

New records of two ocellated species of the genus *Potamotrygon* Garman, 1877 (Chondrichthyes: Myliobatiformes: Potamotrygonidae) for Paraguay and Bolivia.

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Abstract

New records of *Potamotrygon amandae* Loboda & Carvalho, 2013 and *Potamotrygon pantanensis* Loboda & Carvalho, 2013 for Paraguay and Bolivia are reported based on specimens analyzed and identified in institutions of Europe and the United States. Both species are now reported from Mamoré (just *P. amandae*) and Guaporé rivers (tributaries of Madeira river) in Bolivia, and from the Paraguay river, near Asunción in Paraguay. These are the first records of both species for the mentioned countries, and also from the upper Amazon basin (Bolivian localities).

Resumen

Nuevos registros de *Potamotrygon amandae* Loboda & Carvalho, 2013 y *Potamotrygon pantanensis* Loboda & Carvalho, 2013 para ríos de Paraguay y Bolivia están delimitados con base en especímenes analizados e identificados en instituciones de Europa y Estados Unidos. Ambas especies están ahora reportadas para los ríos Mamoré (solamente *P. amandae*) y Guaporé (tributarios del río Madeira) en Bolivia, y del río Paraguay, cerca de Asunción en Paraguay. Estos son los primeros registros de ambas especies para estos países, y también para los sistemas de la alta cuenca del Amazonas (localidades en Bolivia).

Introduction

The monophyletic family Potamotrygonidae is currently subdivided in two subfamilies, five genera and 33 species (Rosa, 1985; Lovejoy, 1996; Carvalho *et al.*, 2003; Carvalho & Lovejoy, 2011; Carvalho *et al.*, 2016), with *Potamotrygon* being the most diverse (26 species) and most widely distributed genus (Rosa *et al.*, 2010; Lasso *et al.*, 2013).

Described in 2013, *Potamotrygon amandae* and *Potamotrygon pantanensis* were recognized exclusively from the Parana-Paraguay basin, with *P. amandae* occurring in upper Paraná and upper Paraguay river systems in Brazil, and *P. pantanensis* distributed in a more restricted area, being endemic to the Northern Pantanal region (upper Paraguay system) (Loboda & Carvalho, 2013). Specimens of *P. amandae* from Argentina were found and analyzed in the collection of Museo Florentino Ameghino (MFA), and some discussion about them and their distribution in that country was also made by Loboda & Carvalho (2013). During a series of visits made in collections of Europe and the United States in 2014 and 2015, five specimens of *P. amandae* and four specimens of *P. pantanensis* from Paraguay and Bolivia were identified, and are reported on herein.

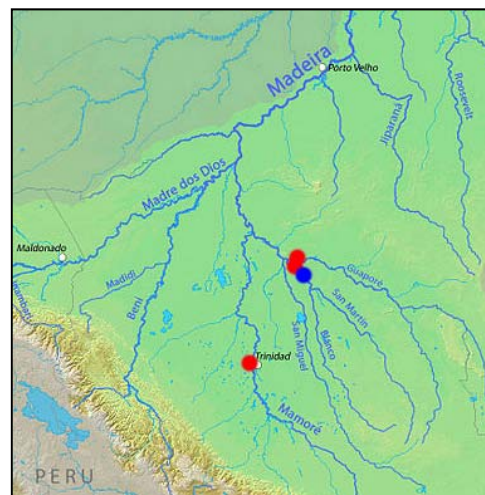


fig. 1. New localities for *P. amandae* (red spots) and *P. pantanensis* (blue spot) in Bolivia

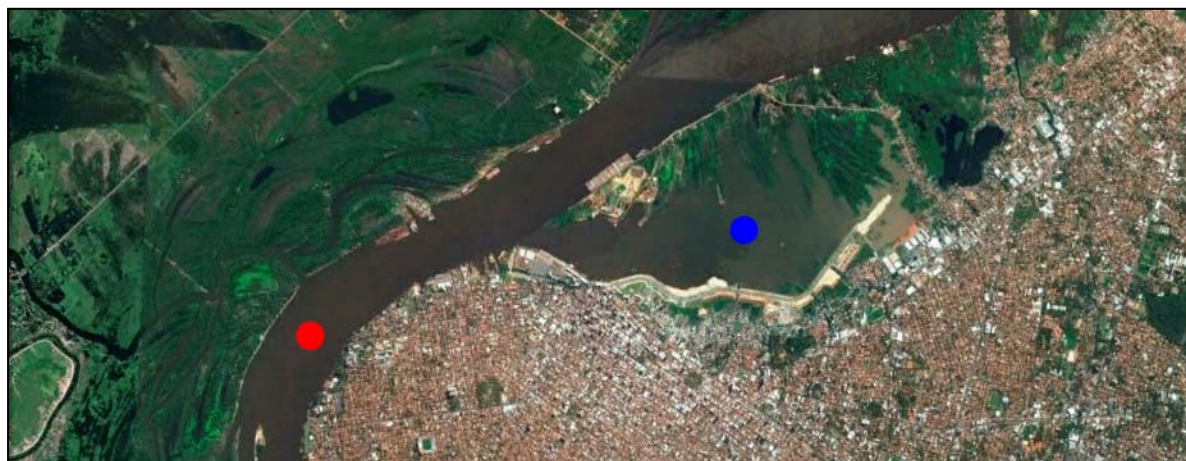


fig. 2. New localities for *P. amandae* (red spot) and *P. pantanensis* (blue spot) in the Paraguay river at Asuncion, Paraguay

Localities in Bolivia for both species are from the Mamoré and Guaporé rivers (Amazon basin) (fig. 1), whereas the localities from Paraguay are restricted to the Paraguay river near the capital Asuncion (fig. 2).

These new records are the first ones for both species in these countries, and also for the Upper Amazon basin, in the Madeira system (fig. 1). As discussed by Loboda (2010) for the specific unit between populations of *P. motoro* through Amazon and Parana-Paraguay basins, these new localities in Bolivia of *P. amandae* and *P. pantanensis* reinforces a possible ancient connection between both basins.

Material and Methods

Specimens analyzed were identified by the diagnostic characters provided with the description of Loboda & Carvalho (2013). The nine specimens are deposited in the following institutions: American Museum of Natural History (AMNH), New York, Natural History Museum (BMNH), London, Muséum National d'Histoire Naturelle (MNHN), Paris, Naturhistorisches Museum Wien (NMW), Wien, National Museum of Natural History (USNM), Washington D.C., Zoologisches Museum Hamburg (ZMH), Hamburg.

Specimens were photographed and, when it was possible, dermal denticles were analyzed by stereomicroscopes. A total of 28 measurements (see Tables 1 and 2) were taken following Loboda & Carvalho (2013).

Specimens examined

Potamotrygon amandae: AMNH 59866, adult female, Laguna Pintado, 0,5 km south of Guapore (Iténez) river, Costa Marques, Beni, Bolivia, 12°30'3"S/64°17'5"W by R.M. Bailey & R. Ramos, 27 Sep 1964. AMNH 59876 (fig. 3), adult male, Guaporé (Iténez) river, Costa Marques, Beni, Bolivia, by A. Ximenez, R.M. Bailey & R. Ramos, 23 Sep 1964. MNHN 1988-810, adult female, Mamoré river, Trinidad, Bolivia by Lauzanne, 14 Dec 1982. NMW 50219, juvenile female, Paraguay river, Hapitapunta, Asuncion, Paraguay. ZMH 10337 (fig. 4), adult female, Paraguay, 28 Feb 1901.

Potamotrygon pantanensis: AMNH 59875, female and male (fig. 5) adults, Guaporé (Iténez) river, Costa Marques, Beni, Bolivia, 12°32,4'S/64°12,7'W by R.M. Bailey, J. Boeseman & R. Ramos, 12 Oct 1964. BMNH 1892.12.29.2, juvenile female, Paraguay river, Asunción, Paraguay by Usher. USNM 181552 (fig. 6), adult female, Asunción bay, Paraguay river, Asunción, Paraguay by C.J. Brown.

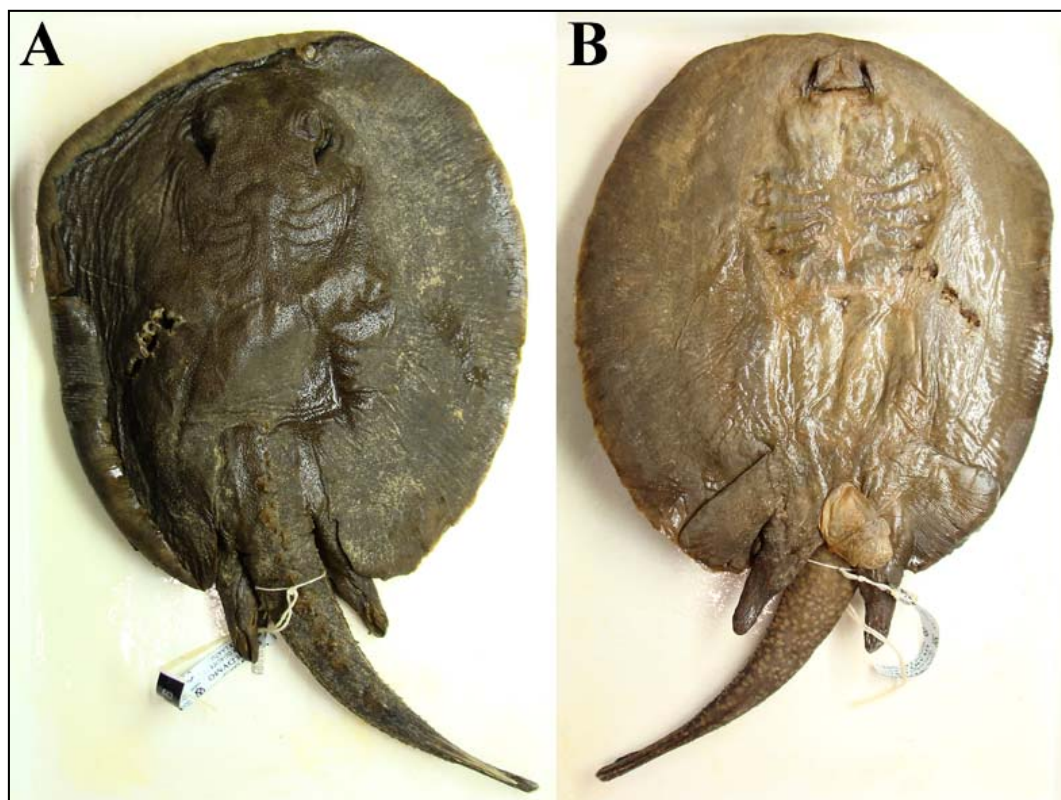


fig. 3. *Potamotrygon amandae* AMNH 59876, 263 mm DW (disc width), from Guaporé river, Bolivia, in dorsal (A) and ventral (B) views

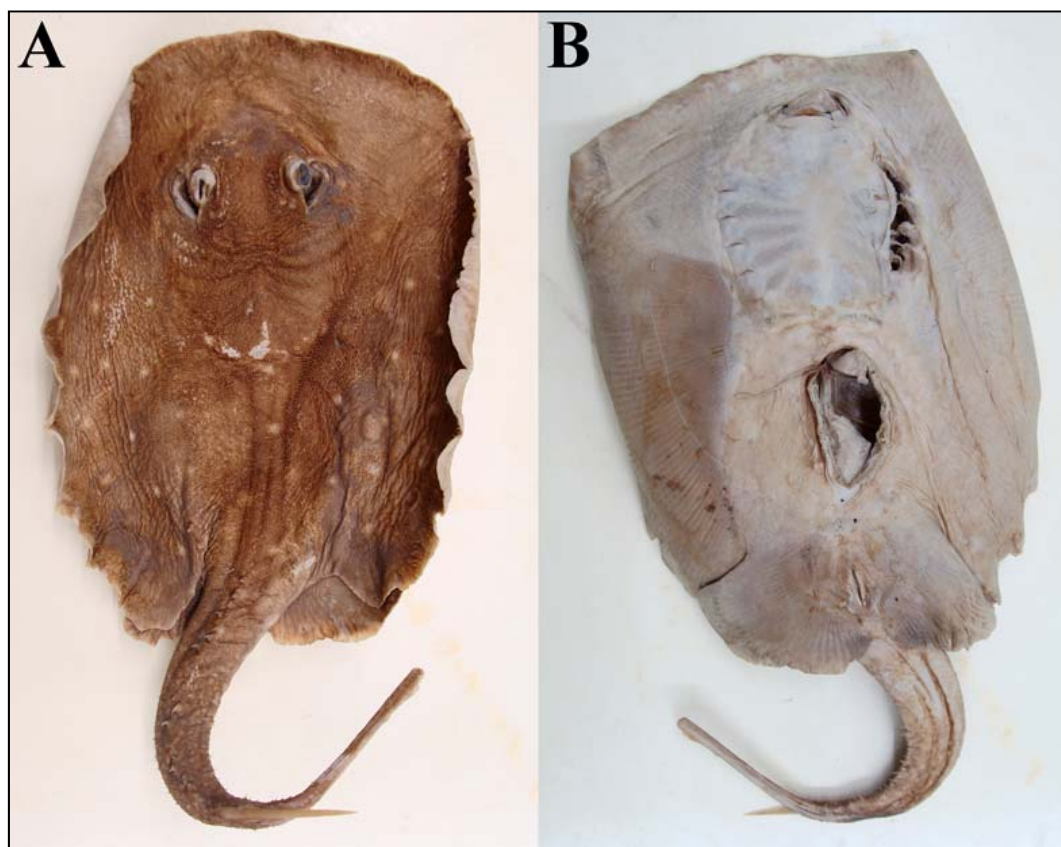


fig. 4. *Potamotrygon amandae* ZMH 10337, 238 mm DW, from Paraguay river, Paraguay, in dorsal (A) and ventral (B) views

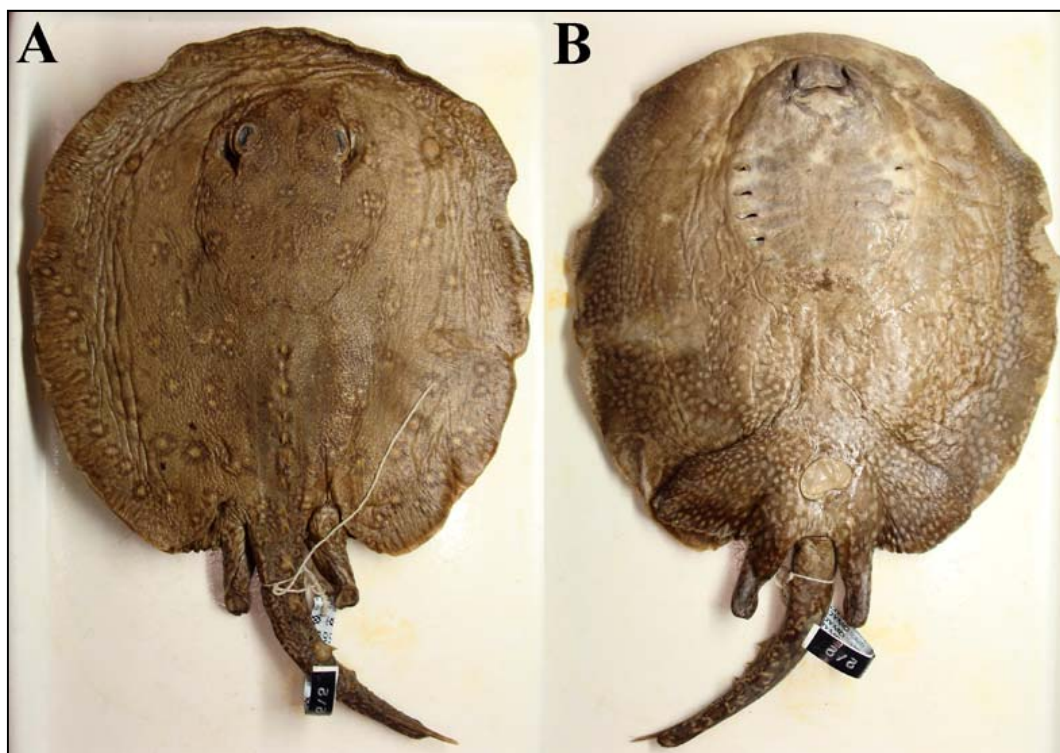


fig. 5. *Potamotrygon pantanensis* AMNH 59875, 263 mm DW, from Guaporé river, Bolivia, in dorsal (A) and ventral (B) views

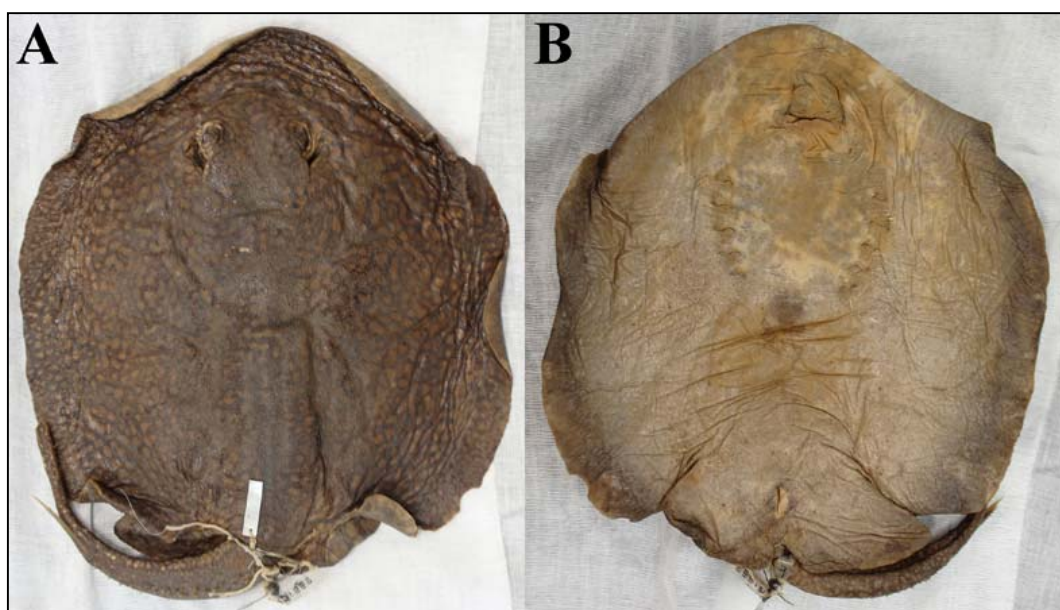


fig. 6. *Potamotrygon pantanensis* USNM 181552, 328 mm DW, from Paraguay river, Paraguay, in dorsal (A) and ventral (B) views.

Results

Potamotrygon amandae. Morphometric data are given in Table 1 (except for NMW 50219).

According to Loboda & Carvalho (2013) and the specimens described here, *P. amandae* is distinguished from its congeners by the dorsal background predominantly dark gray or dark brown, ocelli, when present, composed of two colors with a whitish center surrounded by a gray, dark gray or black ring, ventral disc coloration predominantly gray or dark gray, greater spiracular length with mean around 10% DW, tail relatively long (mean of distance between cloaca and tip around 82% DW) and slender (width in basis around 11% DW), tail rows of pointed spines generally double.

As reported for *P. motoro* (Loboda, 2010), some specimens of *P. amandae* from the Amazon basin (fig. 3) possess tubercles (pointed spines modified, see Brito & Deynat, 2004) in the rows of pointed spines on the tail and also on the margins of the disc.

Potamotrygon pantanensis. Morphometric data are given in Table 2.

As stated by Loboda & Carvalho (2013), some specimens of *P. pantanensis* show a very similar dorsal coloration as does *P. motoro*, but this species can be distinguished from other congeners by possessing a light brown or light gray dorsal coloration with bicolored ocelli and vermiculated markings with beige, yellow, or orange central area surrounded by a gray or dark gray contour, a clearly demarcated gray color area in the anterocentral ventral disc (which in some specimens may form a strip above the first pair of gill slits), tail relatively smaller (mean of distance between cloaca and tip around 73% DW) and broader (width in basis around 13% DW), presence of star-shaped dermal denticles only in the central area of dorsal disc, two or three rows of slender and curved pointed spines on the tail.

Male adult specimen AMNH 59875 from the Upper Amazon basin possess a very peculiar dorsal ocelli pattern in the central area of disc (fig. 5) as a set of small ocelli fused in a big one, and very similar with the pattern of specimens of this species from the Paraná-Paraguay basin shown by Loboda & Carvalho (2013, fig. 31). The AMNH 59875 specimens also present tubercles in the rows of the tail and on the margins of the disc.

Discussion

The geographic distribution of *P. amandae* and *P. pantanensis* were restricted to rivers of the Paraná-Paraguay basin, with *P. amandae* reported from systems of Argentina and Brazil (Loboda & Carvalho, 2013; Almirón *et al.* 2015) and *P. pantanensis* reported just from the Northern Pantanal area in Brazil (Loboda & Carvalho, 2013).

This contribution extends the occurrence area for both species within the Parana-Paraguay basin and to the Upper Amazon basin systems, in rivers of Argentina (just *P. amandae*), Bolivia, Brazil and Paraguay.

Reports of both species from Mamoré (just *P. amandae*) and Guaporé rivers, tributaries of Madeira river, in upper Amazon basin reinforce a possible ancient connection between this portion of the Amazon basin with Paraná-Paraguay. As demonstrated for *P. motoro* by Loboda (2010) and *P. falkneri* by Silva & Carvalho (2011) specimens of *P. amandae* and *P. pantanensis* from the Madeira system show the same external diagnostic morphological characters as the respective conspecific specimens from the Paraná-Paraguay basin, besides the recent geographic separation of these two basins.

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recommended form for reference:

Loboda, T.S. (2016):

New records of two ocellated species of the genus *Potamotrygon* Garman, 1877 (Chondrichthyes: Myliobatiformes: Potamotrygonidae) for Paraguay and Bolivia.

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Table 1. Measurement of *Potamotrygon amandae* specimens analyzed in this study and compared with morphometrical data of Loboda & Carvalho (2013). Mean (x), Standard Deviation (SD) are expressed in proportions of disc width (%DW), and Range is expressed in millimeters (mm) and proportions of disc width.

| Measurements | MNHN 1988-810 | | AMNH 59866 | | AMNH 59876 | | ZMH 10337 | | Measurements data of <i>P. amandae</i> from Loboda & Carvalho (2013) | | | | |
|--------------------------------------|---------------|-------|------------|-------|------------|-------|-----------|-------|--|----------|------------|---------------|----|
| | mm | %DW | mm | %DW | mm | %DW | mm | %DW | x (%DW) | SD (%DW) | Range (mm) | Range (%DW) | n |
| Total length | 550 | 152.8 | 506 | 163.2 | 443 | 168.4 | 449 | 188.7 | 177.7 | 13. Apr | 356 - 592 | 138.2 - 199.6 | 32 |
| Disc length | 364 | 101.1 | 344 | 111 | 283 | 107.6 | 267 | 112.2 | 110.3 | 3.0 | 208 - 380 | 105.5 - 121.4 | 37 |
| Disc width | 360 | 100 | 310 | 100 | 263 | 100 | 238 | 100 | ... | ... | 192 - 341 | ... | 37 |
| Interorbital distance | 60 | 16.7 | 43 | 13.9 | 46 | 17.5 | 33 | 13.9 | 14. Aug | 01. Feb | 26 - 51 | 11.5 - 16.9 | 37 |
| Interspiracular distance | 73 | 20.3 | 55 | 17.7 | 50 | 19 | 46 | 19.3 | 19. Feb | 01. Mrz | 37 - 62 | 17.2 - 21.4 | 37 |
| Eye length | 11 | 3.1 | 8 | 2.6 | 10 | 3.8 | 8 | 3.4 | 04. Sep | 0.6 | Nov 16 | 3.8 - 6.9 | 37 |
| Spiracle length | 32 | 8.9 | 30 | 9.7 | 25 | 9.5 | 25 | 10.5 | 10. Jan | 1.0 | 13 - 34 | 8.2 - 12.8 | 37 |
| Preorbital distance | 74 | 20.6 | 71 | 22.9 | 47 | 17.9 | 46 | 19.3 | 23. Apr | 01. Mrz | 47 - 85 | 21.1 - 26.5 | 35 |
| Prenasal distance | 50 | 13.9 | 34 | 11 | 38 | 14.4 | 37 | 15.5 | 14.0 | 01. Feb | 26 - 51 | 11.8 - 16.8 | 37 |
| Preoral distance | 71 | 19.7 | 53 | 17.1 | 53 | 20.2 | 48 | 20.2 | 20. Feb | 01. Mai | 37 - 71 | 16.5 - 23.1 | 37 |
| Internarial distance | 25 | 6.9 | 23 | 7.4 | 19 | 7.2 | 18 | 7.6 | 07. Sep | 0.7 | 14 - 28 | 6.6 - 9.6 | 37 |
| Mouth width | 30 | 8.3 | 25 | 8.1 | 23 | 8.7 | 20 | 8.4 | 08. Aug | 01. Jan | 15 - 30 | 7.0 - 11.7 | 37 |
| Distance between 1st gill slits | 95 | 26.4 | 81 | 26.1 | 72 | 27.4 | ... | ... | 25. Apr | 01. Jun | 47 - 86 | 22.9 - 29.5 | 37 |
| Distance between 5th gill slits | 52 | 14.4 | 59 | 19 | 51 | 19.4 | ... | ... | 17. Sep | 01. Jan | 32 - 64 | 16.6 - 20.9 | 37 |
| Branchial basket length | 54 | 15 | 55 | 17.7 | 52 | 19.8 | 48 | 20.2 | 17. Mrz | 1.0 | 32 - 58 | 16.1 - 20.0 | 37 |
| Pelvic fin anterior margin length | 70 | 19.4 | 62 | 20 | 50 | 19 | 60 | 25.2 | 23. Jan | 2.0 | 40 - 91 | 18.6 - 27.2 | 37 |
| Pelvic fin width | 212 | 58.9 | 143 | 46.1 | 154 | 58.6 | 138 | 58 | 57.8 | 03. Sep | 100 - 192 | 48.0 - 64.6 | 37 |
| Claasper external length | ... | ... | ... | ... | 45 | 17.1 | ... | ... | 12. Mrz | 01. Feb | 26 - 40 | 10.0 - 13.9 | 9 |
| Claasper internal length | ... | ... | ... | ... | 74 | 28.1 | ... | ... | 25. Jun | 1.0 | 57 - 83 | 23.2 - 26.7 | 9 |
| Distance between cloaca and tail tip | 236 | 65.6 | 205 | 66.1 | 205 | 77.9 | 220 | 92.4 | 82.1 | 11. Mai | 163 - 270 | 54.5 - 102.3 | 32 |
| Tail width | 45 | 12.5 | 32 | 10.3 | 34 | 12.9 | 29 | 12.2 | 11.0 | 01. Apr | 16 - 45 | 7.2 - 13.6 | 37 |
| Snout to cloaca distance | 324 | 90 | 261 | 84.2 | 235 | 89.4 | 230 | 96.6 | 89.8 | 04. Jul | 168 - 312 | 84.0 - 114.6 | 37 |
| Pectoral to posterior pelvic length | 38 | 10.6 | 30 | 9.7 | 21 | 8 | 20 | 8.4 | 13. Jan | 02. Feb | 18 - 60 | 8.4 - 20.7 | 37 |
| Distance from cloaca to sting origin | 171 | 47.5 | 126 | 40.6 | 115 | 43.7 | 116 | 48.7 | 45.6 | 04. Aug | 80 - 164 | 38.6 - 56.8 | 33 |
| Sting length | ... | ... | 58 | 18.7 | 61 | 23.2 | 60 | 25.2 | 22. Jan | 03. Mai | 38 - 81 | 13.9 - 28.8 | 29 |
| Sting width | 8 | 2.2 | 6 | 1.9 | 5 | 1.9 | 4 | 1.7 | 01. Sep | 0.3 | 03. Aug | 1.3 - 2.9 | 31 |
| Dorsal pseudosiphon length | ... | ... | ... | ... | 10 | 3.8 | ... | ... | 03. Jan | 0.8 | 07. Dez | 2.3 - 5.2 | 8 |
| Ventral pseudosiphon width | ... | ... | ... | ... | 29 | 11 | ... | ... | 9.0 | 1.0 | 21 - 26 | 7.1 - 10.3 | 8 |

Table 2. Measurement of *Potamotrygon pantanensis* specimens analyzed in this study and compared with morphometrical data of Loboda & Carvalho (2013). Mean (x), Standard Deviation (SD) are expressed in proportions of disc width (%DW), and Range is expressed in millimeters (mm) and proportions of disc width

| Measurements | USNM 181552 | | AMNH 59875 | | AMNH 59875 | | EMNH 1892.12.19 | | Measurements data of <i>P. pantanensis</i> from Loboda & Carvalho (2013) | | | | |
|--------------------------------------|-------------|-------|------------|-------|------------|-------|-----------------|-------|--|----------|------------|---------------|----|
| | mm | %DW | mm | %DW | mm | %DW | mm | %DW | x (%DW) | SD (%DW) | Range (mm) | Range (%DW) | n |
| Total length | 535 | 163,1 | 421 | 160,1 | 417 | 177,4 | 376 | 182,5 | 164,9 | 09. Sep | 407 - 664 | 150,3 - 189,3 | 13 |
| Disc length | 345 | 105,2 | 290 | 110,3 | 250 | 106,4 | 221 | 107,3 | 109,5 | 04. Jan | 235 - 368 | 102,9 - 117,1 | 15 |
| Disc width | 328 | 100 | 263 | 100 | 235 | 100 | 206 | 100 | ... | ... | 215 - 336 | ... | 15 |
| Interorbital distance | 43 | 13,1 | 39 | 14,8 | 33 | 14 | 31 | 15 | 13. Jul | 0,8 | 26 - 60 | 12,1 - 15,4 | 15 |
| Interspiacular distance | 64 | 19,5 | 52 | 19,8 | 45 | 19,1 | 39 | 18,9 | 19. Sep | 01. Jan | 43 - 83 | 16,4 - 21,7 | 15 |
| Eye length | 11 | 3,4 | 11 | 4,2 | 9 | 3,8 | 8 | 3,9 | 04. Mai | 0,5 | Dez 17 | 3,9 - 5,6 | 15 |
| Spiracle length | 37 | 11,3 | 26 | 9,9 | 25 | 10,6 | 19 | 9,2 | 08. Jul | 0,6 | 20 - 41 | 7,6 - 9,6 | 14 |
| Preorbital distance | 74 | 22,6 | 63 | 24 | 55 | 23,4 | 44 | 21,4 | 22. Mrz | 01. Mai | 45 - 85 | 19,8 - 25,6 | 14 |
| Prenasal distance | 42 | 12,8 | 35 | 13,3 | 32 | 13,6 | 32 | 15,5 | 14,0 | 01. Mrz | 31 - 68 | 11,6 - 15,4 | 14 |
| Preoral distance | 62 | 18,9 | 51 | 19,4 | 45 | 19,1 | 43 | 20,9 | 20. Jan | 01. Mrz | 46 - 92 | 17,9 - 22,5 | 14 |
| Internarial distance | 25 | 7,6 | 20 | 7,6 | 17 | 7,2 | 15 | 7,3 | 08. Feb | 0,4 | 17 - 32 | 7,8 - 8,9 | 15 |
| Mouth width | 29 | 8,8 | 24 | 9,1 | 19 | 8,1 | ... | ... | 08. Apr | 0,8 | 17 - 39 | 7,3 - 9,8 | 15 |
| Distance between 1st gill slits | 83 | 25,3 | 71 | 27 | 60 | 25,5 | 52 | 25,2 | 25. Sep | 0,5 | 54 - 113 | 25,1 - 26,6 | 15 |
| Distance between 5th gill slits | 58 | 17,7 | 48 | 18,3 | 43 | 18,3 | 37 | 18 | 18. Feb | 0,9 | 36 - 75 | 16,7 - 19,8 | 15 |
| Branchial basket length | 57 | 17,4 | 51 | 19,4 | 41 | 17,4 | 34 | 16,5 | 17. Mrz | 0,7 | 36 - 74 | 16,5 - 18,5 | 15 |
| Pelvic fin anterior margin length | 70 | 21,3 | 65 | 24,7 | 48 | 20,4 | 42 | 20,4 | 22. Jul | 02. Feb | 53 - 90 | 19,5 - 26,8 | 15 |
| Pelvic fin width | 162 | 49,4 | 170 | 64,6 | 150 | 63,8 | 112 | 54,4 | 60,6 | 03. Mai | 123 - 256 | 54,9 - 65,7 | 15 |
| Clasper external length | ... | ... | 42 | 16 | ... | ... | ... | ... | 13. Jul | 1,0 | 31 - 35 | 13,1 - 14,4 | 2 |
| Clasper internal length | ... | ... | 70 | 26,6 | ... | ... | ... | ... | 26. Jan | 02. Jun | 60 - 65 | 24,3 - 27,9 | 2 |
| Distance between cloaca and tail tip | 210 | 64 | 170 | 64,6 | 194 | 82,6 | 193 | 93,7 | 73,4 | 08. Jan | 196 - 280 | 61,9 - 91,2 | 12 |
| Tail width | 40 | 12,2 | 28 | 10,6 | 27 | 11,5 | 25 | 12,1 | 13. Feb | 01. Feb | 24 - 54 | 11,2 - 15,5 | 15 |
| Snout to cloaca distance | 283 | 86,3 | 236 | 89,7 | 207 | 88,1 | 177 | 85,9 | 92,3 | 04. Apr | 181 - 376 | 84,2 - 96,6 | 15 |
| Pectoral to posterior pelvic length | 40 | 12,2 | 25 | 9,5 | 30 | 12,8 | 25 | 12,1 | 16. Apr | 03. Mai | 32 - 70 | 10,5 - 21,5 | 15 |
| Distance from cloaca to sting origin | 120 | 36,6 | 133 | 50,6 | 110 | 46,8 | 100 | 48,5 | 46,5 | 4,0 | 105 - 194 | 39,6 - 53,6 | 13 |
| Sting length | 53 | 16,2 | 49 | 18,6 | 51 | 21,7 | 47 | 22,8 | 18. Apr | 01. Mrz | 41 - 59 | 16,3 - 19,4 | 5 |
| Sting width | 5 | 1,5 | 5 | 1,9 | 4 | 1,7 | 5 | 2,4 | 01. Jul | 0,4 | 04. Mai | 1,3 - 2,3 | 5 |
| Dorsal pseudosiphon length | ... | ... | 9 | 3,4 | ... | ... | ... | ... | ... | ... | ... | ... | 0 |
| Ventral pseudosiphon width | ... | ... | 31 | 11,8 | ... | ... | ... | ... | ... | ... | ... | ... | 0 |