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Freshwater dolphin/fisheries interaction in the Central Amazon (Brazil)

by

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Abstract

An analysis of the relative importance of different types of fishing gear on Amazon dolphin mortality based on samples of 33 *Inia geoffrensis* and 34 *Sotalia fluviatilis* revealed the lampara seine was most lethal (82.8 %) for *Inia* whereas drifting and fixed gill nets (38.3 % and 35.3 %, respectively) were most important in *Sotalia* mortality. These three types of gear accounted for a total of 92 % of all *Inia* captures and 88.2 % of *Sotalia* incidental captures. The use of nylon gill nets in fishery in the Amazon is widely spread throughout the whole region, and with increasing fisheries pressure the potential for dolphin/-fisheries interactions is much greater. Competition between man and dolphin for commercial fish is still minimal in the Central Amazon. Dietary analysis has shown that only 43 % of 53 identified prey species are of commercial value and that the dolphins generally prey on size-classes of fish below those of commercial interest. Interviews with fishermen in the boats, in the fishmarket and in the shops supposedly selling dolphin products were conducted in an attempt to quantify the overall incidental kill attributed to commercial fisheries operations. The results showed that in the Central Amazon dolphin catches are incidental and only a very small number of these carcasses are used for commercial purposes.

Keywords: **Fisheries, incidental capture, freshwater dolphins, Central Amazon, boto, tucuxi.**

*Dr. Robin C. Best passed away on December 17, 1986. He was a Research Associate of the Vancouver Public Aquarium.

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Introduction

The Amazonian freshwater dolphins, *Inia geoffrensis* (boto) and *Sotalia fluviatilis* (tucuxi), have been little studied and their population size, number, and status are still unknown (BEST & SILVA 1994; SILVA & BEST 1996). As part of a general study of the biology and conservation of the aquatic mammals of the Amazon region, researchers at the National Institute for Amazonian Research (INPA) in Manaus have undertaken a study of these two dolphins (MAGNUSSON et al. 1980; SILVA & BEST 1982, 1994, 1996; SILVA 1983, 1986, 1990, 1994, 1995; BEST 1984; BEST & SILVA 1984, 1989a, b, 1993, 1994). Although knowledge of these species has increased in recent years (e.g. TRUJILLO 1994; Mc GUIRE 1995; UTRERAS 1996) much remains to be learned about their biology and conservation status.

The increasing fisheries pressure in the Amazon in the last decades has greatly heightened the potential for dolphin/fisheries interactions. This in turn could adversely affect the status of the dolphins, both through higher rates of incidental mortality in fishing gear and through direct competition for certain fish species. Recommendations for studies of the quantitative aspects of entanglements and fisheries interactions were made during the "Workshop on mortality of cetaceans in passive fishing nets and traps" (IWC 1994).

Material and methods

In this paper we summarize data on 67 dolphins, 33 *Inia* and 34 *Sotalia*, collected between May 1979 and March 1984 in the Central Amazon region. This collection is the result of our contacts with local and with INPA's fishermen and is by no means a quantitative sampling of all dolphin mortality for this region.

In an attempt to quantify the overall incidental kill resulting from commercial fisheries operating in the Central Amazon, a total of 132 boats were visited, and fishermen were interviewed when they arrived in the harbour to sell their fish. The main questions were: 1) Number of fishery-days per trip; 2) Size and capacity of the ice box; 3) The distance of the fishing area from Manaus; 4) Type of fishing equipment used during the fisheries operation; 5) The main target species; 6) Frequency of incidental catching of boto and tucuxi; 7) Number of botos and tucuxis caught in the last two trips; 8) Damage to the nets and the cost of repair; 9) The use of boto and tucuxi carcasses.

Visits and interviews in the shops and in the market in Manaus supposedly selling dolphins products were also conducted. The main purpose of the visits was to find out if the products were available and the use of the different parts of the dolphins. The interview was always made as an informal conversation as if the interviewer was a person shopping.

Results

Our interviews with the fisherman showed that the average number of fishery-days per trip for these boats varies between 2 and 30 days, depending on the size and capacity of the ice box, and the distance of the fishing area from Manaus. Of these boats, 67.4 % were fishing with lampara seines, 24.2 % with drifting gill nets, 3.8 % fixed gill nets, and 4.6 % with other types of fishing equipment. The main target (91.7 %) was the jaraqui *Semaprochilodus* sp., a very popular and abundant species of the Semaprochilodontidae family.

There are 13 types of fishing gear in use in the Amazon region (PETRERE 1978; GOULDING 1980; SMITH 1981). Of these, only three may be considered a risk to dolphins. Lampara or beach seines accounted for 43.3 % of the dolphins captured, but were more lethal for *Inia* (82.8 %) than *Sotalia* (Table 1, Fig. 1). This difference probably results from the facts that these seines are used from beaches and that *Sotalia* generally avoids shallow inshore areas (SILVA 1983; SILVA & BEST 1994). *Inia* uses the partially set net as a wall to assist in the catching of fish while the fishermen await large schools of migrating fish of the genera *Semaprochilodus*, *Curimata*, *Hemiodus*, *Hemiodopsis*, *Brycon*, etc. Often these dolphins are inside when the net is closed and are thus more frequently captured. Both species of dolphins are to some extent protected by local superstitions and usually, if captured alive, are released unharmed. Mortality occurs infrequently when the dolphins become tangled in the net or trapped in the purse.

The second most important fishing gear in relation to dolphin mortality is the fixed gill net, which accounted for 28.4 % of dolphin mortality in our sample. This method has a slight tendency to capture more *Sotalia* (63.2 %) than *Inia*. Such gill nets are of varying lengths and mesh sizes, depending on the type of fish to be captured. Large-scale use of gill nets in the Amazon is relatively recent (SMITH 1981) and is related to the availability of nylon for manufacture. As the location of fixed gill-nets within a river varies greatly, both species of dolphins may be caught, usually with high mortality due to the ease of entanglement. *Inia* has become adept at stealing fish from this type of net and may cause significant damage to the net. Adult *Inia* are, in most cases, capable of tearing their way out of these nets if entangled.

The third type of fishing gear which is responsible for dolphin mortality is the drifting gill net used mainly in the fishery for large catfish (e.g. *Brachyplatistoma* spp.). As they are used in the main river channels, they capture principally *Sotalia* (92.9 %) as this habitat is less frequented by *Inia*. Moreover, the larger *Inia* is usually capable of tearing free from this type of net, and thus rarely appears as a by-catch in this fishery.

The "other" category in Table 1 refers essentially to animals killed by harpoon. This type of killing is casual, and may occur when a dolphin is disturbing a fisherman or his fishing gear, or may simply be a case of presenting an irresistible target.

There is some seasonality in the captures (Fig. 1), in that many of these fisheries are dependent on seasonal fish migrations as well as the concentrating effect of the low dry-season river levels.

Only 5 boats admitted encounters with tucuxi (a total of 9 individuals). Only one dead animal was found, entangled in a fixed gill net; the others were caught in lampara seines and released alive. Five boats admitted encounters with *Inia* (a total of 6 animals), four using lampara seines and two drifting gill nets. One animal escaped through the net and the others were said to have been released alive.

Although no quantitative data are available on the total incidental kill of freshwater dolphins, as well as any population impact, we have been able to define the three types of fishing gear involved. Of these, lampara or beach seines account for about 21 % of the total fish catch, gill nets for about 15 % and drifting gill nets for approximately 13 % (BAYLEY 1981). In general, in the Central Amazon, if dolphins are captured alive they are released.

There is a small market value for the dried eyes and sexual organs of the dolphins, which are used as a love charm, but the meat has no market value as it is not eaten. All catches are probably incidental and only a very small number of any carcasses are used

for commercial purposes in the Central Amazon. An unquestionable hostility towards dolphins does exist on the part of the commercial fishermen. This hostility, which could negatively impact both dolphins species, has been countered traditionally by numerous protective superstitions about the dolphins (SILVA 1990; SLATER 1994). However, as the economic pressures of the commercial fishery become greater, these superstitions are likely to be less respected, especially by the younger fishermen.

Dolphin competition with commercial fisheries

In a study of food habits and feeding ecology of both Amazon freshwater dolphins, SILVA (1983, 1986) found that *Inia* and *Sotalia* together consumed more than 53 species of fish. *Inia* was much more a generalist predator, with 43 prey species, while *Sotalia* took 28 species. Some 13 species of fish were consumed by both dolphins. Analyses involving the frequency of occurrence and biomass of the prey species (BARTHEM 1981) indicated that little competition exists between these two sympatric dolphins.

Comparing dolphin prey species with the fish species sold at the fish market in Manaus (PETRERE 1978), 43 % (Table 2) of those eaten by the dolphins have some commercial value. However, virtually no competition exists between dolphin and fishermen; based on percentage weight as a means of testing the relative importance of these commercial species for human consumption and for dolphin food (Fig. 2). Additionally, we have noted that the size-ranges of commercial fish species eaten by the dolphins are generally much smaller than those taken in gill nets (Fig. 3). The dolphins are therefore preying on the more abundant smaller size-classes. Should the commercial exploitation of a given fish species be intensified, this dual exploitation of large and small size-classes could be damaging to that fish species. However, given the wide array of species utilized by each dolphin they would likely be able to switch to other more nutritionally profitable prey.

Conclusion

Our investigations indicated that information given by fishermen are not precise, and most of the time they are afraid to answer, refuse to talk, or lie in an attempt to avoid future problems with fisheries legislation or tax increases.

There is a lack of information on gillnet and other fisheries techniques involving entanglement or entrapment of aquatic mammals species throughout the Amazon region. Here, fisheries operate with almost no control on activities, which makes the collection of adequate statistical information extremely difficult. Both *Inia geoffrensis* and the riverine ecotype of *Sotalia fluviatilis* are apparently abundant throughout their present distribution (BEST & SILVA 1989a, b; SILVA & Best 1994, 1996; BOROBIA et al. 1991). However, estimates of population density over the range of these river dolphins are not available and recommendations on conservation research needs and fisheries management need to be implemented (CRESPO et al., unpubl.; IWC 1994).

Resumo

Uma análise da importância relativa dos diferentes tipos de aparelhos de pesca na mortalidade dos golfinhos da Amazônia baseado na amostra de 33 *Inia geoffrensis* e 34 *Sotalia fluviatilis*, revelaram que a rede de arrasto foi a mais letal (82,8 %) para *Inia* enquanto que a rede de deriva e malhadeiras fixas 38,3 % e 35,3 % foram, respectivamente, mais importante na mortalidade de *Sotalia*. Esses três tipos de redes contribuiram para um total de 92 % de todas as capturas de *Inia* e 88,2 % das capturas acidentais de *Sotalia*. O uso das redes de nailon nas pescarias na Amazônia, é amplamente utilizada em toda a região. Com o aumento da pressão da pesca, o potencial para interações entre golfinhos/pescarias é bem maior. A competição entre o homem e os golfinhos pelos peixes comerciais ainda é mínima na Amazônia Central. Análise dos hábitos alimentares desses golfinhos, mostraram que somente 43 % das 53 espécies de presas identificadas possuem valor comercial e que geralmente, os golfinhos predam sobre classes de tamanhos de peixes menores do que as classes de tamanhos de interesse comercial. Entrevistas com pescadores nos barcos, mercados e lojas, supostamente vendendo produtos originários de golfinhos foram feitas na tentativa de quantificar a captura acidental atibuida a pesca comerial. O resultado mostrou que na Amazônia Central a captura de golfinhos é acidental e apenas uma pequena proporção das carcaças são usadas para fins comerciais.

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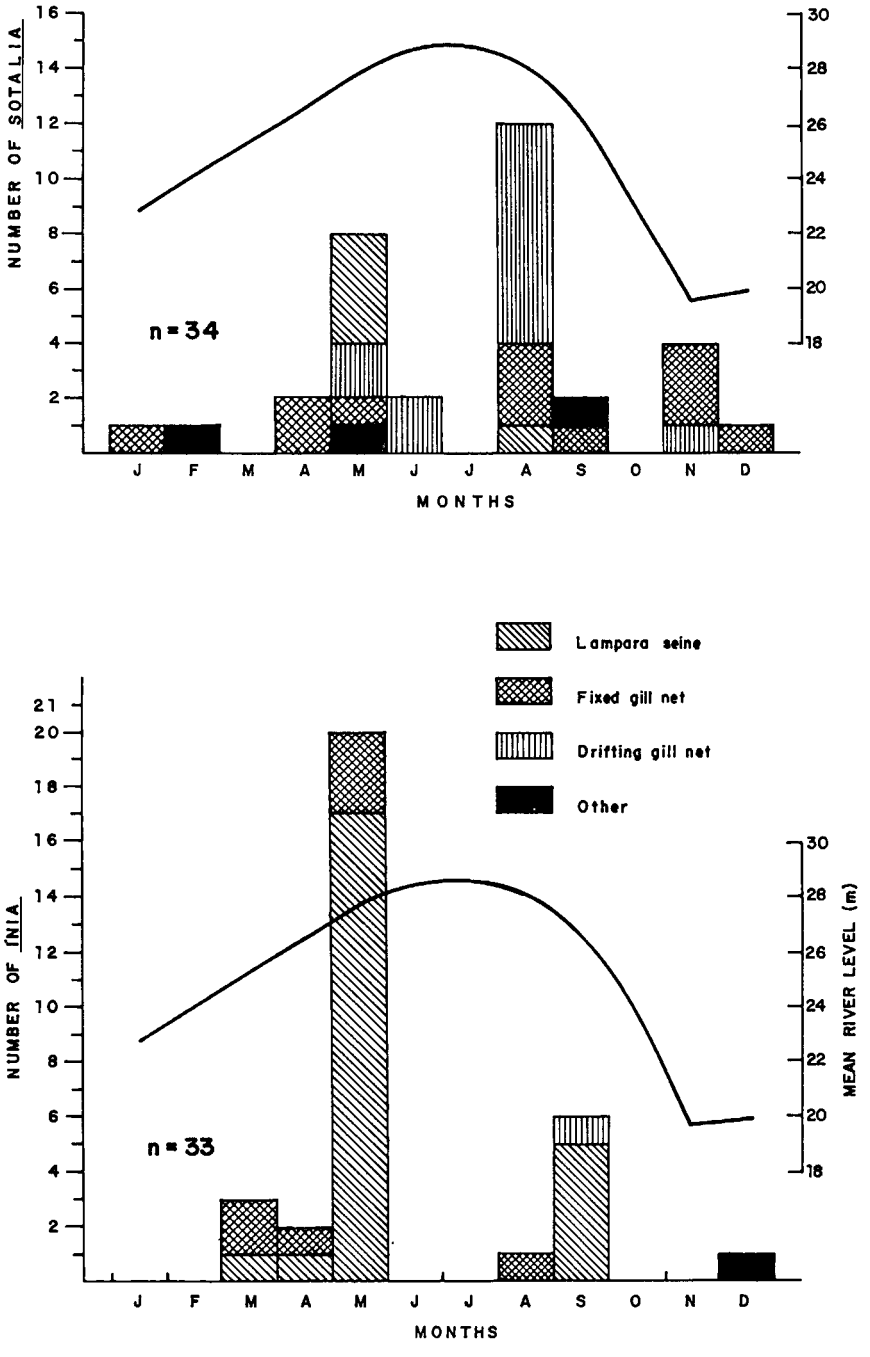

Fig. 1:
The number of freshwater dolphins, *Ina* and *Sotalia*, captured in different types of fishing gear in the Central Amazon (Brazil), showing month of capture and the mean annual river levels at the time of capture.

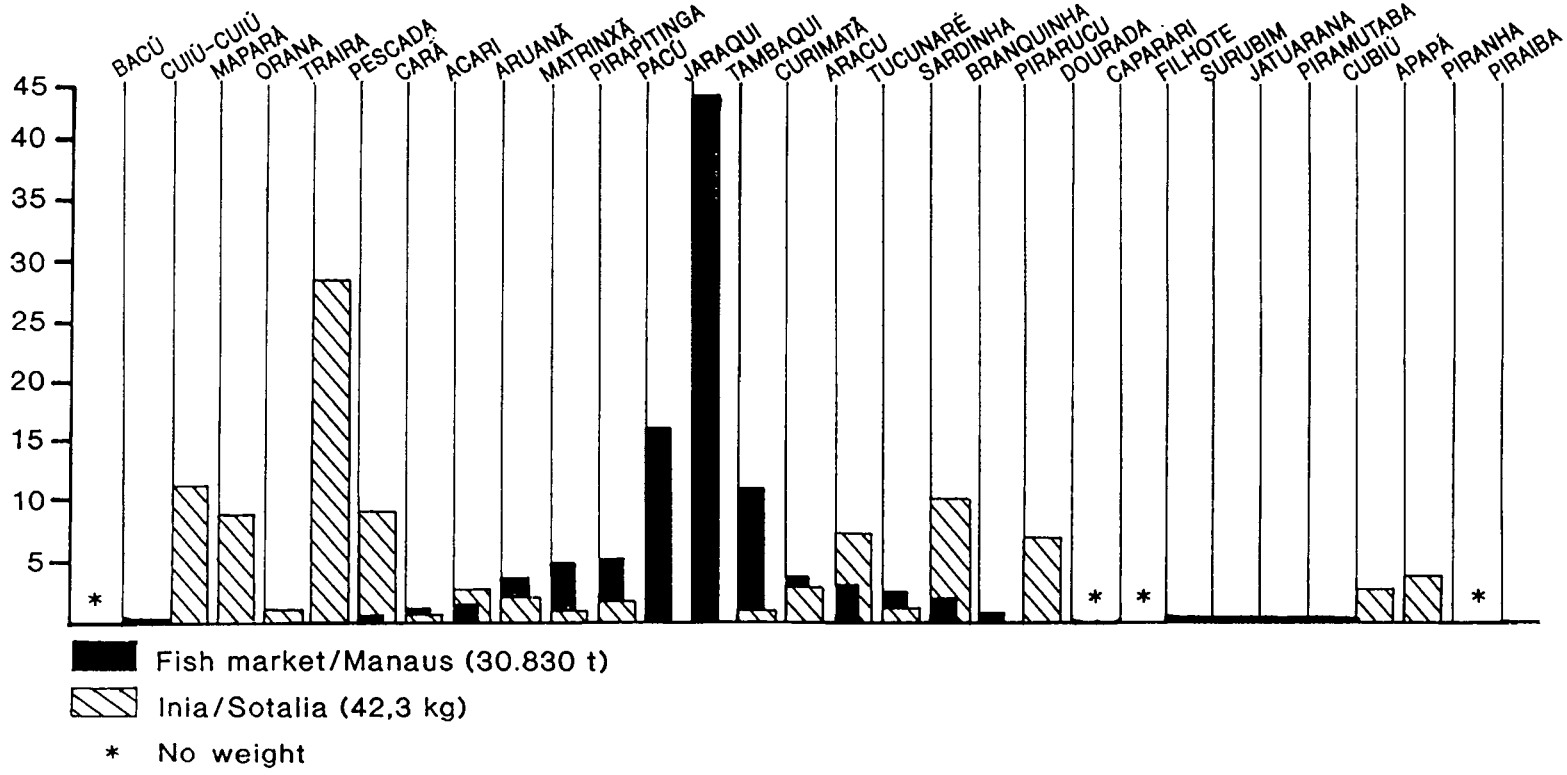

Fig. 2:
A comparison of the relative proportions (% weight) of fish commercialized in the fish-market at Manaus, Brazil, and the commercial species of fish consumed by the freshwater dolphins, *Inia* and *Sotalia*.

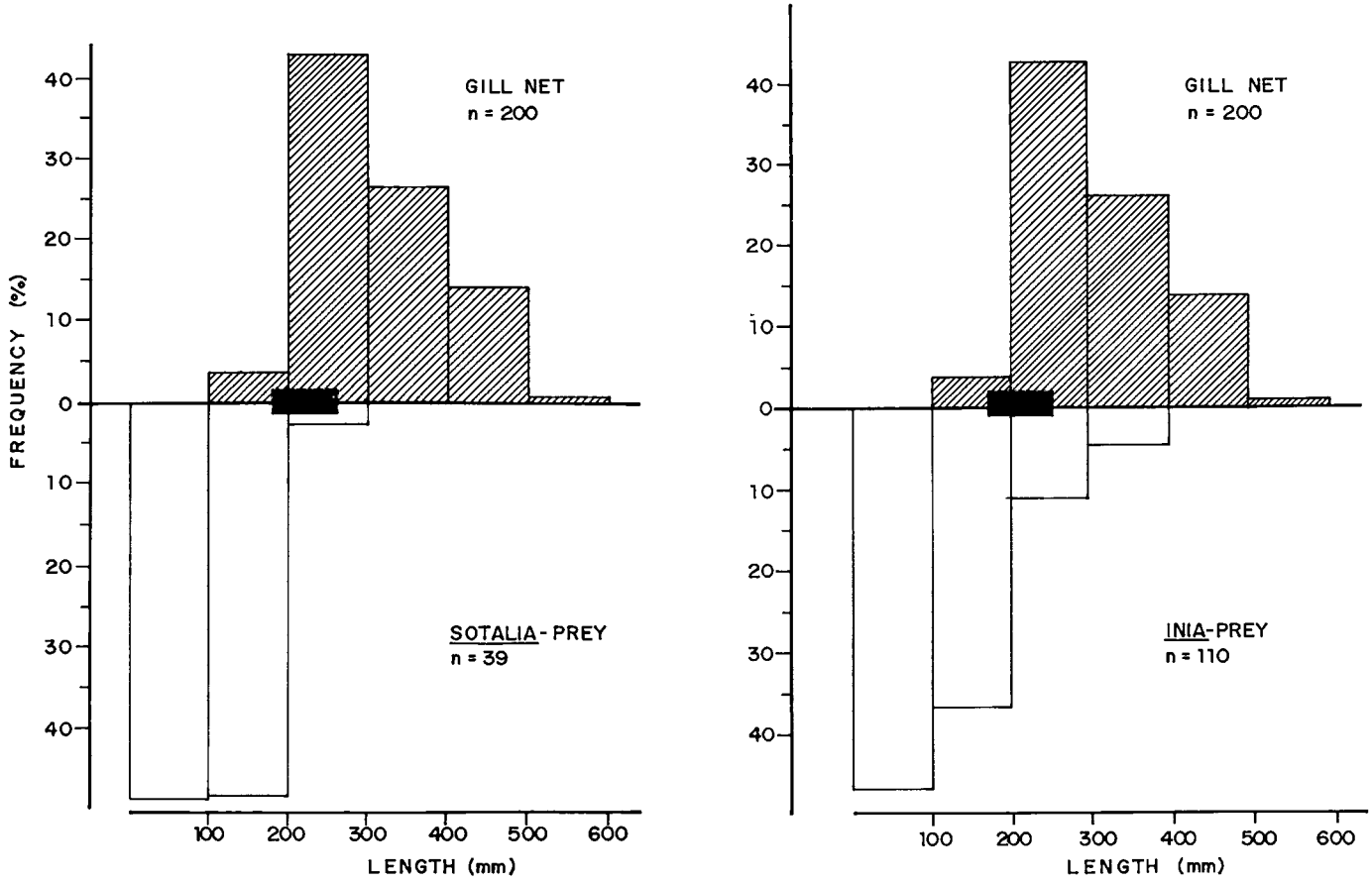

Fig. 3:
Data on the size-frequency of *Plagioscion* spp. (freshwater croakers) captured in commercial gill nets at Lago Amana, Japurá River (BRATHEM 1981) compared with those recorded from dolphins collected in the same lake at approximately the same time.
The black bar indicates length range of sexual maturity for these species.

Table 1: Capture of dolphins in different types of fishing gear in the Central Amazon, Brazil.

Type of fishing gear	*Inia*		*Sotalia*		Total	
	N	%	N	%	N	%
Lampara seine (rede de arrasto)	24	82.8	5	17.2	29	43.3
Fixed gill net (malhadeira)	7	36.8	12	63.2	19	28.4
Drifting gill net (caçoeira)	1	7.1	13	92.9	14	20.9
Other	1	20.0	4	80.0	5	7.5
Total	33		34		67	

Table 2: Common and scientific names of fish in Fig. 2.

1	Bacú	*Pterodoras* spp.
2	Cuiú-cuiú	*Oxydoras niger*
3	Piraíba	*Brachyplatistoma filamentosum*
4	Piramutaba	*B. vaillantii*
5	Filhote	*Brachyplatistoma* sp.
6	Dourada	*B. flavicans*
7	Caparari	*Pseudoplatistoma tigrinus*
8	Surubin	*P. fasciatum*
9	Pirarucú	*Arapaima gigas*
10	Aruanã	*Osteoglossum bicirrhosum*
11	Tambaqui	*Colossoma macropomum*
12	Pirapitinga	*C. bidens*
13	Pacú	*Mylossoma* spp., *Myleus* spp.
14	Apapá	*Pellona* spp.
15	Jatuarana	*Brycon* sp.
16	Matrinchã	*Brycon* sp.
17	Curimatã	*Prochilodus nigricans*
18	Jaraqui	*Semaprochilodus* spp.
19	Orana	*Hemiodus* spp., *Hemiodopsis* spp.
20	Cubiú	*Eigenmanina melanopogum*
21	Branquinha	*Curimata* spp.
22	Sardinha	*Triportheus* spp.
23	Pescada	*Plagioscion* spp.
24	Aracú	*Schizodon* spp.
25	Traíra	*Hoplias malabaricus*
26	Mapará	*Hypophthalmus* spp.
27	Cará	*Geophagus* spp.
28	Tucunaré	*Cichla* spp.
29	Piranha	*Serrasalmus* spp.
30	Acarí	*Plecostomus* spp.