

## LISTS OF SPECIES

### Mammals, Birds and Reptiles in Balbina reservoir, state of Amazonas, Brazil.

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**Abstract:** The construction of hydroelectric power stations can affect the fauna, including the adaptation to the new lentic conditions, and may lead to the disappearance of some species and the colonization of others. Usually, there is a lack of information in the post-flooding phases. The present study is a preliminary qualitative survey of mammals, birds, and reptiles in the influenced area of the Balbina hydroelectric dam (01°55' S, 59°29' W). Species records were made during field trips to the reservoir with no group specific methods. The conservation status of the identified species followed the classification adopted by IUCN. Twenty-two mammals (one endangered – EN), forty-two birds and six reptiles (one vulnerable – VU) were identified. Although the list presented here is preliminary, if appropriately complemented it can be used to understand the effects of hydroelectric dams on the Amazonian fauna.

#### Introduction

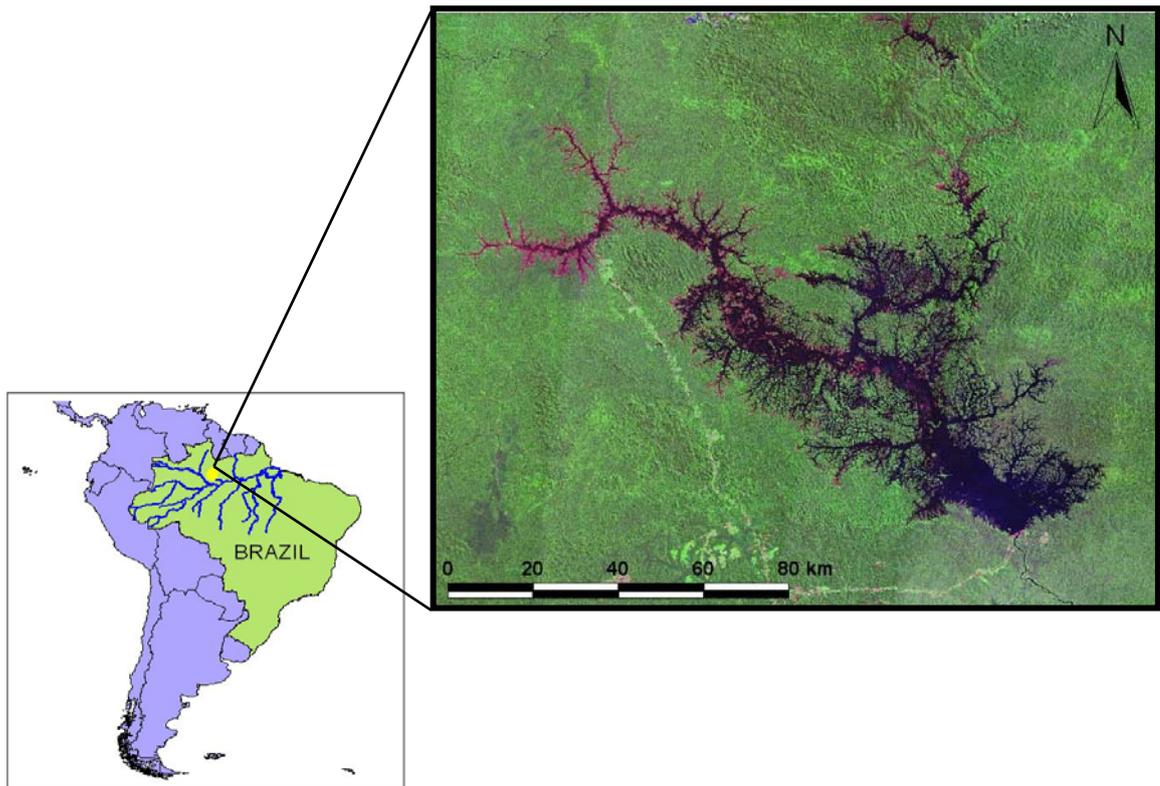
The construction of large hydroelectric power stations can affect the fauna by large impacts on the aquatic and terrestrial environments. Wild animals are intimately related with their surroundings and can be strongly affected by drastic alterations in the habitats. Gribel (1993) emphasizes the matter regarding the drastic impact on the wild fauna caused by the forest flooding, and raises the question about what to do with the animals that live in the areas that will be flooded. The habitat fragmentation and the species isolation on small islands can result, in many cases, in the disappearance of many of them due to the genetic isolation which they will be submitted to. However, the problem becomes even more aggravated due to the lack of studies in the subsequent phases of the flooding, when the formation and stabilization of the lake occur. The flooding of Balbina's reservoir began in 1987 and the lake reached its operational stage at the 50.6 m level in 1989 (Fearnside 1990). Occasional information concerning the occurrence of Giant Otters in Balbina Lake 15 years after its formation lead to the development of a project entitled "Social organization, behavior, and diet of the giant otter (*Pteronura brasiliensis*) in the influenced area of Balbina hydroelectric power station" (Rosas and de-Mattos 2003a; 2003b; Rosas

*et al.* 2007) by the researchers of the *Laboratório de Mamíferos Aquáticos* of the *Instituto Nacional de Pesquisas da Amazônia* (LMA/INPA). Due to the lack of information about the fauna that currently inhabits the Balbina reservoir, and taking advantage of the researchers' presence in the lake during the Giant Otter Project expeditions, the present study aimed to accomplish a preliminary qualitative survey, recording the mammals, birds, and reptiles (Testudines, Crocodylia, and Squamata) in the influenced area of the Balbina reservoir. The information presented here, although not definitive, provides qualitative data on the fauna that currently inhabits this reservoir area.

#### Material and methods

The Balbina dam (01°55' S, 59°29' W) is located on the Uatumã River, a tributary of the left margin of the Amazon River, in the municipality of Presidente Figueiredo, state of Amazonas, 150 km in a straight line from Manaus (Figure 1). The lake covers a total of 4,437.63 km<sup>2</sup> (PROJETO FUNCATE/INPE/ANEEL 2000), and contains 3,299 islands (Rosas and de-Mattos 2003b). The reservoir includes part of the Uatumã Biological Reserve (ReBio Uatumã) and part of the Waimiri-Atroari Indigenous Reserve.

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**Figure 1.** Location of sample area: Balbina Lake in Central Amazon, northern Brazil.

During the six years of the Giant Otter Project (2001 to 2007), records of mammals, birds, and reptiles (Testudines, Crocodylia, and Squamata) were made circumstantially during trips to Balbina Lake accomplished every two months, with duration of seven to ten days. Although nowadays the study area is a huge dendritic lake, the visited areas included sections of what was originally part of the Uatumã River, Pitinga River (tributary of the left margin of the Uatumã River), Pitinguinha River (tributary of the right margin of the Pitinga River), and creeks of the drainage basins of these rivers. The total sampled area corresponded to about 500 km<sup>2</sup>. Most of the sampled area was located inside the Uatumã biological reserve limits. The study was carried out using an aluminum boat with a 40 Hp outboard engine. Most of the records were made between 05:00 and 18:30 h. However, two species could be identified at night by vocalizations (the Red Howler Monkey *Alouatta seniculus* and the

Little Chachalaca *Ortalis motmot*; Tables 1 and 2). It is important to point out that the records were made during the Giant Otter Project's regular activities, and we rarely went into the forest to survey animals other than Giant Otters. However, whenever a visual contact was established with any other species, the identification was confirmed by using binoculars and/or acoustic records, and the species' name, date, time, and sighted place were recorded (geographical coordinates obtained by GPS). Whenever possible, the observed species were filmed and/or photographed for subsequent confirmation of the identification. Nevertheless, since we did not apply a species-specific methodology, a conservative criterion was adopted and only the species that were effectively seen and/or acoustically registered were included in the records. The species' conservation status was based on the IUCN (2007) classification.

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### Results and discussion

A total of 70 mammal, bird, and reptile species were recorded in the influenced area of Balbina reservoir. We identified 22 mammal species (one

endangered – EN) (Table 1), 42 bird species (Table 2), and six reptiles (one classified as vulnerable – VU) (Table 3).

**Table 1.** Mammals recorded in Balbina reservoir and conservation status according to IUCN (2007). EN, endangered; VU, vulnerable; NT, near threatened; LC, least concern; LR/LC, lower risk/least concern; DD, data deficient; and NL, not listed.

Order	Family	Scientific name	Common name	IUCN
Artiodactyla	Tayassuidae	<i>Tayassu pecari</i>	White-Lipped Peccary	LR/LC
		<i>Tayassu tajacu</i>	Collared Peccary	NL
	Cervidae	<i>Mazama americana</i>	Red Brocket Deer	DD
Carnivora	Felidae	<i>Puma concolor</i>	Puma, Mountain Lion	NT
		<i>Leopardus sp.</i>	Wild Cat	--
		<i>Panthera onca</i>	Jaguar	NT
	Mustelidae	<i>Eira barbara</i>	Tayra	LR/LC
		<i>Lontra longicaudis</i>	Neotropical Otter	DD
		<i>Pteronura brasiliensis</i>	Giant Otter	EN
Cetacea	Iniidae	<i>Inia geoffrensis</i>	Pink River Dolphin, Boto	VU
Chiroptera	Emballonuridae	<i>Rhynchonycteris naso</i>	Long-Nosed Bat	LR/LC
Perissodactyla	Tapiridae	<i>Tapirus terrestris</i>	Brazilian Tapir	VU
Primates	Atelidae	<i>Alouatta seniculus</i>	Red Howler Monkey	LC
		<i>Ateles paniscus</i>	Black Spider Monkey	LC
	Callitrichidae	<i>Saguinus midas</i>	Golden-Handed Tamarin	LC
	Cebidae	<i>Cebus apella</i>	Brown Capuchin Monkey	LC
		<i>Saimiri sciureus</i>	Common Squirrel Monkey	LC
	Pitheciidae	<i>Chiropotes sagulatus</i>	Brown Bearded Saki	NL
		<i>Pithecia pithecia</i>	Guianian Saki	LC
Rodentia	Dasyproctidae	<i>Dasyprocta leporina</i>	Red-Rumped Agouti	LR/LC
	Hydrochaeridae	<i>Hydrochaeris hydrochaeris</i>	Capybara	LR/LC
Xenarthra	Myrmecophagidae	<i>Myrmecophaga tridactyla</i>	Giant Anteater	NT
Total number of mammal species				22

During the fauna survey conducted prior to the damming, 90 mammal species were registered by the report produced by ELETRONORTE/CNPq/INPA (*Preservação e utilização científica da fauna. Relatório setorial. Julho-dezembro/1985*, unpublished data). In the present study, the occurrence of only 22 species for this same group

were recorded. This difference is probably related to the methods applied in this study. The species listed here were recorded occasionally, without applying any specific method, with concentrated sampling effort mainly during the day and limited to the margins of the creeks and rivers. Several mammals have nocturnal habits (e.g. bats and

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small rodents) and many of them use the interior of the forest and canopy stratum, thereby significantly reducing the chances of being sighted by us. Additionally, the fauna survey during the pre-damming phase also sampled above and below the dam.

Although the Tucuxi Dolphin (*Sotalia fluviatilis*) is included in the ReBio Uatumã management plan - phase 1 list (ELETRONORTE/IBAMA - Reserva Biológica do Uatumã. Plano de Manejo Fase 1. Documento de Informações Básicas. Brasília, Novembro/1996, unpublished data), we never observed this species in the reservoir. According to the reports conducted before damming, the occurrence of the Tucuxi in the area is mentioned as "probable", but this dolphin was not recorded in the lake on that occasion either. This dolphin species usually uses open waters, occurs in groups of up to six individuals and frequently displays surface behavior (da-Silva and Best 1996). Therefore, if the Tucuxi does occur in Balbina Lake, it would have already been observed by us during the six years of the Giant Otter Project, whose team members have large experience with Amazonian aquatic mammals. It is very probable that *S. fluviatilis* was included in the ReBio Uatumã management plan due to mistaken identification. This species can be easily confused with young Pink Dolphins (*Inia geoffrensis*) even by biologists. The total length of juveniles of *I. geoffrensis* is similar to that of the Tucuxi Dolphin and juvenile Pink Dolphins are completely gray, which could cause the confusion.

It is interesting to note that in 1987, when the floodgates of Balbina were closed, the researchers of LMA/INPA caught, marked, and released nine adult Pink Dolphins in the reservoir under formation, which had become confined in small ponds just below the dam (V. M. F. da Silva, pers. comm.). This species already occurred above the dam and even today can be frequently seen in the lake. The dolphins marked in 1987 received a colored plastic tag attached to their dorsal fin. These tags are known to "migrate" and fall off the animal in a period of approximately one year due to water friction. This "migration" leaves a scar in the dolphins' fin that can be easily identified.

During the last six years, we recorded at least three times Pink Dolphins with that kind of scar in their dorsal fins (February 2003, February 2004, and April 2006).

Although the presence of Amazonian Manatees (*Trichechus inunguis*) was not recorded above the dam during the fauna survey carried out before damming the Uatumã River, the occurrence of this species was mentioned as being possible but in reduced numbers. However, during the six years of the Giant Otter Project, this species was never seen in the reservoir, neither through direct observations nor through traces (feces or chewed up plants). Nonetheless, the Amazonian Manatee is a species that is very difficult to be observed in the wild and unlike the Tucuxi Dolphin, it never exposes more than its nostrils out of the water when breathing (Rosas and Pimentel 2001). Therefore, if it occurs in reduced numbers in the area, it will be extremely difficult to be seen, and one cannot exclude the possibility that this species has never occurred in the lake.

According to the unpublished reports conducted before damming, the Red Howler Monkey (*Alouatta seniculus*) was the most abundant species, followed by the Brown Capuchin Monkey (*Cebus apella*), and the Golden-Handed Tamarin (*Saguinus midas*). In the surveys conducted by us, no abundance estimates were performed. Therefore, comparisons concerning species abundance, or number of individuals of a taxon in an area, population, or community, were avoided. However, *Alouatta seniculus* was very frequently seen and heard (visual and acoustic records), while *Cebus apella* was frequently seen.

At least one mammal species that is classified by IUCN (2007) as endangered (EN) is currently present in Balbina Lake: the Giant Otter (*Pteronura brasiliensis*). Despite the impacts caused by the damming process, this species apparently lives in stable populations. Nevertheless, additional medium and long term studies are necessary in order to obtain better information regarding the viability of these populations.

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**Table 2.** Birds recorded in Balbina reservoir and conservation status according to IUCN (2007). LC, least concern; and NL, not listed.

Order	Family	Scientific name	Common name	IUCN
Anseriformes	Anatidae	<i>Cairina moschata</i>	Muscovy Duck	LC
Caprimulgiformes	Caprimulgidae	<i>Chordeiles</i> sp.	Nighthawk	LC
	Nyctibiidae	<i>Nyctibius</i> sp.	Potoo	LC
Charadriiformes	Jacanidae	<i>Jacana jacana</i>	Wattled Jacana	LC
Ciconiiformes	Ardeidae	<i>Ardea cocoi</i>	White-Necked Heron	LC
		<i>Butorides striatus</i>	Striated Heron	LC
		<i>Ardea alba</i>	Great Egret	NL
		<i>Pilherodius pileatus</i>	Capped Heron	LC
		<i>Tigrisoma lineatum</i>	Rufescent Tiger-Heron	LC
	Ciconiidae	<i>Mycteria americana</i>	Wood Stork	LC
Coraciiformes	Alcedinidae	<i>Ceryle torquatus</i>	Ringed Kingfisher	LC
		<i>Chloroceryle americana</i>	Green Kingfisher	LC
		<i>Chloroceryle amazona</i>	Amazon Kingfisher	LC
		<i>Chloroceryle inda</i>	Green-and-Rufous Kingfisher	LC
		<i>Chloroceryle aenea</i>	American Pygmy Kingfisher	LC
Cuculiformes	Cuculidae	<i>Crotophaga ani</i>	Smooth-Billed Ani	LC
		<i>Crotophaga major</i>	Greater Ani	LC
Falconiformes	Cathartidae	<i>Coragyps atratus</i>	Black Vulture	LC
		<i>Cathartes aura</i>	Turkey Vulture	LC
		<i>Cathartes burrovianus</i>	Lesser-Yellow-Headed Vulture	LC
	Falconidae	<i>Sarcoramphus papa</i>	King Vulture	LC
		<i>Falco rufigularis</i>	Bat Falcon	LC
Galliformes	Cracidae	<i>Crax alector</i>	Black Curassow	LC
		<i>Mitu tuberosa</i>	Razor-Billed Curassow	LC
		<i>Ortalis motmot</i>	Little Chachalaca	LC
		<i>Pipile cumanesis</i>	Blue-Throated Piping-Guan	LC
	Opisthocomidae	<i>Opisthocomus hoazin</i> *	Hoatzin	LC
Gruiformes	Psophiidae	<i>Psophia crepitans</i> *	Gray-Winged Trumpeter	LC
Passeriformes	Cotingidae	<i>Lipaugus vociferans</i>	Screaming Pihás	LC
	Emberizidae	<i>Paroaria gularis</i>	Red-Capped Cardinal	LC
	Icteridae	<i>Cacicus cela</i>	Yellow-Rumped Cacique	LC
Pelecaniformes	Anhingidae	<i>Anhinga anhinga</i>	Anhinga	LC
Piciformes	Picidae	<i>Celeus elegans</i>	Chestnut Woodpecker	LC
		<i>Dryocopus lineatus</i> **	Lineated Woodpecker	LC
	Ranphastidae	<i>Ramphastos tucanus</i>	Toucan	LC
Psittaciformes	Psittacidae	<i>Pteroglossus aracari</i>	Aracari	LC
		<i>Ara arauana</i>	Blue-and-Yellow Macaw	NL
		<i>Ara macao</i>	Scarlet Macaw	LC
		<i>Ara manilata</i>	Red-Bellied Macaw	LC
		<i>Pionus menstruus</i>	Blue-Headed Parrot	LC
Trochiliformes	Trochilidae	<i>Amazilia</i> sp.	Hummingbird	--
Trogoniformes	Trogonidae	<i>Trogon</i> sp.	Trogon	--
Total number of bird species				42

\* Species recorded by Biological Reserve rangers and/or boat skippers working in the study area.

\*\* Species not recorded in surveys previous to the damming.

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Birds are the most well-known group among the vertebrates (Develey 2003). They are extremely diverse, with more than 9,000 different species in the world (de-Schauensee and Phelps 1978). A total of 243 bird species were recorded before damming, of which 157 species were identified close to the dam working site, on the northern side of the Uatumã River, in a period of five days (ELETRONORTE/CNPq/INPA – *Preservação e utilização científica da fauna. Relatório setorial. Julho-dezembro/1985*, unpublished data).

A considerably low number of birds, only 46 species, was recorded in the current study. However, among them, *Dryocopus lineatus* was not recorded in previous surveys conducted before damming the Uatumã River. About 94.5 % of the birds recorded by us were observed in open areas or close to the river margins. Nevertheless, in the same way as for the mammals, it is likely that among the birds that use the interior of the forest, some species with a certain degree of threat could be found.

**Table 3.** Reptiles recorded in Balbina reservoir and conservation status according to IUCN (2007). VU, vulnerable; LR/CD, lower risk/conservation dependent; LR/LC, lower risk/least concern; and NL, not listed.

Order	Family	Scientific name	Common name	IUCN
Testudines	Podocnemididae	<i>Podocnemis expansa</i>	Giant South American River Turtle	LR/CD
		<i>Podocnemis unifilis</i> *	Yellow-Spotted Amazon River Turtle	VU
Crocodylia	Alligatoridae	<i>Caiman crocodilus</i>	Spectacled Caiman	LR/LC
		<i>Melanosuchus niger</i> **	Black Caiman	LR/CD
Squamata	Boidae	<i>Eunectes murinus</i>	Anaconda	NL
	Teiidae	<i>Tupinambis teguixin</i>	Tegu	NL
Total number of reptilian species				6

\* Species not seen, but captured by Chelonian specialists working in Balbina Lake;

\*\* Species not recorded in surveys previous to the damming.

Regarding the reptiles, six species were observed, which corresponds to 16.2 % of the total species recorded during the damming period. Among them, the Yellow-Spotted Amazon River Turtle (*Podocnemis unifilis*) is currently categorized as vulnerable according to IUCN (2007). However, like all other species here reported, it is believed that its populations do not suffer threats in the reservoir due to the large dimensions of the lake and the low hunting pressure, since it is a biological reserve. The Black Caiman (*Melanosuchus niger*) was recorded in the ReBio Uatumã management plan and was also recorded in this study, but it was not included on the pre-damming fauna list (ELETRONORTE/CNPq/INPA – *Preservação e utilização científica da fauna. Relatório setorial. Julho-dezembro/1985*, unpublished data). This may be due to the fact that this species, at that time, was considered rare or in low density in the Uatumã River, but presently it

has benefited by the lake conditions after the damming of the river (R. Silveira, pers. comm.). According to Best (1984), this species prefers lentic waters such as *várzea* lakes and *igapó* forest, and due to the lack of hunting pressure in the reserve, it was probably able to increase its population size after the lake formation. However, density studies are recommended in order to obtain information regarding the population size of the Black Caiman in the ReBio Uatumã area.

According to dos-Santos (2003), fauna and flora surveys are the first steps for the conservation and rational use of a certain area. Although the results here presented are preliminary, they are certainly an important contribution for the consolidation of the ReBio Uatumã management plan and contain information that can be used for conservation actions in hydroelectric reservoirs throughout Amazon.

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