



Mamirauá Institute for
Sustainable Development

Caiman and **dolphin mortality** associated
to the **piracatinga fishery** in the mid
Solimões river region - Amazonas, Brazil





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Ministry of
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Caiman and **dolphin mortality** associated to the **piracatinga fishery** in the mid Solimões river region - Amazonas, Brazil

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Ministry of
**Science, Technology
and Innovation**

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in the mid Solimões river region - Amazonas, Brazil

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Foreword

Fishing is an important component in Amazonian economy and in the social characterization of the Amazonian people. Market trends, political context and current legal scenario influence and determine the dynamics of the activity. A growing concern has been recently recorded associated with the fishery of the piracatinga (*Calophysus macropterus*), a catfish not particularly appreciated by local inhabitants in the Brazilian Amazon, but which has commanded increasing demand by the Colombian fishing market and, apparently, other non-Amazonian Brazilian markets as well.

The piracatinga fishery is becoming, slowly but surely, an informal cash alternative for riverine communities along the mid course of the Solimões river, in the Brazilian Amazon, as well as an item of interest for regional fish traders. Due to the informal character of the fishery, and the peculiarities of the trade, it is difficult to obtain systematic information on the extent of the fishery, given the fear of fishermen and traders alike to volunteer information, in an attempt to not be associated to illegal activities of caiman and dolphin culling. Nevertheless, based on reports by fishermen and local inhabitants, commercial records from some freezing plants and fish warehouses, as well as reports of individual production from members of fishermen associations, we have clear indications of the increase in trade of this fish in the last 10 years.

This fishery was first recorded in the mid-Solimões river area, Brazilian Amazon, as early as 1997. But it was not until the 2000's, when the first official records of the use of caiman and dolphin as bait in the fishery in the region appeared, that a growing incidence of this fishery associated with its demand by regional trade boats was identified. Those aimed at supplying demands for fish in the Brazilian-Colombian border, especially at the time of Lent and Holy Week, when religious perceptions stimulate greater consumption of fish. This demand for piracatinga has been gradually increasing since then, and is now reported not only immediately prior to the Holy Week, but also throughout the year, and to supply the internal Brazilian market as well.

Fishing and trading piracatinga, at this point, suffer no legal restrictions, but the fact that the activity intensively employs caiman and dolphin meat as bait in the fishery, has lent the activity a predatory and strong environmental threat character. The increasing trends of these activities have raised great environmental and scientific concern, as well as in national and international political arenas.



The potential negative impact of capture of specimens to become bait in the piracatinga fishery, on the natural populations of caiman and dolphin, has raised concerns about the conservation status of those species, especially in the case of the pink dolphin (*Inia geoffrensis*) – considered a charismatic species in the social and cultural contexts, and almost threatened by the Brazilian environmental authorities¹, but as of yet lacking demographic data. The concern as to the use of caiman for this purpose seems lesser, likely due to the great abundances of the species recorded in the region, in particular within the Mamirauá reserve and surroundings. Nevertheless, the parsimony of information on the demography of both species has rendered difficult the understanding of the dimension of effects of such piracatinga fishing practice on the natural populations of dolphin and caiman in the region.

1 - PLANO DE AÇÃO NACIONAL PARA A CONSERVAÇÃO DOS MAMÍFEROS AQUÁTICOS: PEQUENOS CETÁCEOS / Barreto, A.S. ... [et al.]; organizadores Rocha-Campos, C.C., Câmara, I.G., Pretto, D.J. - Brasília: Instituto Chico Mendes de Conservação da Biodiversidade, Icmbio, 2010.



Everson Tavares





Diego de Lima Franco

Since 2003, the Mamirauá Institute has studied, accompanied whenever possible, and recorded different aspects of the piracatinga fishery, the structuring of the new production chain and some aspects of the market and fishery production in the municipality of Tefé, AM. In addition, the Institute has studied the use of caiman and dolphin as bait for this activity within the Mamirauá and Amanã reserves and their surroundings. In this context, we have recorded caiman as the mostly used bait for the piracatinga fishery. This more frequent use is likely associated to the large natural abundance of black caiman (*Melanosuchus niger*) in the mid-Solimões river region. On the other hand, the capture of pink dolphin for use as piracatinga bait has been recorded in a more opportunistic and incidental way, mainly following incidental entanglements in fishing nets, which is in fact considered the major threat to the species, throughout its distribution. Records of directed or intentional entanglement are anecdotal reports by fishermen from other regions where, according to them, massive captures of dolphins are associated with commercial fishing activities.



Nowadays, the piracatinga fishery takes place throughout the year, but presents an activity peak during the month of March. The capture of this fish is done in an artisanal way, and by few members of the riverine communities only. The activity is conducted characteristically by persons from several age classes, who engage in the different phases of the process, from the capture of the bait to benefitting and selling the fish. The main reason for the development of such activities, according to local inhabitants, is the lack of subsistence alternatives and the apparent immediate cash return offered by this kind of fishery.

We hereby intend to present, in a comprehensible and accessible way, part of the large amount of information that has been amassed and analyzed by members of the Mamirauá Institute over the past 10 years. The aim of this document is to make available a rare compilation of paramount information for the understanding of this activity, for a better definition of this environmental crisis that we witness in the Brazilian Amazon, and for the search of better solutions to such a crisis. These information, in a more appropriate format and deepened content, are already being published in scientific media. But we understand that the dissemination of such information among the various other segments of society is necessary, thus allowing a broader debate about these themes. A deeper, informed discussion, and better supported by hard data, regarding this environmental crisis, is fundamental such that better measures be adopted to prevent some of the aspects of the piracatinga fishery to continue. We hope that information presented here may contribute to this informed, free of prejudices discussion, and directed only towards the conservation of natural populations of dolphins and caiman, and to the sustainable use of fishery resources in the Brazilian Amazon.

In the last few years the Mamirauá Institute, in partnership with public law enforcement institutions, has worked on capacity-building of volunteer environmental agents, so that the Mamirauá and Amanã reserve inhabitants may protect their own territories.



Introduction

The piracatinga is one of a number of fish species, commonly known as catfish, member of the family Pimelodidae, Order Siluriformes. It is a medium-sized fish that may attain approximately 50 cm total length and weigh up to 1 kg. This catfish is an extremely voracious carnivore, that feeds mainly on fish and invertebrates, but may also take fish remains and other dead animals, fruit and plant remains. Due to its necrophagous feeding habit, which is opportunistic, local dwellers from the mid-Solimões river region, including the inhabitants from Mamirauá and Amanã reserves, strongly resist to its consumption. For this same reason, the species is not appreciated as a food item in the region, as well as in many other areas of the Brazilian Amazon.



Scientific name

Calophysus macropterus,
Lichtenstein 1819.

Common names

Piracatinga, Urubu d'água Water
vulture, Mota, Zamurito, Picalon.

Fake names in Brazil

Douradinha e pintadinha.

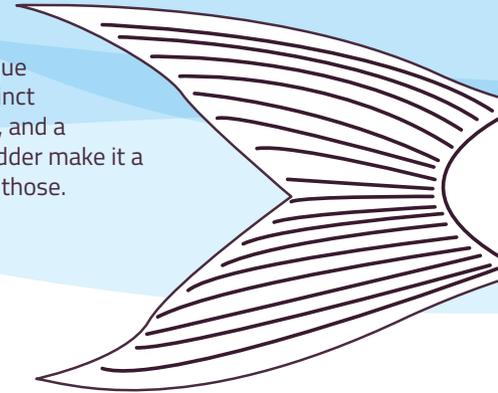
Size

Up to 50 cm total length
and up to 1 kg in weight.



Description

Body somewhat elongated and broad head. Eyes at the top of the head. Flattened barbels, with a maxillary pair extending past the end of the adipose fin. First ray of the dorsal and pectoral fins not firm. Number of spots on the body greatly variable among populations. This fish has, at times, been placed in its own family, the Calophysidae. Despite its external similarity to other pimelodids (long-whisted catfishes), its unique dentition, the distinct location of its fins, and a reduced swim bladder make it a distant relative of those.



The piracatinga

According to the Fundación Omacha², from Colombia, the piracatinga was introduced to the market of Colombian large urban centers at the end of the 1990's, as a market replacement to supply the demand for a different fish species, highly sought for the fishing industry and Colombian consumers, the capaz (*Pimelodus grosskopfii*). Overfishing of this species in that country and a haphazard marketing of the species caused the decline of its populations, previously abundant in the Magdalena river basin (main river in Colombia).

The onset of the piracatinga commercial fishery was a characteristically urban and/or semi-urban activity, where butchery animal remains and innards and

post-processing remains from freezing plants were used as bait. However, the high demand from Colombia for this fish stimulated and has maintained the growth of the fishing and commercial network that explores this replacement of the capaz. This network has strengthened and expanded based on the common principle of supply and demand, where an increase in demand is followed by an increase in supply, in addition to the peculiarities of the current commercial systems in Amazonia.

Under this context, the decline in the capaz fishery in Colombia, associated with the abundant supply of piracatinga in Brazil, allowed the fishing production of the latter to become a potentially profitable alternative.

2 - www.omacha.org

3 - Gómez, C.; Trujillo, F.; Diazgranados, M.C.; Alonso, J.C. Capturas dirigidas de delfines de río en La Amazonia para la pesca de mota (*Calophysus macropterus*): una problemática regional de gran impacto. In: Trujillo, F.; Alonso, J.C.; Diazgranados, M.C.; Gómez, C. Fauna Acuática Amenazada en la Amazonia Colombiana: análisis y propuestas para su conservación. Bogotá, Colombia: Fundación Omacha; Fundación Natura; Instituto Sinchi; Corpoamazonia, 2008.

Distribution

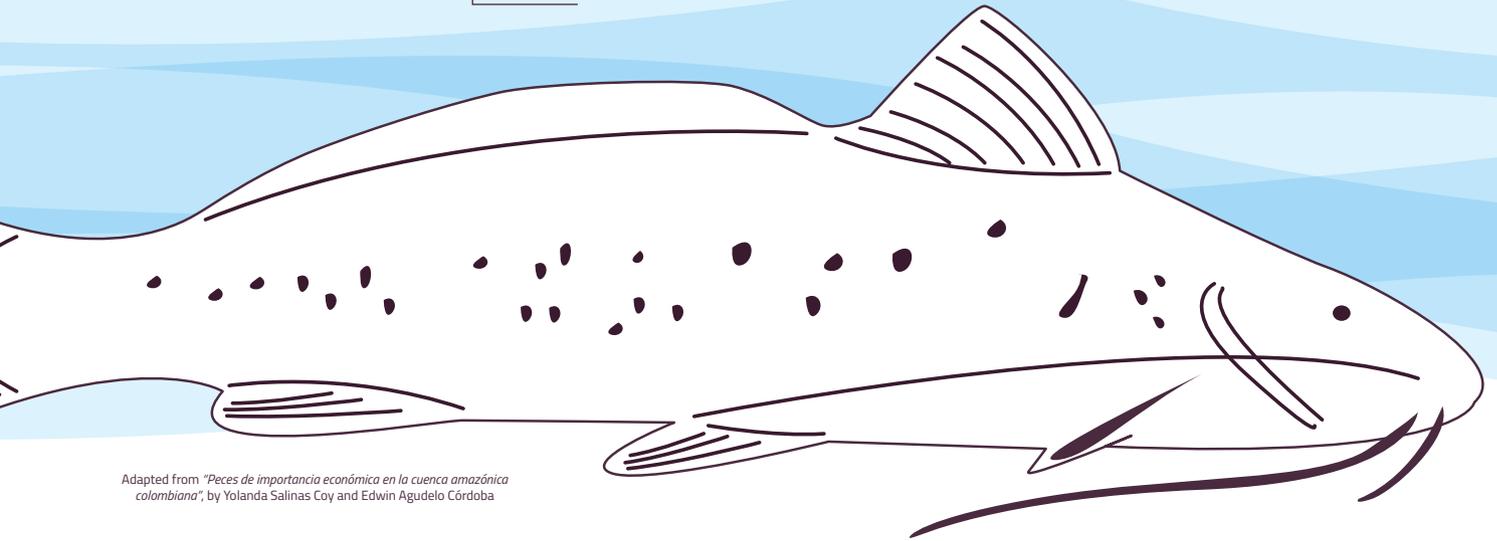
Amazonas and Oricono river basins.

Habitat

Common in shallow waters in the Amazon, near river margins, where it is often seen in concentrations close to human populations, consuming food remains.

Diet

Opportunistic and necrophagous carnivore

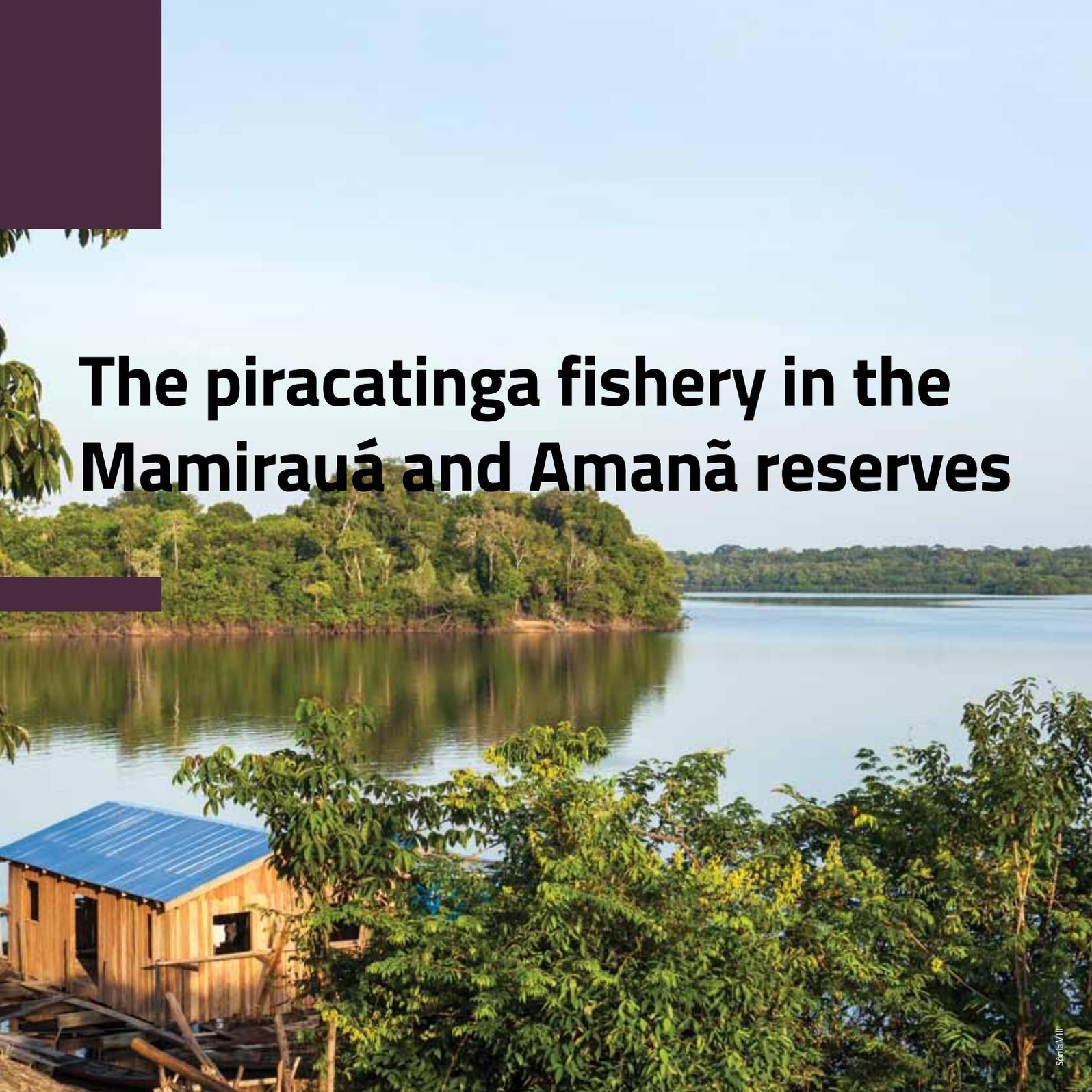


Adapted from "Peces de importancia económica en la cuenca amazónica colombiana", by Yolanda Salinas Coy and Edwin Agudelo Córdoba

This raised interest of producers from the fishing segment and, subsequently, of fishermen and riverine communities, including many that did not have the tradition in this fishing activity, let alone a fishery for this catfish. The piracatinga fishery has broadened its geographical reach, generating insertion of new technologies and new commercial relations, aiming at a larger productivity and consequently greater income. Due to these factors, in the past 15 years we have observed an evolution in the initial segments of the production chain, especially in bait production and in the fishing activity itself. Circumstances which involved the beginning of the use of caiman and dolphins as bait for this fishery are yet not well known, and are not well documented, but today we are aware that these are the predominant bait in this type of fishery in the mid-Solimões river region.

The potential profitability of the fishery and the fact that transport, marketing and consumption of piracatinga have no legal restriction, in addition to lacking law enforcement, cause fishermen and traders to not have any concern about the illegal aspect of using caiman and dolphins as bait.

The capture and fishing process of piracatinga has evolved most rapidly in the past few years, showing a great variety of techniques and adaptations, many of them associated to specific groups of fishermen. Catching piracatingas in the mid-Solimões river region is generally done by one of three main methods: using a corral or box without a door; employing a corral, or simple box; or simply using a canoe. All these fishing techniques employ bait as attractants to facilitate the capture of piracatinga.

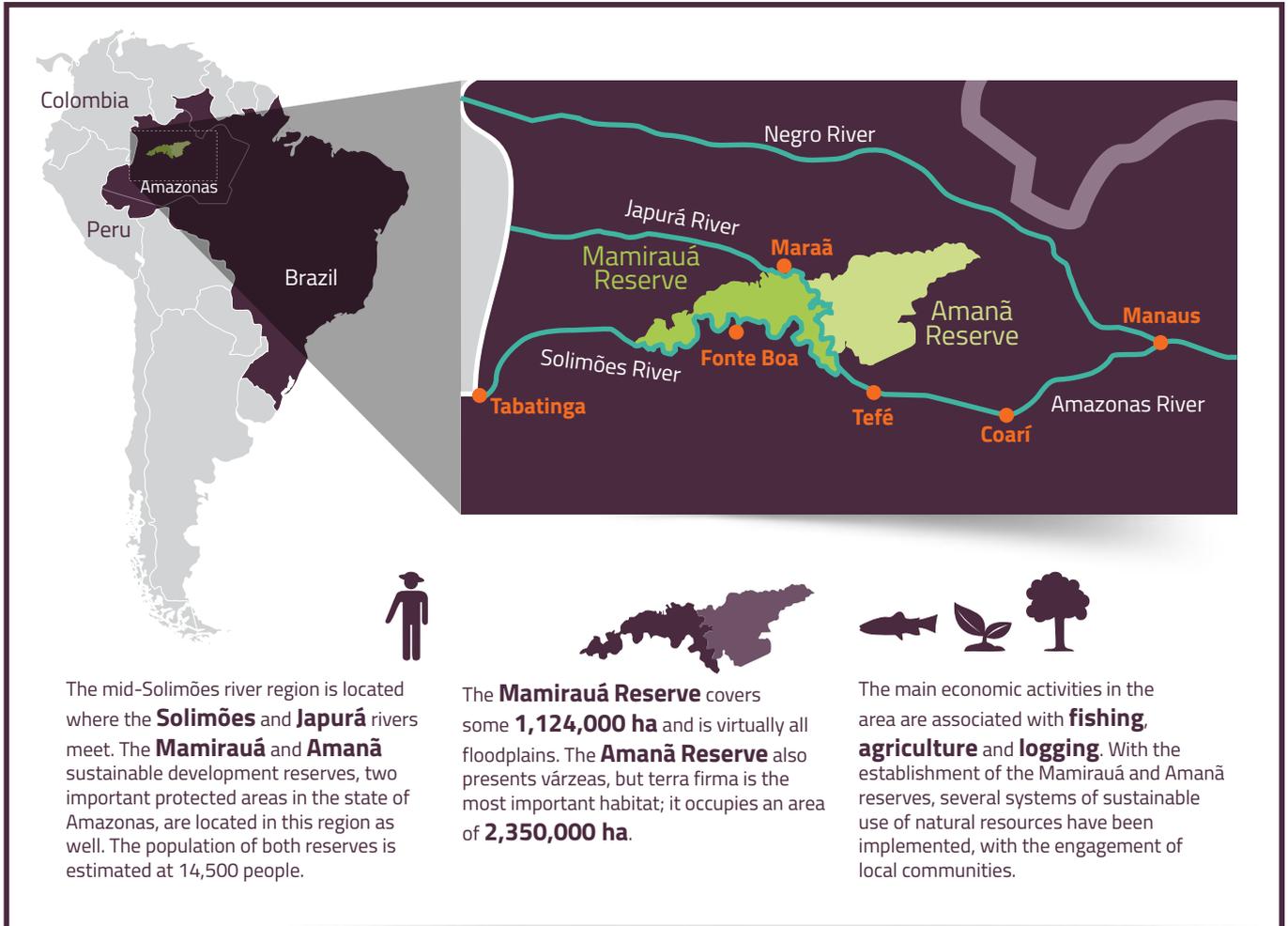


The piracatinga fishery in the Mamirauá and Amanã reserves

Traditionally, in the mid-Solimões region, the catfish fishery is conducted by means of a combined system of nets and hooks. Target species are large and supply a market strongly established decades ago. This activity demands heavy investments and great efforts on the part of fishermen specialized in this type of fishery. The technique used in the piracatinga fishery, however, is characterized by a lack of specialization, low level of investment, focus on a small-size species and by the use of bait from large dead animals, preferably with large amount of fat, which does not constitute a traditional activity by the fishermen in the region.



Mid-Solimões river region



The first records of the piracatinga fishery in the surroundings of the Mamirauá Reserve occurred around 1997. The first documentation on these records appeared in 2001, when a report was elaborated and sent to IBAMA, and distributed to environmental organizations⁴. These reports describe the use of caiman as bait, using wooden boxes locally known as "corrals" as the fishing gear. First with anecdotal records, and then compiling information through opportunistic and systematic monitoring, the Mamirauá Institute has managed to record some characteristics of this system, associated with fishing and marketing piracatinga. These information range from the capture of caiman and dolphins to be used as bait, to relevant aspects of the production chain and its insertion in the economic dynamics of the region.



Marcelo Santana

4 - Estupiñán, G.M.B.; Marmontel, M., Queiroz, H.L., Souza, P.R., Valsecchi, J.A., Batista, G.S., e Pereira, S.B. A pesca da piracatinga (*Calophrys macropterus*) na Reserva de Desenvolvimento Sustentável Mamirauá. MCT / IDSM. (Relatório Técnico). Tefé AM: IDSM. 2003.

1. The types of bait

According to current piracatinga fishermen, fishing success is closely related to the quality of the bait. Bait with greater content of fat are preferred by the piracatinga. Other relevant factors, according to fishermen, are the water level, capture site and moon phase during which the fishery is conducted, as this is an essentially nocturnal activity. Another factor considered paramount to the efficiency of this fishery is the experience and concerted effort by the fishing team. This explains the variability in productivity even among fishermen who employ the same technique and the same types of bait.

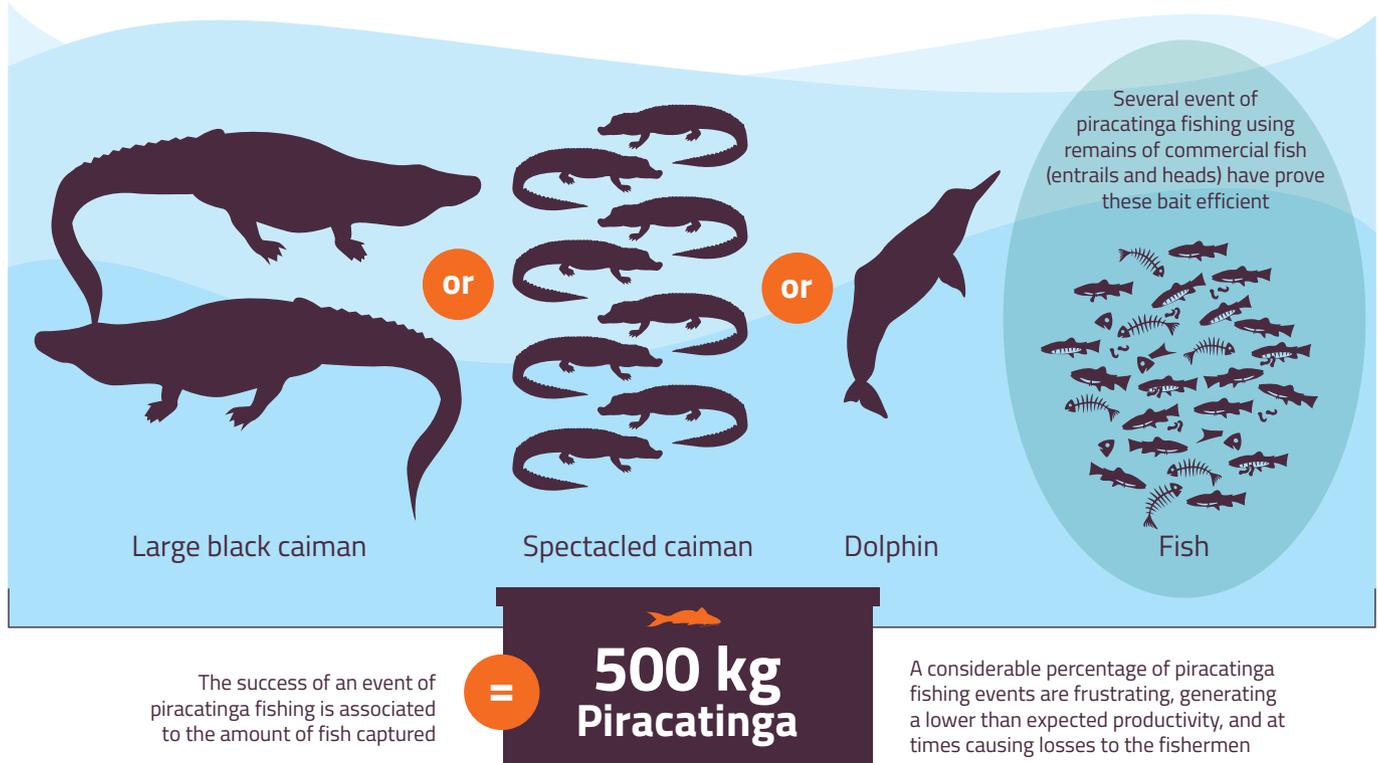
The bait mainly used in the mid-Solimões region to catch piracatinga are the black caiman and the spectacled caiman (*Caiman crocodilus*), where the former is more frequently used. The pink dolphin is reported as a preferential type of bait, but its use depends on availability of carcasses found or incidentally entangled in fishing nets. The use of tucuxi (*Sotalia fluviatilis*) is occasional. There are reports of bait from a few species of fish, especially pellona (*Pellona* spp.), rock bacu (*Lithodoras dorsalis*) and innards from other commercially important fish, such as redbtail catfish (*Phractocephalus* spp.) and sorubim (*Pseudoplatystoma* spp.).

Data collected in some areas of the Mamirauá and Amanã reserves allow to infer that in the local piracatinga fishery there is a clear predominance of use of black caiman bait, especially because those are available year round. Dolphin, although reported as a preferential bait, has its use restricted due to the difficulty in its capture. In general, according to the fishermen accounts, and field monitoring, when dolphin bait are available, the use is at the ratio of 3:7, with a clear predominance of caiman over dolphin bait. During an event of piracatinga fishery, more than one caiman may be used (up to three individuals of black caiman, and up to five spectacled caiman). When dolphin bait is used, it usually corresponds to a single animal. Piracatinga fishing events have been recorded using a combination of bait, or mixed bait of dolphins and caiman, in addition to the opportunistic use of carcasses or even parts of other animal species.

The size of the animal and the amount of fat are considered fundamental factors for the success of the fishery, at least according to fishermen involved in the research. Poor-efficiency, or event frustrated fishing events, are explained by fishermen due to the capture of "thin", although large (above 3 m) caiman. This fact is associated with the body score of the animals, which is determined by the availability of food, and is inherent to the hydrological cycle of the region, in itself a determinant factor of the fishery seasonality.

The type of bait and its productivity

Fishermen say that two large black caiman, or eight spectacled caiman or one dolphin are necessary to bait approximately 500 kg of piracatinga.



According to the perception of fishermen who have used dolphin meat to fish piracatinga, this animal's flesh is considered one of the most efficient for the piracatinga fishery, which would favor the fishery yield. Nevertheless, there are no hard data to confirm or reject such perception by the local fishermen. According to some of those fishermen, besides the high percent of fat in the flesh, dolphin blood also works as an attractant to piracatinga.

For piracatinga fishermen, fishing success is evaluated by the amount of piracatinga captured. In many cases, animals caught to be used as bait in this fishery are discarded once the storage capacity of the corrals and/or canoes employed in the activity is reached. Similar disposal occurs when fisheries are unsuccessful, due to the low amount of fat in the bait.

2. The process of bait production



Photos: Diogo de Lima Franco

In the mid-Solimões region, obtaining and preparing piracatinga bait is an activity that oftentimes engages the fishermen themselves. This activity demands catching and culling animals that will be used as bait one or two days prior to the fishing date.

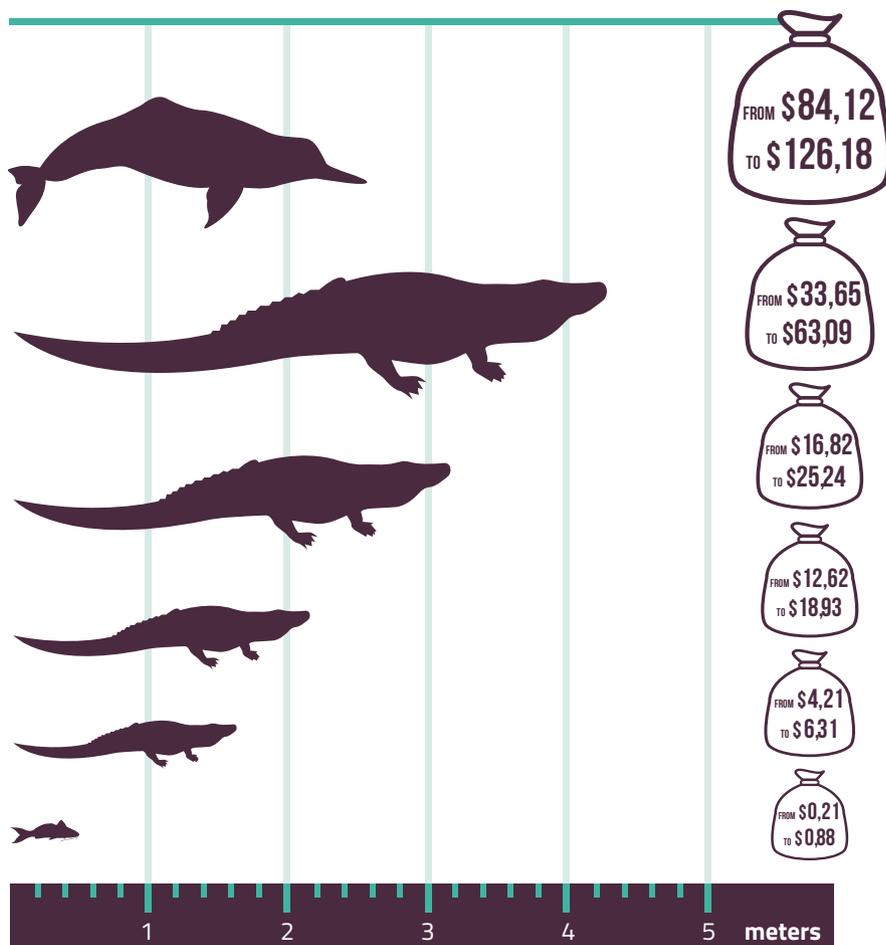
Besides the piracatinga fishermen who catch their own bait, in the past four years we have recorded the emergence of a group of bait providers. Those avoid getting engaged in the fishery, but act as specialized hunters to supply animals (especially caiman) to piracatinga fishermen. This is a clear sign of an evolution in the production chain. The emergence of this new link in the production chain, although incipient, is associated to the difficulty of inserting these hunters in other productive activities, to the growing demand of bait - especially during the high water period, when caiman and dolphin disperse in the environment - and to the guarantee of a quick cash return.

The bait hunters generally work by demand, catching and culling animals only after specific request for use by piracatinga fishermen. Requests may vary from three up to 20 caiman per week. In the case of dolphins, trade is generally associated with opportunistic events, when animals die from entanglement in fishing nets and are then donated or sold to piracatinga fishermen. However, there are a few sporadic records of fishing boats that transport and trade dolphins among piracatinga fishermen. In some of these cases, traded dolphins result from entanglement in commercial fishing nets. In several of these cases the animals are said to come from distant regions, such as the Purus, Japurá, or Içá rivers, but we have no way to confirm such reports

There are price lists for the supply of caiman bait; in 2013 values ranged from R\$ 10,00 for 1,5-m caiman up to R\$ 200,00 for a 4-m caiman. Dolphins found or killed in fishing nets are taken opportunistically or donated for the piracatinga fishery; this is common practice among fishermen, but does not necessarily imply an economic gain for volunteering the animal. We have no recent records of trade in pink dolphins to be used as bait. However, according to some traders and fish buyers, the price for an individual of pink dolphin ranged from R\$ 100,00 to R\$ 300,00 per animal, depending on capture site and animal size.

How much is an animal worth?

Valuing piracatinga and bait according to size and species



With the increase of commercial demand of piracatinga, demand-and-supply of bait has intensified. This has generated a market value for caiman and dolphin. Figures can vary with the size of the animals, time of the year and demand by buyers.

Capture events of caiman are often linked to orders by fishermen. Most dolphin carcasses are from incidental entanglement and marketing is opportunistic.

The species' ecological role or the effect on the natural populations are not taken into account in this valuation.

Caiman captures are part of the historical and cultural context of riverine communities in many parts of the Amazon. In the mid-Solimões region, this capture was strongly associated with activities of hunting and trade of meat and hide in the years 1960, 1970 and 1980. In the 1960s this trade involved selling hides abroad, and the sale of salted meat for several parts of Amazonia. In the following period of the 1970s and 1980s, a persistent but illegal commerce of the meat persisted to supply regional markets. During this period there was even an incipient local market for meat. With the recent increase in the piracatinga fishery in the past 10 years, this hunting activity is again becoming frequent in the mid-Solimões region.

Caiman hunting, of preferably large animals, takes place at night. Animals are searched for with the use of flashlights, and located by the shine of their eyes. They are then immediately harpooned and rapidly culled, using a club or an ax to break their skulls. When this is not enough, the hunter may sever the cervical medulla with a machete. A single caiman hunting event for bait may produce up to 12 caiman (larger than 3 m) in one night. Caiman culling for use as bait takes place throughout the year.

Dolphin culling in the mid-Solimões region, however, are not frequent, according to piracatinga fishermen. When they do occur, they normally take place during daytime. This is a more occasional or sporadic activity, as it is much more complex, involving a great number of people, and normally demanding the use of long

fishing nets, of strong material and large mesh. This kind of fishing gear is not easily available, and demands a certain degree of specialization by those who will use it. Great part of the dolphin bait used in piracatinga fishery come from incidental captures in fishing nets. The fisherman may find the animal entangled (which is not uncommon), and use the carcass of the drowned animal. Or, if the animal is still alive, the fisherman may intentionally cull the animal. This practice occurred in the mid-Solimões region even prior to the emergence of the piracatinga fishery, and derives from an old conflict between fishermen and dolphins. But it is also true that this new piracatinga fishing practice, as of the last few years, stimulated by the potential cash gains in selling or using animals in the fishery, markedly strengthened that behavior.

The few reports describing dolphin hunting in the mid-Solimões region indicate that this is an activity associated with the water level, and of a strongly opportunistic character. When a group of animals is sighted in a channel, fishermen will circle them with large fishing nets, and try to harpoon them. Harpooned animals are culled by a sequence of ax hits to their skulls, following the animals' fatigue. The reports of directed dolphin culling events indicate that they take place during the dry period (August-October), when the water level facilitates animals being encircled. Contrary to what happens with caiman culling, the seasonality in the dolphin culling events greatly limits their use in the fishery.

3. Implications of the use of caiman and dolphin to produce bait

Fishermen who use bait, either caiman or dolphin, for the piracatinga fishery in the mid-Solimões region, maintain that the pink dolphin provides greater piracatinga yield. According to them, it is possible to fish up to four times more piracatinga, when compared to what can be produced using a similar-sized caiman. Despite the potential yield and efficiency of the dolphin bait, the great effort demanded to obtain it, and the risk of severe punishment by environmental authorities may constitute a disincentive to cull dolphins. Such are the limitations always mentioned by interviewed fishermen. In conjunction with the seasonal variation in appropriate conditions for dolphin capturing, these factors may limit the use of dolphin in the piracatinga fishery, and therefore explain the less frequent use of dolphin bait in the mid-Solimões region.

The situation is quite different as it pertains to caiman. Caiman are found in high densities in several environments of the Mamirauá Reserve, as well as some habitats in the Amanã Reserve. Traditionally, caiman culling is part of the daily life of local dwellers. The species of caiman that occur in the region are target of some fear and resentment by local inhabitants, and several of them perceive caiman as a threat to themselves and their families. These factors lead to dissemination of the use of caiman, which became the most frequent bait used for the piracatinga fishery in the mid-Solimões region.



One crucial factor in the concern generated by the use of dolphins as bait is associated to the emblematic figure of the pink dolphin in Amazonia, and its projection in the national and international contexts. The repeated publicizing of the problem by the media, as well as alerts by environmental institutions and research groups, not always followed by an adequate confirmation, may dissipate the attention to the focus of the real problem. And this focus is the lack of detailed studies that allow us to categorically maintain what the effects of this inadequate use of dolphin and caiman are. In fact, we know very little about the population dynamics of these species, and about their movement patterns.

For this reason, up to now we are still unclear as to the real effects of hunting and removal do individuals on the natural populations of dolphins and/or caiman in the region. The current concern is widely justified, but it is a fact that the confirmed effects of such activities on those populations are yet unknown. So far, only a few effects on segments of dolphin and caiman populations have been documented, and at a local - not regional - level. These are worrisome effects, but not yet totally understood, and their extrapolation to wider scales must be exercised with greater caution.

Given the piracatinga fishery peculiarities, especially because of the informal character of the fishing events, it is difficult to obtain a figure for the total piracatinga yield, let alone of animals culled for such purpose. Nevertheless, based on the monitoring and recording of piracatinga fishery aspects during 2013, we may infer that approximately 2,300 caiman were culled to be used in the piracatinga fishery in the surroundings of the Mamirauá Reserve. This number may be quite surprising, but it is important to keep in mind that this is a simple estimate, related to average fishing events by locality and average number of culled animals; one must also keep in mind that the piracatinga fishing activity is seasonal, varying in intensity over the year. It must also be noted that in 2013, in the studied localities, events using dolphins for the piracatinga fishery were null.

4. The piracatinga fishermen

The piracatinga fishery is an activity that demands great physical effort, although apparently it may not require an extensive knowledge or especially developed abilities from its participants. This is an activity practiced primarily by young or middle-age men. However, there are records of fishing conducted by children and teenagers. From field records and approximations to some piracatinga fishing events in the Mamirauá and Amanã reserves and surroundings, we are able to describe some aspects of techniques used in this fishery in the mid-Solimões region. We characterize fishermen in three large groups:

4.1 Consolidated groups of piracatinga fishermen

Fishermen may already be considered specialized in the fishery for the species, due to the great frequency which they dedicate to it. They follow a clear and systematic fishing system - involving from construction and maintenance of corrals up to trading piracatinga - which is relatively constant over the year. The fishery represents a permanent activity in the daily life of these fishermen. It is characterized by being executed by groups of 4-5 fishermen who share the fishing activities, from obtaining and preparing bait, the fishery itself, previous filleting of the fish, up to its sale. These fishermen have specific sites to fish, and the key characteristic is their good organization structure, attested by the efficient work division and by the commercial contacts which allow them to easily channel the production.



4.2 Groups of occasional piracatinga fishermen

This kind of group of piracatinga fishermen is usually formed by means of affinity, friendship or degrees of relatedness, and characterized by being constituted shortly before the arrival of traders. These are not groups continuously established on a day-to-day basis for this purpose. The members use, although in an improvised way, the same fishing gear used in other fishing activities. In this kind of group there are no specific roles or attributions given or defined ahead of time to the participants. Tasks are shared and actions are improvised in moments immediately prior to the capture of the bait. The incentive to these "sporadic" groups seems to be the good selling price of piracatinga in the mid-Solimões region, negotiated and established when the request is made by the trader, with short notice. If the price is considered attractive, the group gathers and realizes the production negotiated by

the end of a few days. But this incentive may also be associated to demands or momentary interests by the participants, such as the need to acquire some kind of good, e.g., sound devices, medication, or a trip to town for health purposes. This demand typifies a number of non-specialized fishermen who have been observed in Amazonia in the past decades, characterized by an extremely opportunistic profile and low specific ability. This kind of occasional fishermen group finds its strength by producing mainly in the fishing off season and/or closed season, when other income sources from fishing are paralyzed. Similar to the planning of the activity, the places to catch bait and fishing itself are defined in a totally improvised manner. In this kind of fishing group, the participation of teenagers and children, some younger than 12 years - including with parental consent - has been identified.

4.3 Urban fishermen

The urban fishermen are mostly characterized by conducting their activities throughout the year and not having their "own" fishing areas. However, they are highly specialized. The structuring of their routine fishing activities depends on the demand and market conditions, as well as the conditions of accessibility to water bodies where fishing takes place. Very seldom do these fishermen conduct fishing activities within protected areas, such as the reserves in the region. In this kind of fishermen group, the piracatinga fishery is neither a part of the work routine, nor part of their main goal. For the fishermen involved, this fishery represents but a complement of economic adjustment, executed in instances such as the end of the fishing trip where yield was not as expected. They generally use fish entrails accumulated over the fishing days, resulting from the pre-processing of these other species of fish

(mainly the large catfish, such as sorubim, caparari, pellona and piramutaba, or even the larger ones such as piraiba or pirarara, all long-whiskered catfish usually fished for in the mid-Solimões region). The fishermen may use chicken and other past due processed meat, as well as butchery material acquired in towns along with provisions for fishing. This group also uses caiman and dolphins they find entangled in fishing nets during their usual activities. They may also send (or sell) the latter to other fishermen who show greater interest and/or need to use them as bait in their piracatinga fishing activities. Occasional and opportunistically, urban fishermen may also practice directed captures of caiman to produce bait.

Who fishes for piracatinga?

Characteristics of piracatinga fishermen groups in the mid-Solimões river region

	Consolidated groups	Occasional fishermen	Urban fishermen
Average size of fishing group	From 4 to 5 	From 1 to 3 	From 3 to 4 
Fishing frequency	Throughout the year, on a daily basis 	Between 3 and 4 months during the dry period (Aug to Nov) 	Throughout the year, opportunistically 
Fishing site	Close to the communities 	Close to the communities 	No definite site. Do not fish in protected areas
Fishery structure	Specialized fishermen. Task sharing prior to fishing, from bait catching to eviscerating 	No specific roles or attributions. Characterized by improvisation of activities	No specific roles or attributions. Organized for commercial fishing, however piracatinga fishery is improvised
Bait	Mainly caiman 	Caiman, dolphin, fish 	Remains of fish and other processed meat. Entangled caiman and dolphin 
Bait production	Hunting, purchase of entangled animals 	Hunting, purchase of entangled animals 	Remains from butchery site, entangled animals 
Motivation	Complement of usual income 	Complement of income to attend immediate needs 	Opportunistic complement of income 
Age of fishermen	Mainly adults 	Adults and sometimes children and teenagers 	Adults 

5. The piracatinga fishing systems

The fishing frequency, as well as the techniques inserted in the fishing methods, is related to the economic activities developed by fishermen, and their degree of engagement in the social structure of the community or its surroundings. The systems and characteristics of the piracatinga fishery are strongly associated with the social and cultural aspects, along with the ability and technique of each of these three groups of fishermen.

A determinant factor in the structuring and choice of the piracatinga fishing system by these groups of fishermen is the need to disguise or hide signs that may indicate or relate individuals and/or communities as participating in illegal activities, especially related to the use of caiman and dolphin as bait. Therefore, it may not be very convenient to use very large or conspicuous technology and gear, which may be spotted from a distance.

The choice of the technique is also related to the search of an efficient process, which guarantees the capture of a large amount of preferably large-sized prey (which is a selective criterion for marketing), as well as the yield and efficacy of the bait, in the shortest possible period.

In this sense, and considering these interrelated factors, three current piracatinga fishing systems have been identified in the mid-Solimões region:

5.1 Fishing with a corral or pen with door

The fisherman positions himself on a platform above the corral, which has a system of doors, and moves the bait towards the interior of the pen, thus attracting the piracatingas inside, and confines the fish by closing the door. In this system the fisherman does not have direct contact with the fish confined within the corral. The lateral cracks in the corral play an important role in the size selection of piracatingas, by allowing the exit of small animals and retaining the commercial-size individuals (buyers pay different prices for different sizes).

5.2 Fishing with a doorless corral or pen

In this system a wooden corral is also used, positioned a few meters from the river bank, and the fisherman stands in the water up to his knees, with a chunk of bait, usually a caiman tail, between his legs. Piracatingas approach to feed and are captured by the fisherman with his own hand. When the fisherman catches the piracatinga, he throws it into the three-ton storage capacity corral. The size of the fish is manually selected by the fisherman, at capture, and also by the corral cracks, as above.

5.3 Fishing with a canoe

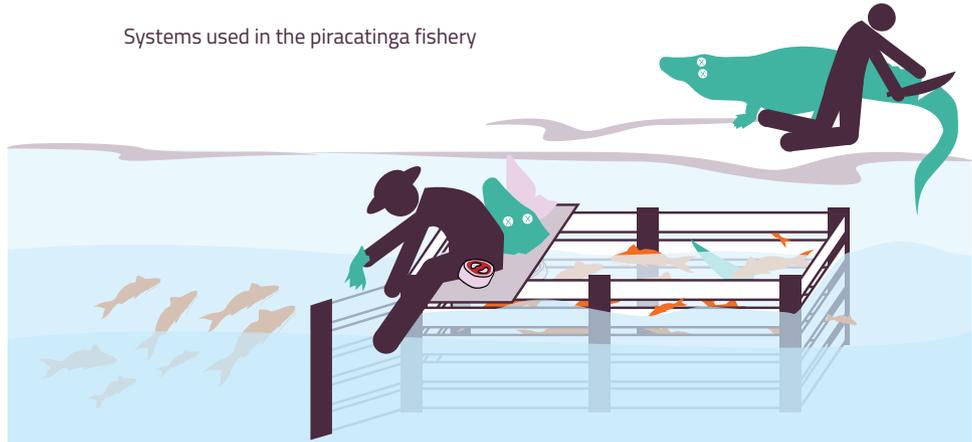
This system has similar characteristics to the doorless corral, but the latter is replaced by a canoe. When the fisherman catches the piracatinga, he throws it into the canoe. In this system, however, manual capture is the only way of size selection, and the fisherman must exercise his discriminatory capacity to select animals that shall attain a more interesting market price. This system is used, in general, by solitary fishermen with little amount of bait, whereas the others are mostly used by groups of two, three or four fishermen, using a large amount of bait.

How the piracatinga is caught

Systems used in the piracatinga fishery

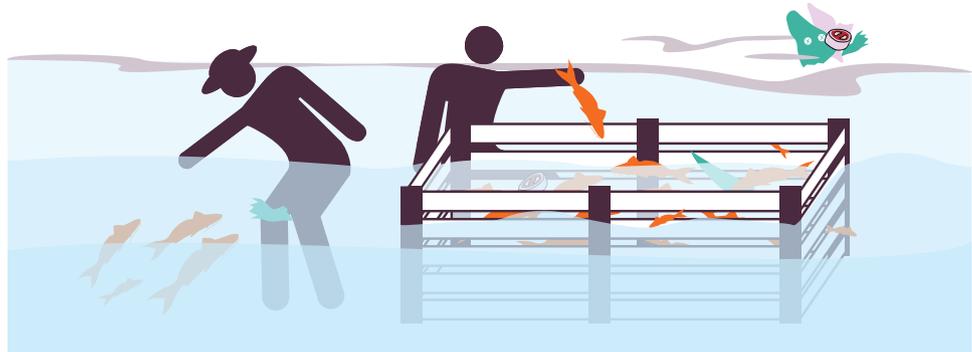
Fishing with a corral with door

The fisherman sits on top of the corral and attracts the piracatinga into the corral with bait. He then closes the door, trapping the fish inside.



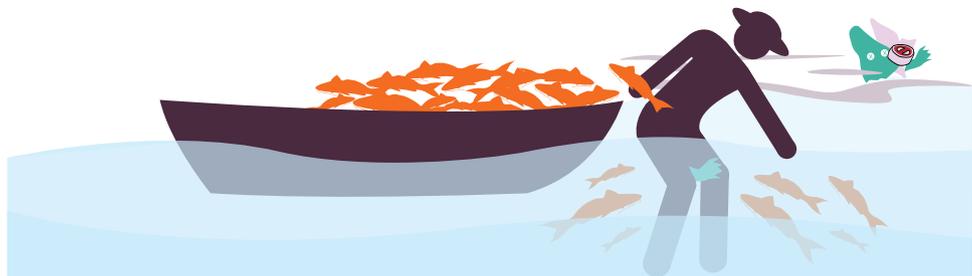
Fishing with a doorless corral

The fisherman stands in the water, close to the river bank. Holding a chunk of bait between his legs, he attracts the piracatingas and catches them by hand. The fish are then thrown into the corral.



Fishing with canoe

The fisherman stands in the water, close to the river bank. Holding a chunk of bait between his legs, he attracts the piracatingas and catches them by hand. He then throws the fish into the canoe.



6. The piracatinga production chain

The piracatinga fishery has become so popular in the last few years in the mid-Solimões river (and possibly in other regions of the Brazilian Amazon as well) that it starts to consolidate a wide productive chain, already inserted in the fishing context of the region. Slowly the piracatinga has moved from being a low commercial-value fish of sporadic consumption, into a product with commercial value potentiated by commercial demands from Colombia, where the piracatinga entered the internal markets to supply the demand for other commercially overexploited fish.

The commercial consolidation of the piracatinga as a "regular fish" is also part of the recent insertion and establishment of this species in the Brazilian market. There are records of piracatinga marketing in urban centers of the North, Northeast and Southeast Brazil, where piracatinga is traded already processed, and sold to the end consumer as catfish fillet^{5,6,7}. In these markets the piracatinga was introduced with commercial fake names, more palatable to the taste of the urban consumer, hiding its irregular origins (and its opportunistic and necrophagous habits), such as "pintadinho" or "douradinha". They are offered at favorable prices to the end consumer, therefore irregularly competing with other catfish of traditional commercial acceptance in those markets.

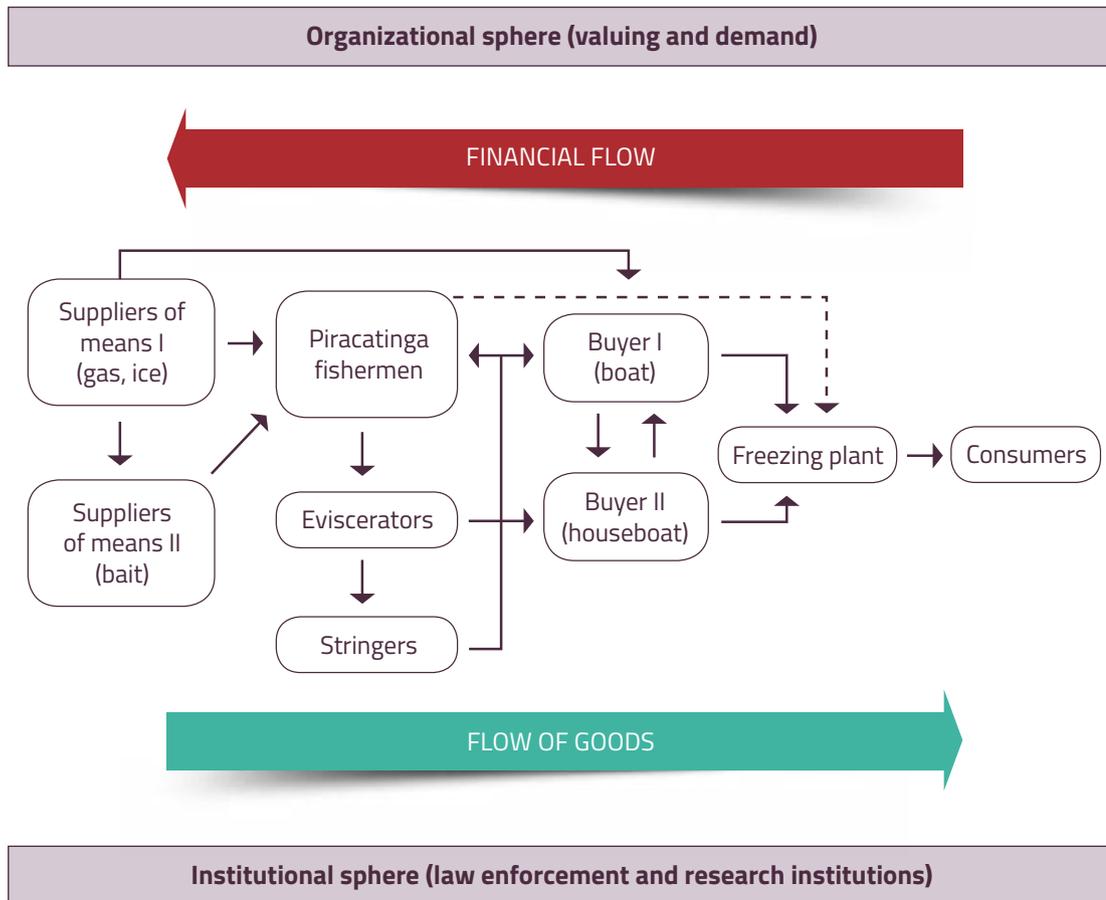
On a regional scale, the production chain of the piracatinga fishery may be very complex, and one person may perform several activities within the chain. It is common as well, as already described, that several phases of the fishery be executed by the same person. For example: fishermen who catch and provide bait, or traders who provide basic supplies for the fishery. There are also bait hunters, specialized in providing caiman and dolphin, people to eviscerate the fish, and even those who work exclusively tying the piracatinga for weighing (stringers) and stocking it in the traders' boats. The sharing and specialization of work within the production chain is recent, but already generates an "industrialization" of the fishery, therefore increasing the production scale and, consequently, allowing the increase in bait hunting events and the fishery itself.

5 - Brum, S.M. Interação dos golfinhos da Amazônia com a pesca no Médio Solimões. Manaus: INPA, 2011. Dissertação de Mestrado.

6 - Brum, S.M.; Silva, V.M.F. Manejo participativo de pesca: importante ferramenta para a conservação dos golfinhos da Amazônia. 10º Simpósio sobre Conservação e Manejo Participativo na Amazônia - Instituto de Desenvolvimento Sustentável Mamirauá, Tefé, Amazonas. 2013. p.75-76

7 - Da Silva, V.M.F.; Martin, A.R. Impact of human activities upon two species of dolphins in Amazonian flooded forest, Brazil. 17th Biennial Conference on the Biology of Marine Mammals. Cape Town, 29 November - 3 December 2007.

Piracatinga production chain



The scope and characteristics of the production chain has been poorly studied. The greatest concern about the piracatinga fishery by law enforcement and research institutions is about the type of bait used.

The production chain is associated to the supply-and-demand principle. Its structuring is influenced by the hydrological cycle, activity routine and task sharing among fishermen, as well as traders' priorities and commercial trends in other products.

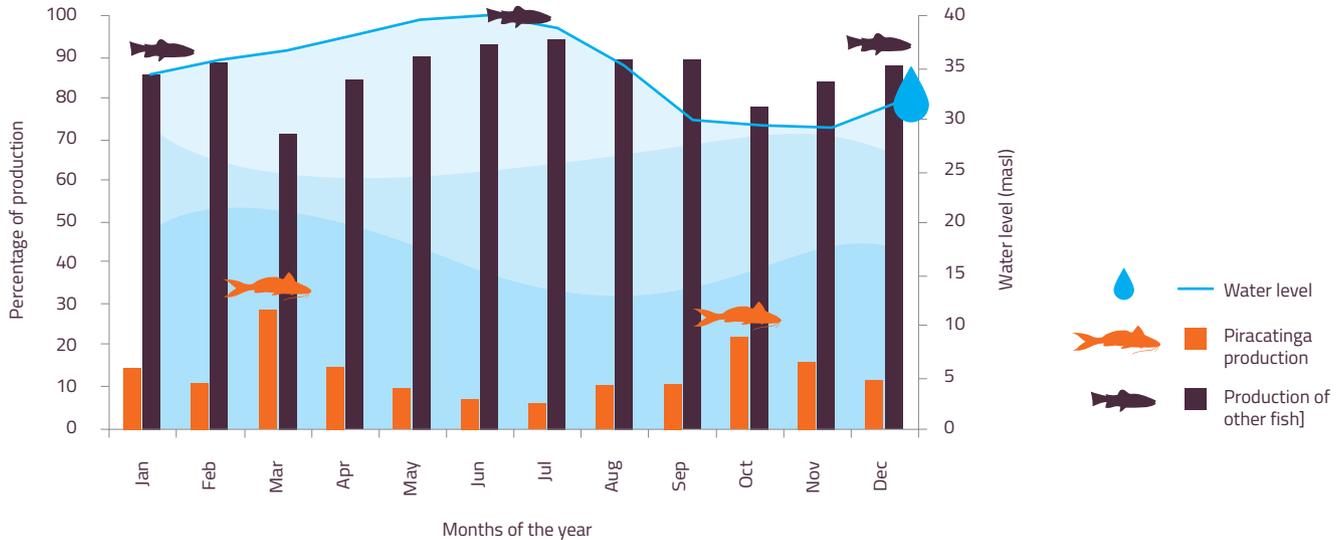
The perception that the piracatinga fishery is an activity of easy execution and high profitability, associated with an immediate payment, has called the attention of several amateur fishermen, who become involved in the activity misled by the promise of a high return rate associated with minimum effort. Nevertheless, the clandestine character of producing bait, the risk represented by the capture of piracatinga by hand, associated to the inexperience in capturing the fish, may generate a much lower profitability than that hoped for or expected. This, apparently, has discouraged several community dwellers who tried to get involved in the activity in the mid-Solimões river.

Therefore, only a small fraction of community dwellers - which does not exceed 15% of those who recognize themselves as fishermen - regularly participates in activities of the piracatinga fishery. In most cases, the income derived from the piracatinga sale is recognized as an alternative or additional income to the gain represented by other economic activities, since the piracatinga fishery seems to frequently result in frustrated events. In fact, these frustrated events, where the volume of piracatinga fished is not enough to cover the investment, represent up to 26% of the total, causing losses of up to 225% in some viability analyses conducted.

The development and consolidation of the piracatinga fishery in the mid-Solimões region are associated to a local context of the basic principle of "supply and demand". In it the fisherman does not need to travel to sell its production, as in most cases intermediary traders will approach the fishermen to buy the fish, directly at the communities. In addition, intermediary traders usually pay cash, when they buy the fish. This trend of supply attending the demand is strongly associated to the hydrological seasonality in the region, which determines the commercial fishing calendars.

Piracatinga production

The production of piracatinga, as other commercial fish, is strongly associated to the hydrological cycle of the region. The peaks of production occur in March and October



Seasonality of fishing and marketing piracatinga is determined by the variation in commercial demands and off-season period for other fish of greater commercial interest. Between 2012 and 2013, piracatinga sale prices did not have significant variations, but the sale price to the intermediary trader varied along the year, from approximately \$ 0.21 to \$ 0.31 per kilogram of eviscerated animal. The price is best at the beginning of the receding water period (July) and during the "repiquete" (oscillation of the river water level) (November), moments when the fish for

other species is more difficult, and the other fish are less available in the market. Sale prices for piracatinga are usually pre-established by price tables that fishing boats use as reference at the time of marketing. In several cases, fishermen who live close to urban centers transport their piracatinga production to the floating and freezing plants, conducting direct transactions, therefore cancelling the role of the intermediary, and consequently improving the sale value, which may vary from \$ 0.34 to \$ 0.88, depending on time of the year.

Paradoxically, these marketing values for piracatinga have not significantly changed over the years of the activity. These price fluctuations, however, are recorded for other species of fish traded in the region. Therefore, the piracatinga fishery has apparently become established and managed to overcome the commercial and economic dynamics of fisheries in the mid-Solimões region.

The intensity and manner of fishing are not homogeneous among the communities of the Mamirauá Reserve, neither is the fishing effort applied along the year. This effort may vary in some communities from a few occasional events up to 150 events of piracatinga fishing per year. The piracatinga fishery in the area of the Solimões river and in the surroundings of the Mamirauá Reserve has evolved in its organization and structuring, when compared to the years 2000. It is now common to find houseboats that act as "reception and storage centers", buying and stocking piracatinga fished in the area, to later transport it in regular boats to Manaus or Tabatinga, and in small boats that take the production to freezing plants installed in Fonte Boa. These freezing plants, on the other hand, may transport the product to Tabatinga. In a smaller scale, the production may be sent to Tefé and Alvarães, cities from where it may be directed to Tabatinga or Manaus, depending on the time of the year.

The piracatinga fishery conducted in the lower Japurá river depends, essentially, on the presence of trading boats, and the activity is still considered itinerant in that area. In this case, most part of the production is destined to freezing plants in Tefé, from where it is then sent to Tabatinga (especially during the Holy Week) and, to a lesser degree, to Manaus.

In general, according to reports by fish traders around Tefé, 67% of the piracatinga production in the region is taken to Tabatinga, where it is inserted into the Colombian fish market; the remainder 33% is destined to the local industry in Tefé, Manacapuru and Manaus, where it is processed as a catfish and distributed to the Brazilian market.

Piracatinga marketing flow

The map shows the marketing routes of piracatinga, starting from the mid-Solimões region to the internal (Manaus) and external (Tabatinga) markets



Final considerations



The information presented in this document are part of a diagnosis conducted, mainly, with the collaboration and engagement of persons that at some point fished, fish or were close to fishing events with piracatinga. Most of the information collected over the past 10 years by members of the Mamirauá Institute were collected in a participatory way and with the stakeholders' and communities' consent.

Valoration by local inhabitants on the natural resources is inserted in the cultural and historical context, where the use of natural resources is in accordance with the satisfaction of their basic needs and the immediate return that such activities represent; negative impacts on the natural populations used are not a matter of concern to those stakeholders. This attitude has been changing in a significant way, when one follows recent processes of organization and community engagement in systems of participatory use, such as the fisheries management, or the experiences with community-based tourism in protected areas.

In most cases, piracatinga fishermen, and communities in general, are aware of the illegal character of using caiman and dolphin as bait for the piracatinga fishery, but the level of interpretation of effects of the extractions of such animals and their consequences on the status of wild populations is quite limited. Impressions and perceptions on a negative effect on

the environment, associated to the piracatinga fishery, are not part of the daily life of local dwellers, where the main concern is to be labeled as a criminal in the social context, or the fear of being caught with caiman or dolphin carcasses by some law enforcement or control organization. In fact, because this activity is restricted to some members of the community, piracatinga fishermen are often marginalized and easily pointed out by other community members, from their own community or not, in contexts where the piracatinga fishery is presented as an offense that may bring restrictions or punishment to participatory processes in the communities.

Over the last few years, the piracatinga fishery has been established as a complementary activity to the income sources of fishermen and local inhabitants in the mid-Solimões river region. Its insertion within the regional fishing context, and its growing demand, turns the piracatinga fishery into an activity of commercial relevance. Apparently only external factors, such as market moves, or actions to stop the market, for example, may influence its performance, and disorganize this developing production chain.



Therefore, it is believed that the activity, albeit markedly seasonal and oftentimes irregular, shall continue to pressure in a concerning way the species presently used as bait in the region. Even though we do not have a clear view of the effects of removal of individuals on the populations of bait species in this fishery, this is obviously a factor that needs to be carefully considered. The species used as bait are potentially vulnerable, and some have already been considered threatened in the recent past. All of them are dependent on conservation and protection action, and the continuity and increase in the piracatinga fishery may represent real risks to their populations in the mid-Solimões region.

Dolphins and caiman have suffered threats throughout the centuries: caiman have been the target for illegal commercial exploitation, pink dolphins have been believed to and blamed for impregnating women, representing malignant beings and harming fisheries in general. Besides the noisily published present threat, dolphins and caiman remained victims to accidental captures in fishing and ghost nets, intentional killing in retaliation for conflicts with fishermen, and increase in environmental contamination by chemical products and waste, all inherent to a region undergoing growth and population increase. On the other hand, basic aspects of population dynamics (such as abundance,

age-related mortality and reproductive rates, growth) of these species are still incompletely understood, and constitute essential information to clearly understand how each intervening factor may affect their long term survivorship.

Therefore, the need to broaden and deepen studies towards understanding the effect of such mortality on the natural populations of dolphins and caiman, at the same time as we comprehend more fully the biology and fishing of piracatinga, and the motivations by their fishermen seems obvious.

On July 17 2014, the ministers of Environment and of Fish and Aquaculture in Brazil signed a joint normative instruction (IN interministerial no. 6) with a moratorium of five years for the piracatinga fishery in Brazilian Amazon, effective January 2015.

As other initiatives of this nature, the predicted degree of effectiveness is very low, or at least doubtful, since the activity takes place in remote areas, and due to the lack of human and financial resources to implement such legislation. In addition, such initiatives generate a social problem by rendering illegal catching a fish species that is not considered threatened and, on the other hand, serves as an alternative or additional income source to some local populations.

Amazonian wildlife is protected from predatory actions by a number of laws, in an attempt to guarantee an appropriate conservation status of their populations. The Wildlife Law⁸ is the best known when dealing with the legal context. But the lack of law enforcement actions, associated to the huge expanses of the Amazon, makes actions of constant control quite difficult to implement. By the same token, the lack of geographically broad research and monitoring systems which allow to have clear demographic notions of Amazonian wildlife and their threats is quite worrisome. Monitoring systems and research activities could really provide clear subsidies on the actions to be implemented, as their level of priority, therefore defining truly long term conservation strategies.

The enactment of the moratorium to the piracatinga fishery has been presented as a solution to avoid the extinction of a very charismatic species such as the pink dolphin, where the wide media cover and the support by millions of "environmentalists" has raised the collective feeling of being able to contribute to this cause. Nevertheless, the way the problem has been handled has excluded the main stakeholders in the activity: the riverine fishermen and inhabitants.

The participatory systems of fisheries management, program of community protection of turtle beaches, strategies of ecotourism and community-based tourism are good examples, practiced throughout the Amazon, of how, based on basic sustainability and community engagement principles, the use of natural resources has contributed to the establishment of conservation strategies, not only of one species, but of several ecosystems.

Measures with greater potential effectiveness might be the strengthening of the use of alternative bait (that some of the local inhabitants are already using), the offer or development of other alternative economic activity to be conducted during times of low fishing production when the piracatinga fishery becomes more attractive to most part of fishermen that get involved with it. Another measure would be to follow up the prohibitions and moratoria with an increased capacity of monitoring the marketing of the species, in the whole national territory, controlling with greater capacity the processing freezing plants that generate the fillets sent to markets under fake names that might disguise the identity of the fish.

8 - Lei nº 5.197, de 3 de Janeiro de 1967



With scientific research and participatory management, several initiatives have been implemented, which resulted in conservation and income for the communities. As examples we can mention the 450% increase in natural stocks of arapaima (pirarucu) fish in managed areas of Mamirauá and Amanã reserves, and the approximately 1 million dollars of income generated for communities practicing community-based tourism between 1998 and 2013.

Clearly, fishermen who have dedicated to this fishing modality must be engaged in a deeper, detailed and more inclusive discussion with regards to this activity and its impacts. And all of the stakeholders must, together, strive to a better planning of the activity. It is urgent that we find a way to protect the species presently used as bait - keeping in mind that the piracatinga fishery is not the sole threat to those species -, simultaneously guarantee the sustainability of the exploitation of piracatinga stocks - which might be presently fished at an inadequate way - and, finally, guarantee the maintenance of the fishing activities, as those are central to the survival of the riverine communities along the mid-Solimões, as well as other parts of Amazonia.

The insertion of the social component in the discussion, the deepening of the studies and the improvement of monitoring on freezing plants seem to be more efficient ways to deal with the problem than criminalizing portions already traditionally marginalized of the rural population of the Amazon.





Searching for solutions



Eunice Venturi

To contribute more elements to the discussion of the piracatinga problem we stress:

1. The most widely used bait in the mid-Solimões region is the black caiman, with dolphins playing a secondary role.
2. Studies on production chain show a very variable profitability of the activity to the fishermen, however the price of the piracatinga has remained stable at least for the last seven years in the mid-Solimões region.
3. The dynamics of the piracatinga fishery in the mid-Solimões region is associated to two main components: the river level (the flood pulse) and the commercial demand by buyers, which makes this activity irregular, although taking place year-round.
4. In some portions of the Mamirauá Reserve, the piracatinga fishing activity has declined in the past two years, probably related to law enforcement, awareness and environmental education activities.
5. Some communities (sectors) which have traditionally fished piracatinga, have given up the activity with the introduction of other management activities, especially pirarucu fishing.



To approach a solution that takes into account environmental, social and economic factors, a number of parameters still need to be investigated in greater depth. Mamirauá Institute researchers have been working on those issues in the past few years:

- a) population dynamics and reproductive biology of piracatinga in the region;
- b) deeper analysis of piracatinga fishing and landing in the Tefé market;
- c) role of dolphins and caiman in the piracatinga fishery of the region;
- d) impact of bait hunting on the local populations of caiman and dolphin, in terms of regional abundance, local movements, and interrelations among subpopulations;
- e) the search for alternative bait must be stimulated among researchers, outreach practitioners, managers and other stakeholders engaged in biodiversity conservation and fisheries development in the region.



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The absence of demographic data on caiman and dolphin populations in the Amazon. This is one of the reasons why we cannot state what the real impact of the piracatinga fishery on the populations of these species is. The enactment of a moratorium on the piracatinga fishery has been presented as a solution to avoid the extinction of a charismatic species such as the pink dolphin, and the media cover and the support by environmentalists has raised the collective feeling of contributing to this cause. However, this approach has excluded the main stakeholders in this activity: the local fishermen and riverine dwellers. Over the past few years, the Mamirauá Institute has implemented or supported initiatives which, with the support of riverine communities, result in conservation of natural resources. This is the case of the participatory systems of fisheries management, programs of community protection of turtle beaches, and ecotourism and community-based tourism strategies. Practiced throughout the Amazon, supported by basic principles of sustainability and community engagement, the use of natural resources has contributed to the establishment of conservation strategies, not only of a species but of several ecosystems. As to the piracatinga issue, we believe that a broad debate, supported by scientific results, is the main route to reach the conservation of natural resources.



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