

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES  
OF WILD FAUNA AND FLORA



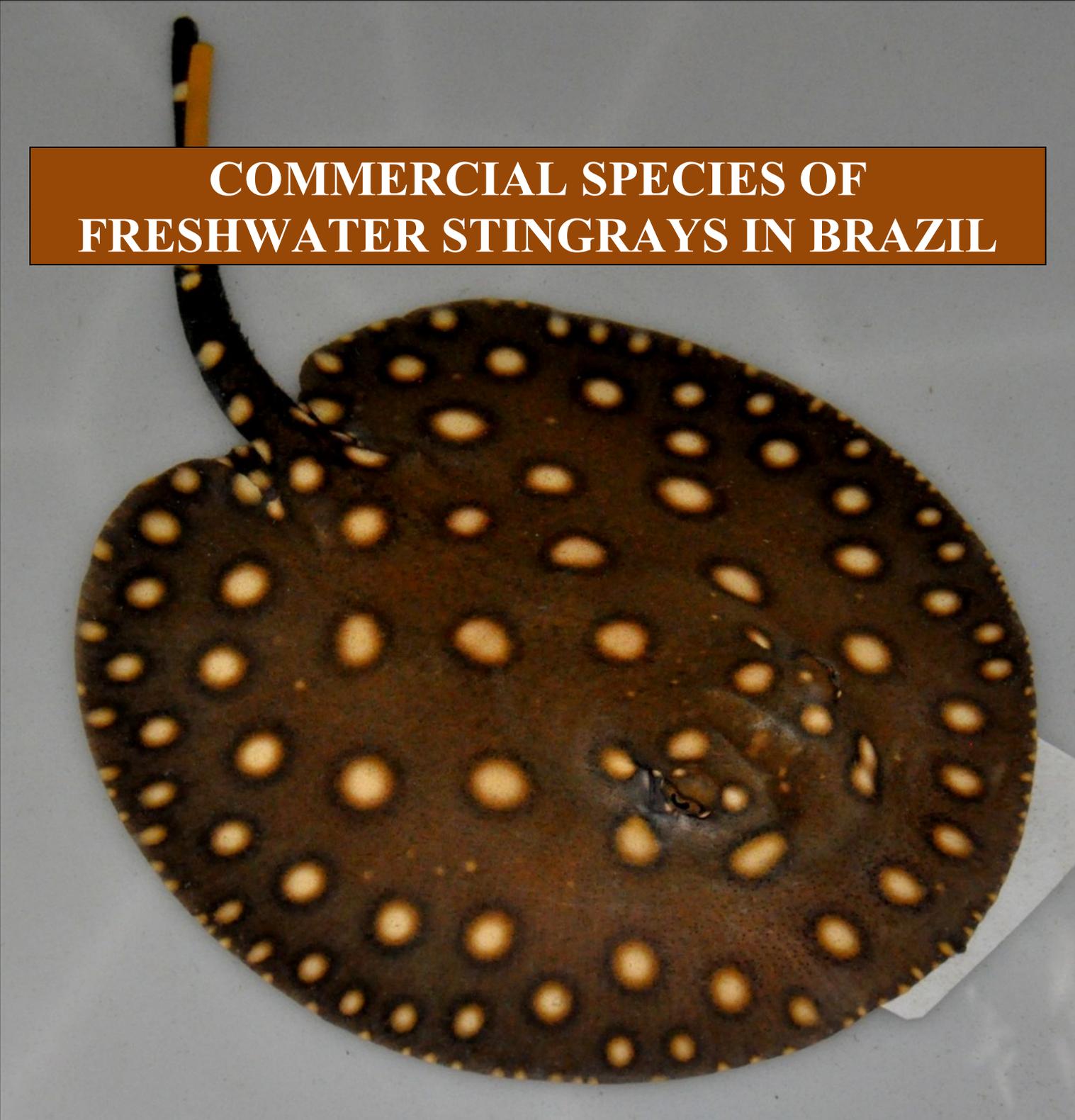
Twenty-ninth meeting of the Animals Committee  
Geneva (Switzerland), 18-22 July 2017

COMMERCIAL SPECIES OF FRESHWATER STINGRAYS IN BRAZIL

This document has been submitted by Brazil in relation to agenda item 24\*.

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# COMMERCIAL SPECIES OF FRESHWATER STINGRAYS IN BRAZIL

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**May/2017**

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## INTRODUCTION

After a long period of careful consideration, Brazil requested in June 2016 the inclusion of its populations of all species of the genus *Potamotrygon* in CITES Appendix III. This inclusion was made in attention to the COP Decision 15.85, that called on the range States of species of the family Potamotrygonidae to consider the listing of endemic and threatened species of freshwater stingrays in CITES Appendix III considering the need of cooperation of other Parties to achieve an effective control of trade.

The Brazilian proposal was received by CITES secretariat, that published the Notification to the Parties n°2016/056, which informed the Brazilian request, together with a similar request from Colombia, that also list all its known species of *Potamotrygon* genus in CITES Appendix III.

This document was prepared in order to support the implementation by importer countries, and contains general information on freshwater stingrays in Brazilian fisheries, including data on occurrence, photographs and identification tips that help the parties to combat the illegal trade of the Brazilian populations of freshwater stingrays.

## KNOWN BIODIVERSITY

South American freshwater stingrays are included in a single family (Potamotrygonidae) and presents unique but poorly known biological and ecological characteristics, which represents a challenge to taxonomists. The family comprises 4 genera and 32 valid species.

The genus *Potamotrygon* itself comprises 27 valid species, 21 occur in Brazil and 11 of them are endemic. However, the Host Parasite Collection webpage from University of São Paulo - USP (<http://www.ib.usp.br/hpc/>) presents, at least, another 9 possible undescribed species in Brazil. Most species are restricted to a single basin or river system.

The proposal to include all species of *Potamotrygon* genus in Annex III instead of listing it individually was due to the large volume of illegal trade on species not described by science. Therefore, this was a precautionary measure, a strategy to protect all species despite the taxonomic obstacles that could take a long time to be solved. These serious issues were previously addressed by the Regional Workshop On South American Freshwater Stingrays (AC24 Doc. 14.2) and Freshwater Stingray Expert Workshop – Cites Working Group (AC28 Doc. 18).

## THE INTERNATIONAL TRADE ON FRESHWATER FISHERIES

### FOOD PURPOSES FISHERIES

This type of fishing is restricted to some areas where commercial fishing with hook and line takes place such as Amazon River mouth (Araujo *et al.* 2004a). On Amazonas state it was observed that the catch aims individuals with more than 2 kilograms, so 50% of the captured stingrays are discarded, and that about 80% of them are dead before this (BESSA; SIQUEIRA, 2008).

Commercial fisheries with trawl nets along the Solimões-Amazonas River also fish freshwater stingrays as bycatch. There are no scientific information and no records of the amount of stingrays released from the gear in these fisheries (Araujo *et al.* 2004a). There is also a regular capture on the Purus river basin, but the main fishery area in Brazil seems to be the one in Tapajós river, on Santarém - Para state. On the Purus river basin, fishermen say there is a demand of 5 tons/year with eventually bigger orders (BESSA; SIQUEIRA, 2008).

The main species on this fishery seems to be the *Paratrygon aiereba*, *Potamotrygon scobina*, *P. motoro* and *P. orbignyi*, and the first one is the most valued. The information about this fishery and its custody chain is old and rare, in general. Non official data says that the commerce for other states or countries only occurs after the fish is processed and stingrays are regularly sold as other species, to achieve better prices in the market.

The main buyers for freshwater stingray's meat seems to be cities of southern and central region of Brazil, Japan and Korea (Araujo 2005). However, there's no information about this fishery after 2008 and no official data that could confirm the export of freshwater stingrays species recently.

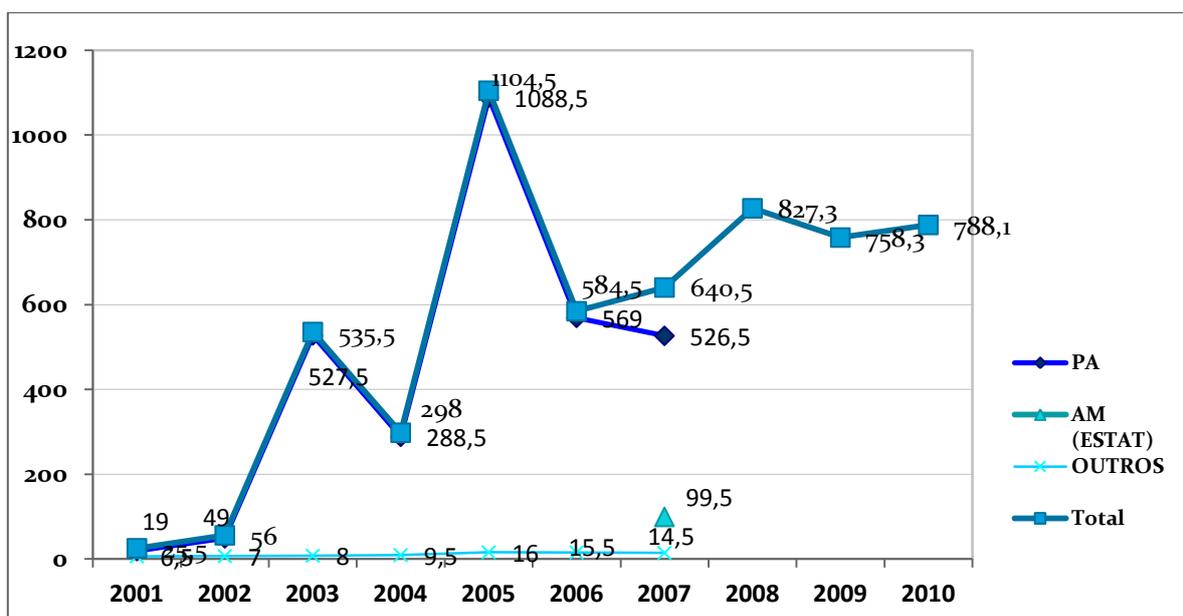


Fig.1: Tons of Freshwater Stingrays caught in Brazil from 2001 to 2010

**ORNAMENTAL FISHERIES**

As said by Araújo and Charvet-Almeida (2004), this fishery has been taking place for near three decades in the Brazilian Amazon. Until 1989 there was no regulation in Brazil and no data exists before this time. In the end of nineties, a partnership between IBAMA and scientific institutions led to the development of new regulations which determine a quota system for a specific list of species of freshwater stingrays that could be exported in.

Brazil has specific regulations to control the exportation of ornamental fish since 1992, and since 2004 there are specific rules for freshwater stingrays. The current regulation only allows the exportation of six species of *Potamotrygon* genus, based on a quota system. This country also forbidden the export of specimens with diameter bigger than 30cm, considering biological issues and the conservation of bigger breeders on nature. As registered by Rincon and Charvet-Almeida (2006), the quotas were based mainly on biological information about the *Potamotrygon wallacei*, from Rio Negro, and applied to the other species based on the comparison of known distribution and population dynamic.

Brazil don't put any restrictions to the captive breeding of the stingrays but, until now, only 2 or 3 companies demonstrated interest on that, and only one inform IBAMA that are having success. However, nothing concrete has been shown until now, and all exports are of wild individuals.

After some years of this control measures, it was noted a better level of compliance by regular exporters, but we also realize that the high prices reached by some species had encouraged the illegal trade. The main targets of this illegal trade appear to be forbidden species and animals bigger than the maximum size allowed to be caught. There's also information about the smuggling of regular fishes to supply exporters of neighbors countries with some high value species outside the quotas controlling system. The main objective of the inclusion of the *Potamotrygon* species on CITES was to stop this illegal trade.

**BRAZILIAN STINGRAYS SPECIES EXPORTED SINCE 2003**

Espécies	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
<i>P. motoro</i>	7.367	7.166	3.271	-	-	110	296	156	88	306	79	79	418	31
<i>P. schoederii</i>	545	218	286	-	-	18	0	3	0	0	0	0	0	0
<i>P. orbnyi</i>	1.058	1.236	533	-	-	62	50	94	8	2	15	46	38	0
<i>P. leopoldi</i>	375	806	1.259	-	-	454	3.106	3.222	3.099	3.507	4.852	4.016	2.641	373
<i>P. cf. henlei</i>	343	758	562	-	-	56	263	916	168	76	297	130	336	6
<i>P. cf. hystrix</i>	1.355	2.522	1.090	-	-	454	969	1.019	1.252	1.236	232	1.032	2.275	0
<b>TOTAL</b>	<b>11.043</b>	<b>12.706</b>	<b>7.001</b>	-	-	<b>1.154</b>	<b>4.684</b>	<b>5.410</b>	<b>4.615</b>	<b>5.127</b>	<b>5.475</b>	<b>5.303</b>	<b>5.708</b>	<b>410</b>

**SPECIMENS IMPORTED FROM BRAZIL, BY EACH COUNTRY, SINCE 2014**

Country	2014	2015	2016
<b>Hong Kong</b>	1785	1740	223
<b>Taiwan</b>	1281	722	-
<b>Tailand</b>	981	1145	52
<b>Germany</b>	381	730	-
<b>Japan</b>	197	214	-

Country	2014	2015	2016
<b>Japan</b>	197	214	-
<b>Hungary</b>	161	-	-
<b>USA</b>	133	263	25
<b>United Kingdon</b>	111	56	-
<b>Others</b>	273	774	110

## POTAMOTRYGON SPECIES IN BRAZIL

The family potamotrygonidae has 4 genera: Paratrygon, Pleisiotrygon, Potamotrygon e Heliotrygon. According to Lasso et al (2013), specimens of the genus *Potamotrygon* could be visually differentiated from the other genus, as showed below:

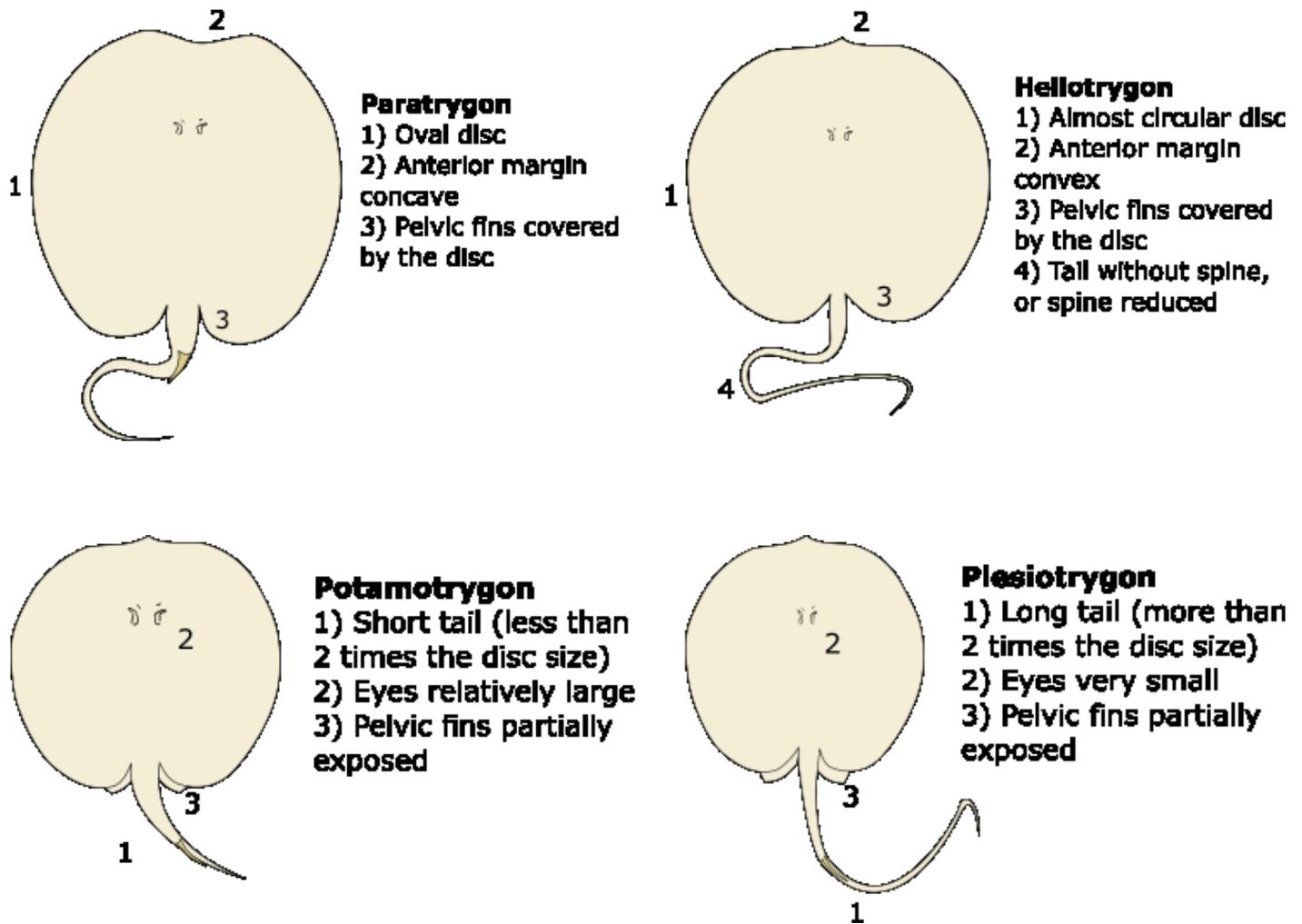


Fig.2: Basic characteristics of each Potamotrygonidae genus

In the next pages, we will present a list of all brazilian species of *Potamotrygon* genus, with information we consider important to help the identification of our species. Although the species present a lot of variation in color patterns, the ornamental market tends to look for specific and regular patterns – the importers needs to know exactly what they are buying, and this need of predictability could help enforcement agents to identify even specific populations.

For detailed identification keys to all *Potamotrygon* species, Lasso *et al* (2016) is the most recent reference and may provide an easy work for enforcement agents.

**SPECIES ALLOWED TO BE CAPTURED AND EXPORTED FROM BRAZIL**



***Potamotrygon henlei***

**Common names:** Raia de fogo, Bigtooth river stingray, Tocantins River Ray, Feuerrochen, P12 (FROESE; PAULY, 2017; LASSO et al., 2013).

**Geographic distribution:** Tocantins and Araguaia rivers (LASSO et al., 2013)

**General remarks:** Its ornamental commerce is limited to 1000 specimens from Pará state in Brazil. Only specimens smaller than 30cm can be caught for the ornamental commerce. It's the second most expensive specie exported from Brazil, but have few registers of illegal trade.

**Identification tips:** The dorsal color pattern is blackish to grayish-brown, with relatively few ocelli. Those ones present a yellowish to light orange color and are usually round, but different elongate shapes could be found. The ocelli have thin black contours and lighter centers (fig 5) and are much larger than the eyes (CARVALHO, 2016a).

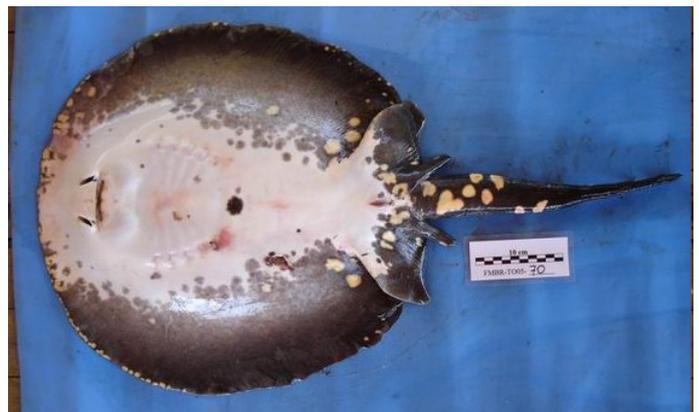


Fig 3: *P. henlei*, dorsal view - USP TO05-70 (by Fernando Marques)

Fig. 4: *P. henlei*, ventral view - USP TO05-70 (by Fernando Marques)



Fig. 5: *P. henlei*, ocelli detail USP TO05-70 (by Fernando Marques)



## *Potamotrygon leopoldi*

**Common names:** Leopold stingray, White-blotched river stingray, Leopolds Stachelrochen, Xingu River Ray, Arraia Negra, Arraia de letrinha, P13 (FROESE; PAULY, 2017; LASSO et al., 2013).

**Geographic distribution:** Xingu and Fresco Rivers, Xingu River basin (REIS; KULLANDER; FERRARIS, 2003)

**General remarks:** It's the most expensive of the Brazilian stingrays. Its ornamental commerce is limited to 5000 specimens/year, and only specimens smaller than 30cm can be exported for the ornamental commerce. The distribution is completely restricted to Brazil, and it's the main target of illegal trade, since it could regularly reach values as high as US\$2.500 each specimen.

**Identification tips:** *Potamotrygon leopoldi* has an intense black dorsal color, as in *P. albimaculata*, but with large, relatively few and incomplete yellow to whitish ocelli or incomplete rings or sickle-shaped figures with black centers on mid-disc (CARVALHO, 2016a). Other species that could look similar, as *P. motoro* or *P. henlei* shows more brown or grayish colors, and darker rings around ocelli, which is not seen in *P. leopoldi*, considering their intense dorsal color



Fig 6: *P. leopoldi*, dorsal view - USP TO05-89 (by Fernando Marques)



Fig. 7: *P. leopoldi*, ventral view - USP TO05-90 (by Fernando Marques)

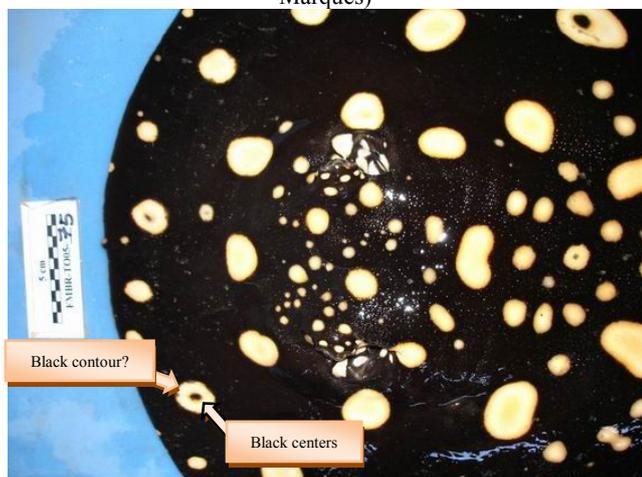


Fig. 8: *P. leopoldi*, ocelli detail USP TO05-85 (by Fernando Marques)



Fig. 9: *P. leopoldi*, diverse color pattern USP TO05-71 (by Fernando Marques)

## *Potamotrygon motoro*

**Common names:** Arraia-pintada, Arraia-de-fogo, Motoro, Manilla, Ocellate river stingray, *Raya motora*, Ocellate river stingray, P1-P3, P5, P11, P19-P24, P44 (FROESE; PAULY, 2017; LASSO et al., 2013; ROSS; SCHÄFER, 2000)

**Geographic distribution:** Argentina, Bolivia, Brazil, Colombia, French. Guyana, Guyana, Paraguay, Peru, Surinam and Uruguay. Uruguay, Paraná-Paraguay, Orinoco, and Amazon River basins (FROESE; PAULY, 2017; LASSO et al., 2013; LOBODA, 2010; LOBODA; CARVALHO, 2013)

**General remarks:** This specie is a secondary target of the fishery both for food and for ornamental purposes. Its ornamental commerce is limited to 4000 specimens on Amazonas state and 1200 on Pará state (where the fishery for food purposes is bigger). Only specimens smaller than 30cm can be fished for ornamental commerce. It never reached the allowed exported quota, and it looks like the market are not interested in big quantities of the brazilian populations of this specie. However, it's one of the main species exported by Peru and Colombia, who had their own populations of this specie.

One remarkable thing about this specie is that its name is the most commonly used to cover illegal trade or non identified specie.

**Identification tips:** Loboda (2010) classified the different color patterns in Amazon basin in 5 groups (classified from CD1 to CD5), with CD1 and CD2 been broadly distributed on Amazon Basin and the possibility to found intermediary forms between CD2 and each one of the other groups.

CD1 is the most known color pattern, much similar to the patterns found in the Paraná-Paraguay basin, and presents a brown or gray dorsal disc, with regular rows of tricolor ocelli (Yellow, orange and black) (fig. 10).



Fig. 10: *P. motoro*, Color pattern CD1, USP AC06-01 (by Fernando Marques)



Fig. 11: *P. motoro*, CD1 ventral view, USP USP AC06-01 (by Fernando Marques)

CD2 presents a similar pattern, but with bigger and more varying ocelli. The ocelli are bicolor (orange/red and black) with a much larger black ring. It also comprehend some variations with open ocelli forming complex patterns.

CD3 It's a pattern dominant in Brazilian populations of Negro and Branco River, with a darker coloration on dorsal disc, tetracolor ocelli (Yellow, orange, black and beige) and a characteristic "belt" of marginal ocelli partially fused on each other. It's occasionally been seen smuggled to Colombia or Peru.



Fig. 12: *P. motoro*, Color pattern CD2, USP AC06-110 (by N. M. Luchetti)



Fig. 13: *P. motoro*, Color pattern CD3, USP RN05-05 (by M. V. Domingues & N. M. Luchetti)

CD4 is a pretty different pattern that occurs in Brazilian and Peruvian populations, and presents vermicular spots and broken ocelli producing complex patterns on the dorsal disc. It's always associated with CD2. It's also exported as "Mantilla ray" from Peru, but we have no information on illegal trade from Brazilian populations.

CD5 is also associated with CD 2 and only occurs in Brazil. In this color pattern, the ocelli could present a "U" format and be camouflaged with the disk color, that is clearer than in the other patterns. It was seen occasionally in the marketing, but it appears to be no target of illegal trade.



Fig. 14: *P. motoro*, Color pattern CD4, USP AC06-88 (by Fernando Marques)

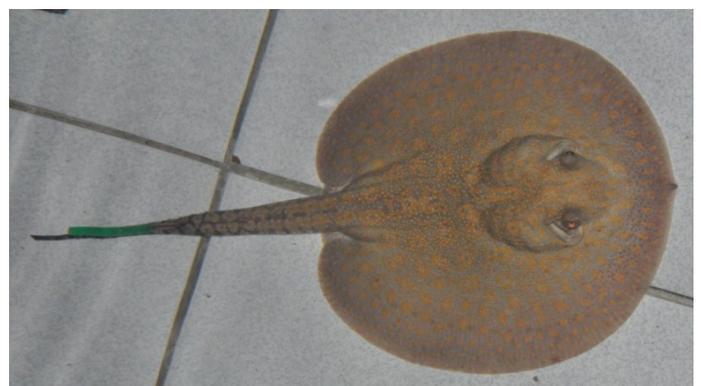


Fig. 15: *P. motoro*, Color pattern CD5 (by Henrique Anatole)

## *Potamotrygon orbignyi*

**Common names:** Smooth back river stingray, Raya tigrita, Raya común, Raia Branca, Arraia Cocal, P10, P61, P23, P46 (FROESE; PAULY, 2017; LASSO et al., 2013; ROSS; SCHÄFER, 2000).

**Geographic distribution:** Bolivia, Brazil, French Guiana, Guyana, Suriname and Venezuela. Widespread in Amazon and Orinoco River basins and in river systems in Suriname, Guyana and French Guiana (DE CARVALHO; LOVEJOY; ROSA, 2003; FROESE; PAULY, 2017; LASSO et al., 2013).

**General remarks:** This species presents color patterns as diverse as *P. motoro*, and is also a secondary target of both the fishery for food and for ornamental purposes. Its ornamental commerce is limited by an annual quota of 2.400 specimens. Only specimens with diameter smaller than 30cm can be fished and traded for ornamental commerce. It never reached the allowed quota, and it looks like the market is not interested in big quantities of this specie. Considering this, and that other countries have their own populations, it's not expected to find specimens of *P. orbignyi* on the illegal trade. However, it's name could be used to trade other species witch fisheries are not allowed.

**Identification tips:** *P. orbignyi* has the dorsal disk varying from dark brown to black, with beige to brown reticulated marks, that forms broad hexagonal or rounded patterns, sometimes randomly distributed. The tail is dorsally provided with lateral vertical bands, and ventrally with transversal bands. In most cases, the tail also have one regular dorsal line of spines, but, eventually, this line could be irregular or the specimen could present two lines (DA SILVA; DE CARVALHO, 2015). It's similar to *P. marinae* and *P. humerosa*.

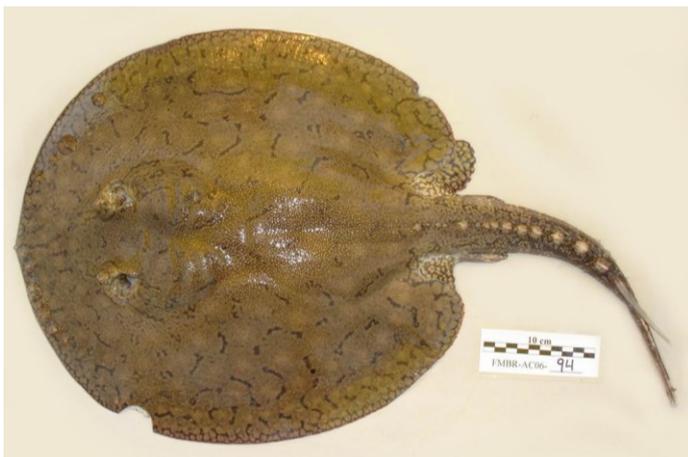


Fig. 16: *P. orbignyi*, Dorsal view, Tarauacá Lake USP AC06-094 (by N. Luchetti)

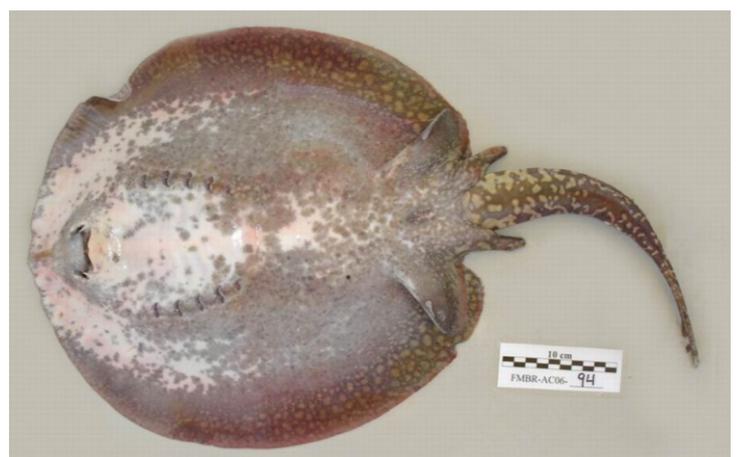


Fig. 17: *P. orbignyi*, Ventral view, USP AC06-094 (by N. Luchetti)



Fig. 18: *P. orbignyi*, diverse color pattern, Xingu river, dorsal view USP TO05-82 (by F. Marques)



Fig. 19: *P. orbignyi*, diverse color pattern, ventral view USP TO05-82 (by F. Marques)



Fig. 20: *P. orbignyi*, diverse color pattern, Tocantins river USP TO05-59 (by F. Marques)



Fig. 21: *P. orbignyi*, diverse color pattern, Tapajós river USP TJ05-43 (by M.L.G. Araújo)

## *Potamotrygon schroederi*

**Common names:** Raia-Flor, Guacamaya, Raya-Trébol, Raya-Perla, Guayanesa (FROESE; PAULY, 2017; LASSO et al., 2013).

**Geographic distribution:** Brazil, Colombia and Venezuela. Amazon, Negro and Orinoco basins (FROESE; PAULY, 2017; LASSO et al., 2013).

**General remarks:** Its commerce is limited to 1000 specimens on Amazonas state. Only specimens smaller than 30cm can be fished for the ornamental commerce. This specie is a secondary target of the ornamental fishery in Brazil, where fishermen used to classify it as a hard to keep species, but is an important species in Colombia. The captive breeding of the species is officially unknown, but is supposed to happen on Southeast Asia.

**Identification tips:** Considering what is said by Rosa (1985), Lasso *et al.* (2013) and Ross and Schäfer (2000), this species present a more oval disc, with a dark grayish-brown surface with yellow to orange spots, forming rosette or brain patterns which decrease in size towards disc margins. The tail presents 5 to 6 yellow or orange large stripes, separated by black bands. It looks similar to *P. tigrina*, endemic species from Peru, differentiated by having a reticulated pattern, instead of rosette or brain forms, on the dorsal disc.



Fig. 22: *P. schroederi*, Dorsal view, USP RN05-43 (by M.Domingues & N. Luchetti)



Fig. 23: *P. schroederi*, Ventral view, USP RN05-18 (by M.Domingues & N. Luchetti)



Fig. 24: *P. schroederi*, Different color pattern, USP RN05-18 (by M.Domingues & N. Luchetti)



**Potamotrygon wallacei**

**Common names:** Cururu, Common stingray, P06, P60 (CARVALHO; ROSA; ARAÚJO, 2016; ROSS; SCHÄFER, 2000).

**Geographic distribution:** Endemic to the Rio Negro drainage in Amazonas, Brazil, occurring from Santa Isabel down to Rio Cuieiras in the vicinity of Manaus (CARVALHO; ROSA; ARAÚJO, 2016)

**General remarks:** This is the main stingray specie of the Amazon state, and the smaller of the 6 specimens permitted to ornamental purposes in Brazil. Its ornamental commerce is limited to 6000 specimens/year and only specimens smaller than 14cm can be fished for the ornamental commerce. Before it's description, it was commonly found in aquarium books and magazines wrongly classified as *P. histrix*, *P. laticeps*, *P. motoro* or *Disceus thayeri* (CARVALHO; ROSA; ARAÚJO, 2016; ROSS; SCHÄFER, 2000).

**Identification tips:** Considering the description by Carvalho, Rosa and Araújo (2016) *P. wallacei* is the smallest sized stingray known, and present a characteristic color pattern, with a light to grayish-brown color on dorsal disc, with irregularly-shaped dark brown to black figures and vermiculations, forming large reniforms or brain-shaped areas at disc center. Light brownish irregular spots on disc periphery usually have darker centers forming weakly ocellated spots, that may be reniform or cerebriiform. The sides of tail presents an alternate light brown and intense black bars that do not connect dorsally, from tail origin to the caudal sting origin. The ventral surface of disc is white with broad, dark brown disc margins, and creamy to grayish center.

Comparing the species with similar color patterns, *P. wallacei* could be visually differentiated from *P. magdalenae*, endemic from Colombia, by having a much shorter tail, without any vermiculate color pattern on it. From *P. orbignyi*, besides the similar color patterns, the dorsal markings differ substantially, as *P. wallacei* does not have a complete or incomplete reticulate pattern, but small or neonate specimens may be confused (DA SILVA; DE CARVALHO, 2015).



Fig. 25: *P. wallacei*, Dorsal view, USP RN05-93 (by M.Domingues & N. Luchetti)



Fig. 26: *P. wallacei*, Ventral view, USP RN05-93 (by M.Domingues & N. Luchetti)

**FORBIDDEN SPECIES OF MAJOR CONCERN**

**ENDEMIC  
OF  
BRAZIL.**

***Potamotrygon albimaculata***

**Common names:** Pretinha, P14, Tapajós freshwater stingray, Itaituba ray (CARVALHO, 2016a; LASSO et al., 2016; ROSS; SCHÄFER, 2000).

**Geographic distribution:** Mid and upper Tapajós River (CARVALHO, 2016a).

**General remarks:** Its capture for ornamental purposes **is not allowed in Brazil**, but it's one of the main targets of the illegal ornamental fishery, probably the most expensive of them. The illegal commerce acts mainly by smuggling specimens by river to Peru and Colombia, where it goes to exporters and then enters the regular ornamental market worldwide. The main buyers appear to be countries of Europe and Asia.

**Identification tips:** According to Carvalho (2016), the adults could be easily identified by its unique color pattern, composed of an intense, uniform dark brown to blackish-brown dorsal color with whitish, circular spots on dorsal disc and tail base, usually smaller than eye-diameter and not closely packed together. It presents a more regular color pattern than their relatives *P. leopoldi* and *P. henlei*.

The ventral disk is dark brown, more intense closer to disc margins and fading towards central disc, with creamy white ventral snout, anterior disc area, and branchial slit region, with few small, faint whitish to grayish blotches on dark brown ventral disc, pelvic fins and ventral tail base.

It could be diagnosed from congeners by its numerous regularly distributed dorsal tail thorns in irregular parallel rows, with a relatively large space between individual thorns.



Fig. 27: *P. albimaculata* Dorsal view, USP MT05-08 (by Fernando Marques)



Fig. 28: *P. albimaculata*, Ventral view, MT05-08 (by Fernando Marques)

## *Potamotrygon brachyura*

**Common names:** Raya gigante, raya “boba”, chucho, raya boba, raya fina, Short-tailed river stingray, giant fresh water sting ray (FROESE; PAULY, 2017; LASSO et al., 2016).

**Geographic distribution:** Argentina, Brazil, Paraguay and Uruguay, Prata River Basin (DE CARVALHO; LOVEJOY; ROSA, 2003; FROESE; PAULY, 2017).

**General remarks:** Its capture for ornamental purposes **is not allowed in Brazil**, but it’s possible to find some pictures on internet of specimens in tanks and aquarium. However, this stingray occurs in other countries, and we don’t have information that points to it as a regular target of illegal market in Brazil. Even if it shows up on ornamental fish market, it’s not expected to present big values or quantities. But it is a regular target of sportive fisheries, and dead specimens could be exported as a trophy.

**Identification tips:** It is the bigger *Potamotrygon* species, reaching 90cm of diameter and 250kg. It has a remarkable short tail and a characteristic dorsal reticulate pattern, making it easy to identify (ROSS; SCHÄFER, 2000).

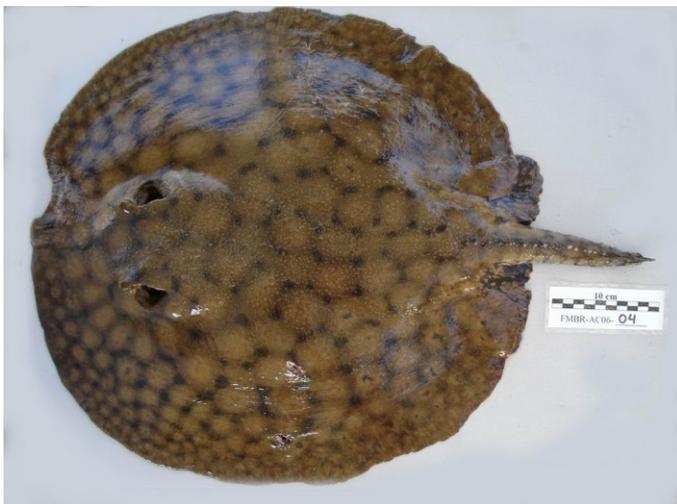


Fig. 29: *P. brachyura*, Dorsal view, USP AC06-004 (by Fernando Marques)

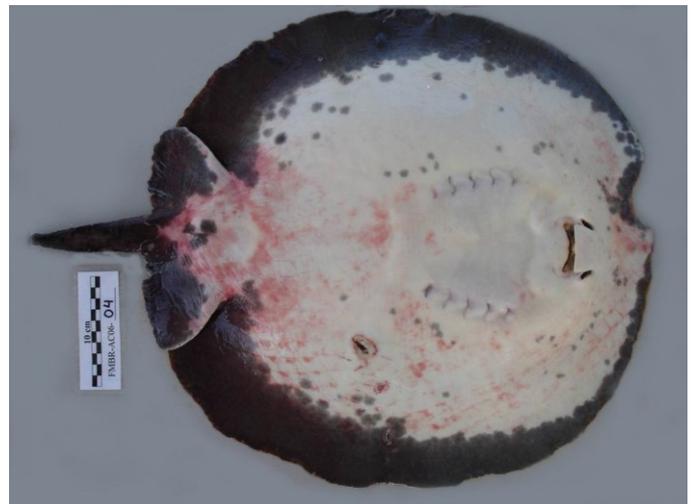


Fig. 30: *P. brachyura*, Ventral view, USP AC06-004 (by Fernando Marques)

## *Potamotrygon falkneri*

**Common names:** Large Spot Stingray, Otorongo Ray, P25 to P36, P49 to P54 (FROESE; PAULY, 2017; LASSO et al., 2013; ROSS; SCHÄFER, 2000).

**Geographic distribution:** Argentina, Bolivia, Brazil, Paraguai e Peru. Paraná-Paraguay River basin, from Cuiabá and Piquiri rivers (among others) to the La Plata River, and Amazon Basin (FROESE; PAULY, 2017; LASSO et al., 2013; SILVA; CARVALHO, 2011).

**General remarks:** Its capture for ornamental purposes **is not allowed in Brazil**, but it's possible to find many pictures on books, magazines and on internet of specimens in the aquarium trade. There are three main color patterns found in the ornamental market, which treats them as different species with different codes and names:

- 1- “Falkneri” pattern, known by the commercial code P53. This pattern is our main concern, as it appears to be the most common in Brazil.
- 2- “Castexi” pattern, known by “Otorongo”, “Estrella”, “Triginus”, “Motelo” or “Carpet ray”, and the commercial codes P25 to P36 or P54. Although it's possible to find specimens with similar patterns in Brazil, we don't have information about exports from Brazil. Specimens with this patterns are known to be exported only by Peru;
- 3- “Menchacai” pattern, known by “Tigre” the commercial codes P49 to P52. Although it's possible to find specimens with similar patterns, we don't have information about exports from Brazil. Specimens with this patterns are known to be exported only by Peru;

There are many intermediate colorations among these patterns, but the ornamental market seek some regularity on the color pattern of specimens exported.

**Identification tips:** The main visual characteristics are the dorsal disc is dark brow with yellow or white spots, on the same size or smaller than the eyes, that could be circular, oval, vermicular or in rosette pattern. One to three irregular rows of spines over the previous section of the tail and a tail with the same color pattern than the dorsal disc (SILVA; CARVALHO, 2011)

The “falkneri” pattern (fig. 18 to 21), most important for us in terms of ornamental exports, has a big quantity of medium spots with a “mosaic” appearance. It seems to have some questions about this been a new species, still to be confirmed. Information of aquarists says it's not exported regularly, and is usually expensive when available. The registers are regularly associated with Brazilian rivers, but it's expected to be found in the other countries as well.

The stingrays of “castexi” group, commonly exported from Peru, used to show a pattern with a big quantity of very small spots, that could both been completely distant one another or aggregate, forming roses or maze figures. The patterns exported with the codes P25 and P26 are the most similar to the “falkneri” pattern, supposed to be smuggled from Brazil. The “falkneri” pattern, however, tends to show bigger spots, with more equivalent sizes and less space between them. It's also similar to *P. limai*. The fact is that the ornamental market has 13 different commercial codes for what we are naming “castexi” pattern.

The stingrays with the “menchacai” pattern found in the market normally presents mainly spots only in vermicular form, similar to the pattern shown by *P. tatiánae*, an endemic species of Peru Silva & Carvalho, 2011A, 2011B). *P. rex*, another brazilian endemic species, also shows a similar pattern, but currently we had no information of illegal trade on this species and it presents a completely different distribution range.



Fig. 31: *P. falkneri*, Dorsal view, USP BZ-21 (by Janine Caira)



Fig. 32: *P. falkneri*, Ventral view, USP BZ-21 (by Janine Caira)



Fig. 33: *P. falkneri*, different color pattern, USP BZ-30 (by Janine Caira)



Fig. 34: *P. falkneri*, different color pattern, USP BZ-45 (by Janine Caira)



Fig. 35: *P. falkneri*, "Castexi" color pattern, USP BZ-30 (by Janine Caira)



Fig. 36: *P. falkneri*, "Castexi" color pattern, USP MS04-32 (by Natalia Luchetti)

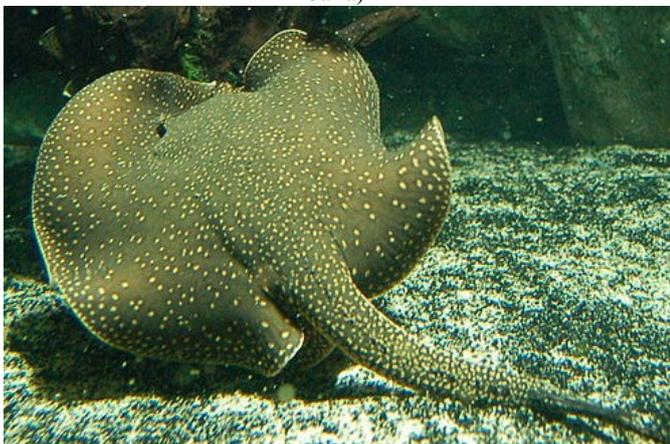


Fig. 37: *P. falkneri*, "Castexi" color pattern (By KoS (Own work) [GFDL or CC BY-SA 3.0], via Wikimedia Commons)



Fig. 38: *P. falkneri*, "Menchacai" color pattern (By Sesamehoneytart (Own work) [CC BY-SA 3.0], via Wikimedia Commons)

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## *Potamotrygon jabuti*

**Common names:** Jabota, Jabuti, Pearl ray P54 (CARVALHO, 2016a; ROSS; SCHÄFER, 2000).

**Geographic distribution:** Mid and upper Tapajós River (CARVALHO, 2016a).

**General remarks:** Its capture for ornamental purposes **is not allowed in Brazil**, but it's one of the main targets of the illegal ornamental fishery. The illegal commerce acts mainly by smuggling specimens by river to Peru and Colombia, where it goes to exporters and then enters the regular ornamental market worldwide. The main buyers appears to be countries of Europe and Asia.

**Identification tips:** It is easily distinguished by its unique dorsal color pattern. However, neonates shares some similarities with *P. motoro* in the color pattern. In this phase, both species have large and relatively few ocelli with light orange centers and slender darker brown contours, but after a few months, the complex marbled pattern of *P. jabuti* becomes apparent (CARVALHO, 2016a).



Fig. 39: *P. jabuti*, Dorsal view, USP TJ05-31 (by M.L.G. Araújo)



Fig. 40: *P. jabuti*, Ventral view, USP BZ-21 (by M.L.G. Araújo)

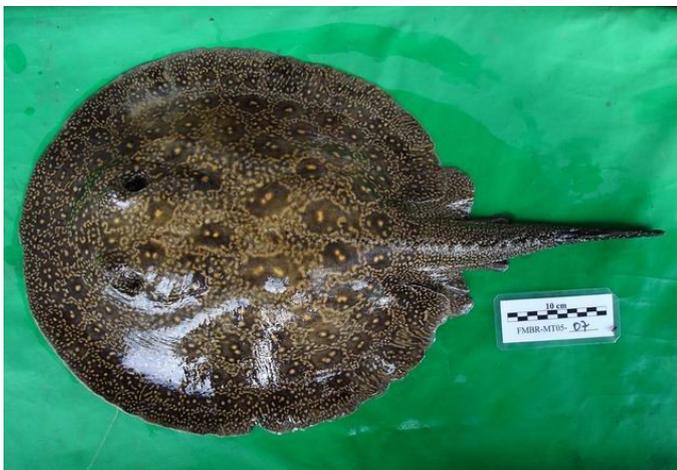


Fig. 41: *P. jabuti*, different color pattern, USP MT05-07 (by Fernando Marques)



Fig. 42: *P. jabuti*, juvenile color pattern, MT05-33 (by Fernando Marques)

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***Potamotrygon limai***

**Common names:** Unknown

**Geographic distribution:** Brazil, probably endemic. Jamari River, upper Madeira River system, Amazon basin (FONTENELLE; DA SILVA; DE CARVALHO, 2014).

**General remarks:** Its capture for ornamental purposes **is not allowed in Brazil**. This is a relatively new specie, with no official records in the ornamental commerce, but there's a possibility that it had already been exported in the past by the name of *P. castexi*, or *P. scobina*, once that we could find some pictures with similar color patterns in magazines and websites that are supposed to be captured in Brazil. Currently, the occurrence of this species is only known to Brazil, but in Lasso *et al* (2016) is said that ornamental fishes exporters from Colombia said that this species could be also found in Colombia. We consider it highly improbable, considering the known distribution, but it demonstrates the commercial interest on this species.

**Identification tips:** According to Fontenelle, Silva and Carvalho (2014), the species shows a dorsal disc with a dark brownish background, covered with beige to whitish, closely packed small spots roughly arranged in small concentric patterns. The spots are wider toward disc margins and may be closely set forming vermicular patterns. The lower back portion of disc presents a characteristic roughly polygonal pattern, interspersed with small light spots.



Fig. 43: *P. limai*, Dorsal view, USP AC06-25 (by N. Luchetti)



Fig. 44: *P. limai*, Ventral view, AC06-25 (by N. Luchetti)



**Potamotrygon rex**

**Common names:** Unknown

**Geographic distribution:** Endemic of Brazil. Middle and upper Tocantins River (CARVALHO, 2016b)

**General remarks:** It's a pretty new species, and we found no information or reference pointing to the illegal ornamental trade of this species. However, as the other “black stingrays”, it presents many characteristics that put it as a potential target of this market. It's important to pay attention.

**Identification tips:** According to Carvalho (2016b), is a massive, brightly spotted form with a blackish-brown disc, tail and most of ventral surface. He considers the species clearly distinct from all congeners, including *P. henlei*, from the Araguaia and lower Tocantins basin, and *P. leopoldi* from the rio Xingu, to which it bears more resemblance. It's color pattern is described as a complex arrangement, consisting of intense yellow to orange spots, mostly smaller than eye-diameter, that form distinct concentric clusters on dorsal disc and tail, separated by a reticulate pattern formed by the dark background color.



Fig. 45: *P. rex*, Dorsal view, USP TO04-01 (by Natalia Luchetti)



Fig. 46: *P. rex*, Ventral view, USP TO04-01 (by Natalia Luchetti)



Fig. 47: *P. rex*, Dorsal view, USP TO04-03 (by Natalia Luchetti)



Fig. 48: *P. rex*, Ventral view, USP TO04-04 (by Natalia Luchetti)



Fig. 49: *P. rex*, Dorsal view, USP TO04-09 (by Natalia Luchetti)



Fig. 50: *P. rex*, Ventral view, USP TO04-08 (by Natalia Luchetti)

## *Potamotrygon scobina*

**Common names:** Raya, Common Ray, Raya mariposa, P37, P38 and P39 (LASSO et al., 2013).

**Geographic distribution:** Brazil, Peru and Colombia, mid to lower Amazon River, lower Tocantins River, Pará River, Trombetas River, Solimões River, Madeira River and Orinoco River (FONTENELLE, 2013; LASSO et al., 2013; REIS; KULLANDER; FERRARIS, 2003).

**General remarks:** Considering Fontenelle (2013), there are new species to be described that have been considered *P. scobina*, and some color patterns could be of interest of ornamental market. Although the similar distribution compared to *P. motoro* and *P. orbygnyi* in the Amazon region, the commercial demand of brazilian populations appears to be smaller for this species. While we know that it's possible that it appears on illegal trade coming from Brazil, currently, we have no information about it.

**Identification tips:** Fontenelle (2013) said *P. scobina* presents a dark to light-brown or grey disk with beige or yellow ocellate spots, the size of the eyes diameter or smaller, with a small dark ring around them. Those spots may be numerous in the middle of the disc, forming rosette patterns around a central ocelli.

He describe four different color patterns for *P. scobina* dorsal disk. The first present bigger and isolated spots, without smallest spots around it, and is the characteristic pattern of the specie; the second pattern resemble the first, but with smaller whitish spots, without the dark rings, on the central-posterior part of the disc. The third pattern looks like the first, but with spots much smaller and more spaced. The last pattern shows many small white spots around the ocelli, forming circular rosette patterns over a dark-brown background.

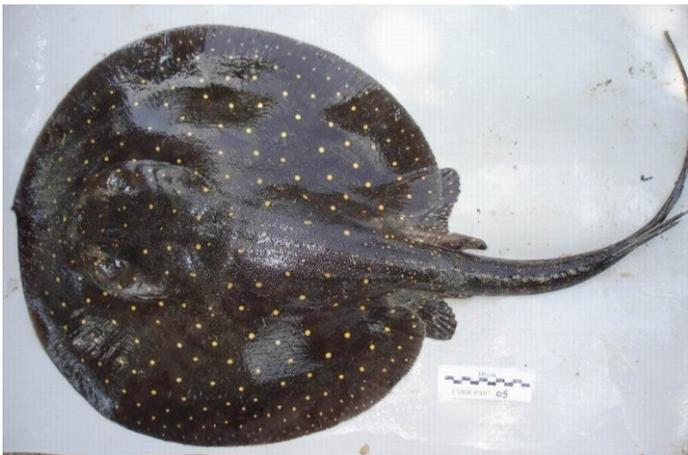


Fig. 51: *P. scobina*, Dorsal view, USP PA07-05 (by F. Marques; M. Cardoso Jr and V. Bueno)



Fig. 52: *P. scobina*, Ventral view, USP PA07-05 (by F. Marques; M. Cardoso Jr and V. Bueno)

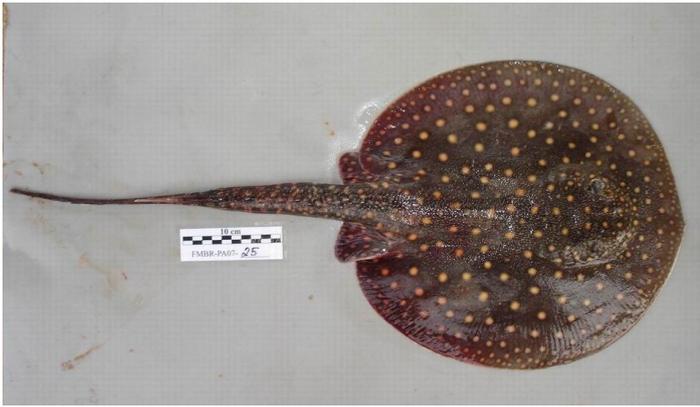


Fig. 53: *P. scobina*, Dorsal view, USP PA07-25 (by F. Marques; M. Cardoso Jr and V. Bueno)



Fig. 54: *P. scobina*, Dorsal view, USP PA07-16 (by F. Marques; M. Cardoso Jr and V. Bueno)



Fig. 55: *P. scobina*, Dorsal view, USP PA07-32 (by F. Marques; M. Cardoso Jr and V. Bueno)



Fig. 56: *P. scobina*, Dorsal view, USP PA07-15 (by F. Marques; M. Cardoso Jr and V. Bueno)

## OTHER SPECIES OF LESS CONCERN

### *Potamotrygon amandae*

**Common names:** Raia-comum, Raia-de-fogo (LOBODA; CARVALHO, 2013).

**Geographic distribution:** Argentina, Brazil, Bolivia and Paraguay, Paraná-Paraguay basin (LASSO et al., 2016; LOBODA; CARVALHO, 2013).

**General remarks:** This species described in 2013 has a broad distribution. Its capture for ornamental purposes is **not allowed in Brazil**, but we believe that it's not a target of illegal market, because it has a color pattern similar, but less attractive than *P. motoro*, which is allowed to be exported in Brazil but are showing low rates of commercial demand.

**Identification tips:** The identification of this species could be harder if you are not sure about where it was caught. If it is known that the specimens comes from the Paraná-Paraguay rivers basin, a combination of characters differentiates *P. amandae* from *P. motoro* and *P. pantanensis*, the other 2 stingrays with ocelli in the region. Firstly, the dorsal disc is predominantly grayish or dark brown, while in *P. motoro* it is gray, dark gray, olive, olivaceous brown, or dark brown, and in *P. pantanensis* it is uniformly brown. Secondly, the ocelli, when present, has two colors, with a whitish, light gray or light yellow central area surrounded by a black peripheral ring, while in *P. motoro* it is tricolored with a peripheral dark ring, yellowish or orange center and an intermediate band between them, and in *P. pantanensis* it is bicolored, with a diameter greater or equal to eye-diameter, and vermiculated markings with a beige, yellow or orange central area surrounded by a peripheral black ring. Finally, the ventral disc coloration is grayish, covering almost all of ventral disc, while it's ventral color is predominantly whitish over central disc in *P. motoro* and *P. pantanensis* (LOBODA; CARVALHO, 2013).



Fig. 57: *P. amandae*, Dorsal view, USP AC06-017 (by Fernando Marques)



Fig. 58: *P. amandae*, Ventral view, AC06-017 (by Fernando Marques)

## *Potamotrygon constellata*

**Common names:** Thorny river stingray (FROESE; PAULY, 2017)

**Geographic distribution:** Amazon River and some big tributaries in Brazil, Colombia, Ecuador and Peru (FROESE; PAULY, 2017; LASSO et al., 2013)

**General remarks:** There are some taxonomic doubts about this species (LASSO et al., 2013). The information found about it on aquarium magazines and books is scarce, and always associated with potential mistakes of identification. The color pattern presented by specimens recognized as *P. constellata* by specialists does not seem to be attractive to the ornamental market, and the distribution area does not comprehend places where this kind of fisheries takes place regularly. Because of it, we do not trust on the identification of any specimen found on ornamental market with that name to illustrate this document. Currently, we do not expect to see this species in the market.

**Identification tips:** The color pattern normally is variable, based on a dark brown disc with small white or yellow spots in the borders, occasionally with broken reticulate pattern of dark pigment. It is said that the body also shows many and big tubercles (ROSA, 1985).



*Potamotrygon humerosa*

Common names: Unknown

**Geographic distribution:** Amazon River basin, since Negro River until Pará River (FROESE; PAULY, 2017; LASSO et al., 2013).

**General remarks:** The information found about this species on magazines and books of ornamental market is scarce and always associated with potential mistakes of identification – most of the time it looks like *P. orbignyi*. Besides its small size, the color pattern presented by specimens recognized as *P. humerosa* by specialists does not seem to be attractive to the market. We do not expect to see this species in the market, except as an occasional identification mistake with *P. orbignyi*.

**Identification tips:** The species has a brown dorsal disc, generally with a reticulated pattern of dark pigments, creating big circular spaces that become smaller near the borders. Similar to *P. orbignyi*, but more rugged and with more and bigger spines on disc and tail (DA SILVA; DE CARVALHO, 2015)



Fig. 59: *P. humerosa*, Dorsal view, USP TJ05-23 (by M. L. G. de Araújo)



Fig. 60: *P. humerosa*, Ventral view, USP TJ05-23 (by M. L. G. de Araújo)

## *Potamotrygon hystrix*

**Common names:** Unknown

**Geographic distribution:** Argentina, Brazil e Uruguai. Uruguay and Paraná-Paraguay basin (LASSO et al., 2016; REIS; KULLANDER; FERRARIS, 2003).

**General remarks:** The information found about this species on magazines and books of ornamental market is scarce and always associated with potential mistakes of identification. For years, our national regulation and the market treats as *P. hystrix* the newly described *P. wallacei*, but the species are quite different, and have completely different geographical distribution. The color pattern presented by this species does not seem to be much attractive to the ornamental market, and the distribution area does not comprehend places where this kind of fisheries takes place regularly, but the small size of adult specimens could become an attractive factor. Currently, we do not expect to see this species in the market.

**Identification tips:** According to Carvalho *et al* (CARVALHO; ROSA; ARAÚJO, 2016), the species present a grayish-olive to dark brown background, with slender, small vermiculate and rosette-like markings, and ventrally it is mostly gray with unpigmented areas near anterior and central disc. Rosa (1985) also said that it has the disc relatively rough with sharp denticles, and a tail with sharp mid dorsal spines, in one irregular row which continues dorsally on disc as double or triple parallel rows.



Fig. 61: *P. hystrix*, dorsal view, USP MS04-41 (by M. L. G. de Araújo)



Fig. 62: *P. hystrix*, ventral view, USP MS04-41 (by M. L. G. de Araújo)



## *Potamotrygon ocellata*

**Common names:** Unknown

**Geographic distribution** Pedreira River and south of Mexiana Island in Brazil (REIS; KULLANDER; FERRARIS, 2003).

**General remarks:** According to Fontenelle, Da Silva e Carvalho (2014), there are taxonomic doubts about this species. Loboda (2010) considered this a *P. motoro* synonym. The information found about this species on aquarium magazines and books is scarce and always associated with potential mistakes of identification.

## *Potamotrygon pantanensis*

**Common names:** Motoro, Raia-Carijó, Raia

**Geographic distribution:** Brazil y Paraguay, Northern Pantanal region, in rivers in the state of Mato Grosso (LASSO et al., 2016; LOBODA; CARVALHO, 2013).

**General remarks:** Its capture for ornamental purposes **is not allowed in Brazil**. Once it occurs on a region of intense tourism and traditional to fisheries, it's possible that it eventually could reach the international market. However, there is no concern of it becoming a regular target of illegal market, once that this species has a color pattern similar, but less attractive than *P. motoro*, which is allowed to be exported in Brazil, but are showing low rates of commercial demand.

**Identification tips:** According to Loboda and Carvalho (2013) the identification of this species could be harder if you are not sure about where it was caught. If it is known that the specimens comes from the Paraná-Paraguay rivers basin, a combination of characters differentiates *P. pantanensis* from *P. motoro* and *P. amandae*, the other 2 stingrays with ocelli in the region: (1) Dorsal disc uniformly brown, while in *P. motoro* it is gray, dark gray, olive, olivaceous brown, or dark brown, and in *P. amandae* it is grayish or dark brown, and some specimens lack ocelli; (2) The ocelli, when present, with two colors, with a diameter greater or equal to eye-diameter, and vermiculated markings with a beige, yellow or orange central area surrounded by a peripheral black ring, while in *P. motoro* it is tricolored with a peripheral dark ring, yellowish or orange center and with an intermediate band, and in *P. amandae* it is bicolored, but with a whitish, light gray or light yellow central area surrounded by a black peripheral ring; (3) Ventral disc with a single, clearly demarcated gray color on the anterocentral part, transversed by a gray stripe over first pair of branchial slits, while in *P. motoro* the ventral color is predominantly whitish over central disc, and in *P. amandae* it is grayish, covering almost all of ventral disc; and (4), two or three rows of small, slender and curved enlarged spines on dorsal tail, while *P. motoro* has a single dorsal row of relatively large, tall and straight enlarged spines, and *P. amandae*, has double or triple rows of small and straight spines.

## *Potamotrygon schuhmacheri*

**Common names:** Unknown

**Geographic distribution:** Brazil, Argentina, Paraguai, Paraná-Paraguay River basin (FROESE, 2016).

**General remarks:** There's few information about this specie. The color pattern described in literature does not seem to be much attractive to the ornamental market, and the distribution area does not comprehend places where this kind of fisheries takes place regularly. Currently, we do not expect to see this species in the market.

**Identification tips:** It's not easy to be identified based on visual aspects. Rosa (1985) describes it as a species with subcircular disc, dorsal surface with reticulate pattern of dark pigment, delimiting irregular yellowish-brown spaces with dark center, which decrease in size towards disc margins. The few pictures founded always shows a dark stingray, with the reticulated pattern being hard to notice. Because of it, we do not trust on the identification of any specimen found on ornamental market with that name to illustrate this document. Currently, we do not expect to see this species in the market.

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*Potamotrygon signata*

**Common names:** Arraia, raia (REIS; KULLANDER; FERRARIS, 2003).

**Geographic distribution:** Endemic of Brazil, Parnaíba River basin (REIS; KULLANDER; FERRARIS, 2003).

**General remarks:** This species is completely isolated from their congeners, in the northeast region of Brazil. There's a small potential for the ornamental market, but the logistic in the distribution area makes it expensive, reducing the odds of finding it on illegal market. Currently, we have no information about illegal exports of this species.

**Identification tips:** According to Rosa (1985) it presents an oval disc with the dorsal surface olivaceous-brown, darker on midline, mottled with small, oval or irregular yellow spots, which occasionally form labyrinthic network. Spots decrease in size towards disc margins, but the largest spots are smaller than eye in diameter. The tail presents dorsal yellow vermiculations.



Fig. 63: *P. signata*, Dorsal view, USP PA07-96 (by F. Marques; M. Cardoso Jr and V. Bueno)



Fig. 64: *P. signata*, Ventral view, USP PA07-96 (by F. Marques; M. Cardoso Jr and V. Bueno)



Fig. 65: *P. signata*, Dorsal view, USP PA07-93 (by F. Marques; M. Cardoso Jr and V. Bueno)



Fig. 66: *P. signata*, Dorsal view, USP PA07-97 (by F. Marques; M. Cardoso Jr and V. Bueno)

## BIBLIOGRAPHY

- ARAÚJO, M. L. G. DE; CHARVET-ALMEIDA, P. **Freshwater stingrays (Potamotrygonidae): status, conservation and management challenges**. Joahnesburg, SA: [s.n.].
- BESSA, J. D. DE O.; SIQUEIRA, J. A. D. **A Pesca de Arraias do Amazonas**. Belém-PA: [s.n.].
- CARVALHO, M. R. DE. Description of two extraordinary new species of freshwater stingrays of the genus *Potamotrygon* endemic to the rio Tapajós basin, Brazil (Chondrichthyes: Potamotrygonidae), with notes on other Tapajós stingrays. **Zootaxa**, v. 4167, n. 1, p. 1–63, 2016a.
- CARVALHO, M. R. DE. *Potamotrygon rex*, a new species of Neotropical freshwater stingray (Chondrichthyes: Potamotrygonidae) from the middle and upper rio Tocantins, Brazil, closely allied to *Potamotrygon henlei* (Castelnau, 1855). **Zootaxa**, v. 4150, n. 5, p. 537–565, 2016b.
- CARVALHO, M. R. DE; ROSA, R. S.; ARAÚJO, M. L. G. DE. A new species of Neotropical freshwater stingray (Chondrichthyes: Potamotrygonidae) from the Rio Negro, Amazonas, Brazil: the smallest species of *Potamotrygon*. **Zootaxa**2, v. 4107, n. 4, p. 566–586, 2016.
- DA SILVA, J. P. C. B.; DE CARVALHO, M. R. Systematics and morphology of *Potamotrygon orbignyi* (Castelnau, 1855) and allied forms (Chondrichthyes: Myliobatiformes: Potamotrygonidae). **Zootaxa**, v. 3982, n. 1, p. 1–82, 2015.
- DE CARVALHO, M. R.; LOVEJOY, N. R.; ROSA, R. S. Family Potamotrygonidae. In: **Check List of the Freshwater Fishes of South and Central America**. Porto Alegre, Brazil: EDIPUCRS, 2003. p. 22–29.
- FONTENELLE, J. P. **Revisão taxonômica do complexo *Potamotrygon scobina* Garman, 1913 (Chondrichthyes: Myliobatiformes: Potamotrygonidae), com inferências biogeográficas**. [s.l.] Universidade de São Paulo - USP, 2013.
- FONTENELLE, J. P.; DA SILVA, J. P. C. B.; DE CARVALHO, M. R. *Potamotrygon limai*, sp. nov., a new species of freshwater stingray from the upper Madeira River system, Amazon basin (Chondrichthyes: Potamotrygonidae). **Zootaxa**, v. 3765, n. 3, p. 249–268, 2014.
- FROESE, R.; PAULY, D. **Fishbase**.
- LASSO, C. A. et al. (EDS.). **Rayas de agua dulce (Potamotrygonidae) de Suramerica. Parte I: Colombia, Venezuela, Ecuador, Brasil, Perú, Guyana, Surinam, Guyana Francesa: diversidad, bioecología, uso y conservacion**. Bogotá, Colombia: Instituto de Investigaciones de Recursos Biológicos Alexander von Humboldt (IAvH), 2013.
- LASSO, C. A. et al. (EDS.). **Rayas de agua dulce (Potamotrygonidae) de Suramerica. Parte II: Colombia, Brasil, Perú, Bolivia, Paraguay, Uruguay u Argentina**. Bogotá, Colombia: Instituto de

Investigación de Recursos Biológicos Alexander von Humboldt, 2016.

LOBODA, T. S. **Revisão taxonômica e morfológica de *Potamotrygon motoro* (Müller & Henle, 1841) na bacia Amazônica (Chondrichthyes: Myliobatiformes: Potamotrygonidae)**. [s.l.] Universidade de São Paulo, 2010.

LOBODA, T. S.; CARVALHO, M. R. DE. Systematic revision of the *Potamotrygon motoro* (Müller & Henle, 1841) species complex in the Paraná-Paraguay basin, with description of two new ocellated species (Chondrichthyes: Myliobatiformes: Potamotrygonidae). **Neotropical Ichthyology**, v. 11, n. 4, p. 693–737, 2013.

REIS, R. E.; KULLANDER, S. O.; FERRARIS, C. J. (EDS.). **Check List of the Freshwater Fishes of South and Central America**. Porto Alegre, Brazil: EDIPUCRS, 2003. v. 2004

RINCON, G.; CHARVET-ALMEIDA, P. O monitoramento da pesca ornamental de raias de água doce está sendo efetivo? Problemas e possíveis soluções nas esferas envolvidas. **Elasmovisor, Sociedade Brasileira para o Estudo de Elasmobrânquios - SBEEL**, p. 4–6, 2006.

ROSA, R. S. **A systematic revision of the South American freshwater stingrays (Chondrichthyes: Potamotrygonidae)**. [s.l.] Williamsburg, College of William and Mary, 1985.

ROSS, R. A.; SCHÄFER, F. **Aqualog Süßwasser Rochen: Freshwater Rays**. Mörfelden-Walldorf: Verlag A.C.S. GmbH, 2000.

SILVA, J. P. C. B. DA; CARVALHO, M. R. DE. A taxonomic and morphological redescription of *Potamotrygon falkneri* Castex & Maciel, 1963 (Chondrichthyes: Myliobatiformes: Potamotrygonidae). **Neotropical Ichthyology**, v. 9, n. 1, p. 209–232, mar. 2011.