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Report on a short study of the dry season feeding ecology and habitat preferences of the golden-backed uacari or bicó, *Cacajao melanocephalus ouakary* (Cebidae: Pitheciinae), on the lower Rio Jaú, Amazonas, Brazil.

No. 2 of the Igapó Study Project Report Series

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REPORT ON A SHORT STUDY OF THE DRY SEASON FEEDING ECOLOGY AND HABITAT PREFERENCES OF THE GOLDEN-BACKED UACARI OR BICO, *Cacajao melanocephalus ouakary* (CEBIDAE:PITHECIINAE), ON THE LOWER RIO JAÚ, AMAZÔNAS, BRAZIL.

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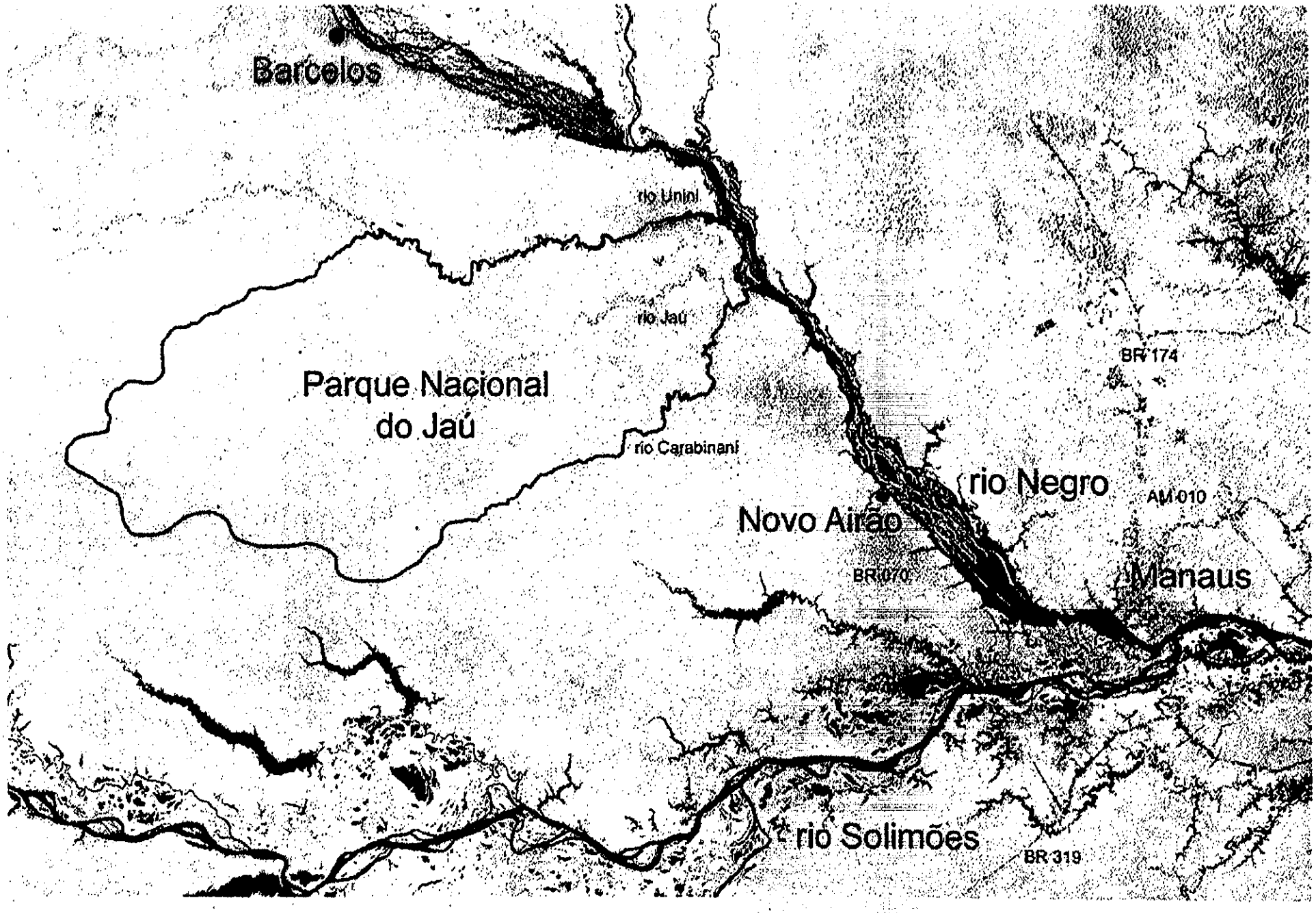
Abstract

Golden-backed uacaris *Cacajao melanocephalus ouakary* were studied in the forests of Jaú National Park, Amazônas, Brazil, for 17 days in late October/early November 2000, the mid-dry season. Studies complimented our previous studies in the wet season of 1999 (Barnett et al., 2000). Eight uacari groups were seen and seven more were heard. Group sizes ranged from 1-100+. Uacaris were recorded in igapó, campina and terra firme forest types. Information was obtained from local informants on seasonal use of these forest types and of other, smaller, more spatially patchy habitat types, with high temporal patchyness in fruit availability (e.g. buritzal). Foods were recorded directly for animals in igapó and terra firme, and indirectly for all three forest types. A total of 64 food plant species were recorded. These included hard fruits, soft fruits and leaves. The physical dimensions and hardness of fruits was recorded for 34 of these species. Together, young leaves of three tree species (*Buchenavia oxicarpa* Combretaceae, *Eschweilera tenuifolia* Lecythidaceae and *Mabea taquari* Euphorbiaceae) appeared to form a substantial dietary component. This is the first record of substantial folivory for this primate. Quantitative transects showed fruit and flower availability to be low in all habitats. Leaves may thus be a refuge food. At Jaú there appears to be considerable overlap in the uacari's diet with that of *Cebus* spp. and *Saimiri*, but only for soft fruits. *Alouatta* was not seen eating the leaves consumed by the uacari. Evidence was obtained that some key wet-season diet components (e.g. *Eschweilera* seeds) were also consumed by macaws and parrots. For golden-backed uacaris the seasonal use patterns for habitats and the food resources within them may be more complex than previously realized.


Barcelos
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Manaus
rio Solimões
BR 319

Results

monkeys:
A total of 17 days were spent searching for uacaris. During this period eight visual contacts were made with uacari groups (five in igapó baixo, three in igapó alto and one in terra firme). There were an additional seven auditory contacts (two in igapó baixo, two in igapó alto, two in campinerana, and one too distant to be certain). Total visual contact time was 1 hour 57 minutes. Contact times varied from fleeting (five seconds) to prolonged (55 mins.). Observer-group distance varied between 15 and 60m. However, the animals usually ran at their first sight of humans. All longer contacts were intermittent, and little in the way of behavioural observation could be made.

Group size varied from 1 to 100+. Contact calls were heard only in larger groups (50+). All groups appeared to be mixed-sex, each with several larger (assumed to be males) and smaller adults (assumed to be females). Independently locomoting juveniles were observed on three occasions. No babies were seen. All groups were in the upper tree canopy (7m from ground in igapó baixo; 10-12m from the ground in igapó alto and 17m in terra firme). In one sighting, seven animals were observed to leap a gap of approximately 10 body lengths (approx. 10m). One large (80+) group of uacaris was seen to be moving with a band (20+) of *Saimiri*. Such associations is noteworthy, for uacaris are generally considered to travel alone, unlike *Cebus* and even other pitheciines (see Leonard & Bennett, 1996).

food items:
Five direct and four indirect feeding records were obtained. A further 55 species were recorded from interviews. These dietary items are presented in Table One and include 64 species from which the fruits were eaten and three species (*Buchenavia oxicarpa* Combretaceae, *Eschweilera tenuifolia* Lecythidaceae and *Mabea taquari* Euphorbiaceae) from which leaves were eaten. Leaves of the three species appeared to be consumed in different ways: for *Buchenavia* the young leaves were nibbled out from the centre of a crown of plucked leaves, which was then dropped; for *Eschweilera* single young leaves appear to be plucked and eaten entire; in *Mabea* only the proximal part of the laminae of near-adult leaves appears to be eaten.

Three feeding observations were obtained in terra firme. Part of a large group was disturbed while eating in a large individual of Ingarana (*Inga laurina* Leg: Mim.). Fresh pods were collected immediately afterwards bearing uacari tooth marks. Analysis of 12 pods showed that the uacaris were nipping out individual seeds, and were not eating the fibrous material of the pod itself. Furthermore, only the largest of the seeds were being eaten. Most eaten pods had seeds remaining in them. Judging by the size of the remaining cavities in the pod wall, the uneaten seeds were always smaller than the seeds that had been eaten. The pod wall is neither thick nor tough, and this behaviour shows that uacaris are capable of the fine degree of food selectivity that has been found to characterize other primate species (e.g. *Ateles p. paniscus;* Roosmalen, 1985b). This tree species is, reportedly, widely used by other primate species in the region, including *Cebus apella* and *Saimiri*.

Fruits of two palms (inaja, *Attalea maripa* and pataua, *Oenocarpus bataua*) were discovered close by, bearing uacari tooth marks. The seeds are protected by a thick (4mm) and immensely hard testa, which required a hammer and nail to open it. Not surprisingly, uacari feeding action was restricted to gnawing the mesoderm from the fruits. Measurements of eaten and uneaten fruits revealed that each fruit had a layer of mesocarp some 2mm thick (weighing 7-8g) surrounding its seed. Observations on two partly eaten fruits and 10 fruits with the mesocarp completely removed revealed no attempts to bite into the seed casing to access the seed. The fruits were being eaten solely for the mesocarp alone.

We received four separate reports that, in the dry season, uacaris descend to the ground in igapó alto to feed on seedlings of *Pouteria* sp. (Sapotaceae) and other (unidentified) tree species. It was also reported that, in late November-early December uacaris feed on a type of beetle larvae that lives beneath the leaf litter in igapó alto. Such actions have not been previously reported for this species of uacari, though Ayres (1986) reports that *C. c. calvus* comes to the ground in várzea to eat seedlings.

Measurements of the hardness and thickness were made of the seeds of 31 uacari food species. These are presented in Table Two. It will be seen that, although 19 species have thick (>2mm) or hard shells, a significant proportion (12, 38.7%) of the documented species are thinner or softer than this. Many of these thinner-skinned fruits were said to be also eaten by *Cebus* spp. and *Saimiri*. These include the thin-

diet of *Cacajao, Chiropotes* and *Pithecia*, no previous studies of Pitheciine diets have recorded leaves as a major dietary component, either seasonally or in total. It would appear that this use is highly seasonal in *C. m. ouakary* and related to the dearth of other suitable foods at this part of the inundation cycle, there being few fruits available in any forest type at this time (see Table Four).

Though it requires further analysis to be sure, consumption patterns of the three leaf types may well be related to phytochemistry. It is common for folivores to consume young leaves, avoiding the high levels of tannins present in older leaves (Chivers, 1998). The avoidance of the very young leaves of *Mabea* may be because it is a member of the Euphorbiaceae, where young leaves in particular are often rich in toxic and ascerbic latex (Gentry, 1993).

Although leaves may be a refuge food in a time of seasonal scarcity, they may also be a source of protein (Chivers, 1998). It may be significant that only young leaves were recorded as being eaten. These generally have lower absolute levels of tannins and phenols and higher proportionate levels of proteins than older leaves (Chivers, 1998). Ayres (1986) recorded lepidopteran larvae as an important seasonal food item in *C. c. calvus*, and thus a protein source. For *C. m. ouakary*, however, no evidence of insect eating has been recorded. Plant leaf chemistry in forests adjacent to black water river systems may act to reduce the density of such invertebrate folivores (da Cunha & Barnett, 1989) – possibly to levels where foraging on them would not be optimal.

The absence of insects in collected fresh fruits is in marked contrast to the situation reported by Barnett et al. (2000), where a high proportion of analysed fruits were so infected. If this is a general occurrence, then it may betoken a general dearth of available protein and eating leaves may be a response to this. In this context it is also interesting to note that no evidence was observed in this season of consumption of the larvae of *Polistes* wasps, an event reported from wet season studies by Barnett et al. (2000). Insectivory is a quite widely reported, if generally low-level affair, in Pitheciines (e.g. Heymann & Bartecki; 1990; Frazao, 1991) and seems to be a response to the low levels of overall protein in their seed-centered diet (and perhaps the very specific lack of particular amino; Chivers, 1998). The records of uacaris feeding on seedlings and on insect-larvae in igapó alto should also be investigated further in this context. This has not been done, even in *C. c. calvus* where the phenomenon was first reported.

competition:
Cacajao is often considered to be an obligate predator of hard-shelled fruits, to be a genus that feeds on little else and, as a result, to have adopted a highly specialized and near competition-free niche (Kinzey, 1992). To this is added a certain degree of habitat specialization; Ayres (1986) reported that few other primates regularly used várzea and Boubli (1997, 1999) found little evidence of microsympatry for three primates at his study site and very low densities of four others. The situation at Jaú appears to be somewhat different from the splendid isolation reported by these authors, with frequent sightings of *Cebus apella, C. albifrons, Saimiri* and (in the wet season, at least) *Alouatta* in habitats used by *C. m. ouakary*. This opens-up the possibility of an active competition for resources between the species.

There certainly appears to be considerable overlap between *Cacajao, Cebus* and *Saimiri* for smaller, softer fruits. It is possible that these are abundant and taken opportunistically. However, the diet of *Cebus apella* in Jaú also includes some very hard-shelled fruits. Lacking the powerful jaw musculature of *Cacajao, C. apella* is reported to access the seeds of mature *Couroupita* spp. (Lecythidaceae) by banging the pyxidium against a branch until the lid pops off, revealing the single large seed within (see Table Two), behaviour also reported by Peres (1991) for *Cariniana micrantha* (Lecythidaceae). In contrast, when eating *Couroupita, Cacajao* simply rips the pyxidium open with its teeth. Both species are reported to eat the softer, young, pyxidia, consuming them whole like small cakes. The extent to which *Cebus*' use of *Couroupita* (and other hard fruits?) might actually deprive *C. m. ouakary* of resources remains to be determined and will depend both on the frequency of the phenomenon and the abundance of *Couroupita* and its proportional importance in the diet *Cacajao*. However, in a list of the twenty most common trees at Jaú, reported by Ferreira (1997) and including 13 known food items of *C. m. ouakary*, the tree genus *Couroupita* was not included. In consequence, this example of diet overlap may be of minor impact in terms of resource competition between the species. This possibility should be confirmed with studies of the crop size, the duration of the crop and the timing of crop availability in relation to other uacari food items.

It appears to be very difficult to get close to uacaris in the Seringalzinho-Flutuante region of the park. This may be due to past (and current?) hunting levels. Though it seems to be slightly easier to approach them from a canoe, it is uncertain if this will be enough to be able to habituate them to a level that permits good observations of the kind the study really demands. Accordingly, it may prove necessary to move the study site to a more remote location within the park.

Overall it would seem that hard seeds and igapó act as dietary refuge for uacaris. This appears to support Jean-Philippe Boubli's idea (Boubli, 1997, 1999) that the genus originated as a specialist sclerocarpic forager in the Campinerana of the Pico de Neblina region, a habitat where hard fruits are plentiful and competitors are few. Only later did the genus spread out into habitats such as várzea and igapó, vegetation types rich in sclerocarpic fruits and relatively poor in species to compete for them.

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TABLE ONE:
PLANTS IDENTIFIED AS CONSTITUENTS IN THE DIET OF *Cacajao melanocephalus ouakary*, JAÚ NATIONAL PARK OCT-NOV. 2000.

Key: I = igapó, TF = terra firme, C = caatinga, FWA = whole adult fruit, FWI = whole immature fruit,
S = seed, M = mesocarp, L = leaf.

FAMILY	SPECIES	COMMON NAME	HABITAT	PART EATEN
Arecaceae	*Astrocaryum gynacanthum*	mumbaca	TF	M
	Astrocaryum jauari	jauari	I	M
	Attalea maripa	inajá	TF	M
	Euterpe precatoria	açaí	TF	FWA
	Leopoldinia pulchra	jará	I	M
	Mauritia flexuosa	buriti	TF	M
	Mauritiella armata	buritirana	C	M
	Oenocarpus bataua	patauá	TF	M
	Oenocarpus minor	bacabinha	TF	M
Apocynaceae	*Couma guianensis*	sorva	TF	FWA
Euphorbiaceae	*Hevea spruceana*	seringueira do igapó	I	S
	Mabea taquari	taquari	I	FWA, L
	Amanoa sp.	bico de japó	I	FWA
Malpighiaceae	*Byrsonima amazonica*	buxuxu	C	FWA
	Burdachia prismatocarpa	pau vidro	I	FWA
Myrtaceae	*Myrcia fallax ou pyrifolia ?*	araçá do igapó	I	FWA
	Marliera sp.	murta	C/I	FWA
	Eugenia sp.	daicu	C/I	FWA
	Myrtaceae sp1	araçá (casca preta)	I	FWA
Melastomataceae	*Clidemia sp.*	buxuxu da campinarana	C	FWA
Memecylaceae	*Mouriri sp.*	jacareúba	C/I	FWA
Rubiaceae	*Alibertia edulis*	apuruí peludo	I	FWA
Nyctaginaceae	*Nyctaginaceae sp.1*	jenipapo	I	FWA
Celastraceae	*Goupia glabra*	cupiúba	TF	FWA
Icacinaceae	*Calatola sp.*	tucano patauá	I	FWA
Annonaceae	*Duguetia sp.*	envira	I	-
	Bocageopsis sp.	envira preta	TF	FWA
Moraceae	*Brosimum parinarioides*	amapá	TF	FWA
Burseraceae	*Protium sp.*	breu branco	TF	FWA
Sterculiaceae	*Theobroma subincanum*	cupuí	TF	FWA
	Theobroma sylvestre	cabeça de urubutinga	TF	FWA
Hippocrateaceae	*Salacia sp.*	bochecha de velho	I	S
Bignoniaceae	*Tabebuia sp.*	capitari	I	S
Vochysiaceae	*Vochysia sp.*	araçá	I	S
	Qualea sp.	comati	TF	S
Lauraceae	*Lauraceae sp.1*	louro abaticarana	I/TF	-
	Lauraceae sp.2	louro amarelo	I	-
Violaceae	*Rinorea sp.*	olho de peixe	I	FWA
Amaranthaceae	*Pleuropetalum sp.*	seringaí da terra-firme	TF	-
Combretaceae	*Buchenavia oxycarpa*	tanimbuca	I	-, L
Humiriaceae	*Sacoglotis sp.*	uchirana	I	-
Chrysobalanaceae	*Couepia sp.*	marirana	C	S
Elaeocarpaceae	*Sloanea laurifolia*	urucurana	I	S

TABLE TWO: QUANTITATIVE DATA ON FRUIT AND SEED WEIGHT AND HARDNESS FOR SOME SPECIES IN THE DIET OF *Cacajao melanocephalus ouakary*.

Key: S = soft, T = tough, H = hard, * = empty shell only, ^ = uneaten fruit only

Species	Resistivity Class	Fruit wall thickness (mm)	Fruit length (mm)	Fruit width (mm)	Fruit weight (g)	Seed length (mm)	Seed width (mm)	Seed weight (g)	Mean number of seeds per fruit	Sample size
"Jabuchicaba"	S	<1	19	19	1.5-2.5				1	4
*Alchornea sp.**	H	2	26-31	21-24					>20	3
Aldinia heterophylla	T	5-13	82-103	61-90	108-320					7
*Attalea maripa^*	H	2	51-52	25-28	16-21			9-13	1	2
Brosimum cf. parinaroides	S	<2	9.5-11	10-12						4
Brysonima amazonica	S	<2	6	5					1	10
Burdachia prismatocarpa	T	2.5-4	19-26	14-17	2	11.5		10	1	10
*Corythophora sp.1**	H	8			90*					1
Corythophora sp.2	H	7-8	50-61	32-53	28-47	30-32	15-21	4-6	1.25 (1-20	6
*Couepia sp.**	H	5-6								2
Couma sp. 2	T	6	36	22					>20	1
Couma sp.1	T	10	43	36					>20	1
*Couratari sp.1**	H	4	42-49	33						2
*Couratari sp.2**	H	4	62	42						1
*Eschweilera sp. 1**	H	3								7
*Eschweilera sp. 2**	H	8								7
Eschweilera tenuifolia	H	2-4			40-150	21-45	7.5-26	2-8.5	25-40	12
Eugenia sp.	T	2#	12-16	9-11		11	8		1	10
Inga laurina	T	0.5-1.25				5.5-13	4.5-9	1	4-13	9
Mabea taquari	S	2.75	14	16						10
Marliera sp.	S	<1	7.5-10	11-11.5					4	2
Myrcia fallax/pyrifolia	S	<1	13-15	14-16					2.5 (1-3)	10
*Oenocarpus batua^*	H	1	28-30.5	19-20	7				1	2
Parkia sp.	T	3								1
Pouteria sp. 1	T	1.5-2	21-28	21-28						3
Pouteria sp. 2	T	1	21	21					3.5(3-5)	5
Salacia sp.	S	1.5	25	25						3
Sloania laurifolia	H	2-4	14-22	12-20		7			1	10
Swartzia polyphylla	T	5.5-8.25	92-149	47-70	125-340			65-120	1	6
Swartzia sp.	T	2	57	37		42	12		1	1

TABLE THREE(ii): RESULTS OF BOTANICAL TRANSECTS FOR IGAPÓ ALTO.

Local: IGAPÓ ALTO (Lago do Patauá – Cachoeira)

		Nº of individuals	
Species	**Common name**	**Transect 1**	**Transect 2**
Mabea taquari	Taquari	15	10
?	Indeterminada 1	7	4
Pouteria sp.	Macucuzinho	6	6
Asrocaryum jauari	Jauari	5	
Myrtaceae sp.2	Araçá (da folha graúda)	7	7
?	Indeterminada 2	1	
Pouteria sp.	Abiu do igapó	4	2
Pouteria elegans	Abiurana	2	1
?	Cipó 1	1	
Lauraceae sp.1	Louro abaticarana	2	
Alibertia edulis	Apuruí peludo	4	2
Himatanthus sp.1	Jarmim	3	
Dalbergia sp.	Arapari	2	
Myrcia sp.	Araçá	1	
Eugenia sp.	Olho de preguiça	4	1
Marliera sp.	Murta	6	1
Burdachia prismatocarpa	Pau Vidro	1	1
Sacoglotis sp.	Uchirana	3	1
Eschweilera tessmannii	Ripeiro	1	
Hevea spruceana	Seringueira do igapó	5	
Lauraceae sp.2	Louro amarelo	1	1
?	Puleiro de pato	1	
Quiina sp.	Indeterminada 3	2	2
?	Cipó 2	1	
Myrtaceae sp 1.	Araçá da casca preta	1	1
Buchenavia oxycarpa	Tanimbuca	1	
Licaria sp.	Indeterminada 4		1
Tabebuia sp.	Capitari		1
Sclerolobium sp.	Tachi		1
?	Orelha de cachorro		1
Elaeoluma sp.	Caramuri		1
Himatanthus sp.2	Jarmim preto		1
Vochysia sp.	Araçá		1
	Nº of individuals	**87**	**46**
	Nº of species	**26**	**21**