Redescription of the advertisement call of *Aplastodiscus arildae* (Cruz & Peixoto) and description of the call of *Aplastodiscus weygoldti* (Cruz & Peixoto) with general notes about the genus in Southeastern Brazil (Anura, Hylidae)

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ABSTRACT. The study of anuran advertisement calls is very significant for it is an important premating premating mechanism. Herein we redescribe the advertisement call of *Aplastodiscus arildae* from an area near type-locality and describe the advertisement call of *A. weygoldti* comparing them to previously described advertisement calls of species of the genus *Aplastodiscus*. Both advertisement calls are simple, non-modulated calls, very similar to each other, but significantly different in what matters to call duration. We describe the first distress call registered for the genus, the distress call of *A. arildae*, that does not have rigid form and was only recorded for one individual. Some general notes of the genus *Aplastodiscus* are given.
KEY WORDS. Distress call; morphological notes; vocalization.

RESUMO. **Redescrição do canto de anúncio de *Aplastodiscus arildae* (Cruz & Peixoto) e descrição do canto de *Aplastodiscus weygoldti* (Cruz & Peixoto) com notas morfológicas sobre o gênero no Sudeste Brasileiro (Anura, Hylidae).** As vocalizações de anuros são um importante mecanismo de isolamento pré-zigótico, e por isso seu estudo deve ser incentivado. Neste artigo re-descrevemos o canto de anúncio de *Aplastodiscus arildae*, de uma área mais próxima da localidade tipo e descrevemos o canto de anúncio de *A. weygoldti* comparando-os a cantos previamente descritos de outras espécies do gênero. Ambas as espécies apresentam os cantos de anúncio simples, não-modulados, muito similares, mas significativamente diferentes no que diz respeito à duração da nota. Descrevemos o primeiro "distress call" registrado para o gênero, o "distress call" de *A. arildae*, que não possui uma forma rígida e foi emitido apenas por um dos indivíduos coletados. Notas sobre o gênero *Aplastodiscus* são dadas.
PALAVRAS-CHAVE. Distress call; vocalização.

Faivovich *et al*. (2005) made a cladistic review of the Hylidae family removing several species from the genus *Hyla* Laurenti, 1768. The *Hyla albofrenata* group, composed of six species: *Hyla albofrenata* Lutz, 1924; *Hyla arildae* Cruz & Peixoto, 1987; *Hyla ehrhardti* Müller, 1924; *Hyla eugenioi* Carvalho-e-Silva & Carvalho-e-Silva, 2005; *Hyla musica* Lutz, 1949; and *Hyla weygoldti* Cruz & Peixoto, 1987 (Cruz & Peixoto 1987, Faivovich *et al*. 2002, Carvalho-e-Silva & Carvalho-e-Silva 2005), is now placed under the genus *Aplastodiscus* Lutz, 1950 (Faivovich *et al*. 2005).

Simpatry is only known for two species in the *Aplastodiscus albofrenatus* group; among *A. musicus* and *A. arildae* in Teresópolis. *Aplastodiscus musicus*, can only be found in altitudes above 1500 m in the Parque Nacional da Serra dos Órgãos (PARNA/SO) in Teresópolis, Rio de Janeiro state while *A. arildae*, is found in altitudes above 600 m in a widespread distribution.

All the species of the genus are very similar in many aspects, presenting as morphological sinapomorphies proportionally large internal metatarsal and metacarpal tubercles, bicolored iris and females with unpigmented eggs for species with known breeding behavior (Faivovich *et al*. 2005), except for the *Aplastodiscus albofrenatus* group that does not present bicolored iris as remarked by Carvalho-e-Silva & Carvalho-e-Silva (2005).

The species in the *Aplastodiscus albofrenatus* group have very similar advertisement calls that, according to Lutz (1949), sound like "water dripping in a bottle", except *A. musicus* that sounds like "an old fashioned glockenspiel", but it is still very similar to the other species advertisement calls.

The study of anuran advertisement calls is important because calling is considered a significant premating isolating mechanism (Pombal *et al*. 1995, Martins & Jim 2003, 2004), even

though all important factors for anuran mate choice are not yet known (Wollerman & Wiley 2002). It seems that this mechanism evolves fine tuning of a functional system; but, to achieve species isolation trought calls, major changes are not required (Heyer 1980). In order to discriminate two different species, one or more different trait, or combinations of traits, in vocalization is needed (Cardoso & Vielllard 1990, Bush *et al*. 2002, Wollerman & Wiley 2002).

Four species of the *Aplastodiscus albofrenatus* group have their advertisement calls described: *A. albofrenatus* from Parque Nacional da Tijuca (PNT), Rio de Janeiro, Rio de Janeiro state (Bokermann 1967); *A. arildae*, from Boracéia, São Paulo state (Heyer *et al*. 1990); *Aplastodiscus eugenioi* (then *Hyla sp. aff. ehrhardti*) from Picinguaba, São Paulo State (Hartmann *et al*. 2004) and Managaratiba, Rio de Janeiro state (Carvalho-e-Silva & Carvalho-e-Silva 2005) and *A. ehrhardti* (Conte *et al*. 2005). Bokermann (1967) also points out the overall similarity among *Aplastodiscus cavicola* Cruz & Peixoto, 1985 (as *H. albosignata* Lutz & Lutz, 1938) from Bocaina and *A. albofrenatus* from Tijuca.

Herein we redescribe the advertisement call of *Aplastodiscus arildae* from an area near the type-locality and describe the advertisement call of *A. weygoldti* comparing them to previously described advertisement calls of other species of the genus *Aplastodiscus*. We also describe the first distress call registered for the genus and some general notes of the genus *Aplastodiscus* are given.

MATERIAL AND METHODS

The data and specimens referring to *Aplastodiscus arildae* were collected in PARNA/SO, Teresópolis, Rio de Janeiro State, during the period from May 2003 to March 2004 and those referring to *A. weygoldti*, were collected in municipality of Domingos Martins, Espírito Santo state, from September to October 1995. The individuals can be found under the numbers 6350; 6477; 9497; 9498; 9499 and 9500 in the Amphibian Collection of the Department of Zoology of Universidade Federal do Rio de Janeiro (ZUFRJ).

It was used a Sennheiser ME-80 directional, active microphone, a Sony WMDC6 tape recorder and cassette tapes TDK chrome 90 minutes to recorde the species in field. The records were made at night, during the moments of higher call activity, and during the breeding season (May to February). The specimens recorded were collected and their snout-vent length (SVL) measured with a 0.1 mm caliper.

In this work we analyzed temporal (note duration and repetition rates) and spectral traits (dominant frequency, fundamental frequency and number of harmonics). Since both species have simple advertisement calls, possessing only a single note with one pulse repeated through time (see Duellman & Pyles 1983), the term "note" is used as synonym of "pulse" in this work.

The technical terms used in this work were adapted of those used in Duellman & Pyles (1983), Cardoso & Vielliard (1990), Heyer *et al*. (1990), Littlejohn (2001) and Martins & Jim (2003).

The data was analyzed with the program Cool Edit v. 96 (Syntrilium Co.), digitalized with a sampling rate of 44100 points in 16 bits mono. Since by definition harmonics are infinite, for practical reasons, only frequencies presenting peaks above -48 dB were measured. All data were compared using "t-Student" test with 0.05% of significance (5% alpha) (Zar 1984).

RESULTS

For both species, the typical advertisement call note present itself in the oscillogram, bell-shaped, with attack shorter than decay (see Littlejohn 2001), and doesn't show modulation in the sonogram (Figs 1-4)

Another type of call, similar to advertisement, but forming a complex call made of three to five notes (similar to *Bufo* Laurenti, 1768 Bufonidae advertisement calls, but with a higher pitch) was heard, but not recorded. We classified this call as a territorial call, for it was only heard in great choir activity (N > 15 approximately). This type of call was also registred for *A. albofrenatus* (Bokermann 1967) and *A. eugenioi* (Hartmann *et al*. 2004), but was not recorded by Bokermann (1967), only remarked, and Hartmann *et al*. (2004) didn't classify the call within any call types.

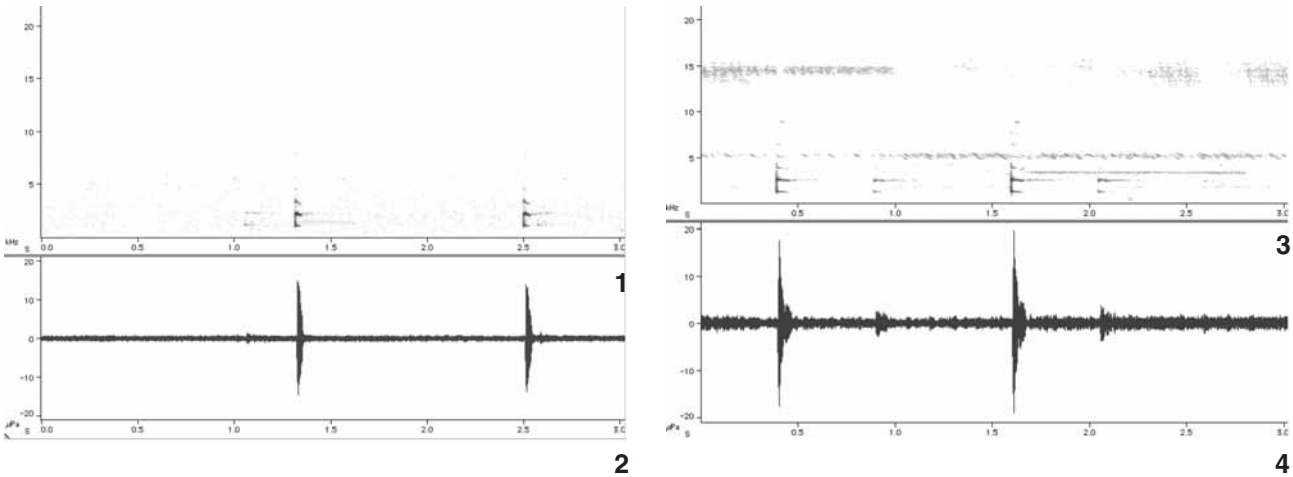
For *Aplastodiscus arildae*, call data of three captured individuals (ZUFRJ 9497, 9498 e 9499; SVL = 40.8, 40.7, 42.1 mm respectively) and a not captured individual were analyzed.

Individual ZUFRJ 9497 was recorded while calling in the central cup of a bromeliad (*Vriesia sp*.) and was the only animal calling when captured. All other individuals were in chorus situations but with different densities of heard calling males. The context of chorusing individual ZUFRJ 9499 was smaller (n = 3) than the context of chorusing individual ZUFRJ 9498 (N > 15).

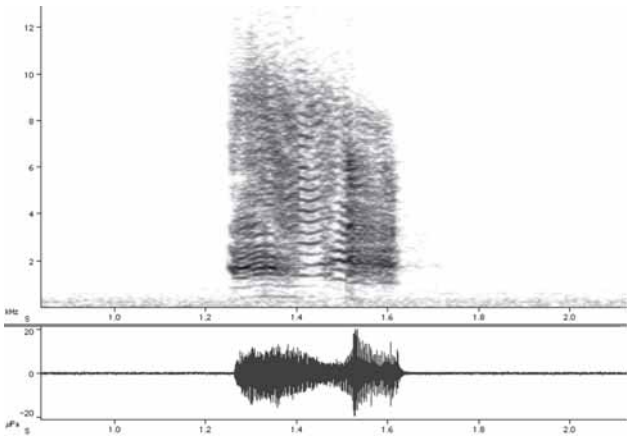
The note duration of advertisement call had an average note length of 26.5 (±4.5, N = 129) ms and did not show a constant number of harmonics, in average 6 (±2), ranging three to ten and modal number of 6 (N = 99). The largest energy concentration was found in the second harmonic (= dominant harmonic) that was in average 2413 (±167.8) Hz and fundamental frequency ranged 1100-1300 Hz. (see figures 1 and 2, tables I and II).

A distress call was emitted by one individual in captivity (ZUFRJ 9500). This call has not a rigid form, with length varying according to stimuli, with an average of 19 (nineteen) harmonics at each 500 Hz of fundamental harmonic. Dominant frequency was 4670.25 (±3093.06) Hz ranging from 1694 to 8629Hz (N = 6 notes). Another call like this was heard in the field, during the day (Carvalho-e-Silva, S. P. pers. obs.) and this is the first record for this call type in the *Aplastodiscus albofrenatus* group and for the genus (Figs 5 and 6).

For *Aplastodiscus weygoldti*, call data of two individuals (ZUFRJ 6350, 6477; SVL = 40 and 38 mm respectively) and a not captured individual were analyzed. Note duration was, in average, 46 (±10) ms. The higher energy concentration (dominant frequency) was found in the second harmonic that was



Figures 1-4. Sonogram and oscilogram of: (1-2) two advertisement calls of *Aplastodicus arildae* (ZURFJ 9497); (3-4) *Aplastodiscus weygoldti* (ZUFRJ 6477) the two less conspicuous calls (with lower intensity) belongs to the not captured individual of *A. weygoldti*.



Figures 5-6. Oscilogram and sonogram of *Aplastodicus arildae* (ZURFJ 9500) distress call.

in average 2591 (±42.7) Hz and fundamental frequency always ranged around 1300 Hz. (see figures 3 and 4, tables I and II). The number (amount) of harmonics was 6(±3), ranging two to ten with modal number of 7 (N = 85).

DISCUSSION

Temporal traits

Note duration

Wollerman & Wiley (2002) studying recognition error possibilities in *Dendropsophus ebracattus* (Cope, 1874), realized that only the duration of the primary note of the advertisement call carried recognition information for this species. Cardoso & Vielliard (1990) found that *Hypsiboas punctatus* (Schneider, 1799) and *H. lanciformis* (Cope, 1871) had similar frequency traits for their advertisement calls, but *H. lanciformis* call could be recognized by its lower duration.

Aplastodiscus arildae advertisement call presented a mean duration of 26.5 (±4.5) ms with high concentration (17% of variation around the average), while *A. weygoldti* calls presented a tendency of being longer, meaning 46 (10.1) ms presenting with a lower concentration (21% of variation) around the average. Note duration for *A. arildae* ranged 20-31 ms against 40-50 ms for *A. weygoldti* (Tab. I).

Heyer *et al*. (1990) found that, in Boracéia, note duration for *Aplastodiscus arildae* ranged 40-60 ms, similar of note duration of *A. weygoldti* herein, but the picture showing a specimen of the species in Boracéia is not a picture of an *A. arildae* specimen. Both species calls differ from *A. albofrenatus* call described by Bokermann (1967) as a short note with a repetition rate of 40 notes/minute and duration of 50 ms, but, unfortunately, the description in his text doesn't match the data depicted in the published sonogram. Conte *et al*. (2005) found for *A. ehrhardti* a note duration of 10.1 (±1.2) ms ranging 8-13 ms, a lot shorter that the species studied herein.

The advertisement call of *Aplastodiscus perviridis*, Lutz, 1950 is a short modulated whistle with mean duration of 116 ms (Haddad *et al*. 2005), a lot longer then both species of this study. This relation is also true when comparing the advertisement calls of the species herein studied with the call of *A. eugenioi* in Picinguaba, São Paulo with a mean duration of 85.64 (±16.77) described by Hartmann *et al*. (2004) (Tab. I).

The duration of advertisement call was significant as well for Abrunhosa *et al*. (2005) when studying the *Aplastodiscus albosignatus* group. With the exception of *Aplastodiscus albosignatus* and *Aplastodiscus ibirapitanga* Cruz, Pimenta & Silvano, 2003, each species has unique call duration. It is important that remains clear that those two species are not sympatric and show different repetition rates and dominant frequencies (see Abrunhosa *et al*. 2005).

Table I. Frequencial and note duration data of individuals herein cited. S stands for standard deviation and N stands for number of unities analyzed. When data was unavaiable it was coded "–". Data from *A. ehrhardti* are derived from original work.

Individuals	Fundamental frequency (Hz)	Dominant frequency (Hz)	S	N (FF & DF)	Note duration (ms)	S	N
A. arildae 6497	= Dominant	1260.1	8.1	28	20.1	0.6	28
		(1239 - 1270)			(19 - 21)		
A. arildae 6498	1200	2358.9	21.3	30	27.4	2.9	30
		(2311 - 2400)			(21 - 32)		
A. arildae 6499	1100	2245.6	31.5	35	31.7	3.0	35
		(2120 - 2280)			(26 - 39)		
A. arildae (not captured)	1300	2631.1	13.7	33	25.3	1.6	33
		(2599 - 2653)			(22 - 29)		
A. weygoldti 6350	1300	2635.8	41.7	28	44.6	10.5	33
		(2574- 2756)			(35 - 43)		
A. weygoldti 6477	1300	2568.0	18.0	28	50.0	8.0	28
		(2558 - 2622)			(38 - 61)		
A. weygoldti (not captured)	1300	2553.0	81.0	15	40.0	10.0	24
		(2284 - 2615)			–		
A. eugenioi (Hartmann *et al.* 2004)	800 - 1200	–	–	–	85.64 (±16.77)	16.8	46
		(2100 - 2500)			(54 -115)		
A. perviridis (Haddad *et al.* 2005)	910 - 1300	–	–	–	116.0	11.0	30
		(2100 - 2500)			(97-156)		
A. albofrenatus (Bokermann 1967)	1000	–	–	–	50.0	–	–
					(40 - 60)		
A. ehrhardti (Conte *et al.* 2005)	1300 - 1500	2660.0	–	40	10.1	–	40
		(2600 - 2900)			(8-13)		

Repetition rate

Martins & Jim (2004) found that during the beginning of chorus activities or in isolated male callers of *Hyla jimi* Napoli & Caramaschi, 1999 (now *Dendropsophus jimi*), and *H. elianeae* Napoli & Caramaschi, 2000 (now *Dendropsophus elianeae*) the repetition rates are lower, but during chorus, those rates, as well as the number of notes per call, are higher.

Heyer *et al.* (1990) found repetition rates for *Aplastodiscus arildae* in Boracéia of 42-102 notes/minute, that are higher than the repetition note recorded for ZUFRJ 9497(29 notes/minute) that was calling alone in the day of recording, but similar to repetition rates of individuals choiring (43-98 notes/minute). Similar data was registered for *A. weygoldti* as well (7.3 notes/minute when alone and 40-46 notes/minute in chorus). Both species repetition rates, differ from *A. eugenioi* (as *Hyla sp. aff. ehrhardti*) repetition rate of 22 notes/minute (Hartmann *et al*. 2004), but the authors didn't remark the chorus situation of the recorded specimens. The highest repetition rate was found by Conte *et al*. (2005) of 204-264 for *A. ehrhardti* individuals. Since the sonogram of Bokermann (1967) does not agree with his description, we were unable to compare it with our data (Tab. II).

The emission of notes with different temporal traits in chorus situation can be related to the maintenance of individual space among active neighbor males (Martins & Jim 2003). Our t-Student tests showed that repetition rates in our data, were unique even between the individuals of *A. weygoldti* recorded together, thus we are able to infer that repetition rates are actively adjusted for each chorus situation.

This phenomenon has already been observed for other species within Hylidae family: *Dendropsophus nanus* (Boulenger, 1889), *Dendropsophus sanborni* (Schmidt, 1944), (Martins & Jim 2003), *Scinax argyreornatus* (Miranda-Ribeiro, 1926) and *S. rizibilis* (Bokermann, 1964) (Pombal *et al.* 1995). It is also known for, at least, two others species within Leiuperidae Bonaparte, 1850 family: *Engystomops pustulosus* (Cope, 1864) and *E. petersi* Jiménez de la Espada, 1872 (Ryan & Rand 2001).

When we analyzed the variation coefficients of call interval from animals that were in chorus activity and calling alone it was possible to notice some tendency of chorusing animals to call more regularly. "Lonely-callers" coefficients of variation ranged between 27-59% (ZUFRJ 9497 and ZUFRJ 6350), while "chorus-callers" presented a variation of 13.7-31% (*A. arildae* not captured individual and ZUFRJ 9499). Cardoso

Table II. Interval call data of individuals herein cited. S stands for standard deviation and N stands for number of unities analyzed. Interval is the time elapsed between the beginning of two calls. When data was unavaiable it was coded "–". Data from *A. ehrhardti* are derived from original work.

Individuals	Intervals between calls	S	N	Variation coefficient of intervals (S/X)*100	Repetition rate (notes/min)
A. arildae 6497	00:02.125	00:00.570	27	27	29
	(00:00.993-00:03.225)				
A. arildae 6498	00:00.980	00:00.137	29	14	60
	(00:00.716-00:01.208)				
A. arildae 6499	00:01.437	00:00.448	35	31	43
	(00:00.862-00:02.680)				
A. arildae (not captured)	00:00.611	00:00.079	34	13	100
	(00:00.470-00:00.901)				
A. weygoldti 6350	00:08.395	00:04.982	32	59	7
	(00:00.00-00:22.425)				
A. weygoldti 6477	00:01.366	00:00.301	27	22	43
	(00:01.008-00:01.972)				
A. eugenioi (Hartmann *et al.* 2004)	–	–	–	–	22
A. perviridis (Haddad *et al.* 2005)	00:00.469	00:00.228	30	49	120
	(00:00.343-00:01.609)				
A. eugenioi (Conte *et al.* 2005)	00:00.269	–	40	–	204264
	(00:00.206-00:00.337)				

& Vielliard (1990) also noted some difference among lonely and chorus callers in *Hypsiboas punctatus* but didn't pay much attention to it. We did not analyze call interval of not-captured *A. weygoldti*. This individual was recorded in ZUFRJ 9499 track as background so; due to the high level of noise; we were unable to define precisely the temporal limits for several notes. The amount of definable intervals was too low (N = 5) and we preferred to exclude this individual for this analysis. So, Conte *et al* (2005) probably recorded two chorusing animals since the variation coefficients of call intervals of both their individuals were around 10% according to their data.

For future works, we strongly recommend that chorus situation should be elicited when describing amphibian advertisement calls.

Spectral traits

Both species advertisement calls herein depicted differ from *Aplastodiscus perviridis*, for they don't present modulated calls as described by Haddad *et al*. (2005) for this specie. With the exception of *A. cavicola*, all species within the *Aplastodiscus albosignatus* group have non-modulated calls (see Abrunhosa *et al*. 2005). In accordance to Faivovich *et al*. (2005) we also think that only future research will define whether any character state related to the advertisement calls could be considered as a synapomorphy of the genus *Aplastodiscus*, or of any of its internal clades.

Dominant frequencies

Aplastodiscus arildae and *A. weygoldti* emit advertisement calls with dominant frequency in the second harmonic ranging 2120-2653Hz for *A. arildae* and 2284-2756Hz for *A. weygoldti*. Hartmann *et al*. (2004) do not remark a dominant frequency for *A. eugenioi* in Picinguaba, SP but the sonogram in their work clearly shows a dominant frequency in the second harmonic even though there is not a spectrogram available. This dominant frequency in the second harmonic of the advertisement call may be the plesiomorphic state for this character for the genus since all known advertisement calls of *Aplastodiscus albofrenatus* and *A. perviridis* groups (except for *A. albofrenatus* for that in it's original sonogram nothing is mentioned) present this character but, the species of the *Aplastodiscus albosignatus* group present dominant frequencies in the third and/or in the fundamental harmonic (Abrunhosa *et al*. 2005). Five calls of one individual of *A. weygoldti* (ZUFRJ 6350) presented the dominant frequency in the fundamental harmonic, but the amount of energy of this harmonic was practically the same of the second harmonic, just a little bit higher.

Cardoso & Vielliard (1990) could not differ *Osteocephalus subtilis* Martins & Cardoso, 1987 and *Hyla punctata* calls only for its temporal structure, but they were easily separated for their dominant frequencies. We were not able to separate *A. ehrhardti* and *A. weygoldti* using the dominant frequency as

Table III. P values for Dominant frequencies T-Student test. * Not captured.

	ZUFRJ 6350	ZUFRJ 6477	A. weygoldti *	ZUFRJ 9497	ZUFRJ 9498	ZUFRJ 9499	A. arildae *	
ZUFRJ 6350	1	> 0.001	> 0.001	> 0.001	> 0.001	> 0.001	> 0.001	
ZUFRJ 6477	2.014	1	> 0.001	> 0.001	> 0.001	> 0.001	> 0.001	
A. weygoldti *	2.037	2.060	1	> 0.001	> 0.001	> 0.001	> 0.001	
ZUFRJ 9497	2.030	2.024	2.069	1	> 0.001	> 0.001	> 0.001	Found critical P
ZUFRJ 9498	2.010	2.004	2.056	2.024	1	> 0.001	> 0.001	
ZUFRJ 9499	2.001	2.002	2.048	2.020	1.999	1	> 0.001	
A. arildae *	2.024	2.010	2.064	2.002	2.011	2.011	1	

Expected critical P

character. Both species present this second harmonic around 2600 (Tab. I). Actually, our T-Student tests (95%) showed that dominant frequencies were individual for each animal in this study (Tab. III). Due to the low number of captured individuals, it was not possible to make a relation between animal size and dominant frequency. But as general information, at least for *Aplastodiscus arildae*, larger animals seem to have lower dominant frequencies. One individual (ZUFRJ 9497) whose average dominant frequency was 1260.1(±8.1) Hz (Tab. I) is the exeption, but it is important to remark that this particular individual was record calling inside the cup of a bromeliad and this may have had an influence in the signal. For this animal, the vegetation, or thinking more specifically, the calling site choice produced an alteration in his specific signal as happened with *Centrolenella fleischmanni* (Boetger) Centrolenidae in Wells & Schwartz (1982) study.

Fundamental harmonic

The fundamental harmonic of the herein studied species of *Aplastodiscus* ranged 1100-1300 Hz (while *A. weygoldti* always presented 1300 Hz).

Aplastodiscus perviridis has a fundamental frequency of 910-1300 Hz (Haddad *et al*. 2005), *A. albofrenatus* is according to original sonogram (Bokermann 1967) is 1000 Hz, *A. eugenioi* presents fundamental harmonic that ranges from 800 to 1200 Hz (Hartmann *et al*. 2004), A. ehrhardti 1300-1500 Hz and the *A. albosignatus* group ranges 700-1040Hz (Abrunhosa *et al*. 2005).

Like dominant harmonics, fundamental harmonics couldn't separate the species.

Number of harmonics

One captured individual (ZUFRJ 9499) and one not captured of *Aplastodiscus weygoldti* presented fewer harmonics in sonogram then other co-specific recorded males, especially higher harmonics. That absence of higher harmonics may have happened because some environment factors, such as the vegetation between the animal and the microphone, may interfere in signal quality by reflection or amortization (Wells & Schwartz 1982, Duellman & Trueb 1986, Cardoso & Viellard 1990), and, since every time the distance between source and receiver doubles, the signal loses 6 dB (Wollerman 1999), frequencies with lower amount of energy should fade out first.

In a general matter, the number of harmonics were or too variable (variation coefficients = 3.5-40.03% for *A. arildae* and 23.5-42.58% for *A. weygoldti*) to assure a specific relationship.

Nevertheless, modal numbers had shown (at least in *Aplastodiscus albofrenatus* group described calls and for *A. perviridis*) a specific number of harmonics per species. *Aplastodiscus ehrhardti* presented the smaller number of harmonics (two to four) according to (Conte *et al*. 2005) followed by *A. eugenioi* (= *Hyla sp. aff. ehrhardti*, Hartmann *et al*. 2004) (three harmonics), and *A. perviridis* with four harmonics (Haddad *et al*. 2005). The species herein studied presented modal number of six (*A. arildae*) and seven (*A. weygoldti*) harmonics. Even though we are comparing modal numbers in our data with mean numbers for the previously described calls, we figure that this character may be elucidative if calls, in the future, have more standardized recordings.

GENERAL CONSIDERATIONS

Types of calls

Aplastodiscus perviridis also presents three types of courtship calls (Haddad *et al*. 2005) that were not observed by us in neither of our studied species, but we were not able to presence the whole breeding behavior of those species. Males of *A. perviridis* studied by Haddad *et al*. (2005) shown four types of calls (announcement + three different courtship calls), *A. eugenioi* studied by Hartmann *et al*. (2004) showed three (announcement + two) and *A. albofrenatus* by Bokermann (1967) presented two types (announcement + one), *A. weygoldti* also presented the same two types of *A. albofrenatus* (advertisement and territorial) and *A. arildae* presented three types: advertisement, territorial and distress call. This is the first record of a distress call for the *Aplastodiscus* genus.

Even though Heyer (1980) affirms that morphological resemblance indicates a high level of filetic relationship, Straughan (1973) says that parallelism and convergence problems may appear just like any other character, so, homologies can't be based only in vocalizations because similar calls can be produce by completely different apparatus and vice versa.

Morphological remarks

Carvalho-e-Silva & Carvalho-e-Silva (2005) remarked that the species in the *Aplastodiscus albofrenatus* group have a red-orange iris. In our observations, *A. arildae* and *A. weygoldti* presents a bi-colored iris characteristically with a 'ring' (for the pupil is elliptical). Even though the internal 'ring' has a smaller radius comparing to the other species of the genus similar to the species in *Aplastodiscus albosignatus* group (see Abrunhosa *et al*. 2005). This ring may be gray as affirmed by Carvalho-e-Silva & Carvalho-e-Silva (2005) for the *Aplastodiscus albosignatus* group or presenting a lighter coloration in comparison to the external ring, tending to white.

AKNOWLEDGEMENTS

To Itamar A. Martins, Luis N. Weber, Adriano L.C. Pinto, Roberta R. Pinto, Luiz A.P. Gonzaga e Sergio R. dos Santos.

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Received in 17.I.2006; accepted in 13.XI.2006.