RN	I	1
<i>Green Philautus</i>	CN	I	8
<i>Bronze Philautus</i>	RN	I	3
<i>Yellow-thighed Philautus</i>	RN	I	2

Table 5.2. Members of the Lackunda anauran communities. CW = Common and widespread.; CN = common in restricted habitats; RW rare and widespread; rn Rae in restricted habitats.

A = Pools and lakes

B = Edges of pools and lakes

C = Overhanging vegetation

D = Streams

E = forest/plantation floor

F = open grassland

G = small ponds and wells

H = Puddles

I = Vegetation away from water.