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Feeding ecology of the invasive gecko species *Hemidactylus mabouia* (Moreau de Jonnès, 1818) (Sauria: Gekkonidae) in São Sebastião (Brazil)

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Abstract. In this study the feeding ecology of *Hemidactylus mabouia* (Moreau de Jonnès, 1818) is analyzed based on stomach contents of specimens collected in 1964, 1965 and 1967 in São Sebastião, southeastern Brazil. *Hemidactylus mabouia* is an alien invasive species, especially in South America, with known negative impacts on its environment. Our results suggest that the studied population shows a generalist feeding habit. We detected a nearly complete niche overlap in the diet of males, females and juveniles. The most important prey items of all specimens were lepidopterans followed by dipterans. In general, most prey items were winged insects, which may be characteristic for populations living close to human civilization. Different to other studies on the diet of *H. mabouia* juveniles showed the highest trophic diversity.

Key words. Gekkonidae, naturalized and invasive species, diet composition.

INTRODUCTION

On a global scale, alien invasive species are an increasing problem with unpredictable negative effects like niche displacement, competitive exclusion, mutualism, extinction, and biodiversity loss (Mooney & Cleland 2001; Clavero 2005). Members of the genus *Hemidactylus*, also called "house geckos", live synanthropically (Vanzolini 1980; Howard 2001), which is also true for *Hemidactylus mabouia* (Moreau de Jonnès, 1818) (Spawls 2002). Among other countries (Fuenmayor 2005) *H. mabouia* occurs native in Central and East Africa and Madagascar and is an alien invasive species in many states of South America, for example, Brazil (Vanzolini 1978).

The gecko is characterized by small body-size (maximum 70 mm) (Hodge et al. 2003). It is able to change its body color, varying from greyish white to dark brown, and the body is drawn with v-shaped bands (Murphy 1997). All over its dorsum it has small and granular scales and weakly keeled tubercles arranged in transverse rows (Hodge et al. 2003). It is primarily a nocturnal predator (Dixon & Soini 1986) hiding during the day (Avila-Pires 1995) and reaching its activity maximum in the evening (Branch 1988). One reason for the synanthropy of the gecko may be the availability of a magnitude of potential prey items attracted by light at night, for example, flies, bugs and moths (Howard 2001; Pianka & Vitt 2003).

Due to increasing worldwide trade *H. mabouia* was able to colonize new territories (Carranza & Arnold 2006). Potential reasons why *H. mabouia* is such a successful invader are that it is a good colonizer (Hughes et al. 2015) and is often described as a generalist predator (Zamprogno 1998) making it easy for the gecko to survive in new areas. Multiple introduction pathways have been proposed, including natural rafting (Kluge 1969) and transport via slave trade ships (Goeldi 1902; Breuil 2002). As additional invasion pathway it has been observed that the species is able to stick its eggs to fishing ships (Breuil 2009).

Once introduced *H. mabouia* is known to negatively affect populations of other geckos (Short & Petren 2012), as was also suggested for other geckos of the genus *Hemidactylus* (e.g., Cole et al. 2005). Therefore it is important to study the ecology of these species in order to assess the effects of the invasive species on its new environment. In the present study stomach contents of *H. mabouia* specimens from São Sebastião (state São Paulo, Brazil) were analyzed and the trophic niche was assessed including ontogenetic and sexual differences in diet composition. The results are compared to the trophic niche of a native gecko species (*Gymnodactylus darwinii* [Gray, 1845]) which occurs sympatrically in São Paulo state and Pernambuco state (e.g., Oliveira et al. 2016). We assessed if there is a possible competition for food between the two species. Although *G. darwinii* occupies diverse kinds of environments such as rainforests and forest edges, it occupies also human populated regions (Teixeira 2002; Almeida-Gomes et al. 2008). Since both species overlap in habitat preferences as well as in the time of foraging (Pellegrino 2005), a competition for prey items is likely.

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MATERIAL AND METHODS

Specimens were collected in São Sebastião (Brazil) at different locations and times and preserved in 70% Ethanol. Six samples were collected in October 1964 (ID 3238–3243), 15 samples are part of a batch collected in October 1964 and March 1965 (ID 3255–3269, no exact month is traceable for single specimens) and an additional 48 specimens were collected in August 1967 (ID 3190-3237). All specimens originated from the collection of P. Müller (Trier, Germany, original IDs given) (Müller 1968, 1969), which was recently transferred to the Zoologisches Forschungsmuseum Alexander Koenig, Bonn (ZFMK).

All specimens were confirmed to be identified as *Hemidactylus mabouia*. Main identification characters are: lamellae on the fourth toe do not reach the base of digit and the numbers of scansors beneath the first toe (Murphy 1997). Furthermore, *H. mabouia* has enlarged and weekly keeled tubercles on the back, which are arranged in 12 to 18 transverse rows (Spawls 2002). Male specimens could be identified by the presence of preanal pores (Avila-Pires 1995).

Snout-vent length, mouth-width and head-width of all specimens were measured with a digital caliper (accuracy ±0.01mm). According to Dixon & Soini (1986) adult male specimens may reach a snout-vent length between 58 and 67 mm and females a length between 61 and 70 mm. We made three specific categories: male, female or juvenile (< 55 mm). Additionally, females and males were jointly analyzed as the category of adults. In total, there were 69 tested specimens: 11 males, 23 females (equals 34 specimens in the category of adults) and 35 juveniles.

All specimens were dissected with a scalpel by cutting from anterior to posterior of the ventral side. The dermis was fixed laterally with pins, and often parts of the intestinal tract had to be taken sideward to reach the stomach which was then removed with two cuts. The first cut was placed at the approximate place of the duodenum and the second directly beneath the esophagus. Thereafter the stomach was taken out and kept in 70% ethanol. Stomachs were opened with a scalpel by a longitudinal cut and all content was removed with a dissection needle and transferred to a Petri dish for identifications. All stomachs and prey items are kept in the collection of the ZFMK.

All prey items were identified under a stereomicroscope (Olympus) to the level of order following Müller (2011). In the order Hymenoptera, Formicidae (ants) were identified to family level. Some prey items were too fragmented to be identified and were categorized as “others”. They have been considered in context with volumetric calculations only. Length and width of single prey items was measured with a digital caliper (accuracy ±0.01mm) and the volume of each item was estimated with the formula for the volume of an oblate ellipsoid (Magnusson 2003), because the form of an oblate ellipsoid is close to the shape of most insects:

$$V = \frac{4}{3} * \pi * l^2 * w$$

where l is the length and w the width of the food item. Number, volume and frequency of the different prey categories were used to calculate the importance value of prey (IV; Gadsen 1997) of each prey category following:

$$IV = \frac{V_{ij}}{SV_{ij}} + \frac{N_{ij}}{SN_{ij}} + \frac{F_{ij}}{SN_j}$$

Where V_{ij} = Volume of food item i in predator j, SV_{ij} = total volume of all stomachs, N_{ij} = number of elements of food item i in predator j, SN_{ij} = total number of prey items in sample, F_{ij} = number of stomachs of predator j in which food item i was found, SN_j = total number of stomachs (Gadsen 1997).

To determine whether specimens show a generalist or a specialist feeding habit, different indices were used: the Simpson’s Index considers diversity richness and evenness and is therefore well suited to assess if a species is rather a generalist or a specialist predator. Results close to zero indicate nearly no diversity of prey items and if the index equals one this would imply infinite diversity (Simpson 1949). The Simpson’s Index of Diversity was calculated with the following formula:

$$D = 1 - \sum_{i=1}^{s} \frac{n_i(n_i - 1)}{n(n-1)}$$

where n_i = number of food item i in all stomachs and n = total number of prey items. The Shannon-Index (Shannon 1948) indicates the trophic diversity in prey consumption of the different groups:

$$H_s = -\sum p_i * \ln(p_i) \text{ and corresponding } H_{max} = \ln(N)$$

where p_i = number of all prey items of category i divided by number of all prey items of all categories and N = number of all prey items of all categories. The higher the value of the index the more diverse is the diet. By dividing H_s by H_{max} the evenness E_h was calculated:

$$E_h = \frac{H_s}{H_{max}}$$

E_h ranges between 0 and 1. Results close to one indicate an even distribution of prey items and close to zero indicate an irregular distribution. To test for niche-overlap between the different groups (males, females and juveniles) Pianka's Index was used (Pianka 1973):

$$O_{jk} = \frac{\sum_{i=1}^{n} P_{ij} * P_{ik}}{\sqrt{\sum_{i=1}^{n} P_{ij^2} * \sum P_{ik^2}}}$$

Where P_{ij} and P_{ik} are the frequencies of consumed prey item *i* in the different categories *j* and *k*. The result of the Pianka's index can vary between 0 and 1.A value of zero represents no similarities in prey consumption between the tested groups and values closer to one indicate a high niche overlap.

For results of prey size, snout-vent length, head-width and mouth-width a Mann-Whitney U-test was performed to test if differences between categories were significant (Whitney 1947). To account for allometric growth the ratio of head-width to snout-vent length and the ratio of mouth-width to snout-vent length were used to test for significant differences. All data was analyzed using Microsoft Excel 2010.

RESULTS

Of the 69 specimens five (7.25%) had empty stomachs. Hence, for feeding ecology analyses 64 samples remained, of which nine were males, 22 females and 33 juveniles. In total, 474 single prey items could be identified belonging to 14 different categories (Table 1). 13 categories represented Arthropods: one in the category of Crustacea (Isopoda), ten of the class Insecta (Blattodea, Coleoptera, Diptera, Hemiptera, Hymenoptera, Formicidae and others), Lepidoptera, Lepidoptera larvae and Orthoptera and two categories of the class Arachnida (Araneae and Ixodida). In some stomachs we found small stones representing an additional category. In total there were eight items of Crustaceans, 440 of Insecta and 21 items of Arachnida (see Table 1). On average the specimens had 7.4 prey items in their stomachs. In all samples the most common prey items found were Diptera (N = 243) followed by Lepidoptera (N = 102) and Hemiptera (N = 37), though the Importance Value (IV) is slightly higher for Lepidoptera (IV = 1.25) than for Diptera (IV = 1.23). This is mainly caused by the volumetric distribution of prey items (Table 1).

Volumetrically Lepidoptera represent the largest part of all stomach contents with a volume of 53.84% followed by Orthoptera (V = 11.25%) and Coleoptera (V = 8.62%). Although Diptera occurred in the highest number they only represented 7.5% of the volume of all stomach contents (Table 1). Frequently detected categories were Diptera (F = 68.75%) and Lepidoptera (F = 51.56%), followed by Hemiptera and Coleoptera (both F = 23.44%) and Araneae and Orthoptera (both: F = 15.63%) (Table 1).

Prey composition in males

In total there were 11 males available of which two had empty stomachs. Additionally two males were infected with nematodes within their stomachs. In terms of prey consumption nine of the twelve different prey categories were found in males, which is the smallest quantity found. On average in male specimens we detected 7.56 items per stomach. Numerically Lepidoptera were the most common item N = 22 (36.07%) followed by Diptera N = 13 (21.31%) and Isopoda N = 7 (11.48%). In terms of volume Lepidoptera (V = 35.73%) were most important, whereas Diptera only represented 1.75% of the total volume. Lepidoptera are the most significant food item with an Importance Index of 1.24, followed by Diptera (IV = 0.88) and Coleoptera (IV = 0.86). In terms of frequency, Diptera were found in six of nine stomachs (66.67%), Coleoptera and Lepidoptera in five of them (55.56%). One stone was found in a stomach and male specimens are the only category where Isopoda were found (Table 2).

Prey composition in females

One of the female samples had an empty stomach, hence 22 remained for analyses. On average they had fewer items per stomach than males (6.18 vs. 7.56). In terms of numbers, Lepidoptera N = 45 (37.19%) and Diptera N = 37 (30.58%) are dominant. Also, Lepidoptera were represent the highest volume with 59.93% of all stomach content of female samples, followed by Orthoptera (V = 14.44%). Diptera were found in 16 (72.73%) of the total 22 stomachs, Lepidoptera in 13 (59.09%), which were also most important (IV = 1.52) followed by Diptera (IV = 1.09) (Table 2).

Prey composition in juveniles

Of the 35 juveniles examined two had empty stomachs while the remaining 33 specimens had on average 9.58 food items per stomach, which was the highest number of all three classes. In terms of quantity Diptera were most prevalent with 193 (66.1%) items, followed by Lepidoptera with 35 (11.99%) and Hemiptera with 23 (7.88%). Though Diptera represented 66.1% of all found items, Lepidoptera was again the most important category with 59% of all stomach contents in terms of overall volume, followed by Diptera with 10.43%. Diptera occurred in 22 (66.67%) stomachs, Lepidoptera in 15 (45.45%) and Hemiptera in 10 (30.3%). Diptera was the most significant food item

Table 1. Overall results of analyzed stomach contents (n = 64). *N* represents the number of prey items found of this category, *% (N)* gives the corresponding percentage in relation to all found items. *V* (in mm³) is the total volume contributed by the item, *% (V)* is the percentage of the volume compared to the total volume. *F* is the frequency and shows in how many stomachs the item is found and *% (F)* shows the corresponding percentage. *IV* is the Importance Value which results out of *N*, *V* and *F*.

Prey catagory	N	N%	V	V%	F	F%	IV
Crustacea							
Isopoda	8	1.54	3294.05	3.14	2	3.13	0.08
Insecta							
Blattodea	1	0.19	296	0.28	1	1.56	0.02
Coleoptera	27	5.19	9050.90	8.62	15	23.44	0.37
Diptera	243	46.73	7878.38	7.50	44	68.75	1.23
Hemiptera	37	7.12	2948.16	2.81	15	23.44	0.33
Hymenoptera							
Formicidae	6	1.15	242	0.23	5	7.81	0.09
others	7	1.35	482.95	0.46	4	6.25	0.08
Lepidoptera	102	19.62	56527.28	53.84	33	51.56	1.25
Lepidoptera larvae	1	0.19	583	0.56	1	1.56	0.02
Orthoptera	16	3.08	11810.98	11.25	10	15.63	0.30
Others	–	–	9596.05	9.14	–	–	–
Arachnida							
Araneae	19	3.65	1690.87	1.61	10	15.63	0.21
Ixodida	2	0.38	0.32	0.00	2	3.13	0.04
Stones	5	0.96	591.16	0.56	5	7.81	0.09
total	474		104991.94				

with an Importance Value (IV) of 1.38, followed by Lepidoptera (IV = 1.16) and Hemiptera (IV = 0.45) (Table 2).

Diversity indices and niche overlap

Simpson's Index of Diversity (D) indicates little differences between males, females and juveniles. Males showed the highest trophic diversity (D = 0.79), followed by females (D = 0.73). When grouping all male and female adults together, the Simpson's Index (D) is 0.76. Prey diversity is smallest in juveniles (D = 0.52). If all samples are grouped together D equals 0.66, which suggests that the animals are likely generalist predators (Table 3).

Results of Simpson's – and Shannon Index suggest similar patterns (Table 3). In only one case regarding the juvenile group did Shannon's Index (H_s) differ from Simpson's Index. Juveniles show highest diversity with H_s = 2.25 and E_h= 0.91, indicating that the diet composition of juveniles is quite evenly distributed. Males (H_s = 1.79; E_h = 0.81) and females (H_s = 1.64; E_h = 0.71) have a lower trophic diversity and also a more uneven distribution of prey consumption. Assessing the category of adults the Shannon-Index was H_s = 1.75 and Evenness E_h was 0.73 (Table 3).

Pairwise comparison between males, females and juveniles using Pianka's Index (O_{jk}) for niche overlap suggests highly overlapping trophic niches. The most remarkable difference detected was between males and juveniles (O_{jk} = 0.85). The remaining comparisons indicated almost a complete niche overlap (Table 4).

Body measurements and prey size

The difference in snout-vent length, mouth-width and head-width of males and females was not significant. Significant differences only occurred between females and juveniles. Prey length is on average highest in males (4.66 mm ± 3.28 mm), whereas female prey width is highest on average (1.68 mm ± 1.12 mm). The longest prey item was detected in a female (SVL 16.74 mm) and although juveniles commonly consume smaller prey a very long prey item with 15.76 mm was also found (Table 5). Prey length

Table 2. N represents the number of prey items found in the specific category (male, female or juvenile), % (N) gives the corresponding percentage in relation to all found items. V (in mm^3) is the total volume contributed by the item, % (V) is the percentage of the volume compared to the total volume. F is the frequency and shows in how many stomachs the item is found and % (F) shows the corresponding percentage. IV is the Importance Value which results out of N, V and F.

	males N = 9							females N = 22							juveniles N = 33						
Prey category	N	N%	V	V%	F	F%	IV	N	N%	V	V%	F	F%	IV	N	N%	V	V%	F	F%	IV
Crustacea																					
Isopoda	7	11.48	1671.12	5.72	1	11.11	0.27	–	–	–	–	–	–	–	1	0.34	1622.93	4.67	1	3.03	0.08
Insecta																					
Blattodea	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.34	296.01	0.85	1	3.03	0.04
Coleoptera	5	8.2	6774.43	23.19	5	55.56	0.86	14	11.57	1950.78	4.57	5	22.73	0.38	8	2.74	325.69	0.94	5	15.15	0.19
Diptera	13	21.31	510.02	1.75	6	66.67	0.88	37	30.58	3740.18	8.77	16	72.73	1.09	193	66.1	3628.19	10.43	22	66.67	1.38
Hemiptera	5	8.2	133.97	0.46	1	11.11	0.19	9	7.44	345.23	0.81	4	18.18	0.26	23	7.88	2468.96	7.1	10	30.3	0.45
Hymenoptera																					
Formicidae	–	–	–	–	–	–	–	2	1.65	39.5	0.09	1	4.55	0.06	4	1.37	202.4	0.58	4	12.12	0.14
others	–	–	–	–	–	–	–	1	0.83	193.97	0.45	1	4.55	0.06	6	2.05	288.98	0.83	3	9.09	0.12
Lepidoptera	22	36.07	10438.69	35.73	5	55.56	1.24	45	37.19	25566	59.93	13	59.09	1.52	35	11.99	20522.59	59	15	45.45	1.16
Lepidoptera l.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0.34	582.94	1.68	1	3.03	0.05
Orthoptera	6	9.84	5376.7	18.4	3	33.33	0.61	7	5.79	6159.49	14.44	5	22.73	0.42	3	1.03	274.79	0.79	2	6.06	0.08
Others	–	–	2595.85	8.89	–	–	–	–	–	3941.62	9.24	–	–	–	–	–	3058.58	8.79	–	–	–
Arachnida																					
Araneae	1	1.64	2.65	0.01	1	11.11	0.13	2	1.65	193.45	0.45	2	9.09	0.11	16	5.48	1494.76	4.3	7	21.21	0.31
Ixodida	1	1.64	1671.12	5.72	1	11.11	0.18	1	0.83	0.18	0	1	4.55	0.05	–		–	–	–	–	–
Stones	1	1.64	41.18	0.14	1	11.11	0.13	3	2.48	531.57	1.25	3	13.64	0.17	1	0.34	18.4	0.05	1	3.03	0.03
total	61		29215.73					121		42661.96					292		34785.22				

Table 3. Results of Simpson's Index (D) and Shannon-Index (H_s) and related Evenness (E_h) for the different categories.

Group	Simpson's Index	Shannon Index	
	D	H_s	E_h
all	0.66	1.56	0.61
adults	0.75	1.75	0.73
males	0.79	1.79	0.81
females	0.73	1.64	0.71
juveniles	0.52	2.25	0.91

Table 4. Results of pairwise comparison of the different categories with Pianka's Index O_{jk}

comparison	O_{jk}
males – females	0.94
males – juveniles	0.85
females – juveniles	0.94
juveniles – adults	0.93

and width were only significantly different between males and juveniles.

The average prey volume was 3062.27 mm^3 in males, 1939.17 mm^3 in females and 1054.1 mm^3 in juveniles (Table 5). The lowest stomach content volume was found in a juvenile with 14.49 mm^3 and the highest volume in a male with 9417.33 mm^3 (Table 5). The only significant difference in the volume of consumed prey occurred between males and juveniles.

DISCUSSION

Hemidactylus mabouia is known to have a generalist feeding habit (Vitt 1995; Zamprogno & Teixeira 1998), which is also the conclusion of this diet analysis. The animals mainly feed on arthropods, mostly insects. Rocha & Anjos (2007) studied a population of *H. mabouia* in an inselberg area in south-eastern Brazil where they found a higher proportion of Araneae, representing numerically 22.4% of the total diet. In a study performed by Alves (2013) Araneae are the most important food item for *H. mabouia* in terms of frequency (20.51%). According to our data Araneae only make up 4.01% of the total number of prey items and occurred with a frequency of only 15.63% in all samples (Table 1). Another prey category that is very different between the studied populations is Diptera. In the study of Rocha &Anjos (2007), Diptera only contributed 1.9% of the total number of prey items, whereas in this study they represent more than a half (51.27%) of all consumed prey items (Table 1). In this study, the number of individual prey items and total volume of Lepidoptera made up high proportions contrary to the study of Rocha & Anjos (2007) where Lepidoptera were detected in just 6.2% in terms of number and 2.8% in terms of volume. Whereas in this study Lepidoptera make 21.52% of food items and are also the most prevalent and important food item constituting a volume of 53.84% of all consumed prey (Table 1). Furthermore, in the inselberg area studied by Rocha &Anjos (2007) the authors found a higher number of different prey categories such as gastropods or diplopods, than we did. These results may be related to the fact that the population examined in the present study was collected in an urban area according to the prey composition. Here a higher proportion of winged insects occurs compared to natural habitats, as they are attracted by artificial light (e.g., as suggested by Bonfiglio et al. 2006). In addition, in concordance with Bonfiglio et al. (2006), these results may be explained by differences in analyzed microhabitats providing different proportions of prey categories.

Intraspecific comparisons

There were no noteworthy differences in the diet of males and females. In juveniles, stomachs numerically contained 66.1% Diptera, only 21.31% in males and 30.58% in females (Table 2). Only in juveniles, Diptera have the highest importance (IV = 1.38) (Table 2), whereas highest importance was detected for Lepidoptera in males and females. One reason for the dominance of Diptera in the diet of juveniles could be that juveniles in general have a smaller mouth-width which excludes large prey items. Whereas males and females show no significant difference in prey size, the consumed prey of juveniles is significantly smaller (Table 5).There was no significant difference found for body size, head-width or mouth-width between males and females, in agreement with the results from previous studies (Anjos & Rocha 2008; Iturriaga 2013).

According to Pianka's index, the diet composition of males, females and juveniles is similar and has high niche overlaps. There is nearly a complete niche overlap between males/females and females/juveniles (O_{jk} = 0.94) (Table 4). Males and juveniles differ the most (O_{jk} = 0.85), but still have a large overlap in diet composition which corresponds with the results presented by Rocha & Anjos (2007).

Shannon and Simpson Diversity Indices results are contradictory: According to Simpson's Index males and females have a higher trophic diversity than the juvenile category (Table 3), whereas Shannon Index indicates juveniles have the highest diversity and males and females have a lower diversity in diet composition (Table 3). Comparing adults, males, females and all samples together Shannon and Simpson's indices suggest similar patterns, besides for juveniles where the Shannon Index is higher than one would expect regarding Simpson's Index (Table 3). Simpson's Index gives more weight to dominant prey categories and can be interpreted as an abundance index, unlike the Shannon Index (Hill 1973). The extremely high number of Diptera (N = 193) (Table 4) in juvenile prey composition could therefore influence Simpson's index. Interestingly, in the stomach of one juvenile we found 83 Dipterans which makes nearly half (43%) of all Diptera detected in this group. This could negatively influence the result of Simpson's Index for the juvenile group. We conclude that the Shannon Index is more reliable for this study suggesting that juveniles have the highest trophic diversity.

Interspecific comparisons

Comparing the feeding ecology of *H. mabouia* with the diet of *Gymnodactylus darwinii* studied by Almeida-Gomes (2013), a competition for food seems quite unlikely. Whereas *H. mabouia* is able to prey on a broad spectrum of arthropods, in this study 13 different prey categories were found (stones excluded), there are only five different categories found (plant material excluded) in the study by Almeida-Gomes (2013) for *G. darwinii*. If both diets are compared with Pianka's Index, it results in a niche-overlap of O_{jk} = 0.19, indicating nearly no overlap between the two gecko species.

CONCLUSIONS

In conclusion, a moderate ontogenetic shift in prey consumption was detected. There are no differences between

Table 5. Snout-vent length (svl), mouth-width (mw) and head-width (hw) in mm, comparison of consumed prey size in mm by the different categories male, female and juvenile as well as total volume (mm³) of prey in the stomachs. N equals the number of total measured items of the group. Range gives the minimum and the maximum sizes of prey width/length and specimen sizes. SD = standard deviation.

Group		Specimens				Prey items			Volume / stomach	
		N	svl	mw	hw	N	width	length	N	mm³
males	range	11	54.83 - 64.29	9.29 - 11.55	10.49 - 13.28	61	0.14 - 6.23	0.21 - 13.78	9	162.45 - 9417.33
	mean ± SD		59.58 ± 3.08	10.14 ± 0.58	11.97 ± 0.79		1.60 ±1.28	4.66 ± 3.28		3062.27 ± 2778.49
females	range	23	54.20 - 63.10	8.83 - 10.85	10.42 - 12.47	121	0.22 - 6.73	0.44 - 16.74	22	28.22 - 7484.19
	mean ± SD		57.40 ± 2.66	9.49 ± 0.54	11.28 ± 0.50		1.68 ±1.12	4.50 ± 2.67		1939.17 ± 24422.89
juveniles	range	35	22.99 - 53.42	3.87 - 10.23	4.80 - 12.08	292	0.10 - 3.89	0.17 - 15.76	33	14.49 - 6590.38
	mean ± SD		43.50 ± 9.13	7.65 ±1.55	9.06 ± 0.80		0.91 ± 0.75	2.56 ± 2.48		1054.10 ± 1461.43

the two sexes. Though diet composition slightly differs compared to other studies, *H. mabouia* is a generalist and opportunistic predator with a high trophic plasticity. Regional differences in diet composition are likely related to differences in prey availability in different microhabitats or different seasons. Further studies should focus on arthropod availability at the different locations and seasons in order to examine the reasons for the differences in prey consumption.

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