

# Diet of Cane Toads (*Rhinella marina*) collected from areas adjacent to human dwellings in Davao City, Philippines

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**Abstract:** Through gut content analysis, we determined the diet and food preference of the cane toad (*Rhinella marina*) collected in selected areas close to human dwellings in Davao City, Philippines. Identifiable gut contents were inspected using a dissecting microscope from twenty four individuals. The most abundant food items are invertebrates followed by plant materials. We report ingestion of pebbles and thread in six samples which were not formerly reported. Degree of food preference (DFP) showed that all food items identified were occasional preferential food items. This supports the idea of the generalist diet pattern of *Rhinella marina*. Moreover, results indicated invasive capabilities of *Rhinella marina* which should be of concern specially on areas where endangered species are present, but at the same time it could be used as biological control for pathogen vectors such as flies and mosquitoes given the frog's capacity to feed on various food items available in the site.

**Keywords:** biological control, food items, insects, invasive frogs

## 1. Introduction

Anurans are sensitive to a variety of anthropogenic stressors and are widely suggested as indicators of ecological condition [1]. It is therefore imperative to not just make biodiversity and species richness research on these species but also focus in its diet analysis as it may provide valuable data in the sustenance of anuran population. Philippines is one of the areas with high biodiversity index of different organisms specially anurans [2]. Data however on diet of Philippine anurans remain scanty with few

published literatures [3, 4, 5] while the vast majority of studies only focused on species richness and population count which often do not present data on diet pattern of anuran species [6]. Species like *Rhinella marina* that can thrive in habitats with high anthropogenic activities and mostly degraded habitats [7], are good species to study in terms of determining food preferences and possible diet patterns. As diet analysis may actually be an effective way to identify organisms that are being consumed by another organism and therefore provide inference into the dynamics of ecological balance in a habitat [8, 6], data of the current study may add to the available literature concerning diet patterns of *Rhinella marina* and its implications to other organisms it feeds on given its invasive nature.

## 2. Methods

*Rhinella marina* individuals were collected manually through hand picking from 1600h to 1900h from the grasslands of Davao Crocodile Park and forest patch of Greenhills, Catalunan Pequeño, all in Davao City. Twenty four individuals were collected. Frogs were sacrificed immediately by injecting 95% ethanol on the basal section of the heart then preserved subsequently on 95% ethanol prior to dissection the following day. A midventral incision was done on each sample to expose the gastrointestinal tract. The gut of each individual was clipped one inch above the cardiac and pyloric ends and contents removed thereafter. Identifiable food items were examined under a dissecting stereomicroscope, sorted and grouped based on similarities of morphological parts. To infer about the consumption of a particular food group, degree of food preference (DFP) was obtained [6].

Abundance was estimated by the number of prey items of each category in each stomach. DFP was calculated using the formula: Degree of Food Preference =  $S(i)/N$ .

### 3. Results and Discussion

Twenty four individuals were collected in the site and all had stomach contents. Gut contents included 9 taxa of invertebrates, 1 vertebrate, 4 plant matter, 2 non-living matter, and eight unidentifiable items. The stomachs were mostly filled with invertebrates. Plant matter were also excised from the guts. For the degree of food preference (DFP), items were all considered occasional for all *Rhinella marina* individuals though the highest DFP rating are the leaves collected from the gut (Table 1).

Table 1. Gut contents of *Rhinella marina* from Davo City sites.

Food Item	N	DFP
<b>Number of Stomachs Examined</b>	24	
<b>Invertebrates</b>		
Blattodea	17	0.71°
Orthoptera	3	0.13°
Chilopoda	3	0.13°
Hymenoptera	6	0.25°
Coleoptera	18	0.75°
Hemiptera	7	0.29°
Diplopoda	5	0.21°
Annelida	5	0.21°
Isoptera	9	0.36°
<b>Vertebrate</b>		
Amphibian eggs	4	0.17°
<b>Plant matter</b>		
Leaves	19	0.79°
Twigs	13	0.54°
Seeds	7	0.29°
Wood	2	0.08°
<b>Others</b>		
Pebbles	5	0.21°
Thread	1	0.04°
Unidentified	8	0.33°

N= number of food items;  $\Sigma$ = total number of specific food items; Degree of Food Preference (DFP)= hp-highly preferential (3<DFP<4), p-preferential (2<DFP<3), s-secondary (1<DFP<2), o-occasional (0<DFP<1)

The results of the current study revealed that in areas close to human dwellings *Rhinella marina* diet is composed chiefly of invertebrates (55.29%). The Coleopterans persistently occurred in the stomachs examined (13.64%) while the

Orthopterans and Chilopodans were the lowest with 2.27%. Results parallel those of Isaacs and Hoyos [9] where arthropods top the list of materials found in the gut of *Rhinella marina* sampled from coffee plantations. The prevalence of Coleopterans in the gut of the samples also substantiate prior reports that these species are commonly consumed by *Rhinella marina* [10, 11] even in forested sites. The persistence of invertebrate food items in the samples examined is promoted by the presence of artificial light since the frog individuals were collected in areas close to human dwellings. Light attracts insects and so makes these organisms available prey for *Rhinella marina* to feed on [12].

Plant matter is also observable in the guts examined, ranks second in abundance next to invertebrates. Similar observations were reported in other studies as well [9, 4]. Although plant materials may not be a direct food item of *Rhinella marina* given that it is a carnivore, the ingestion of plant matter has been associated with significant role in parasite elimination and even in digestion of the exoskeleton of the consumed arthropods [13]. It is then not surprising that plant matter ranks second in the most prevalent food items consumed by this frog.

Inorganic materials (pebbles and thread) were also excised from six gut samples, the first case reported here. This further concretized the generalist and opportunistic feeding nature of *Rhinella marina* as earlier reported [4, 6, 9, 11]. Being the case, the need to analyze diet patterns of *Rhinella marina* in other sites on and or close to human domiciles in relation to ecological dynamics in urbanized areas appears timely and useful. Amphibian egg was also apparent in the results which affirm the cannibalistic nature of this species which could indicate that it could potentially keep its own population at a steady state on its own [14].

### 4. Recommendations

Collection of *Rhinella marina* in other areas close to human habitation is needed to augment data of the current study. Analysis of the amorphous gut contents, preferably through molecular techniques may also shed light on the prey items consumed by *Rhinella marina*.

### 5. Acknowledgement

The researchers commend the help of Professor Analyn Cabras of University of Mindanao for the confirmation of the identities of the food items. Gratuitous Permit was issued by the DENR RXI. Logistical support was also given by Dr. Ana Julia P. Enero, the dean of Arts and Sciences

Department of San Pedro College and the Biology Department of Central Mindanao University.

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