SALAMANDRA 50(2) | 77–84 | 30 June 2014 | ISSN 0036–3375

On the poorly sampled Amazonian frogs genus *Hydrolaetare* (Anura: Leptodactylidae): geographic ranges and species identification

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Manuscript received: 25 September 2013
Accepted: 10 January 2014 by Jörn Köhler

Abstract. We present new geographic records of three species of the genus *Hydrolaetare* and contribute to the identification of these by providing illustrations and a brief discussion on fixed morphological differences among them. Our records extend the known distribution ranges of *Hydrolaetare dantasi* and *Hydrolaetare schmidti* to Amazonas and Roraima states, Brazil, respectively. *Hydrolaetare caparu* is recorded for the first time in Brazil. The species of *Hydrolaetare* can be mainly distinguished by the combination of ventral colour pattern and external morphological characters (toe-webbing formula).

Key words. Amphibia, *Hydrolaetare caparu*, *Hydrolaetare dantasi*, *Hydrolaetare schmidti*, new records, taxonomy, classification, Amazonia.

Introduction

The Amazon Basin has one of the most species-rich amphibian faunae in the world (Duellman 1999). However, information is lacking about the natural history and geographic distribution of several taxa, especially those with elusive habits and are therefore poorly sampled in species surveys. We present new geographic records of three species of the genus *Hydrolaetare* (Galardo, 1963), a group of leptodactylid frogs characterized by relatively low diversity and small numbers of records in amphibian assessments. Additionally, we contribute to the identification of the three species by providing illustrations and a brief discussion on fixed morphological differences amongst them.

The genus *Hydrolaetare* has a disjunctive distribution in the Amazon basin, from Bolivia and the Madeira River basin and state of Acre in northwestern Brazil to scattered locations in Colombia, Peru and French Guiana. The genus consists of three species (Frost 2013). *Leptodactylus dantasi* (Bokermann, 1959) was described based on a juvenile female specimen collected in northern state of Acre, northwestern Brazil (Fig. 1). In the same year, *Limnomedusa schmidti* (Cochran & Goin, 1959) was described based on a single adult male, collected near Leticia, Departamento Amazonas, in Colombia. Based on its morphological distinctiveness, *Limnomedusa schmidti* was soon allocated to a new genus, *Hydrolaetare*, which remained monotypic until forty years later, when a comprehensive redescription of *Leptodactylus dantasi* led to its transfer to the same genus (Souza & Haddad 2003). Along with the redescription and new taxonomic arrangement, additional diagnostic traits for the group were noted, such as the presence of serrated fringes on fingers and toes, the presence of keratinised edges on fringes and differences in toe webbing patterns (Souza & Haddad 2003). Recently, a third species, *Hydrolaetare caparu* Jansen, Gonzales-Álvarez & Köhler, 2007, was described and assigned to the genus based on specimens collected in the Provincia Velasco, Departamento Santa Cruz, in Bolivia.

Despite a modest improvement of the information regarding the genus *Hydrolaetare*, the geographic distributions of the three species are still unclear due to lack of sampling and imprecise species records (Jansen et al. 2007). For instance, *H. schmidti* has been considered to be widely distributed, occurring in patches throughout the Amazon basin in northwestern Brazil, Colombia, Peru, Bolivia, and Guyana (Jansen et al. 2007). The remaining two species have been considered as geographically restricted, with *H. dantasi* being known from three localities in the state of Acre, Brazil (Souza & Haddad 2003) and *H. caparu* only from its type locality in Bolivia (Jansen et al. 2007).

During amphibian surveys conducted between 2011 and 2013 in southwestern and central Brazilian Amazonia, we sampled specimens belonging to genus *Hydrolaetare*. Herein, we describe how these records extend the known geographic distribution of *Hydrolaetare*, and provide a brief account on how *Hydrolaetare* species can be distinguished from one another based on external morphological characters of live or preserved specimens.

Material and methods

Between January 2011 and November 2013 we collected four *Hydrolaetare dantasi* and two *H. caparu* specimens during field work conducted in permanent sampling plots distributed along the interfluve between the rivers Madeira and Purus, in Brazil. Detailed location data and dimensions of sampling plots are available from the Programa de Pesquisa em Biodiversidade website (http://ppbio.inpa.gov.br/sitios), under "BR 319" and "Módulos do Madeira" designations. We surveyed the herpetology sections of the zoological collections of the Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil (INPA-H) and Coleção de Referência da Herpetofauna de Rondônia (UFRO-H) at Universidade Federal de Rondônia – UNIR, Porto Velho, Rondônia, Brazil, for additional records. Specimens examined are listed in the Appendix.

Descriptions of colour in life of specimens are based on field notes and photographs by A. P. Lima and R. de Fraga. Colours after preservation are described based on examined voucher specimens.

Preserved specimens were examined and measured with digital callipers. Measurements were taken as follows: snout–vent length (SVL), head length from tip of snout to posterior edge of maxilla articulation (HL), head width at the level of maxilla articulation (HW), snout length from anterior corner of the eye to tip of snout (SL), eye–nostril distance from anterior corner of the eye to the centre of nostril (EN), internarial distance (IN), eye length from anterior to posterior corner (EL), interorbital distance (IOD), maximum diameter of tympanum (TYM), distance from anterior corner of tympanum to posterior corner of the eye (TED), lengths of Fingers I, II, III and IV, from proximal edge of palmar tubercle to tip of each finger (F1, F2, F3 and F4, respectively), length of palmar tubercle from distal to proximal edge (PTL), maximum width of palmar tubercle (PTW), length of thenar tubercle from distal to proximal edge (TTL), thigh length from the centre of cloacal aperture to the outer edge of flexed knee (THL), tibia length from outer edge of flexed knee to heel (TL), tarsus length from heel to proximal edge of external metatarsal tubercle (TAL), lengths of Toes I, II, III, IV and V from proximal edge of external metatarsal tubercle to the tip of each toe (T1, T2, T3, T4 and T5, respectively).

We used principal component analyses (PCA) in order to reduce dimensionality and produce a smaller number of independent variables that would represent the variation in the external morphology of the three species. Analyses were conducted both on raw morphometric data (all measurements described above, excluding SVL) and residuals of linear regressions between measurements of each individual and its respective SVL, accounting for morphometric variation independent of body size. We investigated the formation of clusters relating to each species on morphometric space graphically by plotting individual scores along the first and second principal components generated by each analysis. In the analyses, we used morphometric data of eight, six and sixteen specimens of *H. dantasi*, *H. caparu* and *H. schmidti*, respectively. PCA were conducted in Systat 8.0 (Wilkinson, 1990).

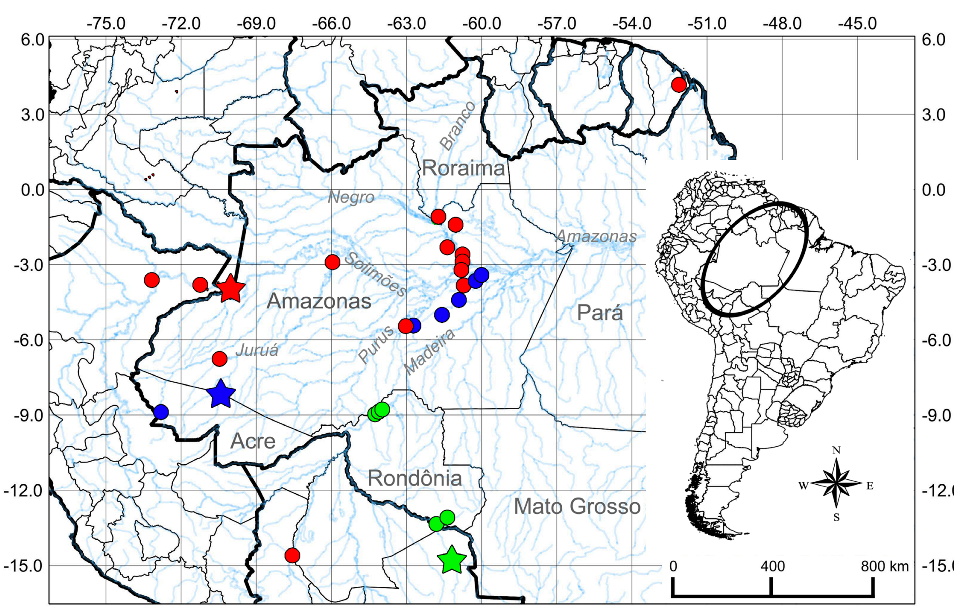

Figure 1. Type localities (stars) and distribution (circles) of the species of the genus *Hydrolaetare*. *Hydrolaetare dantasi* (blue), *Hydrolaetare caparu* (green) and *Hydrolaetare schmidti* (red).

Presence and morphology of webbing and dermal fringes between fingers and toes were verified under a dissecting microscope. Webbing formula notations follow Savage & Heyer (1967, 1997). We compared the observed webbing formula to those described previously for *H. caparu* and *H. dantasi* (Souza & Haddad 2003, Jansen et al. 2007). The specimen deposited at UFRO-H was damaged or deteriorated and not included in the description of webbing formula and occurrence of fringes on fingers.

Results and discussion

Species accounts

Hydrolaetare dantasi (Bokermann, 1959)

Four *Hydrolaetare dantasi* specimens were encountered during nocturnal visual surveys in three permanent sampling grids set up along road BR-319, between the cities of Manaus and Porto Velho within the state of Amazonas, Brazil (Fig. 1). The first record (INPA-H 31964, field number APL 17323) was made on 21 February 2011, at km 100 (03°41'22.13" S, 60°20'06.25" W, 42 m above sea level), approximately 1219 km northeast of the species type locality. Two more records were made at kilometre 300 on the BR-319 (05°00'15.05"S, 61°32'28.22" W, 60 m a.s.l.) on 27 January and 29 November 2013, respectively (INPA-H 31966, field number APL 19148 and INPA-H 33582, field number APL 20410). The fourth record was made at kilometre 200 on the BR-319 (04°23'26.38" S, 60°56'11.07" W, 47 m above sea level) on 1 February 2013 (INPA-H 31979, field number APL 19229). Three of the four specimens (INPA-H 31964, INPA-H 31979, INPA-H 33582) were found in temporary rain puddles in a primary *terra-firme* forest area. The fourth (INPA-H 31966) was found on the muddy ground along an access trail, and escaped to a flooded burrow located about 60 cm from a temporary pond. All specimens were encountered at night, but none was vocalizing.

Additional new records of *Hydrolaetare dantasi* in Brazil were obtained by examining specimens deposited at INPA-H. In February 2003, one specimen (INPA-H 22222, field number APL 539) was recorded by A. P. Lima at Ramal Purupuru (03°21' S, 59°51' W, 34 m a.s.l.), near kilometre 34 on the BR-319, Amazonas State, approximately 1,066 km northeast of the species' type locality. In April 2011, three specimens (INPA-H 28815, INPA-H 28817, INPA-H 28818, field numbers PNNJ 288, PNNJ 380 and PNNJ 287, respectively) were recorded by V. T. Carvalho and H. Condrati in the Parque Nacional Nascentes do Lago Jari (approximately 05°48' S, 63°09' W, 64 m a.s.l.), Amazonas State, approximately 1,070 km northeast of the species type locality.

Hydrolaetare caparu Jansen, Gonzales-Álvarez & Köhler, 2007

On 14 January 2011, we found two specimens of *Hydrolaetare caparu* (INPA-H 31962, INPA-H 31963, field numbers APL 16449, APL 16480, respectively) during nocturnal visual surveys for amphibians in a permanent sampling grid set up on the left bank of the upper Madeira River (09°00'43" S, 64°16'24" W, 71 m a.s.l.), near the city of Porto Velho, Rondônia State, Brazil, under the scope of Wildlife Conservation Program from Santo Antônio Energia. The sampling grid is located about 730 km northwest of the species' type locality in Bolivia (Fig. 1). The two specimens were encountered at night, floating on the surface of rainwater ponds along a riparian forest area, which is seasonally flooded during the rainy season (December to May). No specimen was vocalizing.

Additional new records of *Hydrolaetare caparu* in Brazil were obtained by examining specimens misidentified as *H. dantasi* deposited at the INPA-H and as *H. schmidti* deposited at the UFRO-H. All vouchers originated from Rondônia State: in March 1997, two specimens (INPA-H 7014, INPA-H 7095, no field numbers) were recorded by M. Gordo from the Parque Estadual de Corumbiaria (approximately 12°54' S, 61°46' W, 185 m a.s.l.), located about 230 km northeast of the species' type locality in Bolivia. In 2003, two specimens (INPA-H 15401, INPA-H 15402, no field numbers) were recorded by A. P. Lima from near the reservoir of the Santo Antonio Hydroelectric Power Plant in the municipality of Porto Velho (approximately 08°51' S, 64°04' W, 68 m a.s.l.), approximately 740 km northeast of the species type locality. In September 2011, another specimen (UFROH 1976, field number SA13679) was recorded by Arcadis Logos S.A. in the surroundings of the same reservoir (approximately 09°08' S, 64°22' W, 87 m a.s.l.).

Hydrolaetare schmidti (Cochran & Goin, 1959)

Records of *Hydrolaetare schmidti* in Brazil were obtained by examining specimens deposited at INPA-H. In June 1989, two specimens (INPA-H 1361, INPA-H 1362, no field numbers) were recorded by G. Moreira at the mouth of the Branco River (approximately 01°23' S, 61°51' W, 14 m a.s.l.), Roraima State. The remaining vouchers originated from Amazonas State: in September 1991, one specimen of (INPA-H 2798, no field number) was recorded by C. Gascon at Seringal Condor (approximately 06°45' S, 70°51' W, 179 m a.s.l.), on the middle course of the Juruá River. In June 1992, another specimen (INPA-H 5775, no field number) was recorded by C. Gascon on the Juruá River, at the Vira-Volta village (approximately 03°17' S, 66°14' W, 64 m a.s.l.). In April 1997, nineteen specimens (INPA-H 6923–6941, no field numbers) were collected by G. Moreira in the Anavilhanas Archipelago (approximately 02°28' S, 60°55' W, 17 m above sea level). In April 2011, three specimens (INPA-H 28813, INPA-H 28814, INPA-H 28816, field numbers PNNJ 257, PNNJ 263 and PNNJ 324, respectively) were recorded by V.T. Carvalho and H. Condrati at the Parque Nacional Nascentes do Lago Jari (approximately 05°48' S, 63°09' W, 64 m a.s.l.). The last available record for *H. schmidti* was in February 2012, when one specimen (INPA-H 31965, field number APL 18536 – Fig. 2C) was collected by A. P. Lima in the Anavilhanas Archipelago (approximately 02°28' S, 60°55' W, 17 m a.s.l.).

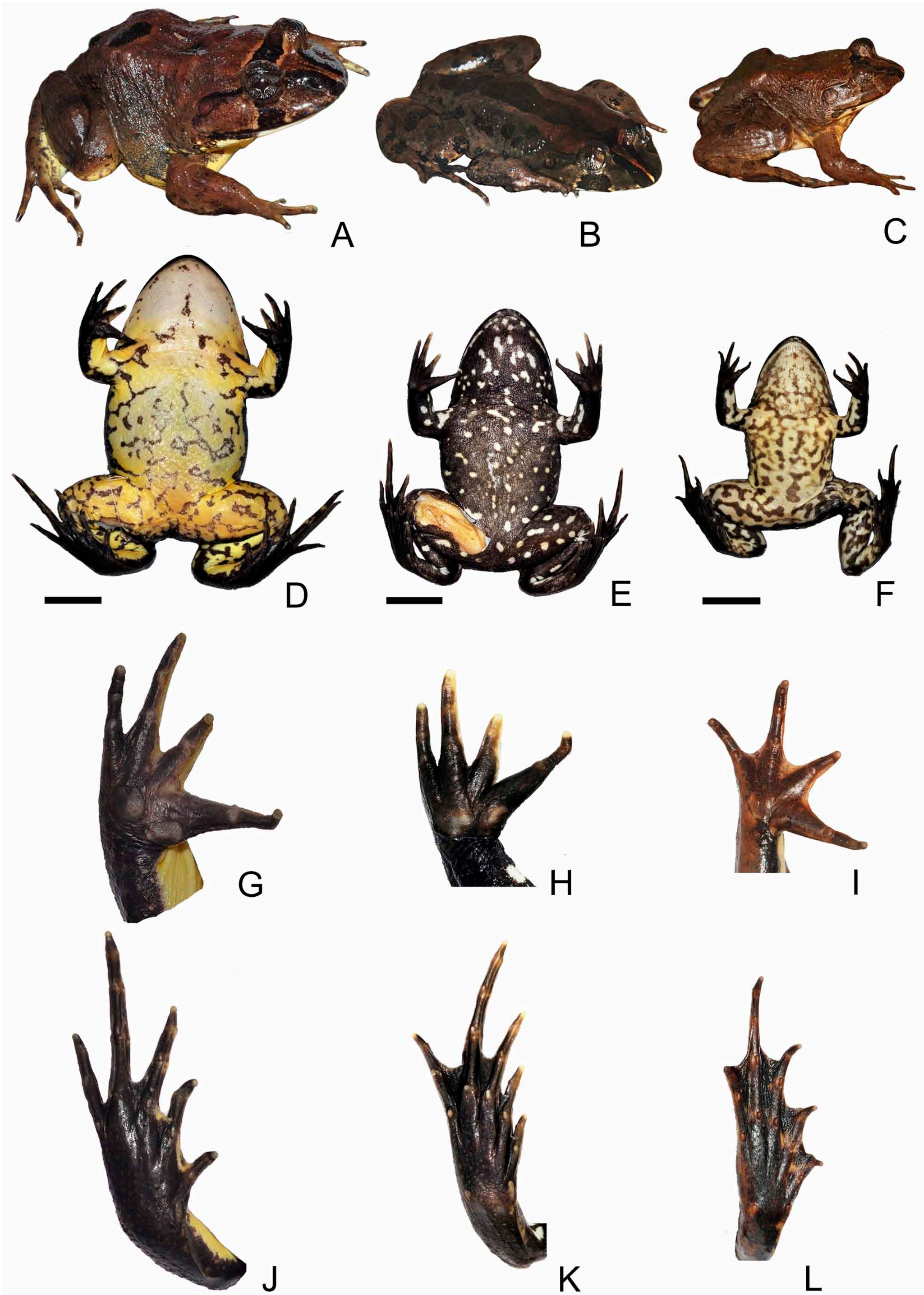

Figure 2. Dorsolateral and ventral views of *Hydrolaetare* species and detailed views of fore and hind limbs. From left to right: *Hydrolaetare dantasi*, (INPA-H 31966, BR-319 road, State of Amazonas, Brazil – A, D, G, J); *Hydrolaetare caparu* (INPA-H 31962, municipality of Porto Velho, State of Rondônia, Brazil – B, E, H, K); *Hydrolaetare schmidti* (INPA-H 31965, Anavilhanas Archipelago, state of Amazonas, Brazil – C, F, I, L). Depictions of dorsolateral views (A, B, C) were edited from photographs of live specimens by A. P. Lima and R. Fraga. The remaining images are obtained from photographs of the same specimens after preservation in 70% ethanol. Scale bars = 10 mm.

Table 1. Diagnostic traits useful for distinguishing the three species of *Hydrolaetare* based on specimens collected in Brazil. Notations for webbing formula follow Savage & Heyer (1967, 1997).

Species	Ventral colour in life	Toe webbing formula
Hydrolaetare caparu	Dark grey or dark brown colour of throat and abdomen, with bright white spots	I 1^{-} – ($1^{1/3}$–2^{-}) II (1^{-}–1^{+}) – (2^{-}–2^{+}) III (1^{-}–1^{+}) – (2^{-}–$2^{1/2}$) IV (2^{-}–$2^{1/2}$) – 1^{-} V
Hydrolaetare dantasi	Yellowish white with light to dark brown marbling	I (2^{-}–2^{+}) – ($2^{1/3}$–$2^{2/3}$) II ($1^{1/3}$–2^{-}) – (3^{-}–$3^{1/4}$) III ($2^{1/2}$–3^{+}) – ($3^{3/4}$–4^{+}) IV (4^{-}–$4^{1/3}$) – ($2^{1/2}$–$2^{3/4}$) V
Hydrolaetare schmidti	Cream or pale orange with light to dark brown marbling	I (1^{-}–$1^{1/2}$) – (2^{-}–$2^{1/2}$) II (1–$1^{1/3}$) – (2^{+}–3^{-}) III (1^{+}–$^{+}$) – (3^{+}–$3^{1/3}$) IV (3^{-}–$3^{1/2}$) – (1–2^{+}) V

Species identification

The species of *Hydrolaetare* can be distinguished by a combination of colour pattern and external morphological characters (Tab. 1). *Hydrolaetare caparu* is easily distinguished by the dark grey or dark brown colour of its throat and abdomen, with bright white spots (Fig. 2E), never dark brown with yellowish white spots (see Fig. 2 in Bokermann 1959) or yellowish white with light to dark brown marbling (like in *H. dantasi* – Fig. 2D), neither cream with light to dark brown marbling (Fig. 2F) nor orange with light to dark brown marbling (like in *H. schmidti*). Colours usually fade in preserved specimens. At the type locality, specimens of *H. caparu* lack a dark vertebral stripe, and this character state was applied to the species diagnosis in the original description (Jansen et al. 2007). However, five new specimens of *H. caparu* collected in Rondônia State have a conspicuous dark vertebral stripe (Fig. 2B), suggesting that dorsal polychromatism occurs within the species' geographic distribution and that dorsal colour pattern should be used with caution as a diagnostic character.

A principal component analysis on 24 raw morphometric measurements produced a first and a second component that applied to almost 91% of the total variation in external morphology of all examined specimens of *Hydrolaetare* (Tab. 2). Most of the variation (~87%) was explained by the first component. All measurements had high and positive loadings on this component, reflecting the influence of variation in body size on all morphometric traits. A second analysis conducted on residuals of regressions of the same measurements against individual SVL produced first and second components that applied to approximately 51% of the total variation in external morphology independent of body size (Tab. 2). Finger and toe measurements had high loadings on the first component, while the second carried information on the variation of head and hind limb traits. However, no clusters of specimens corresponding to each *Hydrolaetare* species were evident by inspecting the distribution of individuals along the first and second axes of both analyses (Fig. 3).

Toe-webbing size variation among examined specimens was: I 1^{-} – ($1^{1/3}$–2^{-}) II (1^{-}–1^{+}) – (2^{-}–2^{+}) III (1^{-}–1^{+}) –

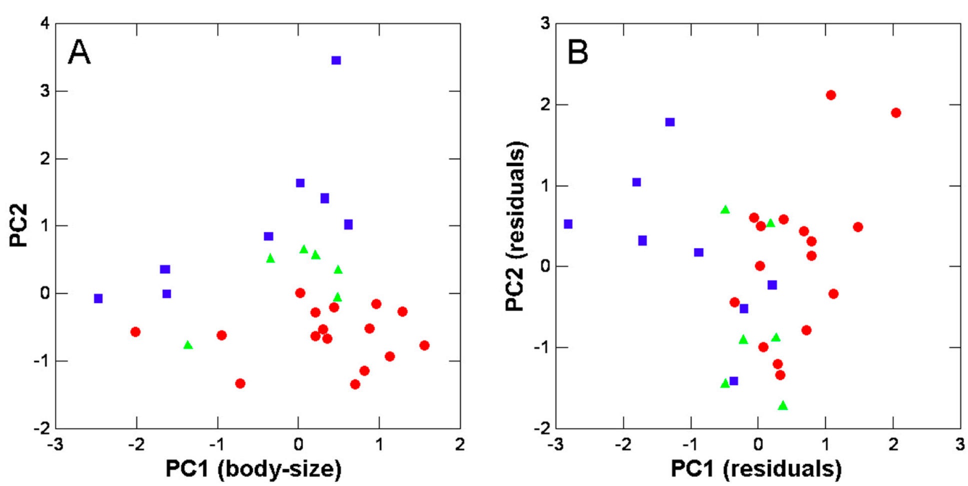

Figure 3. Distribution of 30 specimens of *Hydrolaetare* along the first and second principal components generated from principal component analyses conducted on (A) raw values of 24 morphometric measurements and (B) residuals of regressions of the same measurements against individual snout–vent length. Green triangles = *H. caparu*; Blue squares = *H. dantasi*; Red circles = *H. schmidti*. Note the absence of clusters relating to species in both analyses.

Table 2. Loadings of 24 morphometric measurements on the first four principal components generated by a principal component analysis based on raw values of each measurement (PC1, PC2, PC3, PC4) and residuals of linear regressions between each measurement and the corresponding snout–vent length (PC1*, PC2*, PC3*, PC4*). Measurements were obtained from 30 preserved specimens representing the three species of *Hydrolaetare* (six *H. caparu*, eight *H. dantasi*, and 16 *H. schmidti*), all collected in Brazil. Values in bold indicate measurements with high loadings on the respective principal component. See text for descriptions and definitions of morphometric measurements.

	PC1	PC2	PC3	PC4	PC1*	PC2*	PC3*	PC4*
HL	**0.962**	0.223	0.057	0.082	-0.520	**0.663**	0.356	0.167
HW	**0.968**	0.129	0.139	-0.029	-0.363	**0.658**	-0.346	0.144
SL	**0.966**	0.185	0.082	0.080	-0.609	0.475	0.304	0.242
EN	**0.928**	0.190	0.211	0.160	-0.485	0.533	0.015	0.207
IN	**0.948**	-0.085	0.172	-0.073	0.422	0.412	-0.508	0.090
EL	**0.861**	0.408	0.046	-0.082	-0.474	0.304	0.260	0.121
IOD	**0.830**	0.215	-0.051	-0.008	-0.113	0.097	0.345	0.045
TYM	**0.922**	0.167	0.008	0.128	-0.158	0.347	0.490	0.273
TED	**0.912**	0.071	0.185	0.226	-0.049	**0.630**	0.101	0.364
H1	**0.967**	-0.158	-0.084	0.028	**0.809**	-0.071	0.288	-0.083
H2	**0.982**	-0.127	-0.058	-0.020	**0.861**	0.065	0.269	-0.073
H3	**0.954**	-0.238	-0.092	0.030	**0.866**	0.045	0.253	-0.034
H4	**0.968**	-0.168	-0.125	0.025	**0.822**	-0.058	0.340	-0.195
PTL	**0.798**	0.135	-0.523	0.127	0.105	0.001	**0.818**	-0.099
PTW	**0.857**	0.221	-0.284	0.083	-0.186	-0.211	0.609	-0.218
TTL	**0.739**	0.246	-0.049	-0.610	0.020	-0.429	-0.054	**0.811**
THL	**0.979**	-0.057	0.043	0.008	0.556	0.521	-0.039	-0.073
TL	**0.983**	-0.081	0.110	-0.034	0.522	**0.609**	-0.347	-0.376
TAL	**0.987**	0.021	0.068	0.017	0.234	**0.771**	0.079	-0.211
F1	**0.970**	-0.207	0.009	-0.024	**0.822**	-0.044	0.014	0.495
F2	**0.965**	-0.209	-0.025	-0.069	**0.844**	-0.118	0.029	0.384
F3	**0.974**	-0.193	0.012	-0.054	**0.868**	0.021	-0.033	0.396
F4	**0.971**	-0.181	0.049	-0.012	**0.756**	0.481	0.006	-0.130
F5	**0.933**	-0.313	-0.021	-0.080	-0.520	**0.663**	0.356	0.167
% of total variance explained	**86.9**	**3.8**	**2.3**	**2.2**	**35.5**	**16.3**	**10.6**	**7.9**
Eigenvalue	*20.861*	*0.908*	*0.556*	*0.533*	*8.520*	*3.923*	*2.545*	*1.909*

$(2^{-}-2^{1/2})$ IV $(2^{-}-2^{1/2}) - 1^{-}$ V in *H. schmidti* (Fig. 2L); I $(2^{-}-2^{+}) - (2^{1/3}-2^{2/3})$ II $(1^{1/3}-2^{-}) - (3^{-}-3^{+})$ III $(3^{-}-3^{+}) - (3^{3/4}-4^{+})$ IV $(4^{-}-4^{+}) - (2^{1/2}-2^{2/3})$ V in *H. dantasi* (Fig. 2J); and I $(1^{+}-1^{1/2}) - (2^{-}-2^{1/2})$ II $(1^{+}-1^{1/3}) - (2^{+}-3^{-})$ III $(1^{+}-2^{+}) - (3^{+}-3^{1/3})$ IV $(3^{-}-3^{1/2}) - (1^{+}-2^{+})$ V in *H. caparu* (Fig. 2K).Toe-webbing size variation has not been noted for *H. schmidti* in previous studies (Cochran & Goin 1959, Galardo, 1963, Lescure & Marty 2000, Souza & Haddad 2003, Padial & De La Riva 2005, Jansen et al. 2007). Toe-webbing size variation among examined specimens of *H. dantasi* and *H. caparu* differs partially from the variation described previously: Souza & Haddad (2003) described toe-webbing size variation in *H. dantasi* as I $2^{-} - (2^{1/2}-2^{2/3})$ II $(1^{2/3}-2^{-}) - (3^{+}-3^{1/4})$ III $(2^{1/2}-2^{3/4}) - (3^{4/5}-4)$ IV $(4-4^{1/3}) - (2^{2/3}-2^{3/4})$ V. In *H. caparu* (Janzen et al. 2007), toe-webbing size variation is described as I $(1^{+}-1) - 2$ II $1 - (2^{1/4}-2^{1/2})$ III $(1^{1/2}-2^{-}) - 3$ IV $3 - (1-1^{1/2})$ V.

By summarizing the available information on toe-webbing variation, we are able to provide more reliable webbing formula, demonstrating larger intraspecific variation and this is potentially more useful for distinguishing these taxa (Tab. 1): *H. schmidti* can be easily distinguished from the other species in the genus by its well-developed toe webbings [I $1^{-} - (1^{1/3}-2^{-})$ II $(1^{-}-1^{+}) - (2^{-}-2^{+})$ III $(1^{-}-1^{+}) - (2^{-}-2^{1/2})$ IV $(2^{-}-2^{1/2}) - 1^{-}$ V], which are conspicuously shorter in *H. dantasi* [I $(2^{-}-2^{+}) - (2^{1/3}-2^{2/3})$ II $(1^{1/3}-2^{-}) - (3^{-}-3^{1/4})$ III $(2^{1/2}-3^{+}) - (3^{3/4}-4^{+})$ IV $(4^{-}-4^{1/3}) - (2^{1/2}-2^{3/4})$ V] and *H. caparu* [I $(1^{-}-1^{1/2}) - (2^{-}-2^{1/2})$ II $(1-1^{1/3}) - (2^{+}-3^{-})$ III $(1^{+}-^{+}) - (3^{+}-3^{1/3})$ IV $(3^{-}-3^{1/2}) - (1-2^{+})$ V].

The palmar tubercle is conspicuously longer then the thenar tubercle in *H. caparu* originating from Rondônia State in Brazil (PTL/TTL = 1.11–1.86, mean = 1.53, n = 6). Out of a total of eight specimens of *H. dantasi* examined, five have palmar tubercles that are longer than their thenar tubercles (PTL/TTL = 1.12–1.44, mean = 1.25). The palmar tubercle is slightly shorter than the thenar tubercle in the remaining three specimens (PTL/TTL = 0.67–0.97, mean = 0.81). Most examined specimens of *H. schmidti* have palmar tubercles that are longer than their thenar tubercles (PTL/TTL = 1.01–1.37, mean = 1.15, n = 14). The two remaining specimens have a palmar tubercle that is slightly shorter than the thenar tubercle (PTL/TTL = 0.95–0.96).

Proportions between palmar and thenar tubercles have been pointed out as a diagnostic trait between *Hydrolaetare* species, with the palmar tubercle thought of as being twice as large as the thenar tubercle in *H. caparu*, whereas it would be slightly smaller in *H. schmidti*, and of similar size in *H. dantasi* (Janzen et al. 2007). However, information is lacking on how exactly tubercle measurements were obtained, hampering more detailed comparisons with the observations presented herein.

In Figure 3C of Souza & Haddad's (2003), the palmar tubercle of *Hydrolaetare schmidti* is depicted as being shorter than the thenar tubercle. Measurements taken from the same individual (INPA-H 6934) indicate that the palmar tubercle is actually longer than the thenar tubercle, though. Unlike *H. dantasi* and *H. caparu*, which have well delimited tubercles on their palms, *H. schmidti* has tubercles with low and sometimes indistinct edges. The palmar tubercle of *H. dantasi* was also noted as wide and approximately square-shaped or bifurcate in some specimens (Souza & Haddad 2003). All examined *H. dantasi* specimens originating from Amazonas State have wide and bifurcate palmar tubercles. Among the examined specimens of *H. schmidti*, 11 have bifurcate palmar tubercles, and round in the remaining five specimens. Besides the difficulties in delimiting landmarks for obtaining comparable measurements, overlaps in relative dimensions and shape of tubercles on the palms of the three species (Tab. 1) render character states related to tubercle morphology unreliable diagnostic traits among *Hydrolaetare* spp.

As reported for specimens in the type series of *H. caparu* (Janzen et al. 2007), all specimens originating from Rondônia State have fringes along the inner lateral faces of Fingers II and III. However, a narrow fringe appears on the outer lateral face of Finger II in all specimens except INPA-H 15402. One specimen from the Parque Estadual de Corumbiara (INPA-H 7014) has an additional fringe along the outer face of Finger I. The presence of continuous fringes has previously been noted to be restricted to the inner lateral faces of Fingers II and III, with dermal denticles being present along the lateral faces of the remaining fingers (Janzen et al. 2007). We point out that the ornamentation along fingers can be subject to some degree of intraspecific variation in *H. caparu*.

Hydrolaetare dantasi received a "Least Concern" species status in the IUCN Red List of Threatened Species, based on the presumed species distribution in areas that are subjected to low human-induced environmental impacts (Azevedo-Ramos et al. 2004a). Our records extend the known distribution of *H. dantasi* to Amazonas State, Brazil, and indicate that the species also inhabits forested areas traversed by a road that currently accommodates on low traffic volumes, but which will potentially experience dramatic increases in human activity and deforestation rates in the near future in the wake of major development projects (Fearnside & Graça 2006, Maldonado et al. 2012).

The current IUCN status of *Hydrolaetare caparu* is "Data Deficient" (Jansen 2008). We extend the species' known distribution to Brazil (Rondônia State) and corroborate previously presented evidence that it mainly inhabits seasonally flooded riparian forests (Jansen 2008). These environments are regionally threatened by a growing number of developments related to hydropower, including the damming of large Amazonian rivers. For instance, four of the new records of *H. caparu* were made in locations on the left bank of the upper Madeira River, which are now severely impacted by the reservoir of the Santo Antônio and Jirau Hydroelectric Power Plants. A single population is known to live within a conservation unit, i.e., the Parque Estadual de Corumbiara, Rondônia State, Brazil. Considering the additive effects of a wide variety of environmental threats throughout its distribution, the low number of known breeding populations, and the low density of individuals at each location, we suggest a re-evaluation of the conservation status of *H. caparu*.

Hydrolaetare schmidti received a "Least Concern" species status in the IUCN Red List of Threatened Species based upon its wide distribution and presumed large population size (Azevedo-Ramos et al. 2004b). In Souza & Haddad (2003), the provenance of two specimens of *H. schmidti* (INPA-H 1361 and INPA-H 5775) is misidentified. The correct distribution of INPA-H 1361and INPA-H 5775 extends the species' distribution to Roraima State and expands the known distribution of the species in Amazonas State, respectively.

Although our report suggests that *H. dantasi*, *H. caparu* and *H. schmidti* are more geographically widespread than previously thought, human activity may negatively influence their persistence at regional levels, threatening components of their intraspecific diversity and their overall distribution.

Acknowledgements

We are indebted to Mariluce R. Messias (UFRO-H), Marcia L. Queiroz, Vinicius T. Carvalho and Richard C. Vogt (INPA-H) for the access to collections. M. Ferrão received research fellowships from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) by means of the Centro de Estudos Integrados da Biodiversidade Amazônica (CENBAM) while conducting this study (CNPq – proc. N° 573721/2008-4). P. I. Simões receives a post-doctoral fellowship from CNPq (proj. 401327/2012-4, prog. CSF). R. Fraga receives a PhD fellowship from Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES). Collecting permits were provided by RAN/ICMBio (Reg. 659755 No. 13777-2). This work was supported by PRONEX – FAPEAM – CNPq (proj. 003/2009, proc. N° 653/2009).

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Appendix

Specimens examined

***Hydrolaetare caparu*:** Brazil: Rondônia State: Porto Velho (INPA-H 15402, INPA-H 31962, INPA-H 31963, UFROH 1976); Parque Estadual de Corumbiara (INPA-H 7014, INPA-H 7095, INPA-H 15401).

***Hydrolaetare dantasi*:** Brazil: Amazonas State: BR-319 road, kilometre 100 (INPA-H 31964), kilometre 200 (INPA-H 31979), kilometre 300 (INPA-H 31966, INPA-H 33582); BR-319, kilometre 34, Ramal Purupuru (INPA-H 22222); Parque Nacional Nascentes do Lago Jari (INPA-H 28815, INPA-H 28817, INPA-H 28818).

***Hydrolaetare schmidti*:** Brazil: Amazonas State: Seringal Condor (INPA-H 2798); Vira-Volta village (INPA-H 5775); Anavilhanas Archipelago (INPA-H 6923–6941, INPA-H 31965); Parque Nacional Nascentes do Lago Jari (INPA-H 28813, INPA-H 28814, INPA-H 28816). Roraima State: Branco River (INPA-H 1361, INPA-H 1362).