

Alguns exemplos de artigos  
recentes sobre macroevolução



Comparative testis morphology of Neotropical anurans



Gabriela Baroni Leite<sup>a,\*</sup>, Lilian Franco-Belussi<sup>b</sup>, Diogo B. Provete<sup>c,1</sup>, Classius de Oliveira<sup>b</sup>

Diâmetro e área locular,  
espessura do feixe de fibras  
reticulares, e área das fibras de  
colágeno e feixe de  
espermatozóides

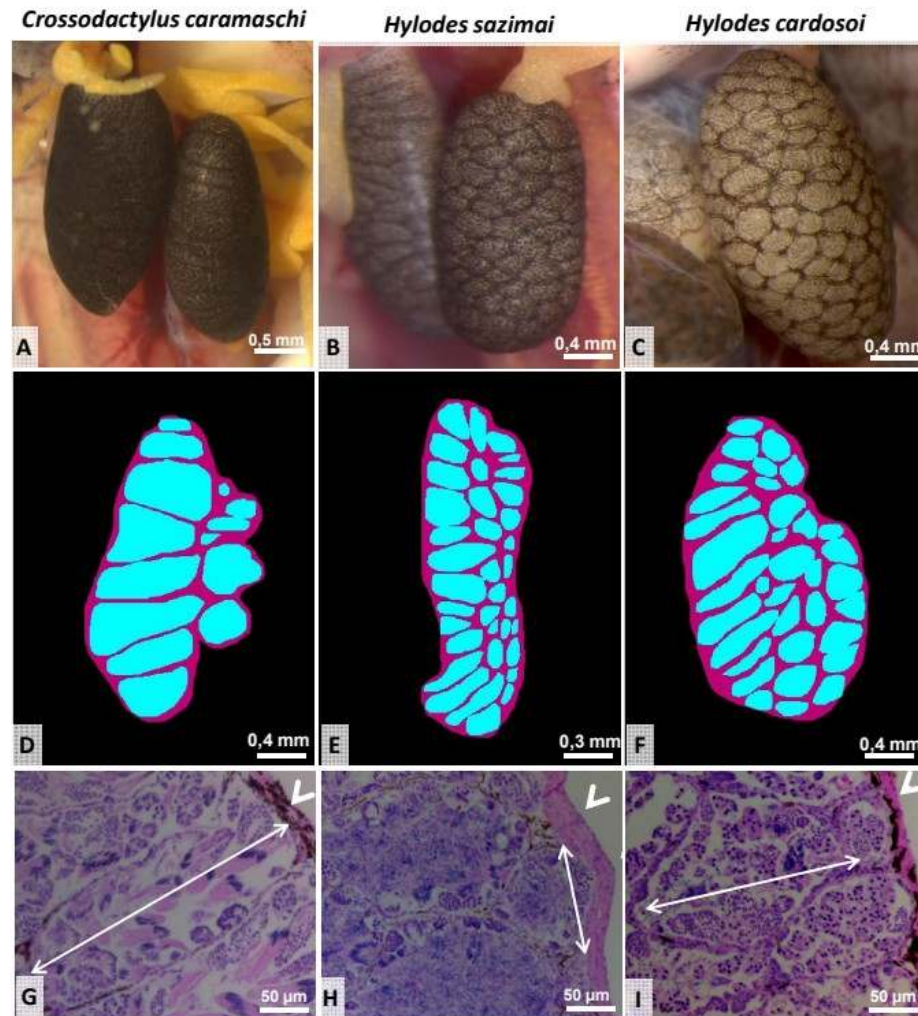
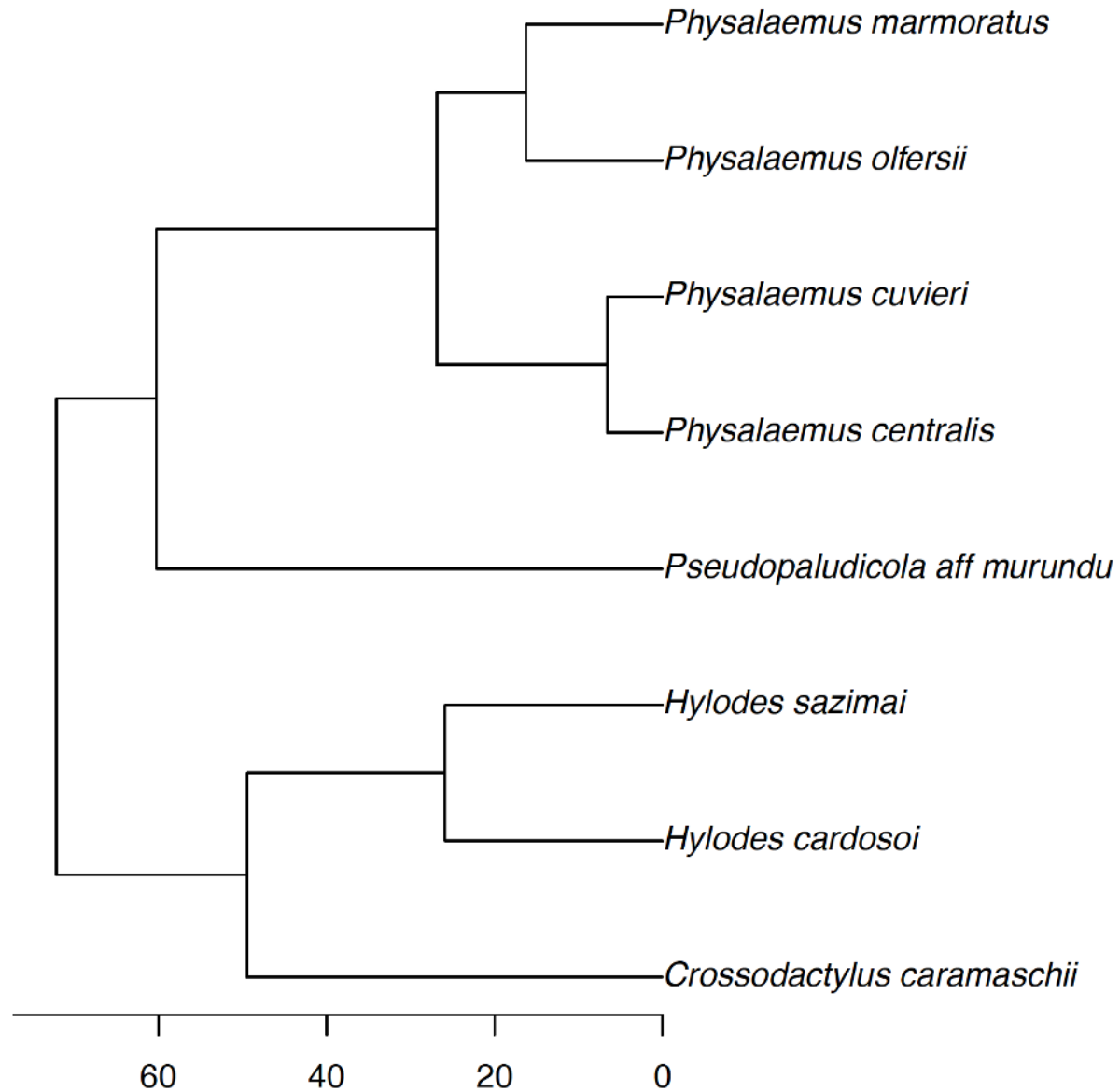
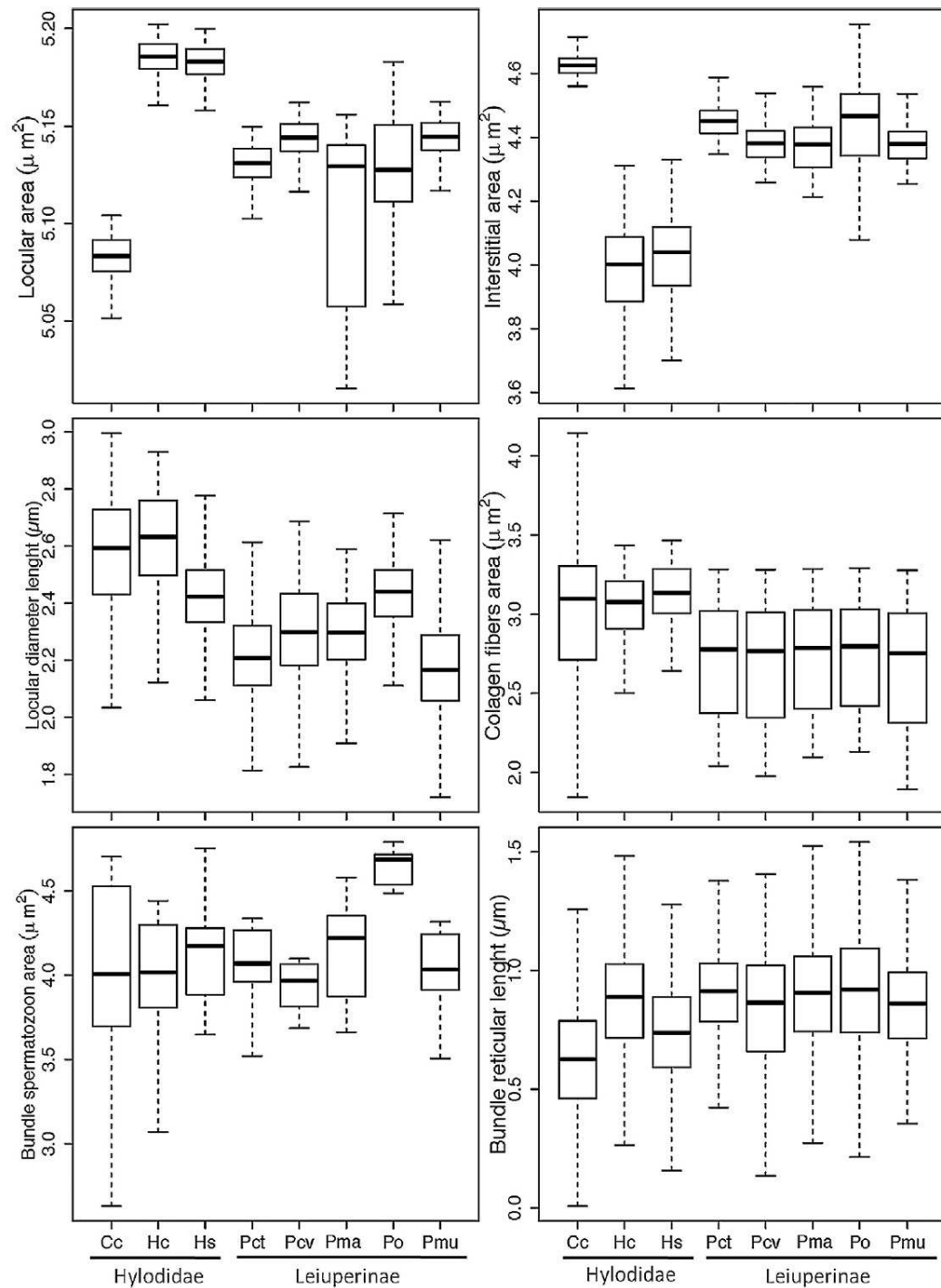


Figure 1



Duas famílias: Hylodidae e  
Leptodactylidae:Leiuperinae

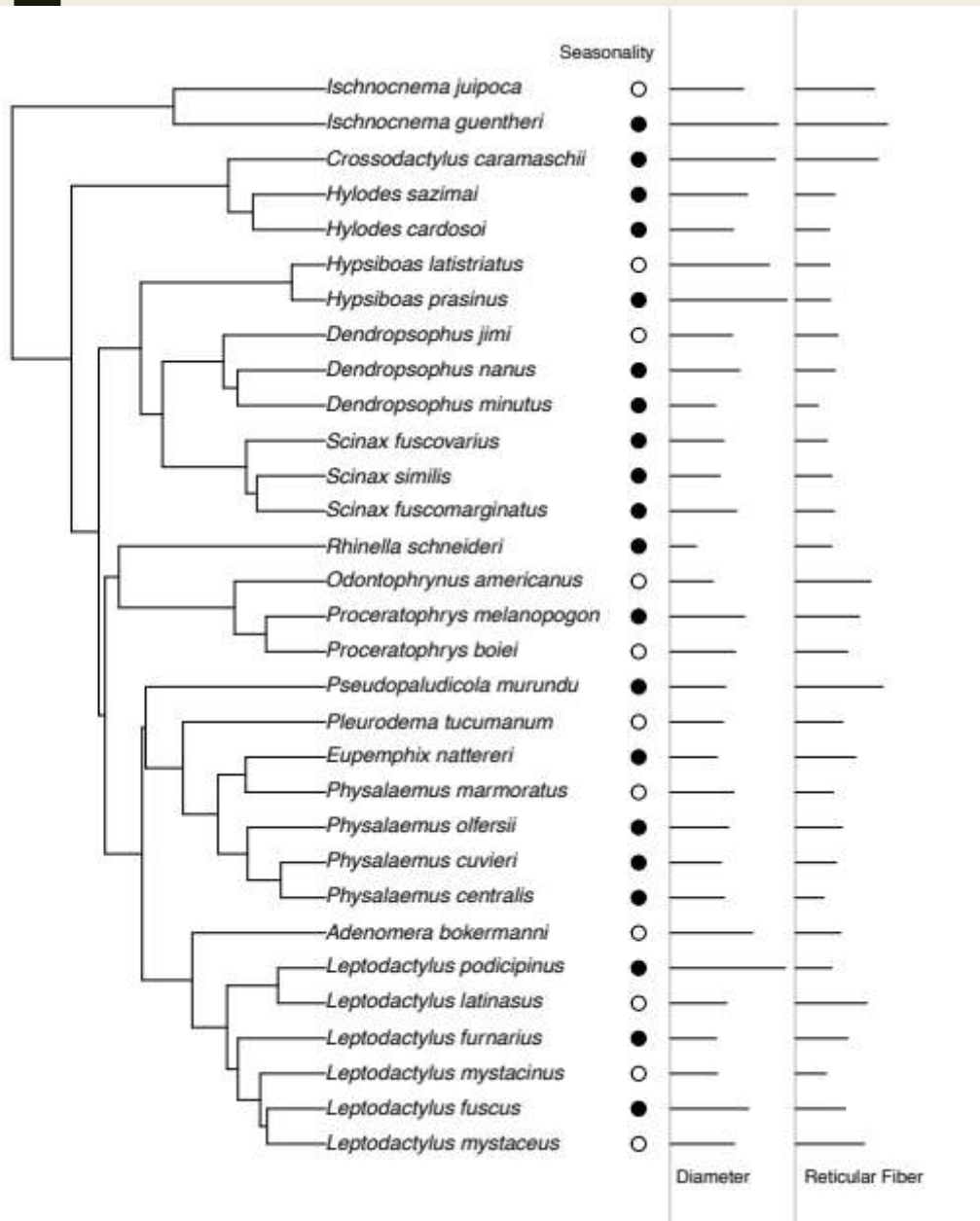


Hylodidae tiveram menos lóculos maiores, Leiuperinae tiveram vários pequenos e fibras mais grossas

Diferenças de estratégias reprodutivas. Hylodidae de riacho e reprodução contínua, poucos ovos, e Leiuperinae de poça e reprodução explosiva, muitos ovos pequenos

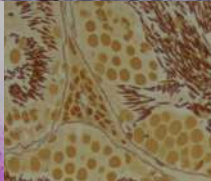
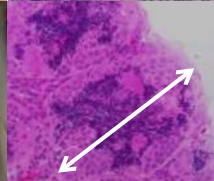
## Life history traits do not influence testicular characters of Neotropical anurans

Gabriela Baroni Leite<sup>1\*</sup>, Lilian Franco-Belussi<sup>2,3</sup>, Diogo B. Provete<sup>3</sup>, Classius de Oliveira<sup>2</sup>

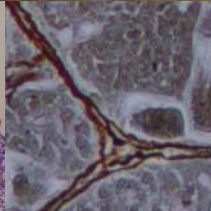
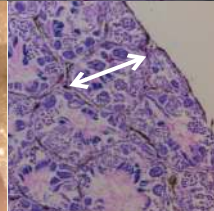


Focamos em dois daqueles caracteres e ampliamos a amostragem taxonômica pra sete famílias agora

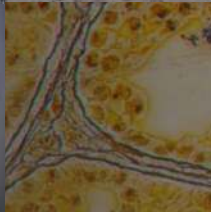
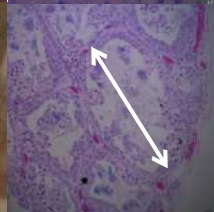
**Microhylidae**  
(*E. cesarii*)



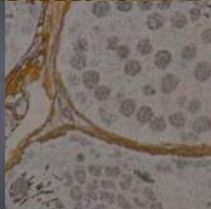
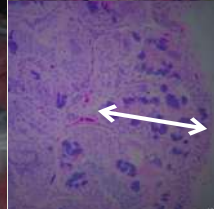
**Leptodactylidae**  
(*P. olfersii*)



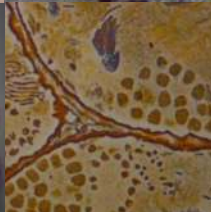
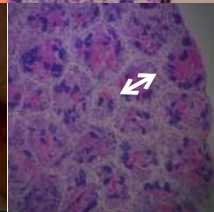
**Odontophrynidae**  
(*P. boiei*)



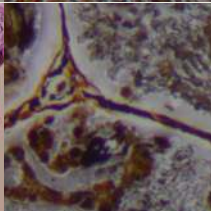
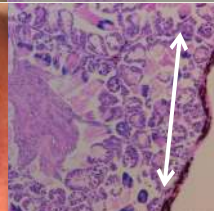
**Bufoidea**  
(*R. schneideri*)



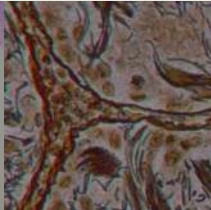
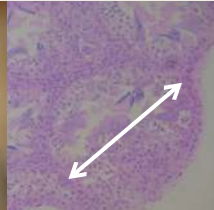
**Hylidae**  
(*S. fuscovarius*)

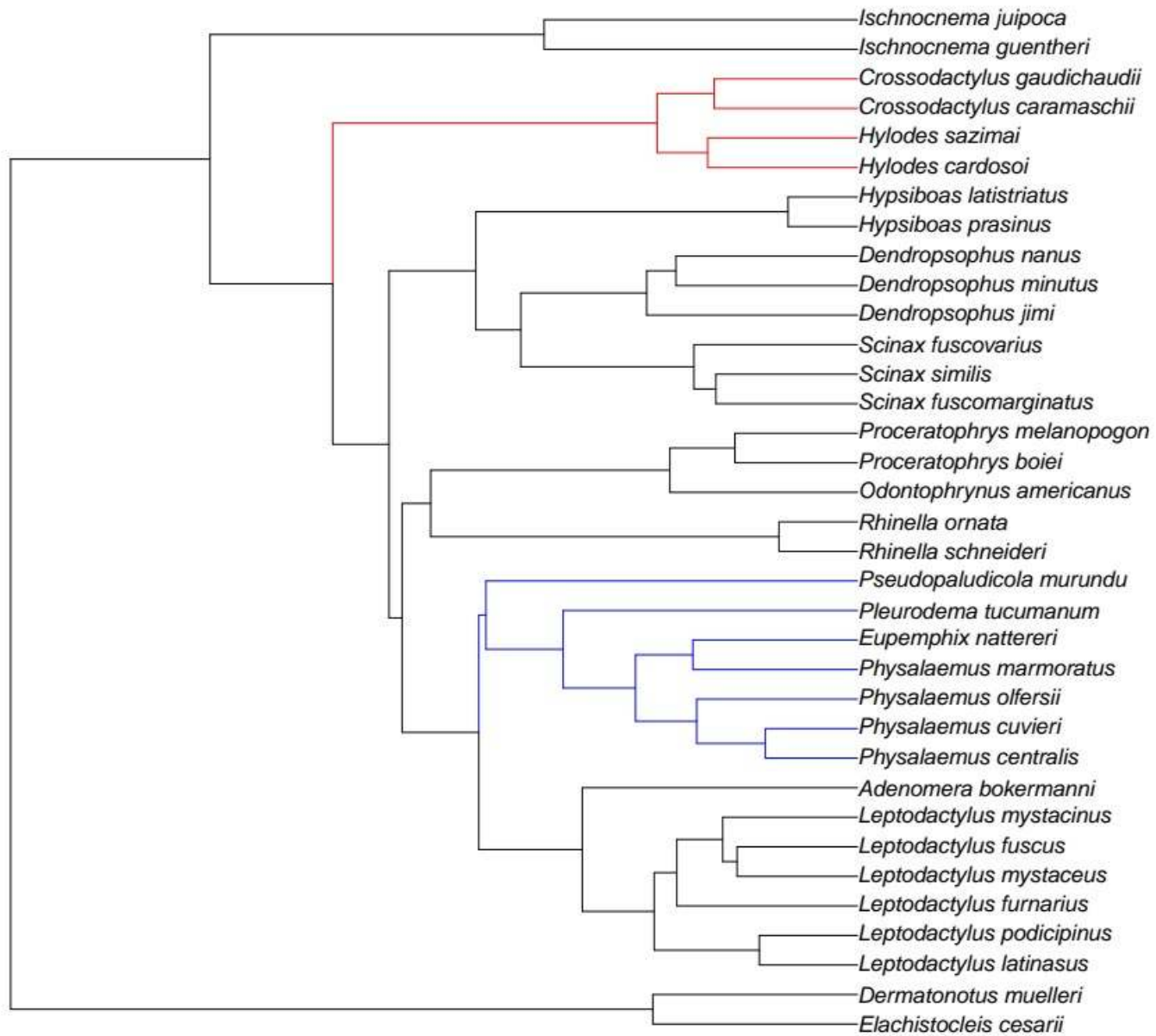


**Hylodidae**  
(*C. caramaschii*)



**Brachcephalidae**  
(*I. guentheri*)

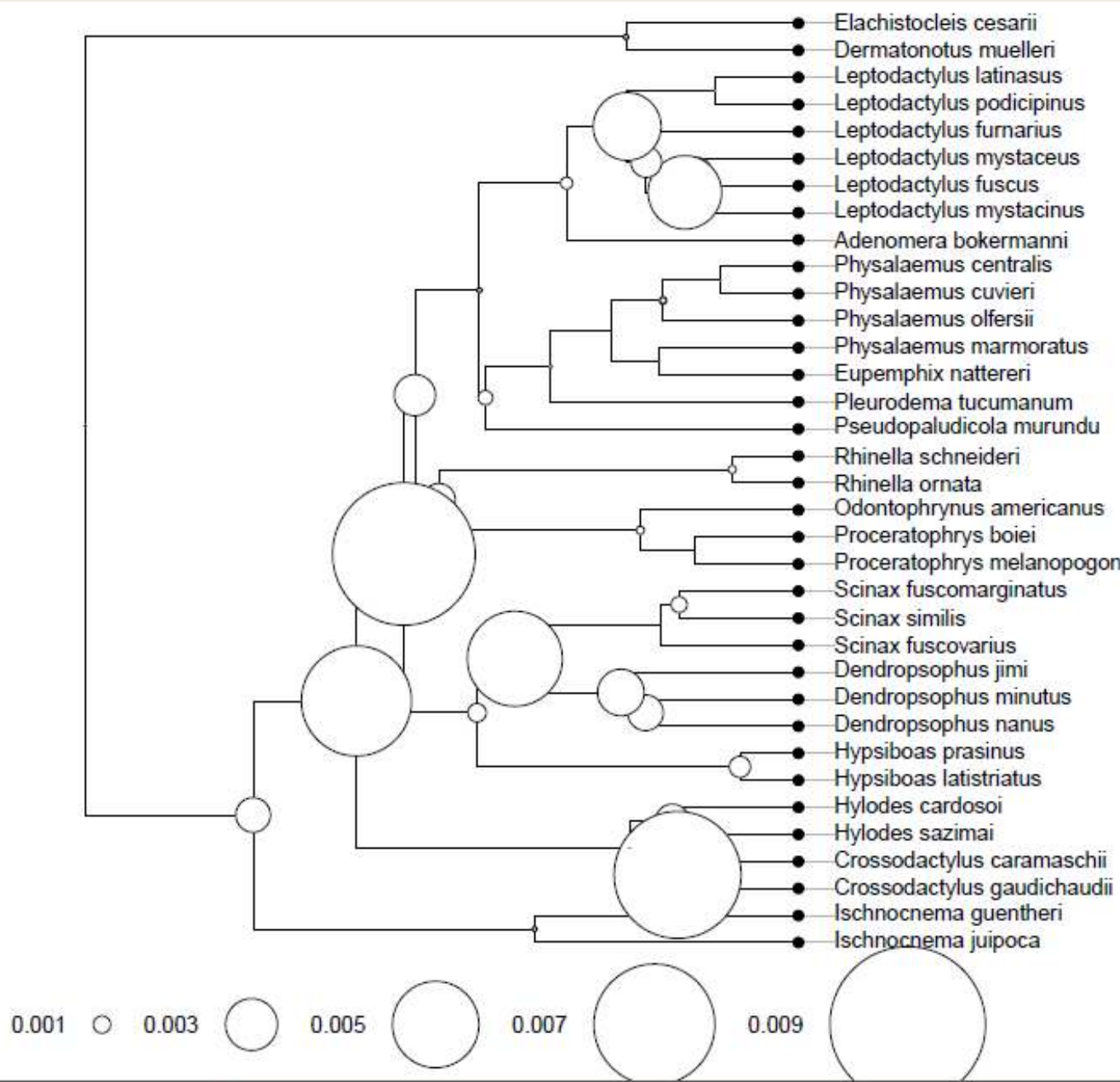


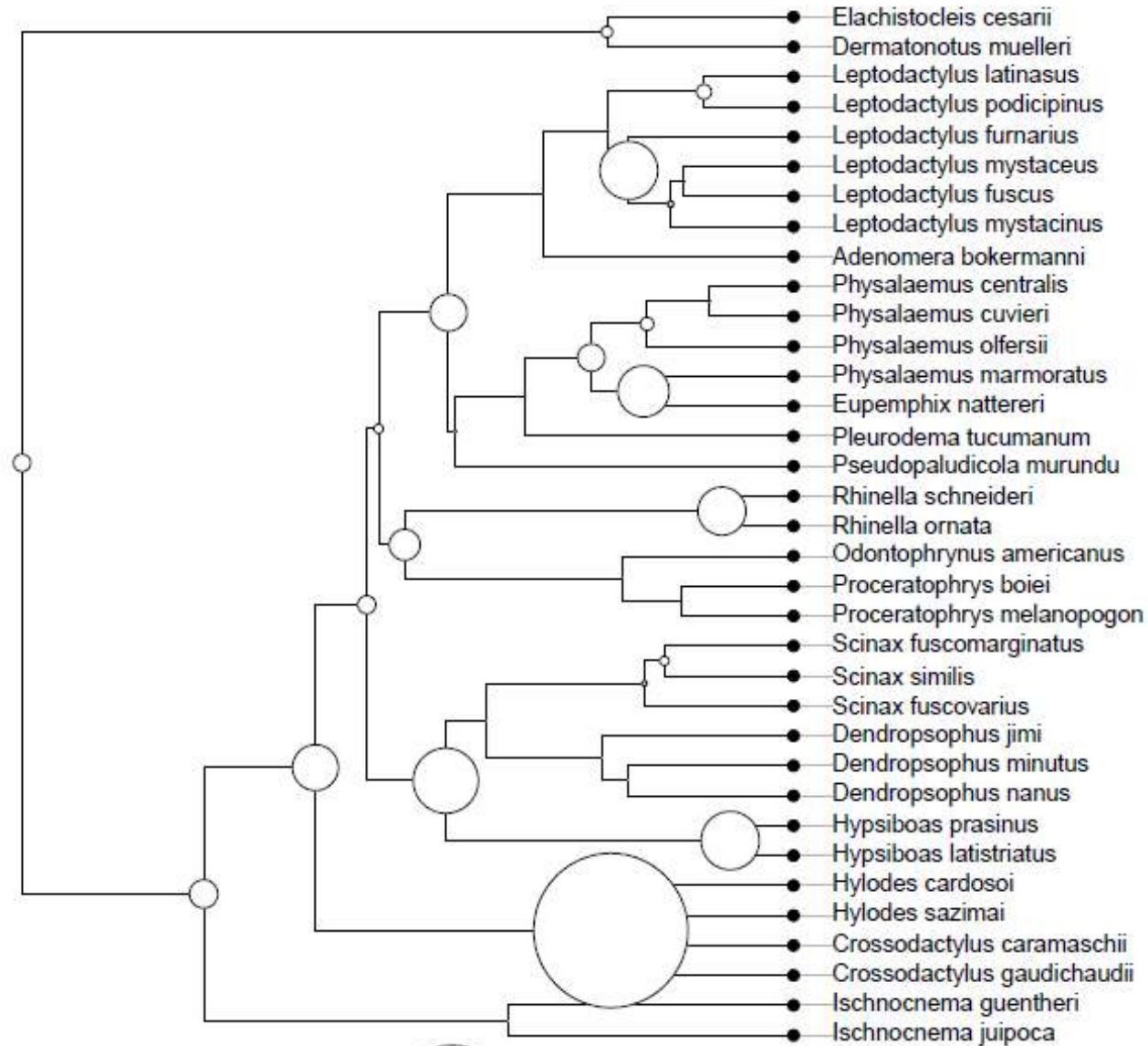


Três picos adaptativos para diâmetro ocular e espessura do feixe de fibras

Diversidade (sinal filogenético)

Diâmetro ocular é um caracter bastante plástico





0.002



0.008



0.012

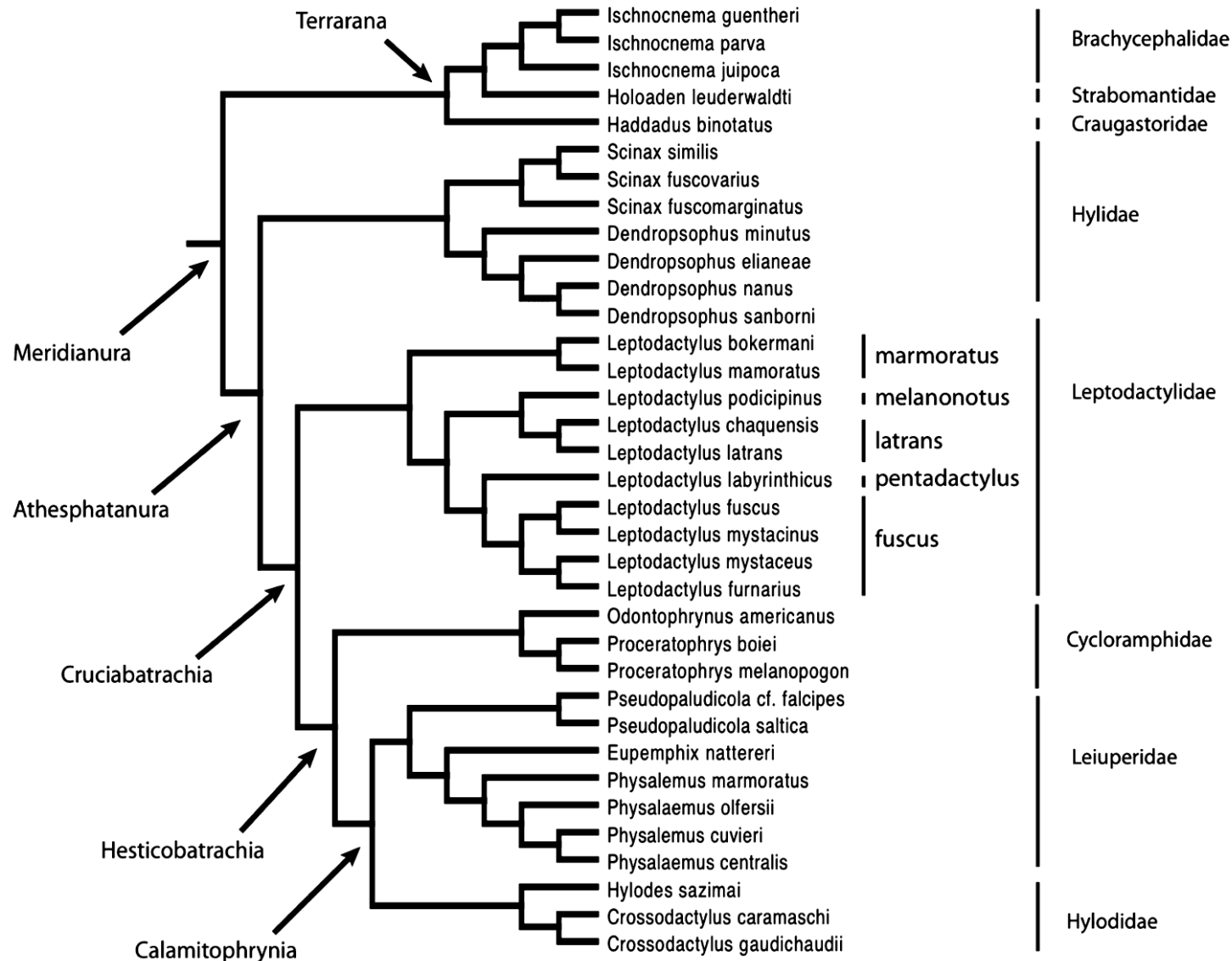


Assim como a espessura do feixe de fibras reticulares

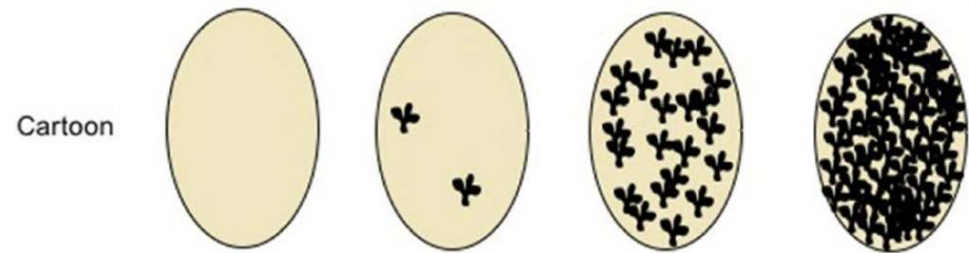
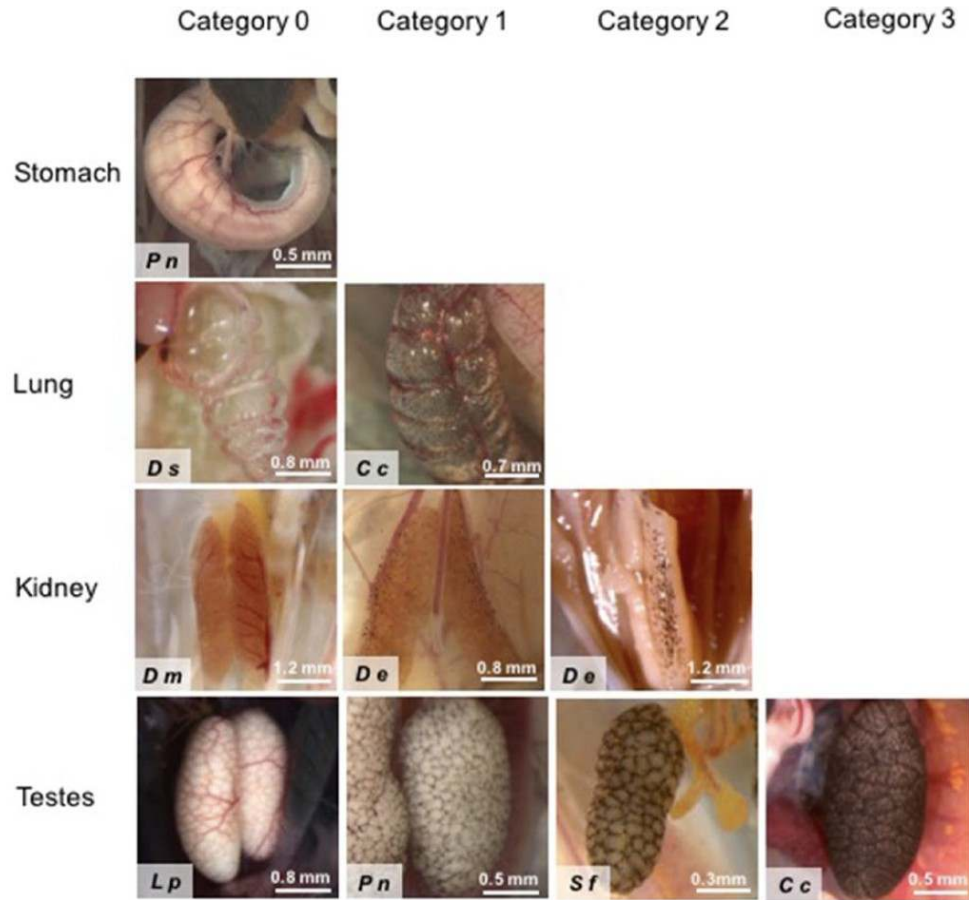
Nenhum character foi influenciado pela sazonalidade de reprodução ou os modos reprodutivos

**Phylogenetic signal and variation of visceral pigmentation in eight anuran families**

DIOGO B. PROVETE, LILIAN FRANCO-BELUSSI, LIA R. DE SOUZA SANTOS, RODRIGO ZIERI, RAFAELA M. MORESCO, ITAMAR A. MARTINS, SILVIO C. DE ALMEIDA & CLASSIUS DE OLIVEIRA



Medimos pigmentação visceral em 12 órgãos internos de 32 espécies de 8 famílias de sapos



Category 0:  
Absence of  
pigment cells  
on the surface  
of organs

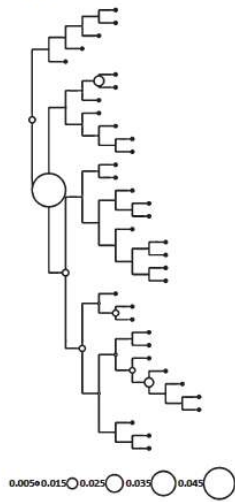
Category 1:  
A few scattered  
pigment cells

Category 2:  
A large amount  
of pigment cells

Category 3:  
A massive amount  
of pigment cells,  
covering all the  
surface

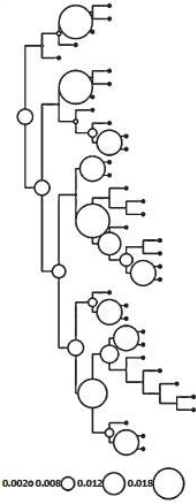


Protocolo Franco-Belussi et al.  
2009

**A Heart**

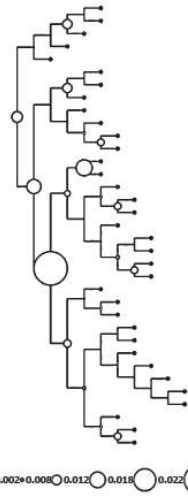
0.0059 0.015 0.025 0.035 0.045

TQE = 0.130  
SN test = 0.02  
FN test = 0.01  
Ro test = 0.01

**B Pericardium**

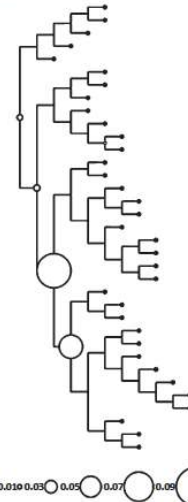
0.0020 0.008 0.012 0.018

TQE = 0.244  
SN test = 0.87  
FN test = 0.73  
Ro test = 0.84

**C Cardiac blood vessels**

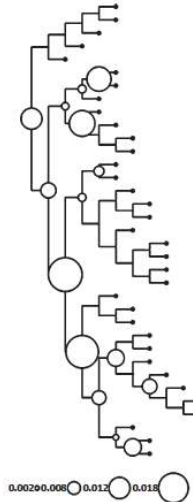
0.0029 0.008 0.012 0.018 0.022 0.028

TQE = 0.121  
SN test = 0.03  
FN test = 0.07  
Ro test = 0.14

**G Testicle**

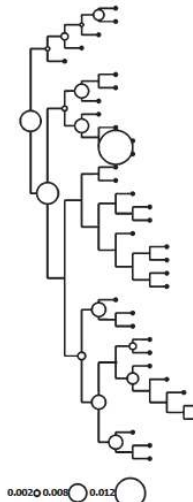
0.010 0.03 0.05 0.07 0.09

TQE = 0.179  
SN test = 0.01  
FN test = 0.01  
Ro test = 0.01

**H Rectum**

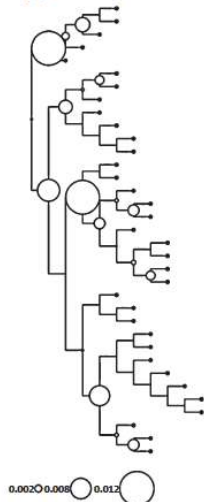
0.0029 0.008 0.012 0.018

TQE = 0.15  
SN test = 0.40  
FN test = 0.07  
Ro test = 0.01

**I Mesenterium**

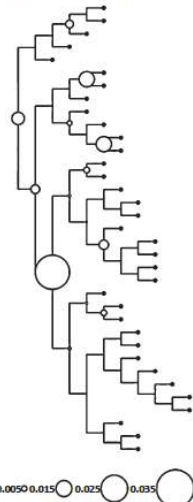
0.0020 0.008 0.012

TQE = 0.084  
SN test = 0.29  
FN test = 0.10  
Ro test = 0.32

**D Lung**

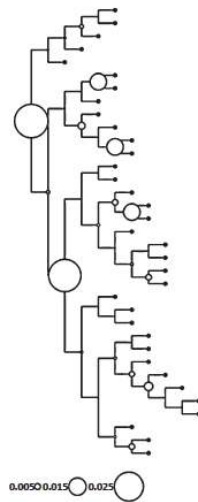
0.0020 0.008 0.012

TQE = 0.078  
SN test = 0.72  
FN test = 0.23  
Ro test = 0.05

**E Kidney**

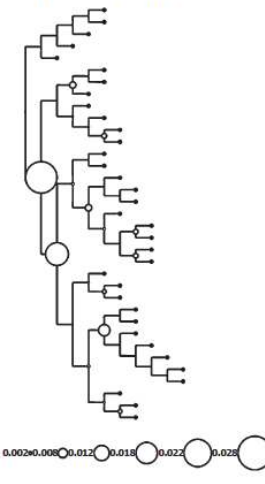
0.0050 0.015 0.025 0.035

TQE = 0.121  
SN test = 0.02  
FN test = 0.01  
Ro test = 0.07

**F Renal veins**

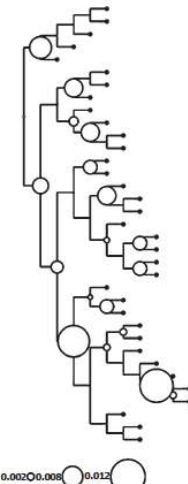
0.0050 0.015 0.025

TQE = 0.152  
SN test = 0.07  
FN test = 0.02  
Ro test = 0.14

**J Lumbar parietal peritoneum**

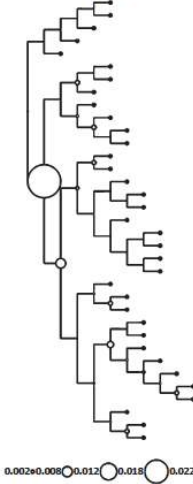
0.0029 0.008 0.012 0.018 0.022 0.028

TQE = 0.092  
SN test = 0.02  
FN test = 0.01  
Ro test = 0.01

**K Vertebral column**

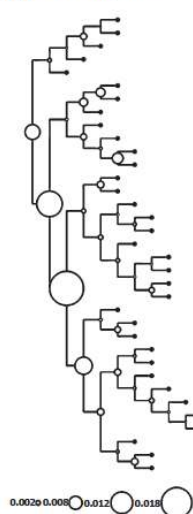
0.0020 0.008 0.012

TQE = 0.096  
SN test = 0.82  
FN test = 0.32  
Ro test = 0.79

**L Lumbar nerve plexus**

0.0029 0.008 0.012 0.018 0.022

TQE = 0.068  
SN test = 0.01  
FN test = 0.11  
Ro test = 0.01

**M All organs**

0.0020 0.008 0.012 0.018

TQE = 0.126  
SN test = 0.01  
FN test = 0.01  
Ro test = 0.01

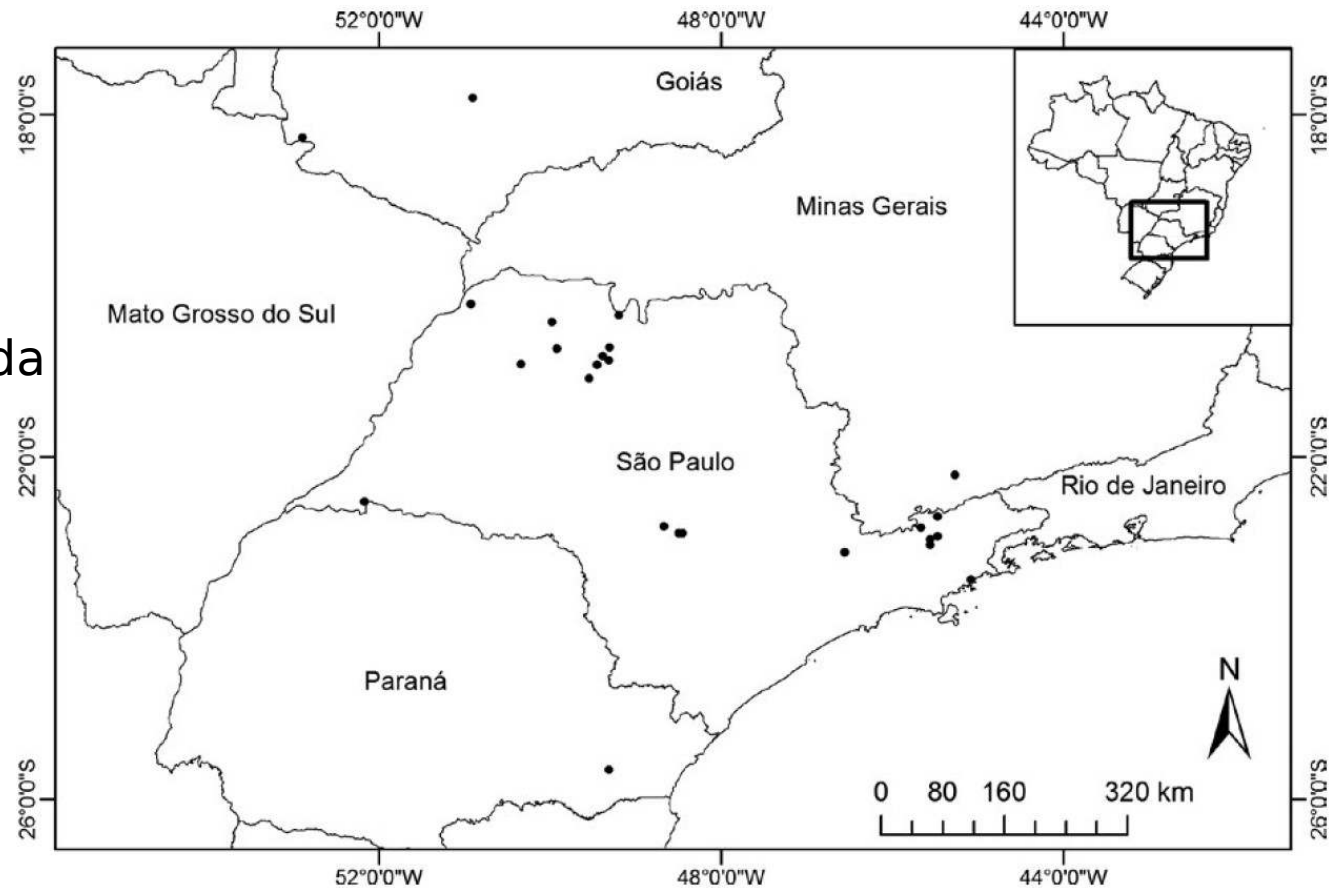
## Environmental correlates of internal coloration in frogs vary throughout space and lineages

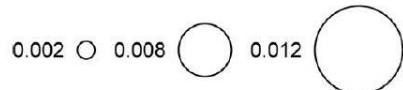
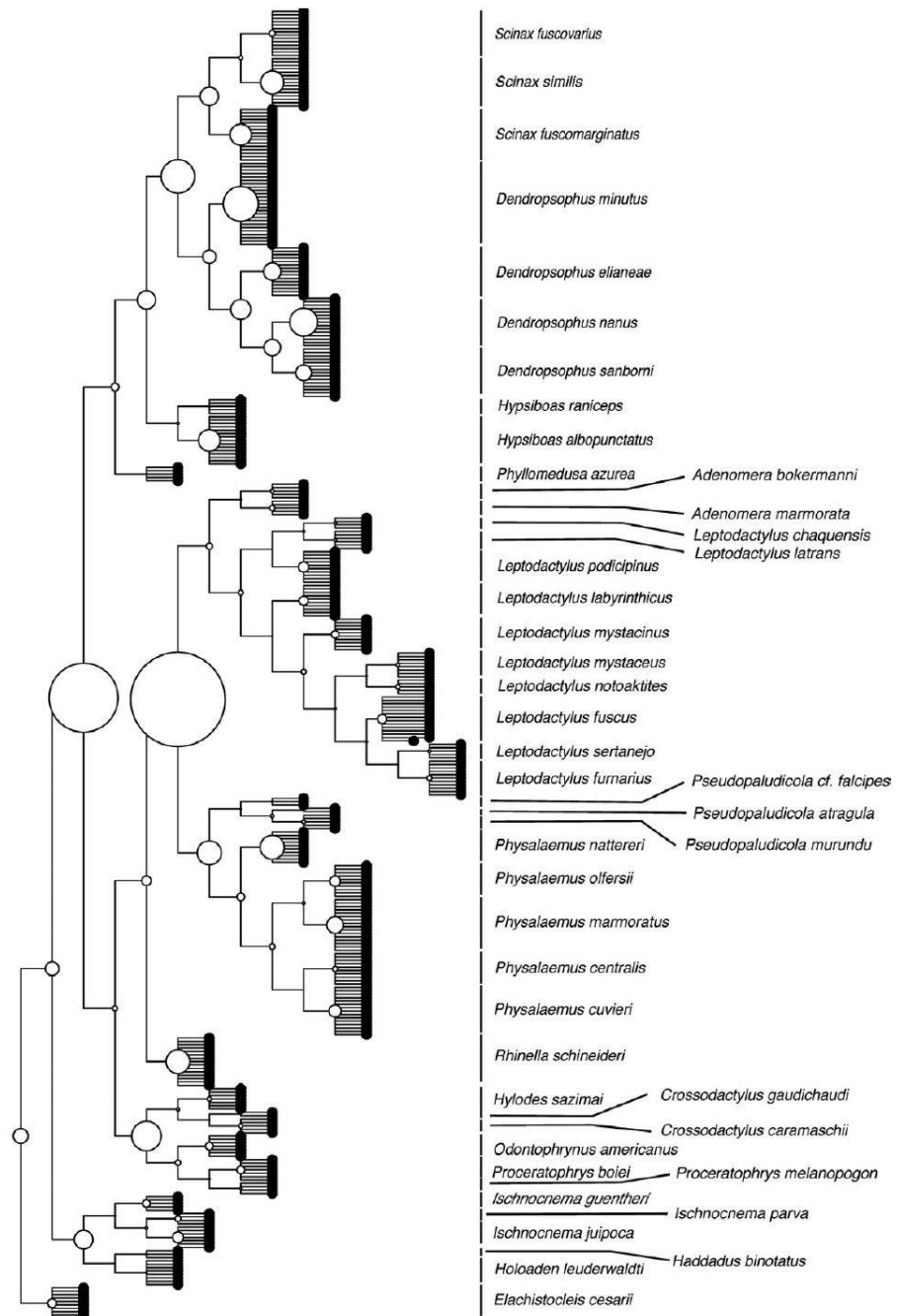
Lilian Franco-Belussi<sup>1\*</sup> | Diogo Borges Provete<sup>2,3\*</sup> | Classius De Oliveira<sup>1</sup>

Variáveis climáticas de 21 localidades:

- UV-B
- Fotoperíodo
- Média da variação diária da temperatura
- Variação anual da temperatura
- Temperatura média do trimestre mais quente

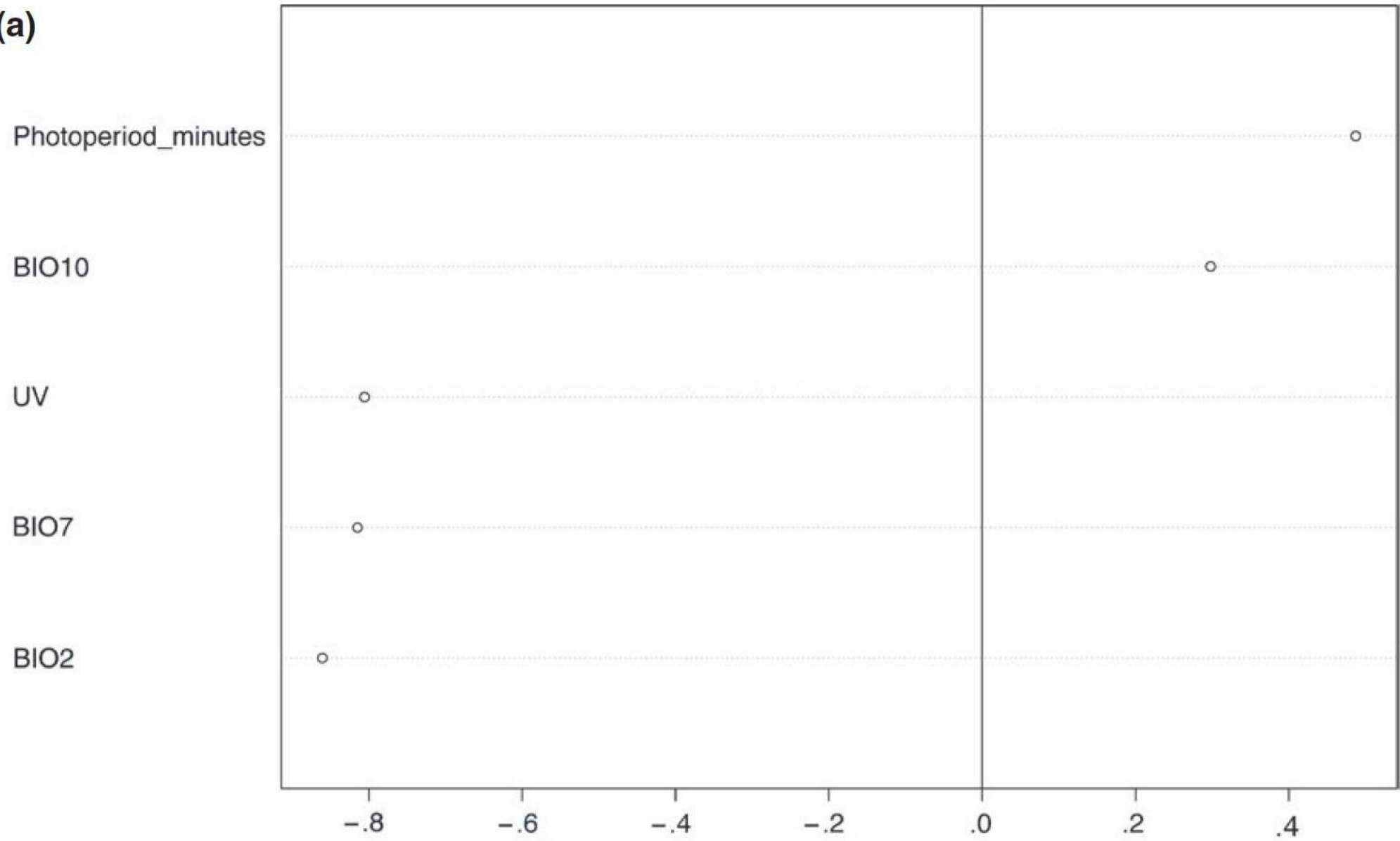
**FIGURE 1** Map showing the sites sampled in this study and those to which we obtained trait data from the literature or museum specimens





388 indivíduos de  
43 espécies de 6  
famílias  
Incluindo  
variação  
intraespecífica

(a)



**(b)**

Heart

Kidneys

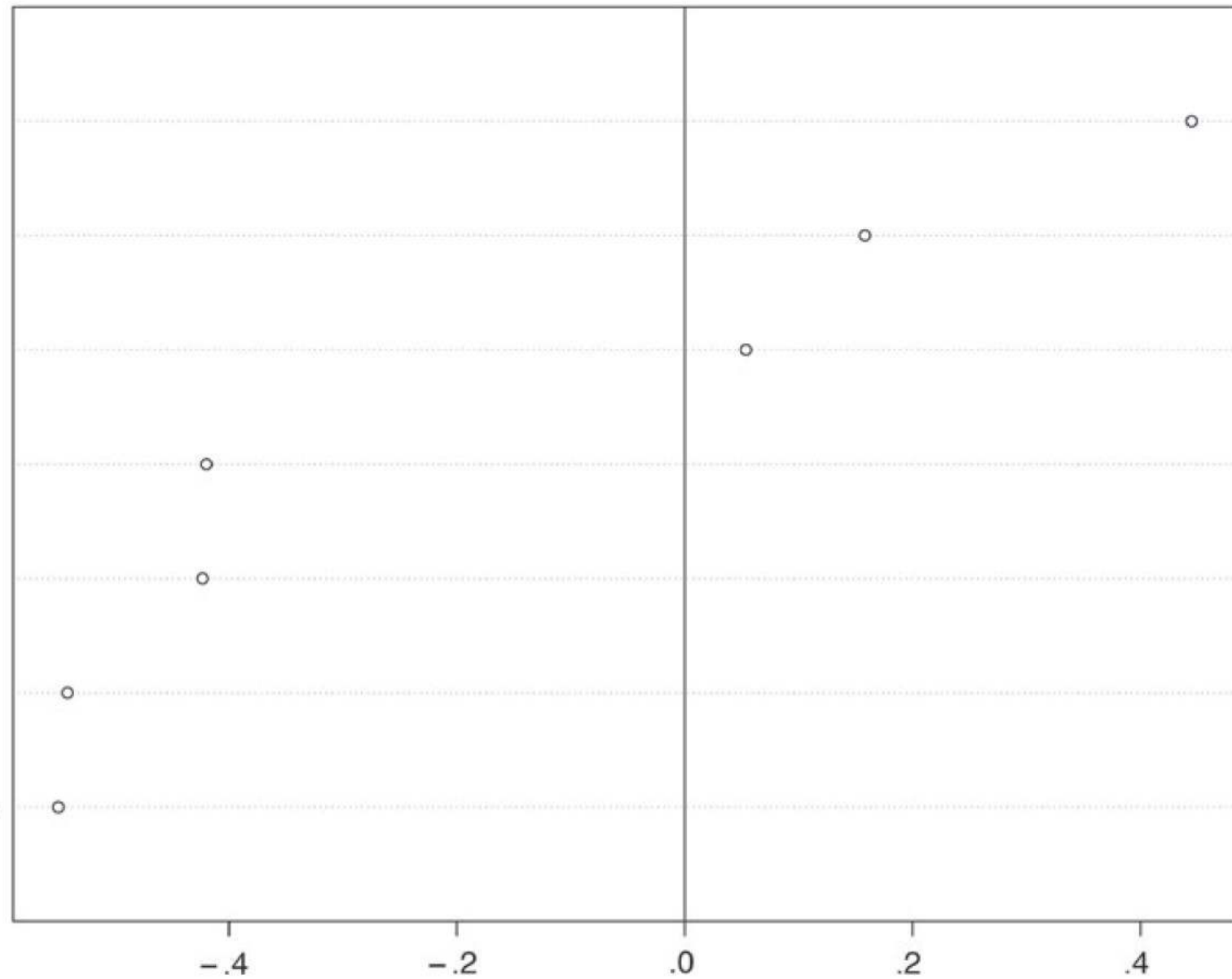
Rectum

Mesenterium

Lungs

Testicle

Lumbar\_parietal\_peritoneum



Correlation with the first axis of RLQ

A coloração do coração, rins, e reto de hylids, *Rhinella schneideri*, alguns *Leptodactylus*, e *Proceratophrys* covariaram fortemente com temperatura e fotoperíodo, enquanto aquela dos testículos, peritônio parietal lombar, pulmões, e mesentério de Leiuperinae, Hylodidae, *Adenomera*, e a maioria dos *Leptodactylus* tiveram maior covariação com UV-B e temperatura.



Samuel C.  
Faria



Carl Thurman



John C.  
McNamara

RESEARCH ARTICLE

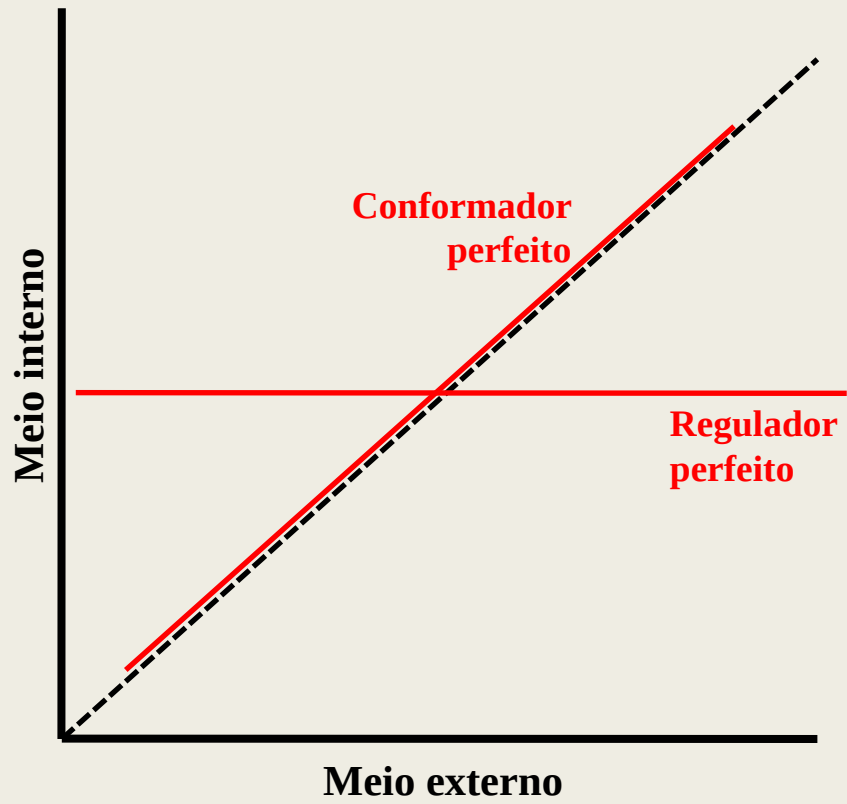
# Phylogenetic patterns and the adaptive evolution of osmoregulation in fiddler crabs (*Brachyura*, *Uca*)

Samuel Coelho Faria<sup>1\*</sup>, Diogo Borges Provete<sup>2,3</sup>, Carl Leo Thurman<sup>4</sup>, John Campbell McNamara<sup>1,5\*</sup>

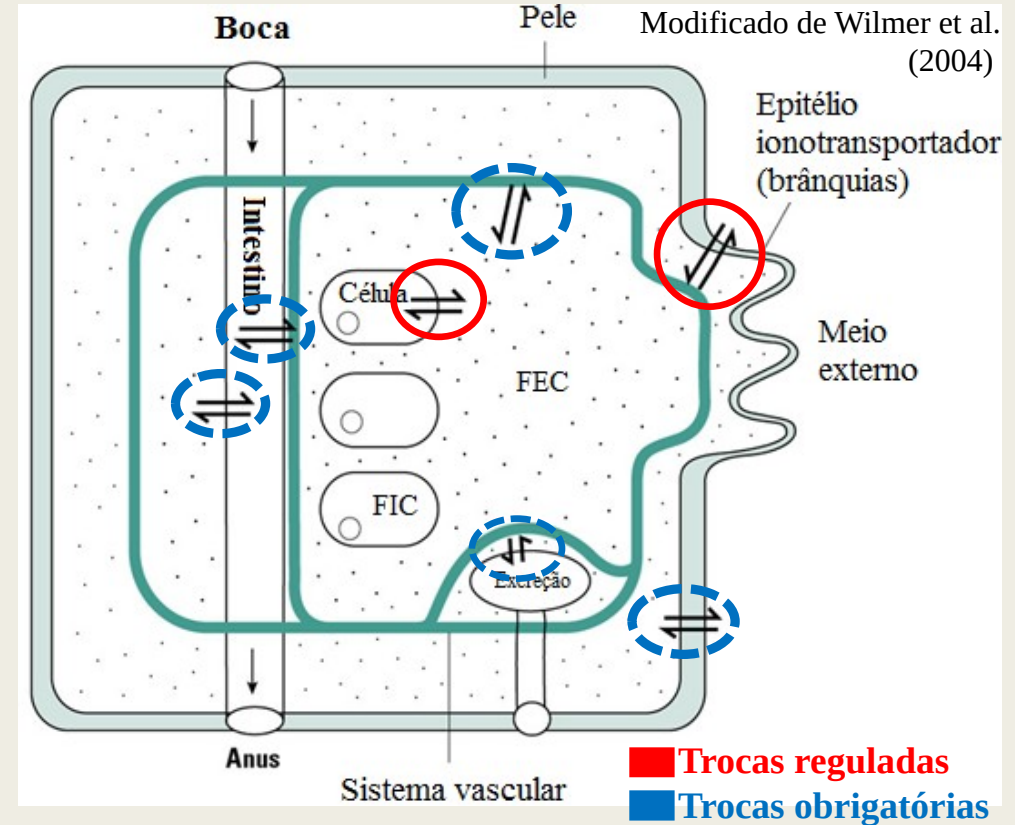


Foto: H. Dale 1947, *Obituary Notices of Fellows of the Royal Society*

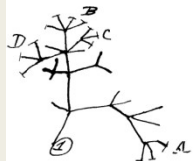
- Walter Cannon (1871-1945) e o conceito de homeostase  
Regulação x Conformação



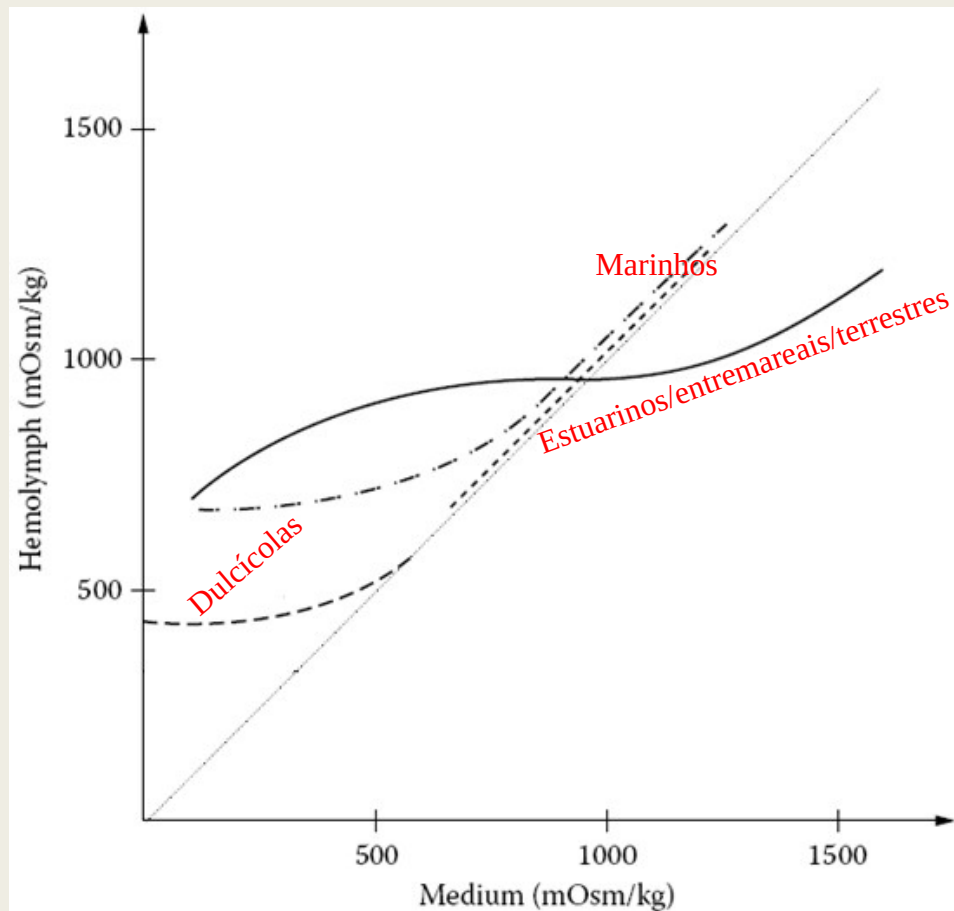
...sobre a importância da homeostase na distribuição biológica



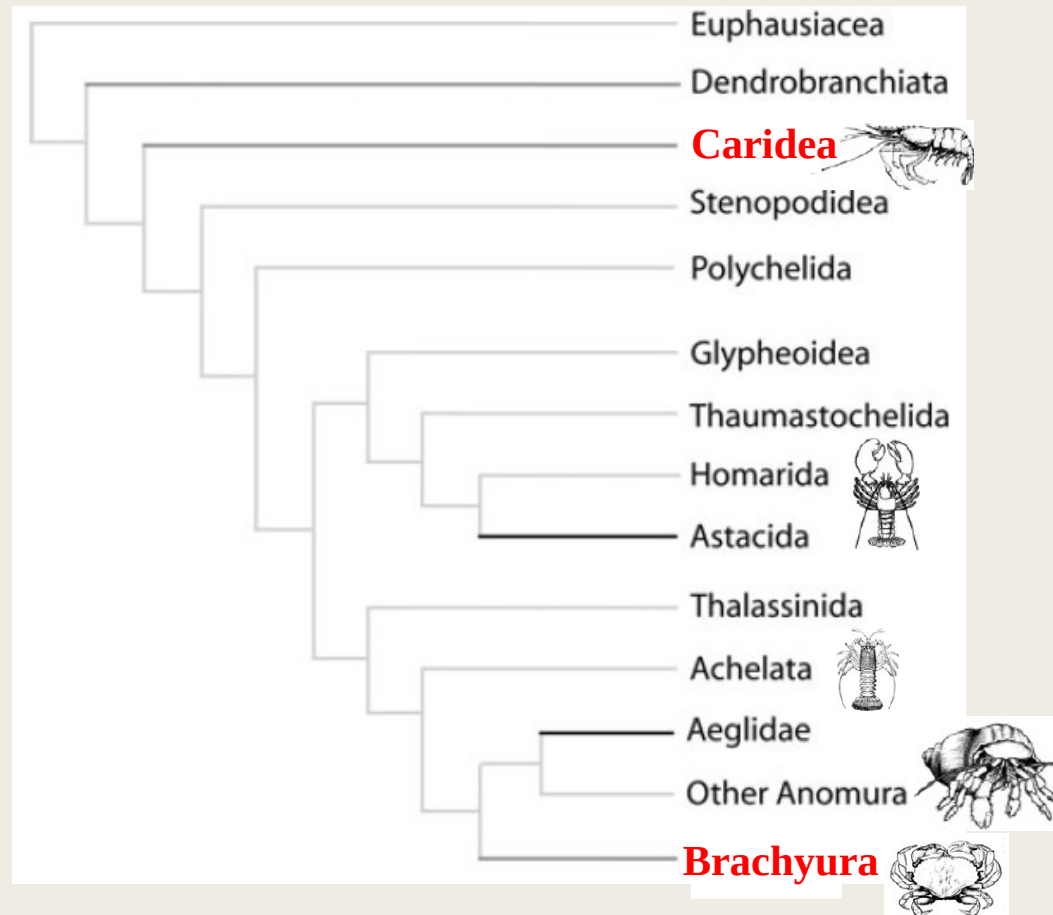
? ↑ homeostase ↔ ↑ independência ?



# Uma evolução da osmorregulação

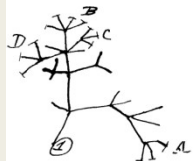


Modificado de Evans 2009

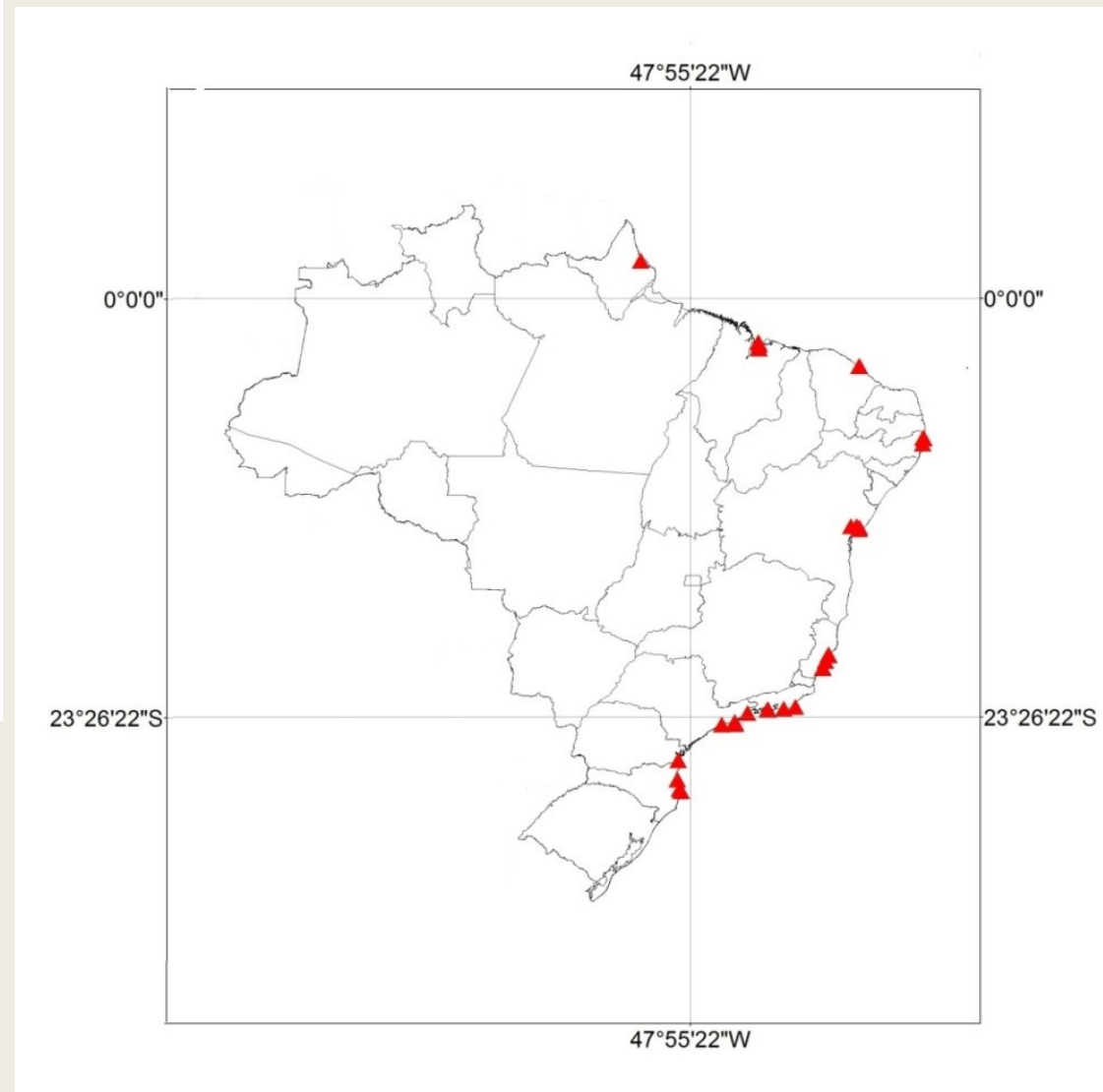
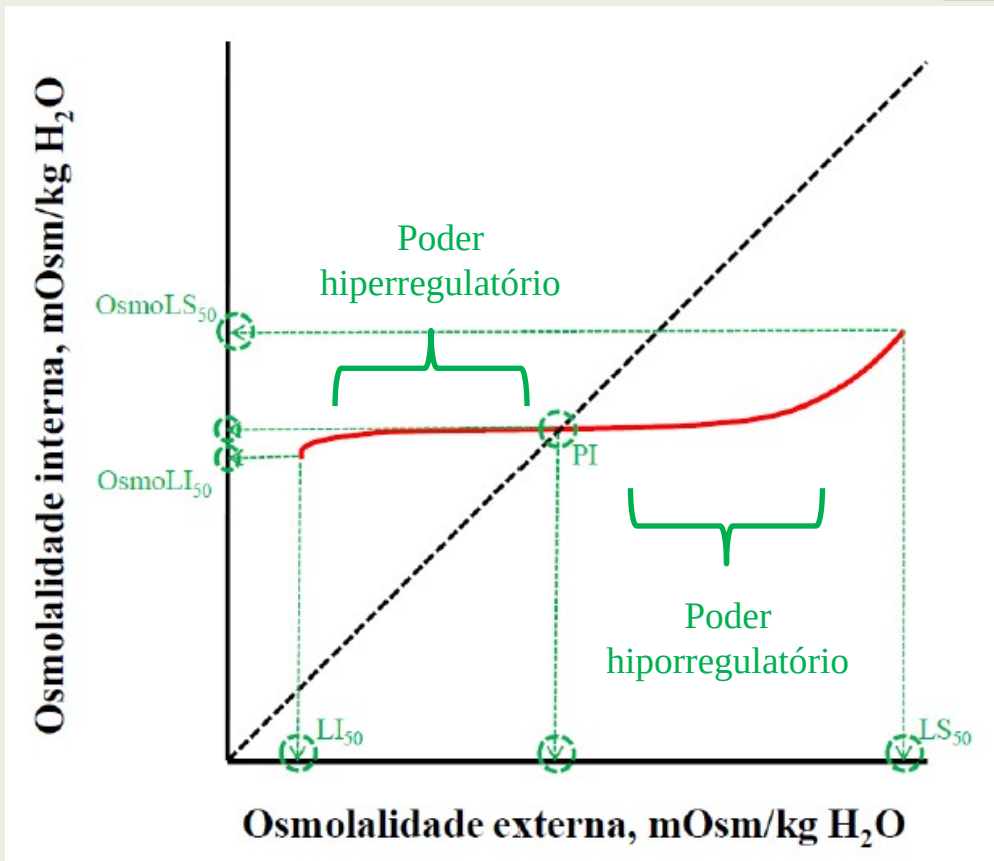


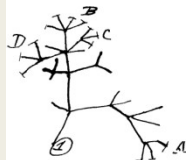
Modificado de Faria et al. 2011





# Uma evolução da osmorregulação

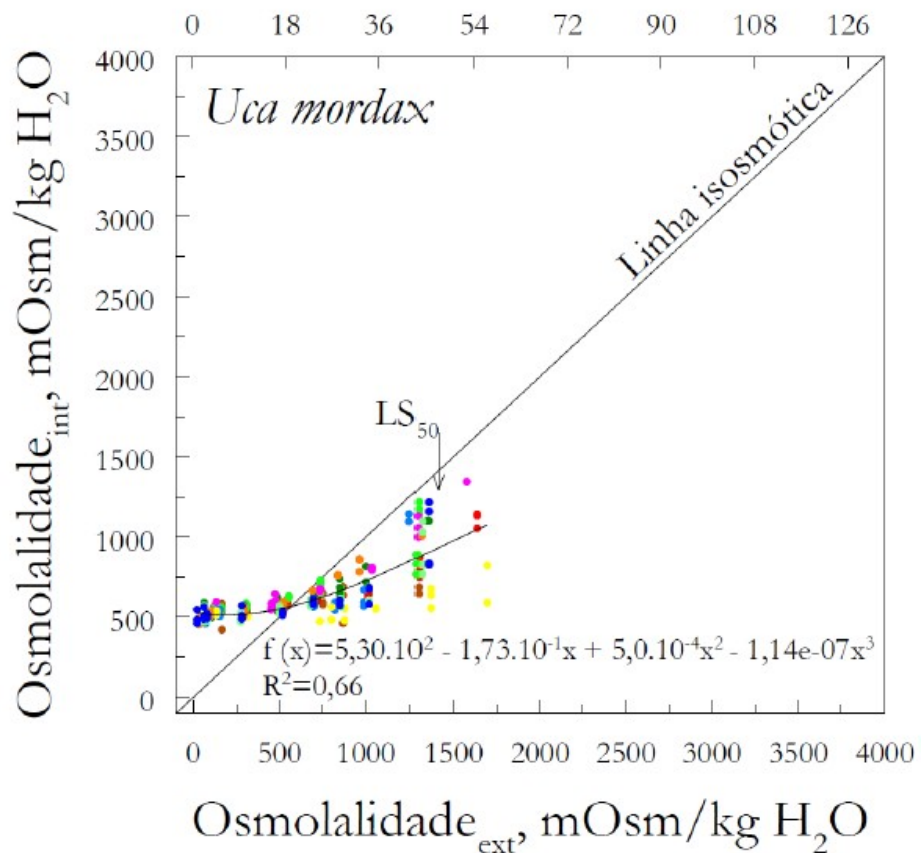




# Uma evolução da osmorregulação



Salinidade, ‰

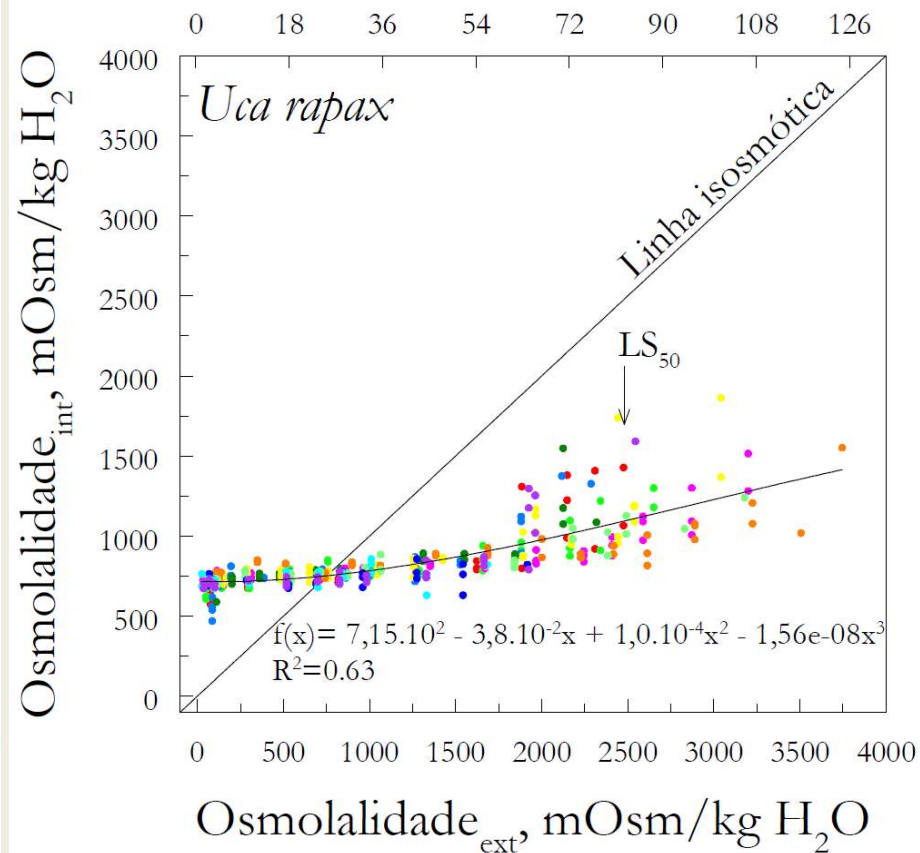


**Oligossalino**

(≤10 ‰ S, 15-299 mOsm/kg H<sub>2</sub>O)

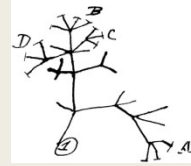


Salinidade, ‰



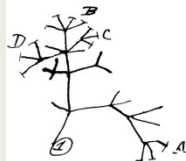
**Eurissalino**

(≥21 ‰ S, 630 mOsm/kg H<sub>2</sub>O)



# Uma evolução da osmorregulação

<i>Uca</i> species	Habitat osmolality (mOsm/kg H <sub>2</sub> O)	Hemolymph osmolality (mOsm/kg H <sub>2</sub> O)	Lower lethal limit (mOsm/kg H <sub>2</sub> O)	Upper lethal limit (mOsm/kg H <sub>2</sub> O)	Hemolymph osmolality at LL50 (mOsm/kg H <sub>2</sub> O)	Hemolymph osmolality at UL50 (mOsm/kg H <sub>2</sub> O)	Isosmotic point (mOsm/kg H <sub>2</sub> O)	Hyper-regulatory index	Hypo-regulatory index	Reference
<b>America</b>										
<i>U. minax</i>	70	600 ± 25	-	2000	570	1590	667	0.86	0.31	Thurman 2002
<i>U. mordax</i>	150 ± 38	558 ± 9	-	1453 ± 54	492 ± 9	1057 ± 68	579 ± 15	0.84 ± 0.02	0.43 ± 0.07	Present study
<i>U. vocator</i>	305 ± 87	653 ± 16	-	2038 ± 105	558 ± 14	967 ± 41	659 ± 24	0.85 ± 0.05	0.78 ± 0.00	Present study
<i>U. victoriana</i>	338 ± 82	677 ± 27	-	1825 ± 151	602 ± 26	1036 ± 36	676 ± 21	0.89 ± 0.02	0.64 ± 0.09	Present study
<i>U. burgersi</i>	349 ± 79	670 ± 17	-	1924 ± 63	608 ± 11	1218 ± 77	669 ± 11	0.91 ± 0.02	0.56 ± 0.07	Present study
<i>U. longisignalis</i>	367	685 ± 15	-	2230	585	1230	693	0.84	0.65	Thurman 2003a
<i>U. cumulanta</i>	385 ± 107	702 ± 24	151	1905 ± 95	645 ± 10	1006 ± 45	752 ± 26	0.84 ± 0.03	0.79 ± 0.02	Present study
<i>U. spinicarpa</i>	387 ± 81	644 ± 12	-	2030	600	1130	682	0.88	0.67	Thurman 2003a
<i>U. rapax</i>	476 ± 63	778 ± 8	-	2475 ± 141	680 ± 14	1195 ± 49	762 ± 12	0.89 ± 0.02	0.74 ± 0.03	Present study
<i>U. uruguayensis</i>	500 ± 87	759 ± 18	-	2307 ± 185	610 ± 29	1360 ± 51	748 ± 19	0.82 ± 0.02	0.6 ± 0.04	Present study
<i>U. thayeri</i>	529 ± 63	770 ± 12	99	1783 ± 49	673 ± 15	1153 ± 30	765 ± 11	0.87 ± 0.02	0.61 ± 0.04	Present study
<i>U. panacea</i>	548 ± 102	796 ± 11	-	2975	660	1440	822	0.75	0.71	Thurman 2003a
<i>U. maracoani</i>	606 ± 72	835 ± 15	153	1786 ± 92	713 ± 11	1277 ± 44	912 ± 10	0.75 ± 0.01	0.57 ± 0.04	Present study
<i>U. leptodactyla</i>	609 ± 84	787 ± 11	33	2585 ± 61	620 ± 17	1303 ± 77	800 ± 16	0.77 ± 0.03	0.72 ± 0.04	Present study
<i>U. pugilator</i>	694 ± 185	850 ± 33	-	3270	620	1660	816	0.76	0.66	Thurman 2003a
<i>U. pugnax</i>	763 ± 54	805 ± 15	100	2700	700	1600	879	0.77	0.6	Thurman 2003b
<i>U. subcylindrica</i>	882 ± 599	785 ± 20	100	3200	800	1520	845	0.94	0.71	Thurman 2002
<i>U. crenulata</i>	917	912 ± 18	58	2910	500	1400	888	0.53	0.75	Thurman 2005
<i>U. major</i>	1129	997	91	2672	750	1400	930	0.79	0.8	Thurman 2010
<i>U. speciosa</i>	1149	903	-	2958	700	1400	822	0.85	0.81	Thurman 2010
<b>Indo-west Pacific</b>										
<i>U. arcuata</i>	339 ± 81	715	-	1350	590	1230	906	0.65	0.27	Lin et al. 2002
<i>U. lactea</i>	1083 ± 24	830	15	1800	500	1700	895	0.55	0.11	Lin et al. 2002
<i>U. vocans</i>	1179 ± 24	812	15	1800	450	1750	911	0.49	0.06	Lin et al. 2002
<i>U. formosensis</i>	1257 ± 33	875	15	1800	500	1510	1009	0.49	0.37	Lin et al. 2002
<i>U. inversa</i>	1260	1177	150	1350	763	1226	1080	0.66	0.46	Spaargaren 1977



## Uma evolução da osmorregulação

- i. Espécies proximamente relacionadas compartilham nichos osmóticos semelhantes? Apresentam uma fisiologia osmorregulatória (estrutura/função) também similar?

*[Análise de autocorrelação/Sinal Filogenético pelo I de Moran]*

- ii. A salinidade dirigiu a evolução da osmorregulação? As capacidades de absorver e secretar sais são dependentes do nicho osmótico?

*[Correlação entre os contrastes filogeneticamente independentes (PICs)]*

*[Regressão entre mínimos quadrados generalizados filogenéticos (pGLS)]*

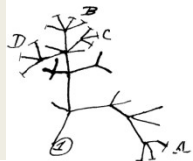
- iii. Quais os estados ancestrais da fisiologia osmorregulatória e do ambiente ocupado?

*[Otimização por máxima parcimônia]*

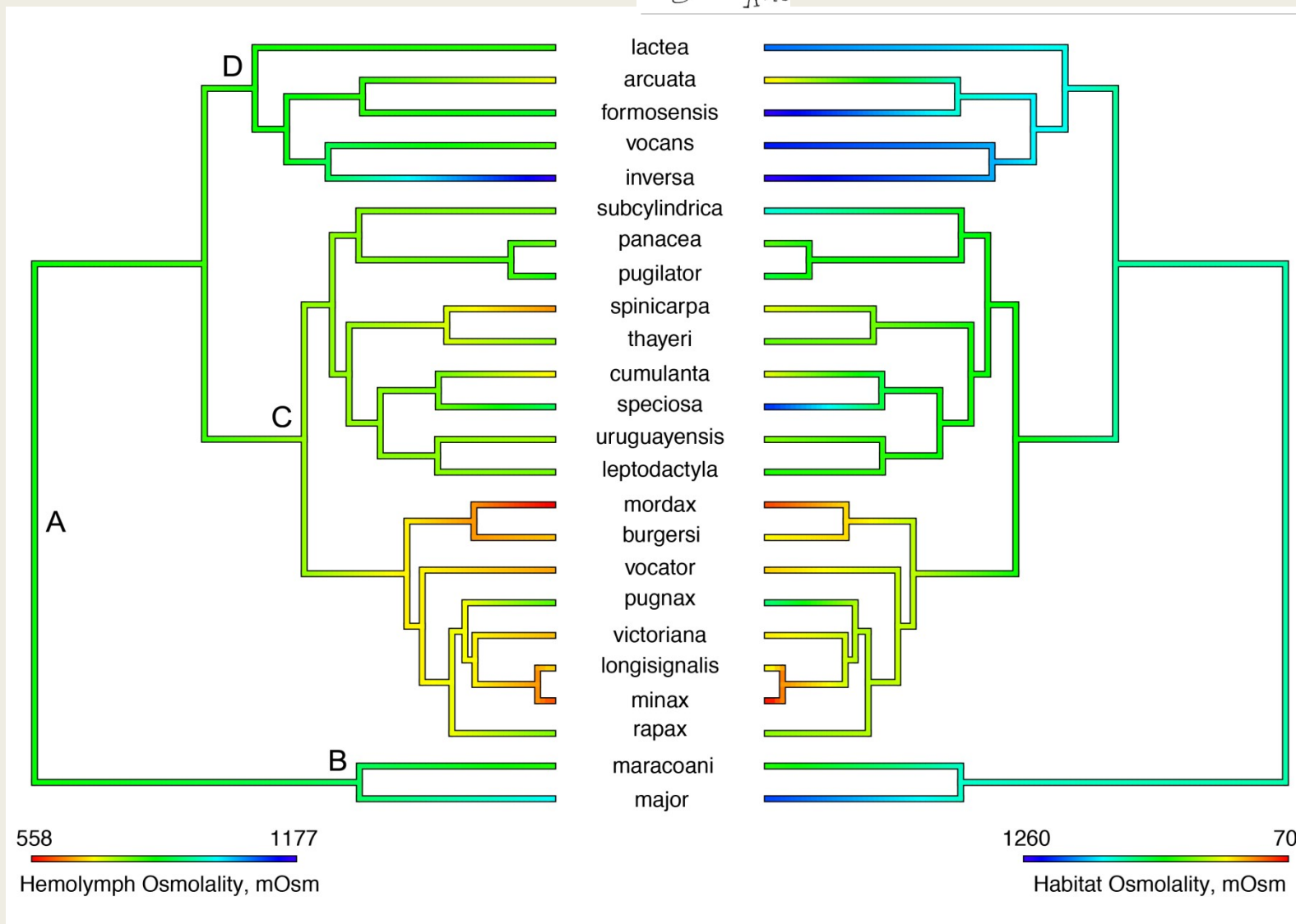
*[Otimização por máxima verossimilhança]*

- iv. Existência de distintos picos adaptativos para o espaço multifuncional da osmorregulação para os clados Americanos e a linhagem do Indo-Pacífico

*[Método SURFACE sob processo Ornstein-Uhlebeck]*



# Uma evolução da osmorregulação



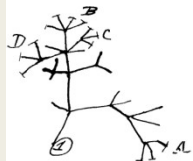
*Regressão convencional*

GLS; inclinação=0,90; **P=0,03**; AICc=44,9

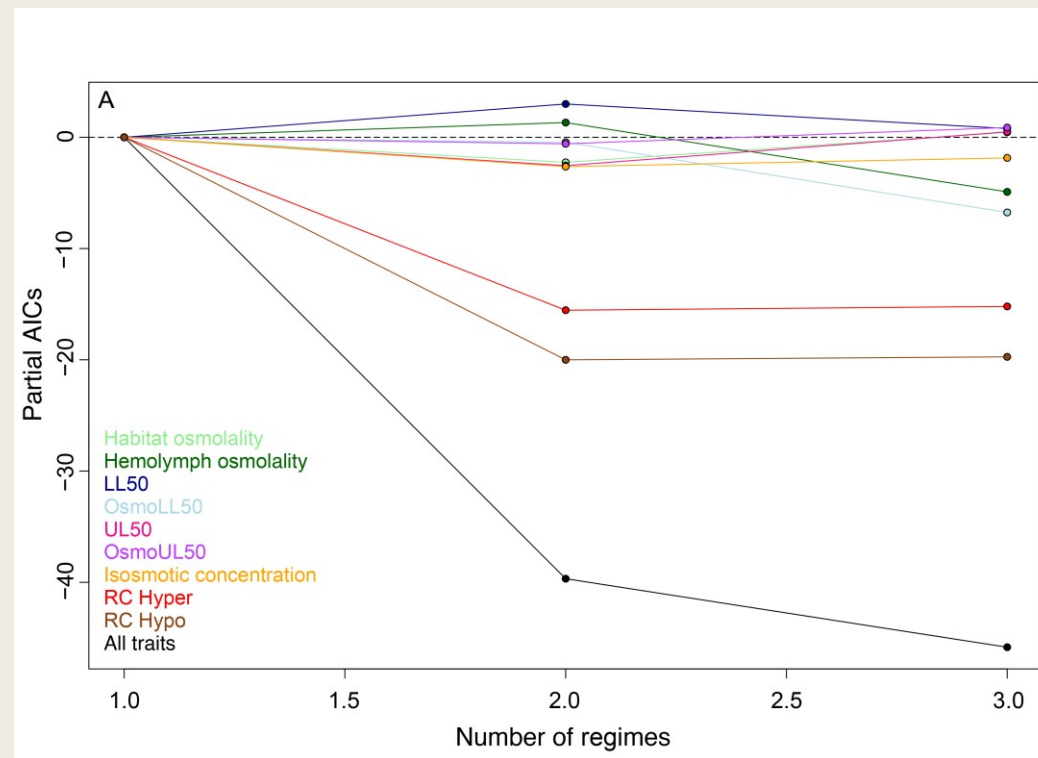
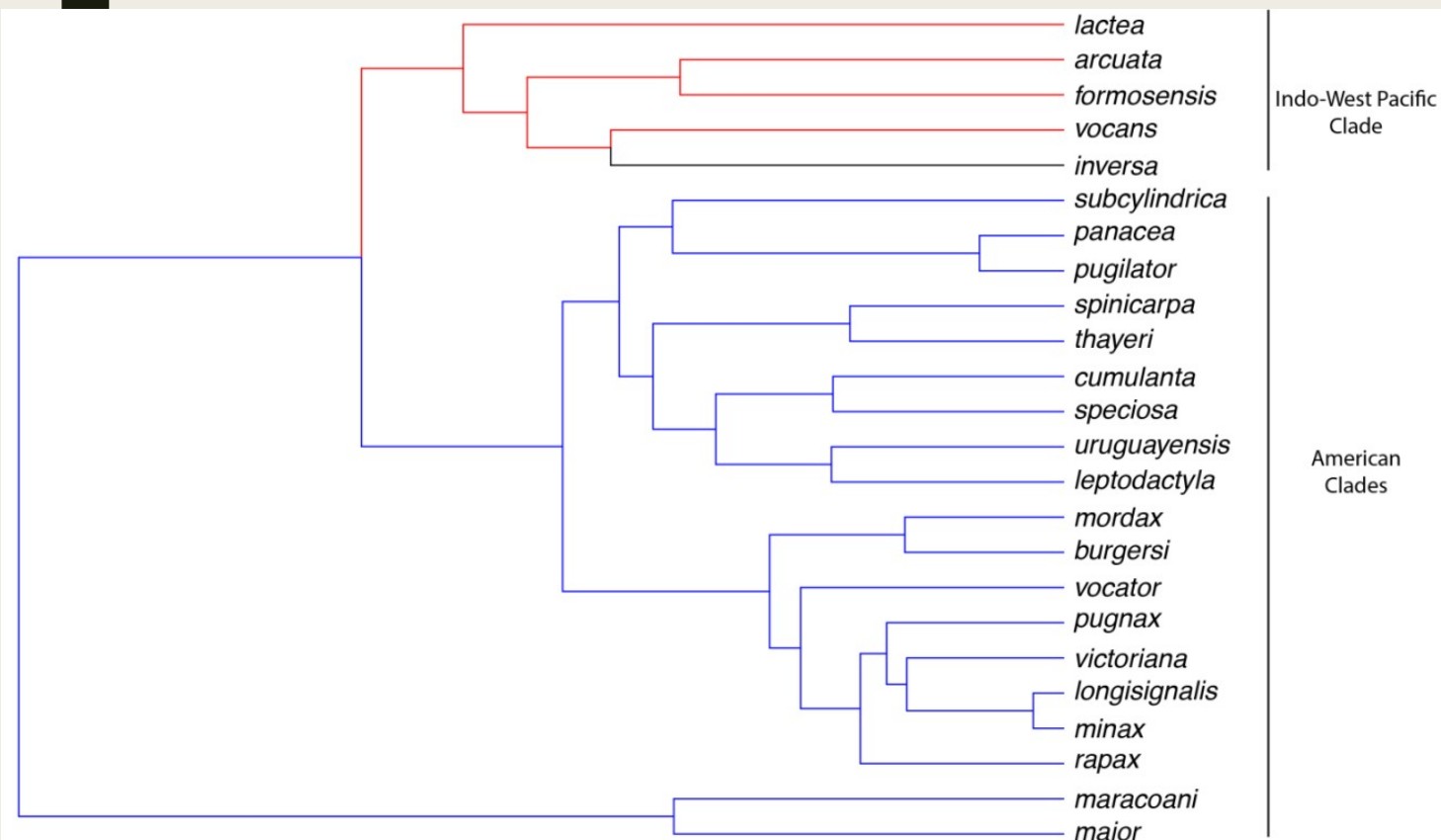
*Regressão filogenética*

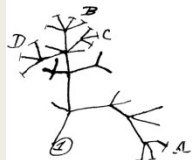
PGLS; inclinação=0,22; **P=0,01**; AICc=39,5

Faria et al. submetido

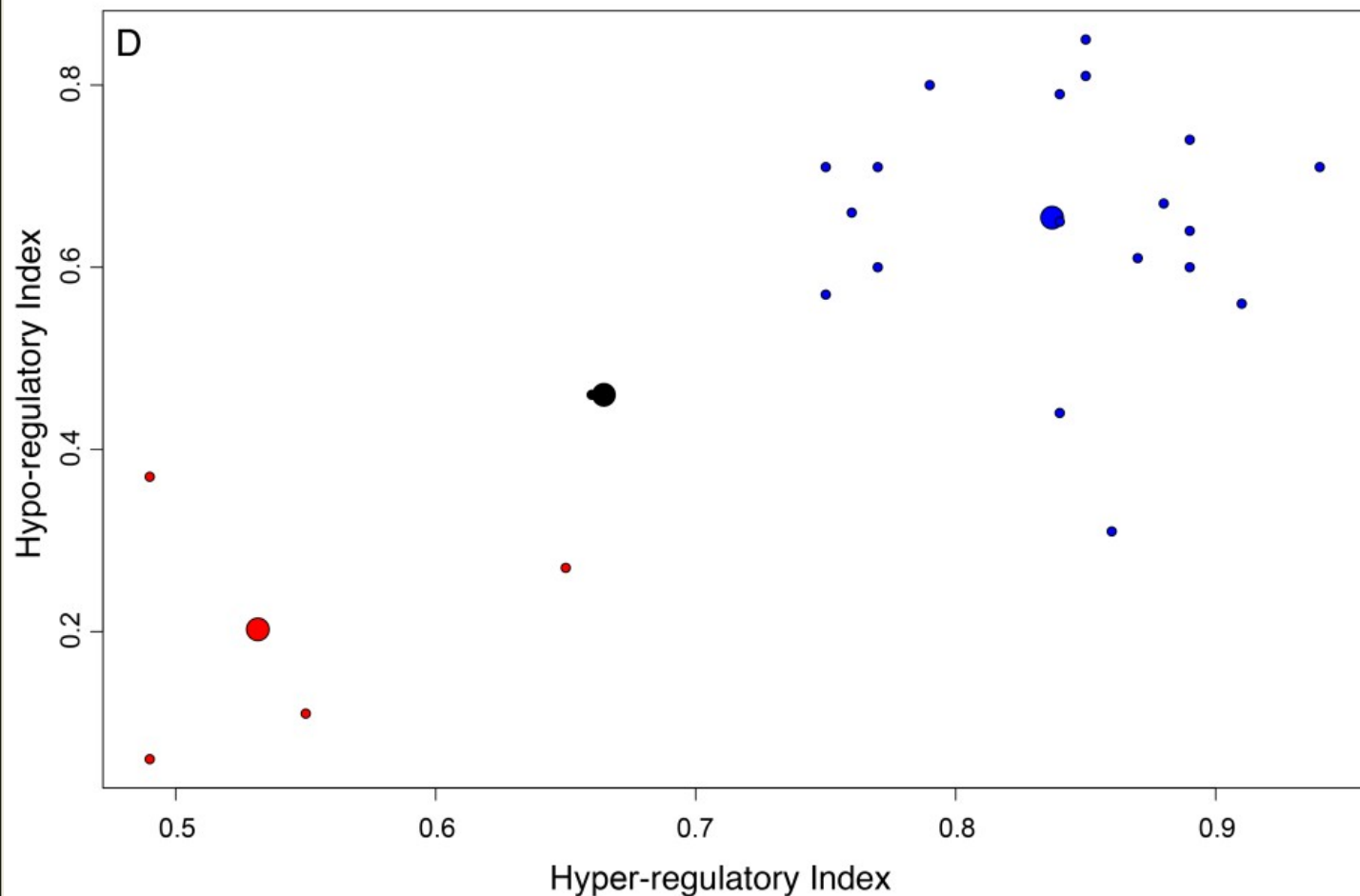


# Uma evolução da osmorregulação



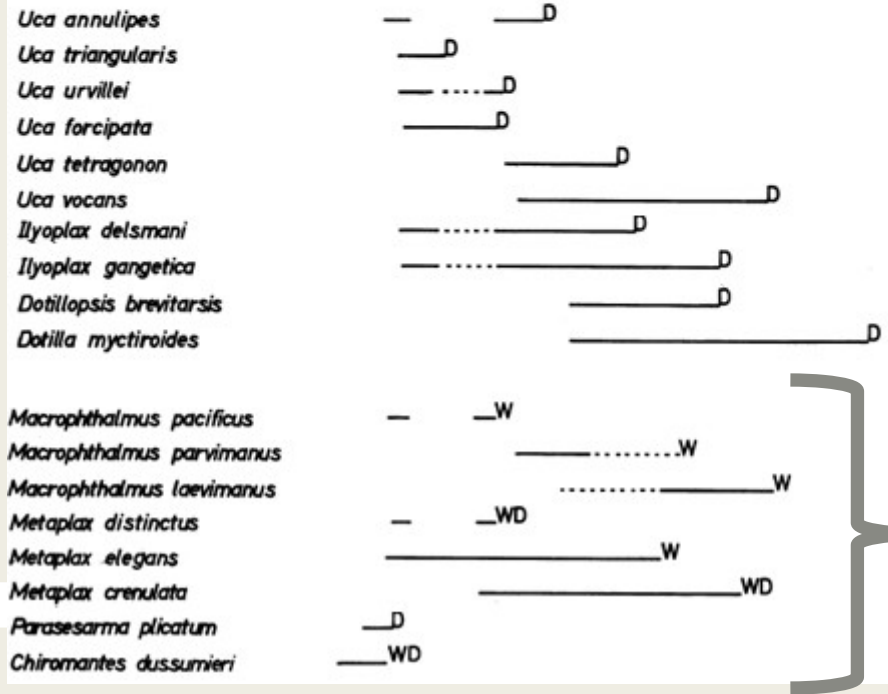
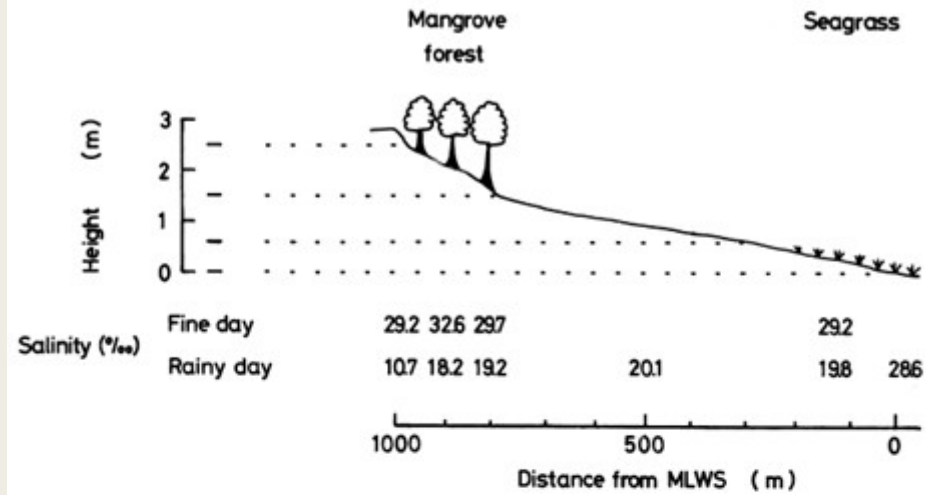
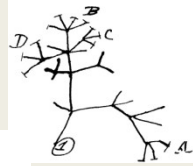


## Uma evolução da osmorregulação



Capacidades hiper- e hiporreguladoras  $\times$  salinidade  
PGLS, inclinação  $\approx 0,0$ ;  $0,8 \leq F \leq 3,3$ ;  $0,1 \leq P \leq 0,4$ ;  $0,3 \leq \alpha \leq 1,7$

# Uma evolução da osmorregulação



Caranguejos mais terrestres:  
 ↓ N° ou área de superfície das brânquias anteriores (respiração)  
 ↑ Área de superfície das brânquias posteriores (osmorregulação)

5-7 pares branquiais

“Pulmões”

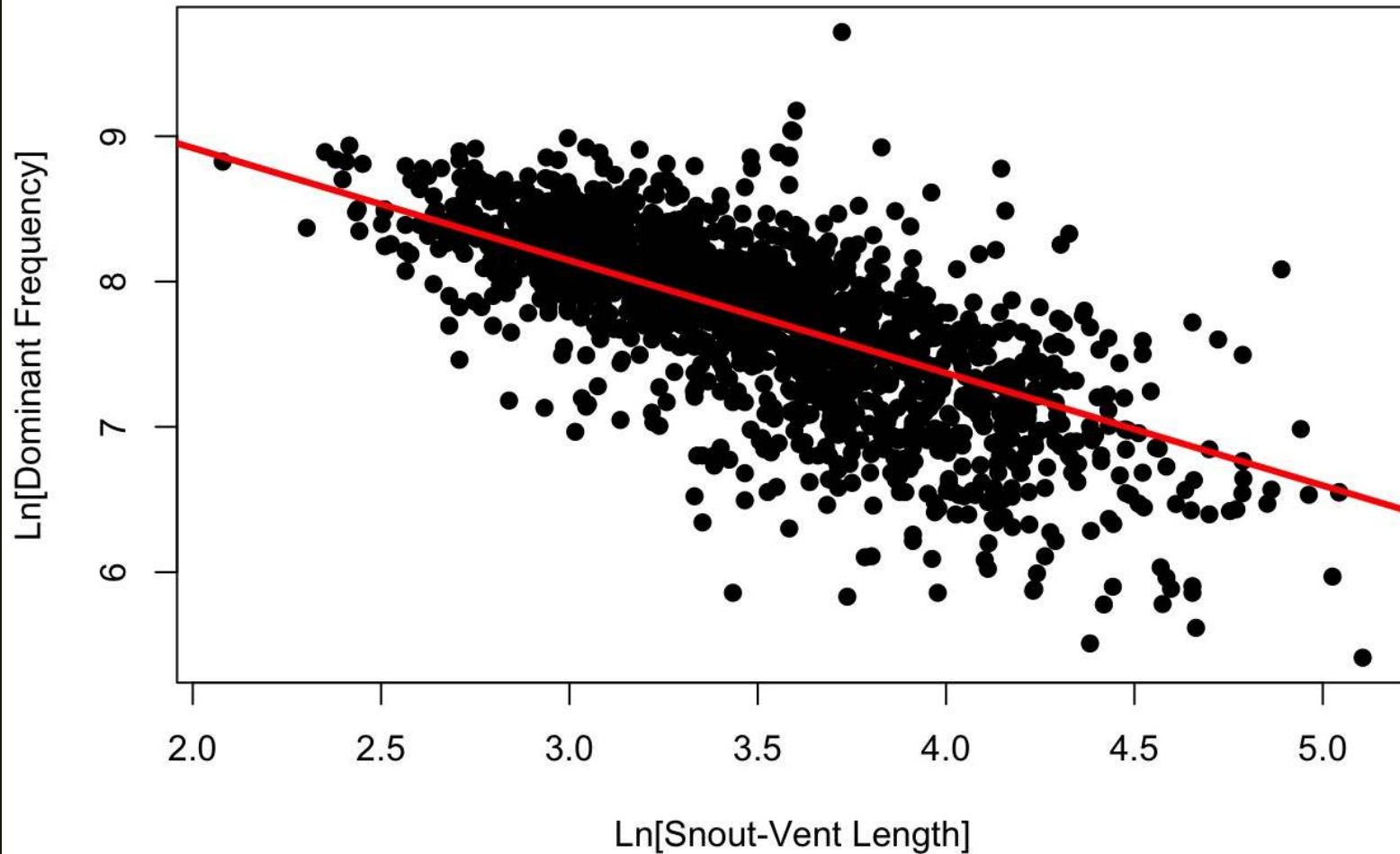
“Tímpanos”

8 pares branquiais

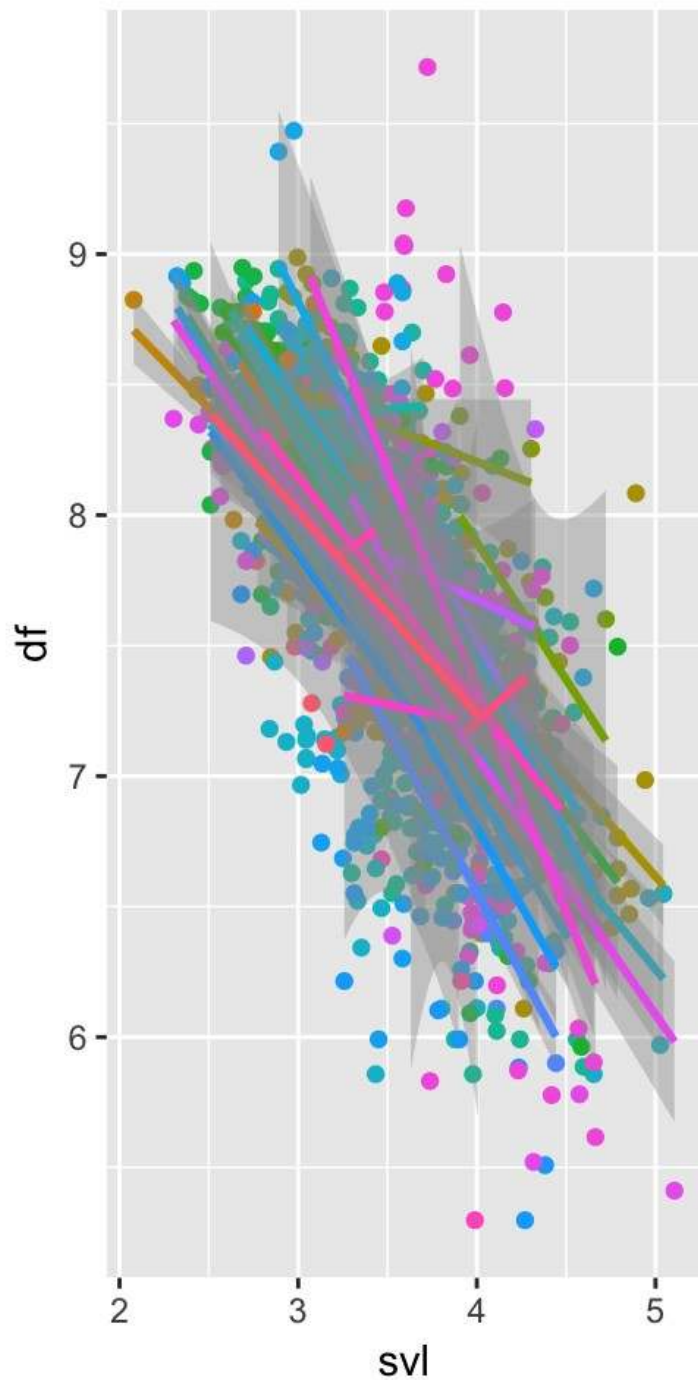
Trade-off  
 Respiração e osmorregulação

1 **Title:** Allometric escape from acoustic constraints in frog calls  
2  
3 **Short title:** Allometric scaling in frog calls  
4  
5 **Authors:** João Filipe Riva Tonini<sup>1,2\*</sup>†, Diogo B. Provete<sup>3,4</sup>†, Natan M. Maciel<sup>5</sup>, Alessandro  
6 Ribeiro de Moraes<sup>6</sup>, Sandra Goutte<sup>7,8</sup>, Luís Felipe Toledo<sup>7</sup>, R. Alexander Pyron<sup>1</sup>  
7

Minor revision na  
Nature  
Communications



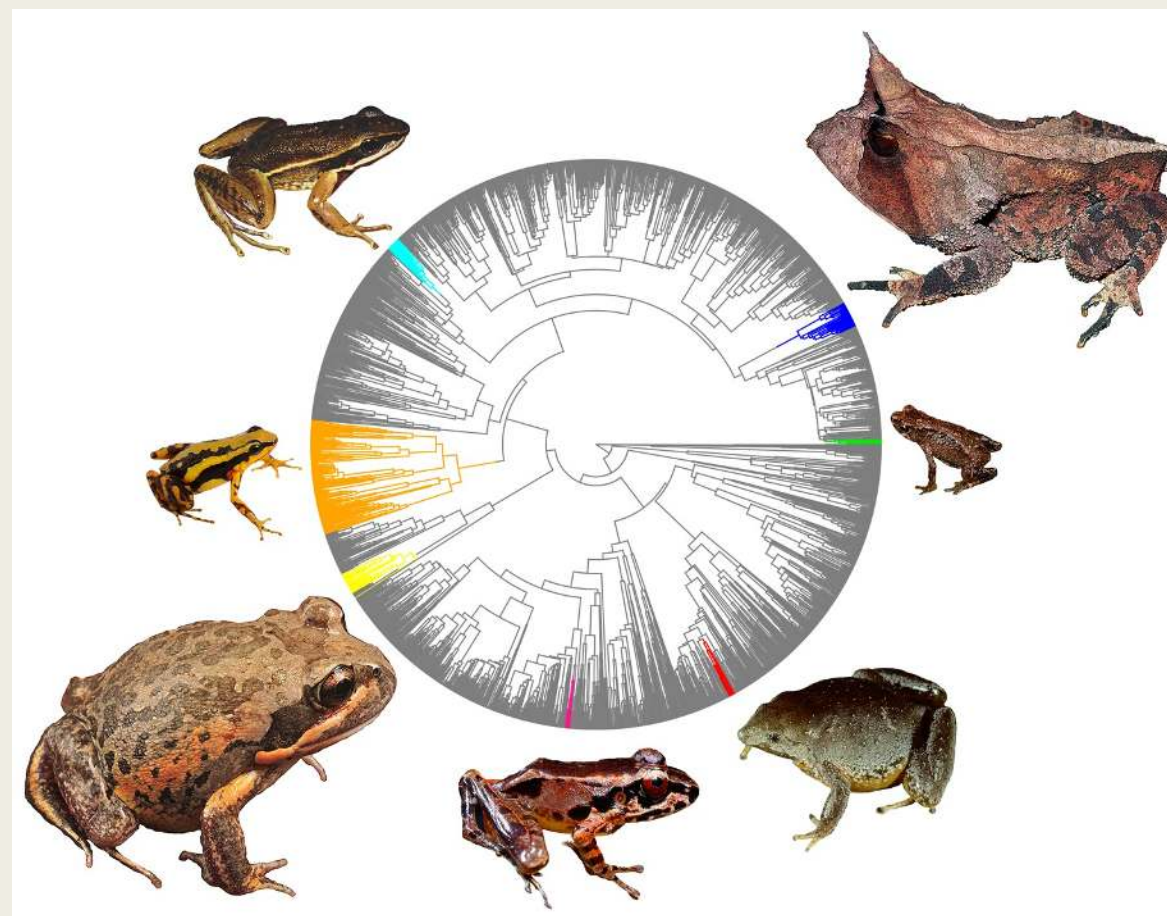
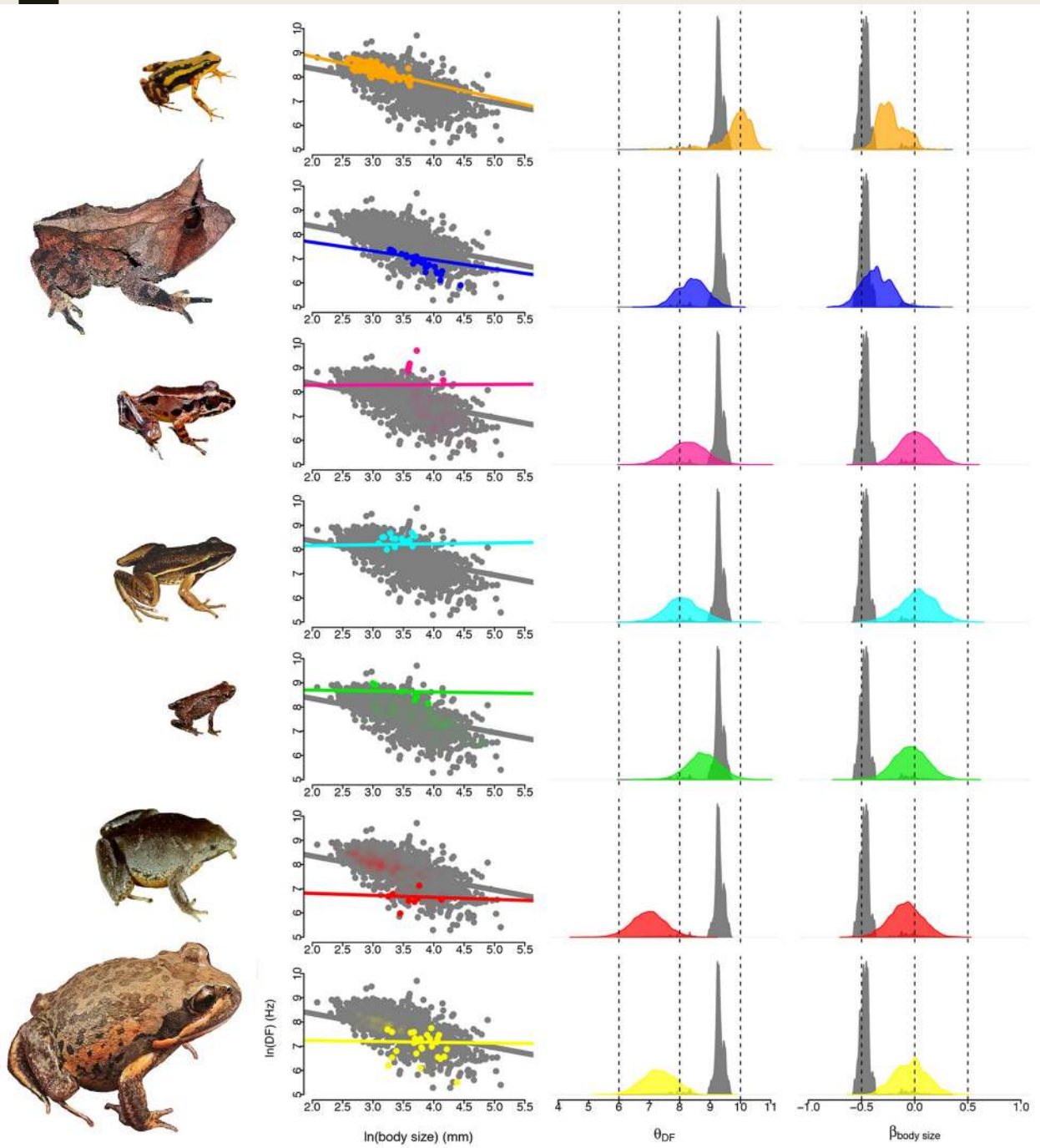
Dados de tamanho de corpo  
(Comprimento rostro cloacal) e  
frequência dominante do canto para  
2,176 espécies de anuros  
de 42 famílias

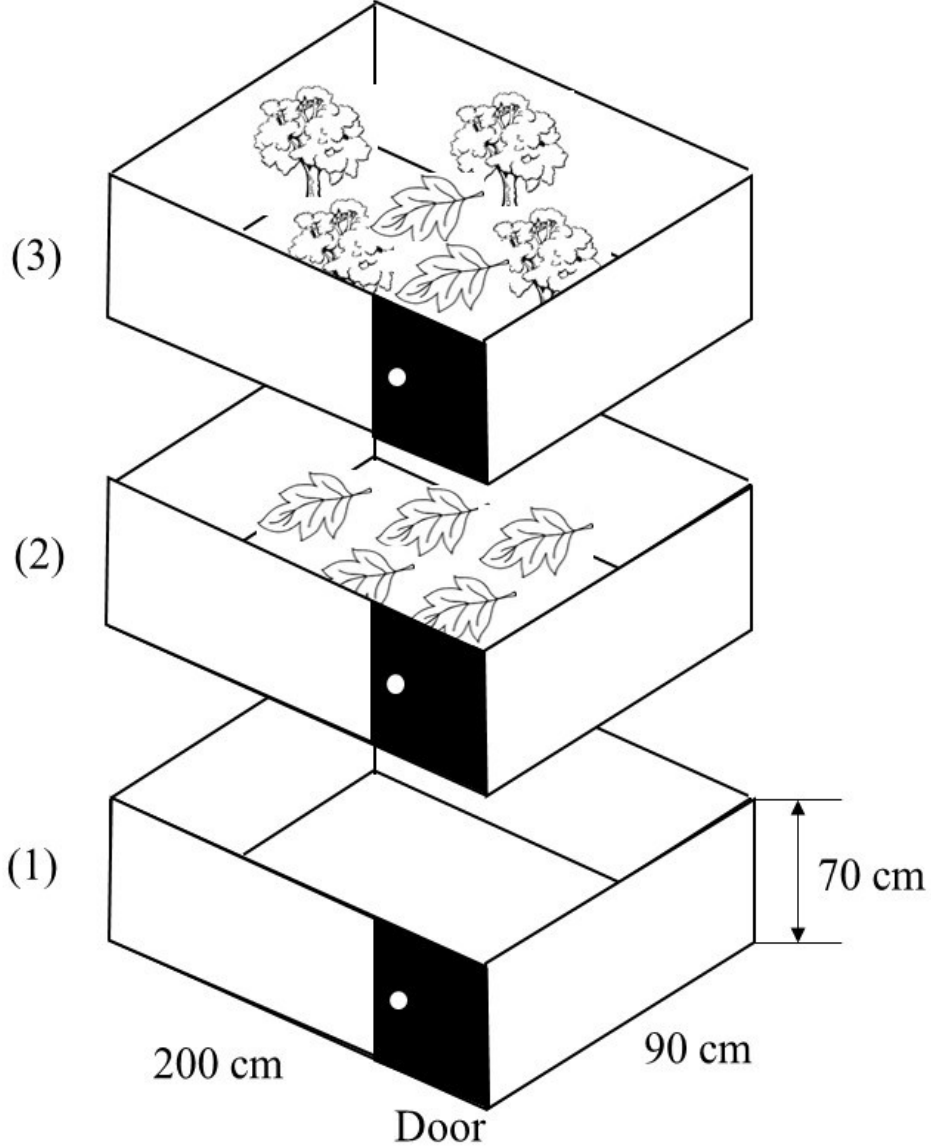


### family

- |                      |                     |                   |
|----------------------|---------------------|-------------------|
| Allophrynidae        | Dicroglossidae      | Odontophrynidae   |
| Alsodidae            | Eleutherodactylidae | Pelobatidae       |
| Alytidae             | Heleophrynidae      | Petropedetidae    |
| Arthroleptidae       | Hemiphractidae      | Phrynobatrachidae |
| Batrachylidae        | Hemisotidae         | Pipidae           |
| Brachycephalidae     | Hylidae             | Ptychadenidae     |
| Brevicipitidae       | Hylodidae           | Pyxicephalidae    |
| Bufo                 | Hyperoliidae        | Ranidae           |
| Calyptocephalellidae | Leptodactylidae     | Ranixalidae       |
| Centrolenidae        | Mantellidae         | Rhacophoridae     |
| Ceratophryidae       | Megophryidae        | Rhinodermatidae   |
| Craugastoridae       | Microhylidae        | Rhinophrynidae    |
| Cycloramphidae       | Myobatrachidae      | Scaphiopodidae    |
| Dendrobatidae        | Nyctibatrachidae    | Strabomantidae    |

88% das espécies compartilham um único regime ancestral que tem sido conservado por 219 Milhões de anos, mas existem ao menos 7 linhagens que “escaparam” dessa restrição





1 Habitat complexity and predator stimulus drive anuran  
 2 antipredatory decision

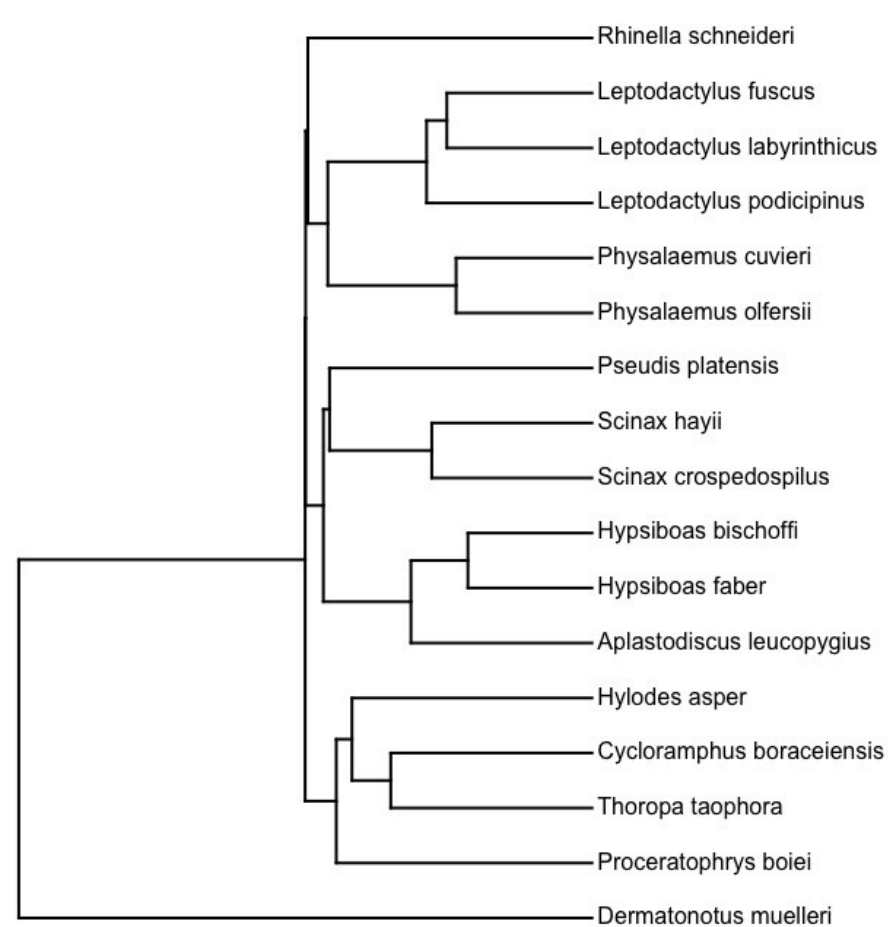
3

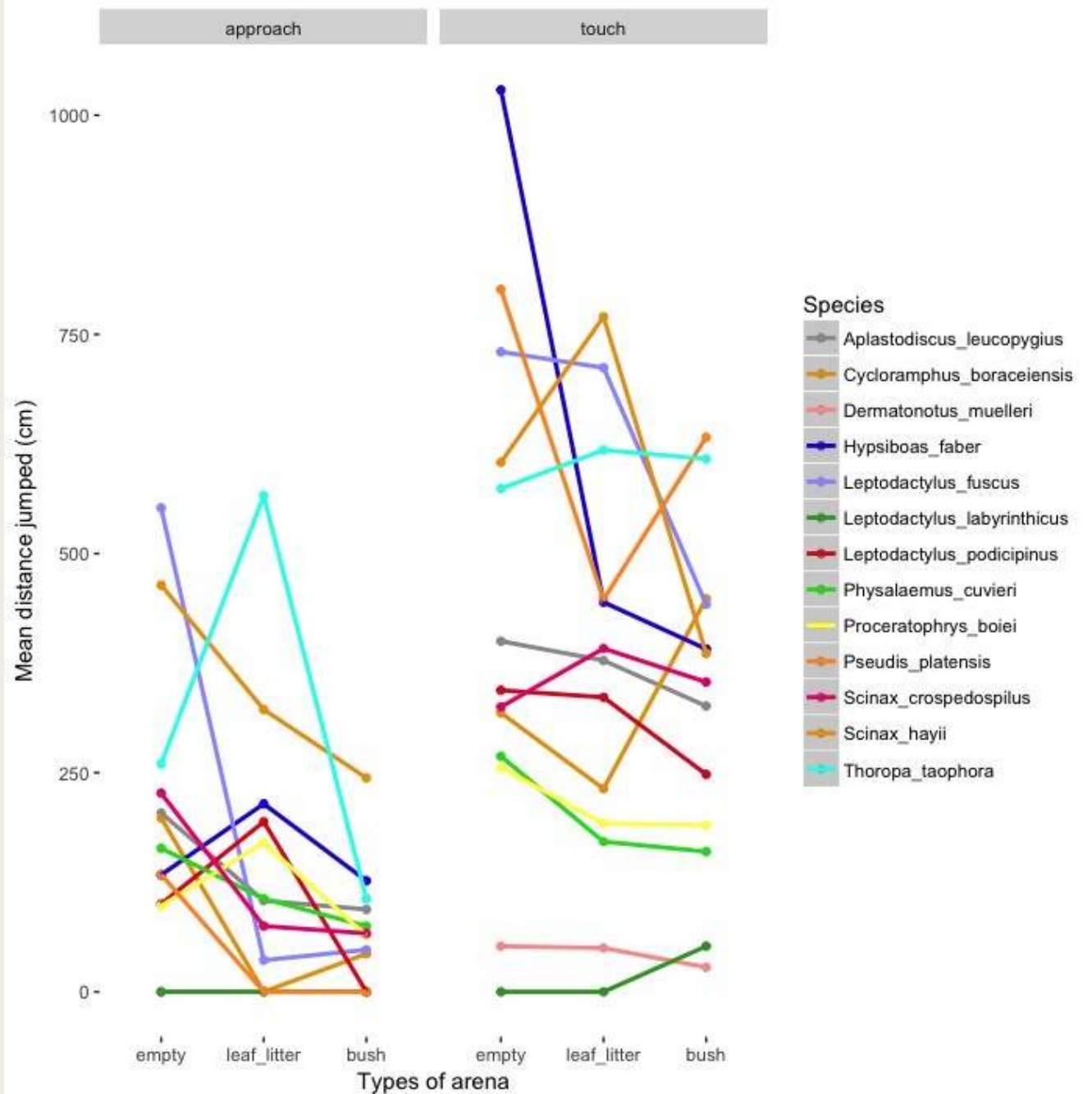


4 Jessyca M. Citadini<sup>1</sup>, Diogo B. Provete<sup>2,3</sup>, Diogo S. M. Samia<sup>4</sup>, Fernando

5

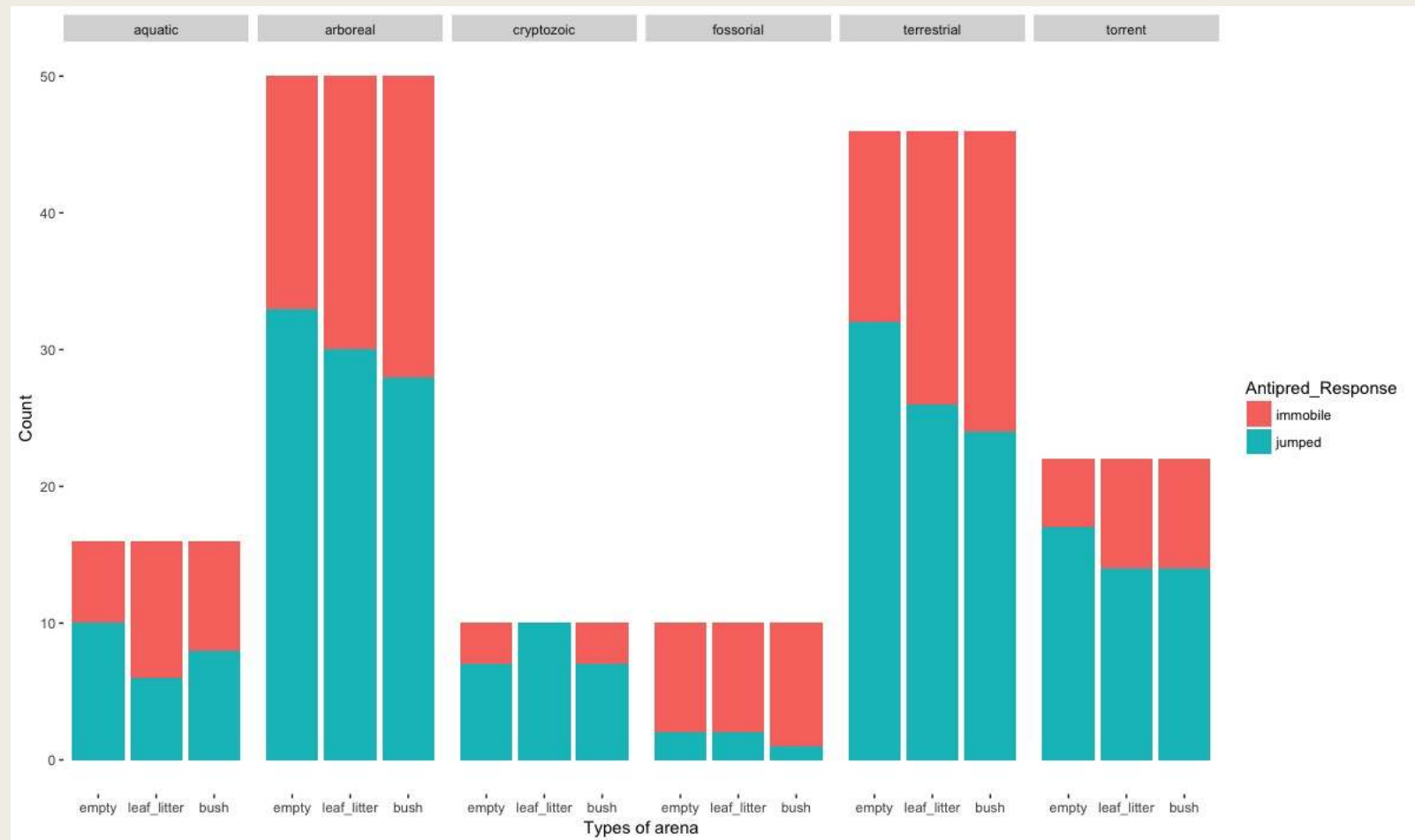
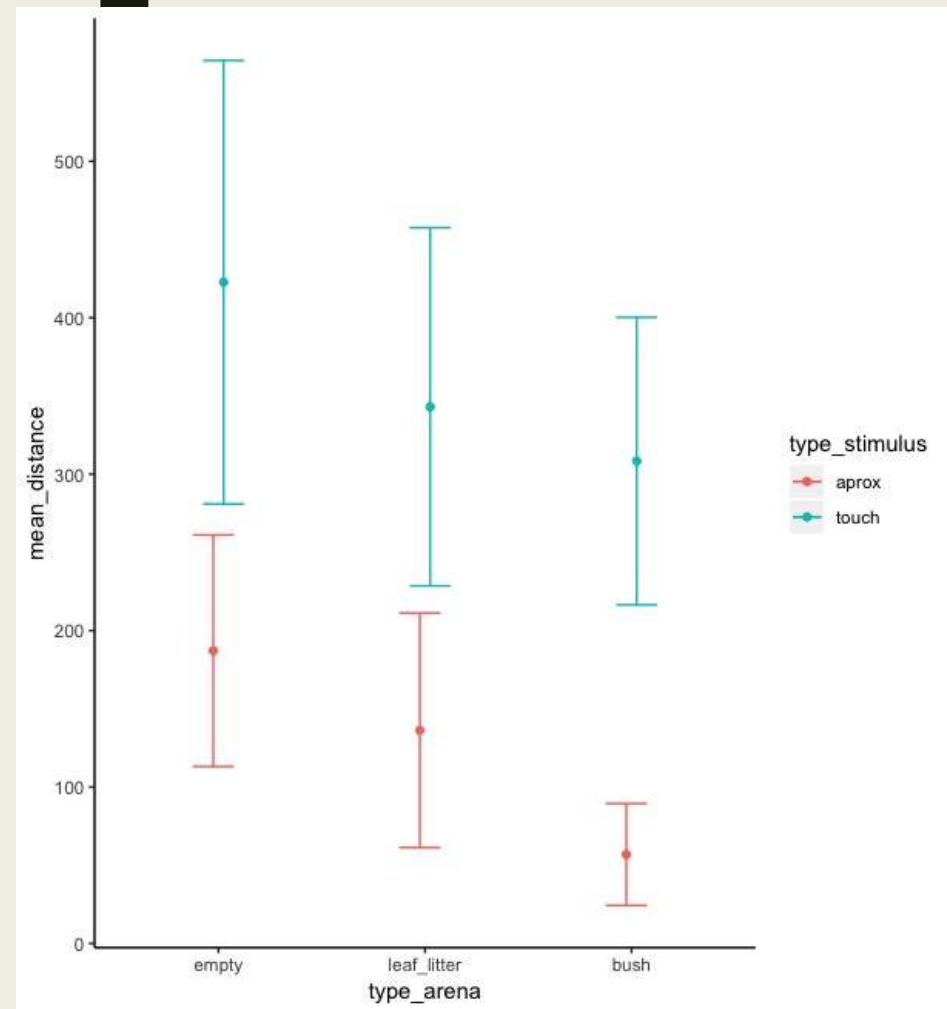
R. Gomes<sup>1</sup>





Todas as espécies pularam mais longe quando tocadas pelo predador do que quando este apenas se aproximou. O tipo de arena e o tipo de estímulo afetaram significativamente a distância pulada.

Encontramos também um significativo sinal filogenético na distância pulada (Pagel's lambda = 0.766; 95% CI = 0.580 - 0.931).



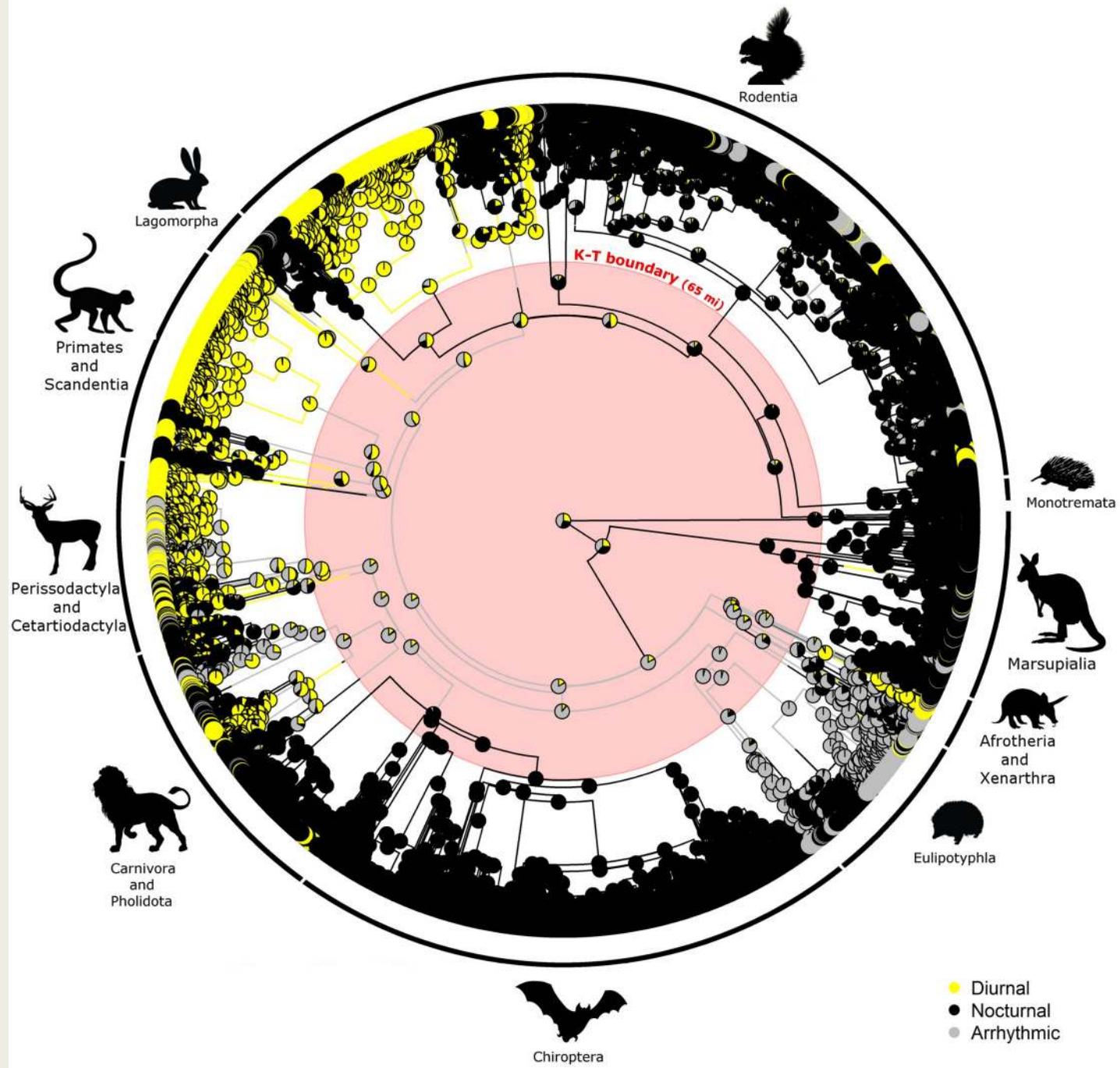
Model with intraspecific variation in the random effects:

```
model2<-MCMCglmm(mean_distance~tipo_arena+tipo_de_estimulo,          random=~Especie+idh(se_distance),
data=df_spe, family="gaussian", ginverse =                          list(Especie=treeAinv), nodes="ALL"
,                                                                    prior=priors, nitt=300000, burnin=25000,
thin = 100, verbose=FALSE)
summary(model2)#estimulo e arena significativos
```

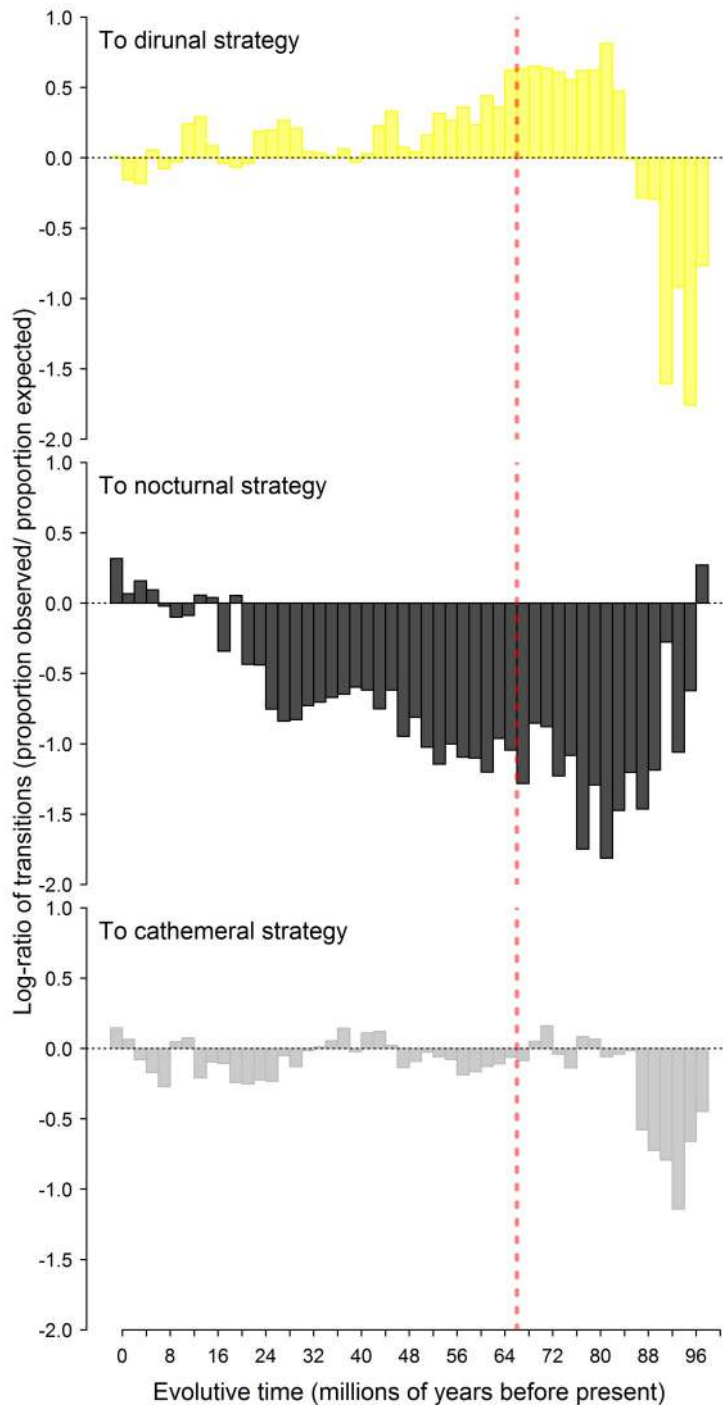
```
##
## Iterations = 25001:299901
## Thinning interval = 100
## Sample size = 2750
##
## DIC: 1300.834
##
## G-structure: ~Especie
##
##           post.mean 1-95% CI u-95% CI eff.samp
## Especie      25881  0.01336   54266    2177
##
##           ~idh(se_distance)
##
##           post.mean 1-95% CI u-95% CI eff.samp
## se_distance.   16135 0.004386   230.8    2750
##
## R-structure: ~units
##
##           post.mean 1-95% CI u-95% CI eff.samp
## units         17141   12022   22968    1614
##
## Location effects: mean_distance ~ tipo_arena + tipo_de_estimulo
##
##           post.mean 1-95% CI u-95% CI eff.samp  pMCMC
## (Intercept)      -42.08 -261.29  164.11   2750 0.67055
## tipo_arenafolhico  45.97  -19.20  110.58   2577 0.17164
## tipo_arenavazia   100.49   31.65  162.55   2750 0.00145 **
## tipo_de_estimulotoque 241.08  190.74  292.49   2979 < 4e-04 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

**The evolution of diel activity patterns and pre-K-T rising of diurnality in mammals**

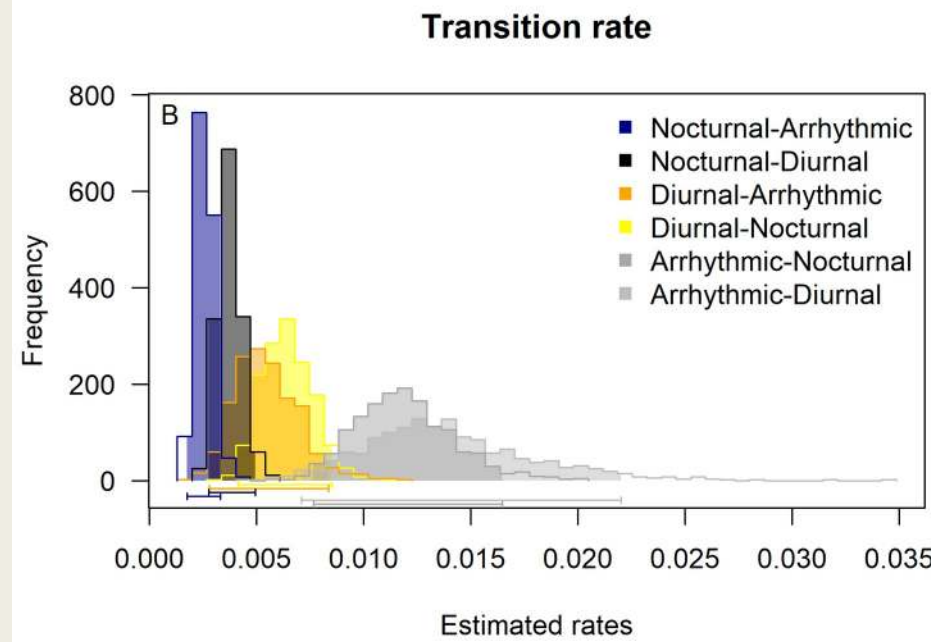
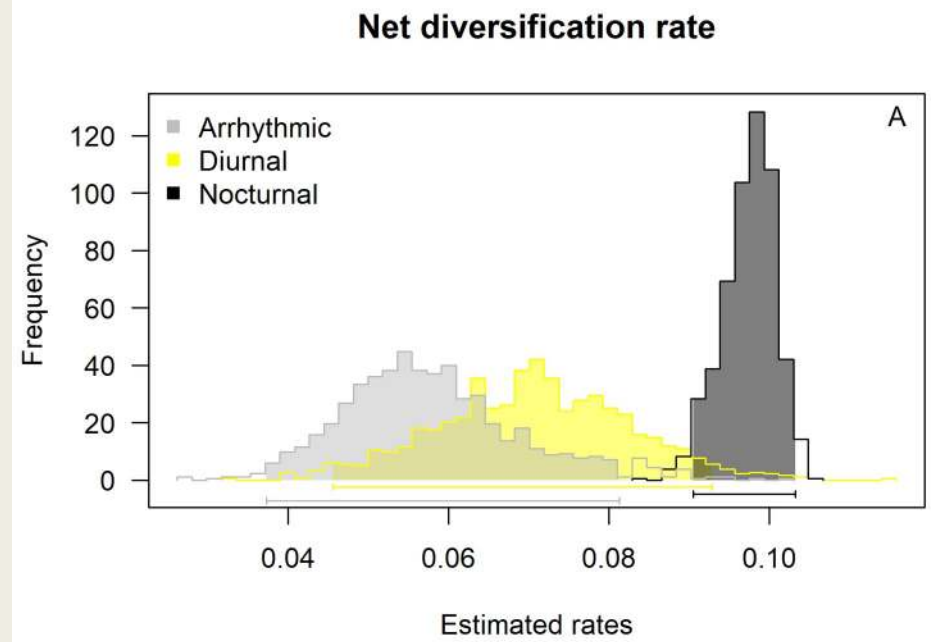
Journal:	<i>Proceedings B</i>
Manuscript ID	RSPB-2017-2736
Article Type:	Research
Date Submitted by the Author:	07-Dec-2017
Complete List of Authors:	Guimarães, Bruno; Universidade Federal do Rio de Janeiro, Proverte, Diogo; Universidade Federal de Mato Grosso do Sul, Ecologia Fernandez, Fernando; Universidade Federal do Rio de Janeiro Oliveira-Santos, Luiz Gustavo; Federal Universitário oficial Mato Grosso do Sul, Ecology



- Hipótese da liberação de nicho temporal por Dinossauros
  - *Extinção de grandes répteis na transição Cretáceo-Terciário pode ter permitido que mamíferos, que antes tinham somente atividade noturna, a se diversificarem como resultado da ocupação do período diurno*
- Usamos um conjunto de dados com ~75% das espécies de mamíferos do mundo, sendo classificadas em diurnas, arítmicas, ou noturnas
- Estimamos taxa de diversificação associada a cada estado de carácter
- Se taxas de transição entre estados mudavam de antes ou depois do K-T



Especialistas foram “evolutionary dead-ends”, com linhagens diurnas sendo mais passíveis de originar espécies com outras estratégias de uso do tempo; enquanto generalistas (i.e. espécies arritmicas) foram a fonte de novas linhagens.



Fim da Parte 3

Perguntas?