



## GROWTH PARAMETERS IN FOUR POPULATIONS OF EDIBLE FROG SPECIES IN THE OUÉMÉ VALLEY (REPUBLIC OF BENIN, WEST AFRICA)

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### ABSTRACT

*This study proposes to analyze the growth parameters of edible frogs in the Ouémé Valley in order to identify species of interest that may present considerable potential for the development of Beninese Raniculture. The methodology used consisted in sampling individuals of *Hoplobatrachus occipitalis*, *Aubria subsigillata*, *Xenopus fishbergi* and *Xenopus tropicalis* in the harvest of the frog catchers and making measurements on them, which made it possible to represent graphs of growth. At the end of the study, the results revealed that *Hoplobatrachus occipitalis* has an average weight and snout length of  $93.8 \pm 33$  g and  $117 \pm 0.8$  mm respectively. *Aubria subsigillata* has an average weight of  $62 \pm 18$  g and a snout-length of  $95 \pm 0.9$  mm and the genus *Xenopus* with an average weight of  $24, 8 \pm 23$  g and a snout-length of  $50 \pm 0.13$  mm. *H. occipitalis* and *A. subsigillata* appear through their seize performances like two species that can be recommended for raniculture.*

**Keywords:** anuran, length, environment, performance, weight

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## INTRODUCTION

The Global Amphibian Assessment (GAA) has found, after analysis of the world's herpetological diversity, that almost a third of all amphibian species are threatened with extinction (Measey, 2011). This observed loss of amphibian species diversity is an indicator of a major ecological unbalance caused by man on the environment, which he transcends on a daily basis without worrying about the fines that they could generate. Thus, to satisfy their food needs, thousands of frogs throughout the world are cruelly captured and sold in the trade by humans. Moreover, in some countries of the world, such as Benin, there are no regulations that abolish this practice. Frogs are therefore captured at will without distinction of age and physiological stage (Gansa, 2020). Faced with this situation, many documents in the literature

prioritise research on frog species consumed by populations. Domestication trials have been conducted on frogs consumed worldwide (Wells, 1977; Barbault, 1984; Heyer, 1994; Rödel, 2000; Morin, 2008; Tohé, 2009; Godome, 2020). However, these authors ignored that, as a prelude to the domestication studies, a reflection on the rationalisation of the approach for the diversification of raniculture products should lead to a particular questioning. This is the question relating to the most interesting growth performances to be taken into account in the process of selecting edible frog species for domestication. This question raises the merit of researching and identifying the growth parameters specific to each species of edible frog and which would determine the consent of populations to eat or not to eat a particular species of frog. To this end,

according to an inventory study of frog species consumed in the Ouémé Valley, four species of edible frogs were identified. These are *Hoplobatrachus occipitalis*, *Aubria subsigillata*, *Xenopus fishbergi* and *Xenopus tropicalis* (Gansa, 2020). The objective of the present study is to analyse the growth parameters of these edible frogs in the Ouémé Valley in Benin in order to identify species of interest that may present considerable growth potential for the development of raniculture in Benin.

## MATERIAL AND METHODS

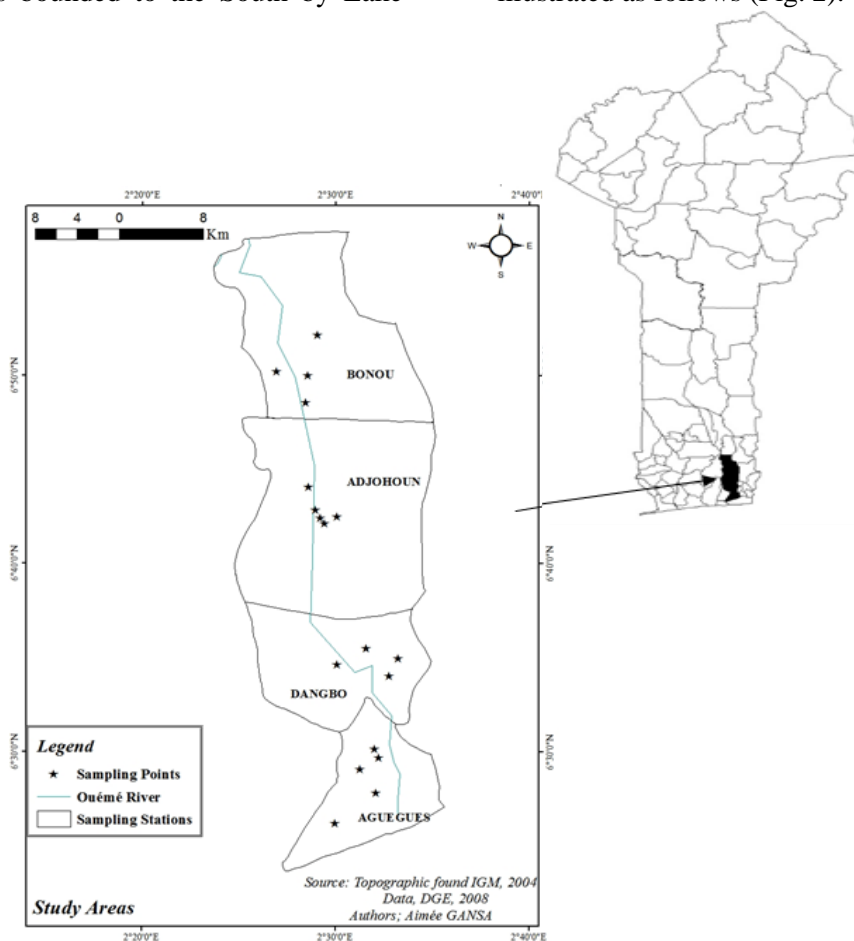
### Study Environment

The present study took place in the Ouémé Valley (Fig. 1). The Ouémé Valley is located between 6°25' and 6°57' North Latitude and 2°21' and 2°38' East Longitude in the South of Benin in the Department of Ouémé (Adjagodo, 2017). It is located in the South-East region of Benin and is bounded to the South by Lake

Nokoué and the Porto-Novo lagoon; to the East by the Pobè-Porto-Novo plateau and to the West by the Sô marshes. The Ouémé Valley is subdivided into three areas, namely: The high delta which extends beyond Bonou; the medium delta: which goes from Bonou to Azowlissè in the Commune of Adjohoun and the low delta: which goes from the downstream side of Azowlissè to the southern side where the river flows into the lagoon complex formed by Lake Nokoué and the lagoon of Porto-Novo. Thanks to its wet ecosystem, it provides a suitable habitat for the development of frogs, which are exploited by the populations. The frog sampling work was carried out in the four Communes that are: Bonou; Adjohoun; Dangbo and Aguégués.

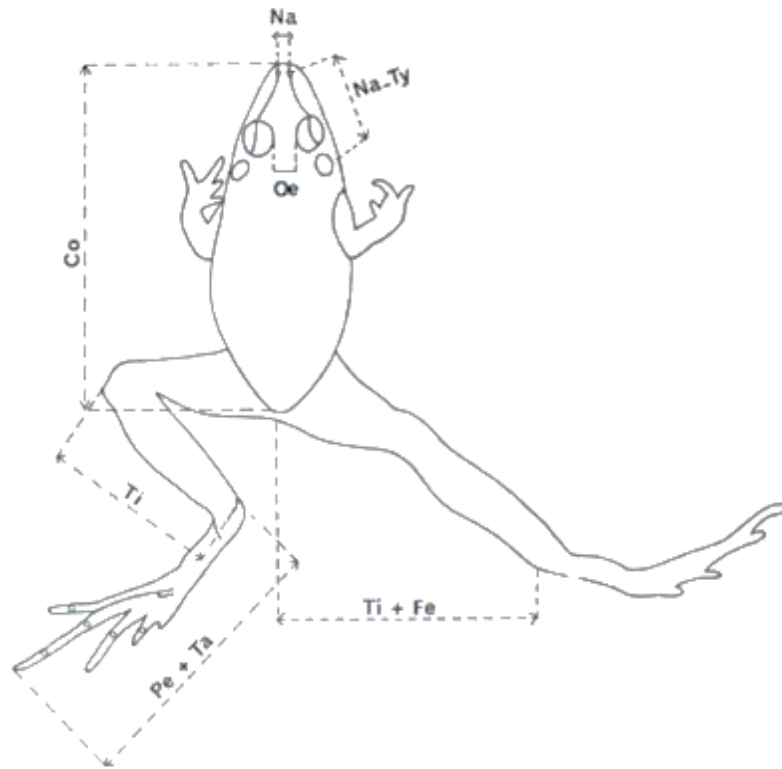
### Sampling and Data Collecting

The measurements carried out on each species of edible frog in the Ouémé Valley are illustrated as follows (Fig. 2).



\*: Sampling points —: Ouémé river □ Sampling stations

**Figure 1: Map of the Ouémé Valley showing sampling points (Gansa, 2020)**



**Key:** Ti: tibia; Pe: foot; Ta: tarsus; Fe: femur; Co: body; Na: nostrils; Ty: eardrum; Oe: orbit

**Figure 2: Type of measurements made on frogs**

At each study station, Adjohoun, Aguégues, Bonou and Dangbo; three frog catchers have been identified. An appointment was made with the catchers at 7am as soon as they returned from capture. The captured frog individuals were separated by species and thirty frog individuals by species were randomly selected. They were counted and measurements were taken on each individual. Data recording lasted three weeks per station and was carried out as follows: the measurements were taken using the double wooden decimeter. The total length was measured from the end of the muzzle to the end of the longest toe of the hind legs. The standard length (SVL) was measured from the end of the muzzle to the tip of the urostyle. The length of the femur was taken from the tip of the urostyle to the junction between the femur and the tibia. The length of the tibia was taken from the femur to the tarsus. The length of the leg was measured from the tip of the urostyle to the end of the longest toe of the legs. The circumference of all the above-mentioned parts of the body was measured with a tape measure. At the end of the measurements, each individual was placed on a scale for weight measurement. The data collected was recorded on a copybook and entered into the Excel spreadsheet (2007) at the

end of the measurements. The correlation matrix between the different morphometric measurements of the edible species was established with the Statview software. The regression line expressing the correlation between the different morphometric variables correlated with each other for each species was developed with Statview. The prizes awarded to edible frogs are a function of the visual appreciation of the size of the frog made by the catchers. Thus, the variations in the weight of anurans as a function of their total length are plotted with Excel (2007) and equations that can translate these relationships for each edible species have been established.

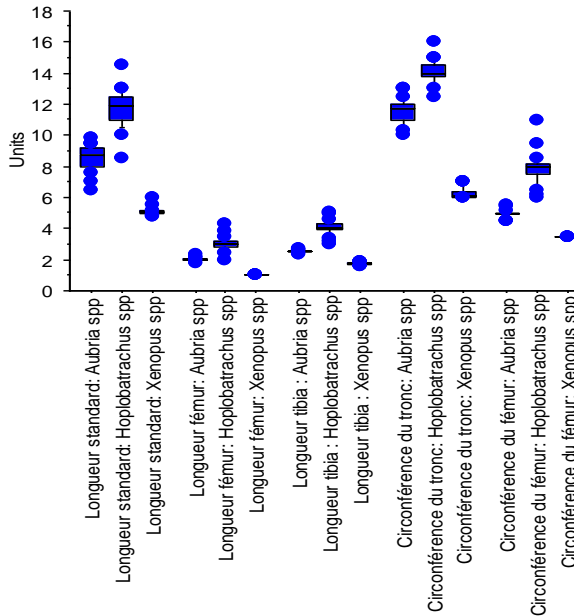
## RESULTS

The figures below show the growth parameters of edible frogs in Ouémé Valley.

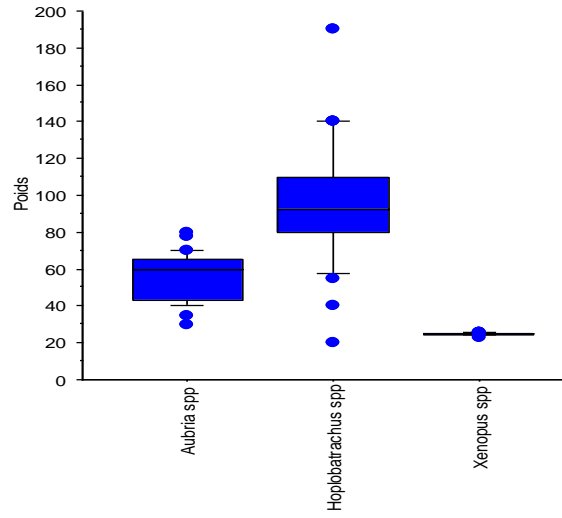
From a measurement point of view, *Hoplobatrachus occipitalis* is the largest of the edible frogs in the Ouémé Valley (Fig. 3). It also has the highest weight among the three genera of edible frogs ( $P_{value} < 0.005$ ) (Fig. 4). The body length and standard body length (SVL) of *Aubria subsigillata* are perfectly positively correlated with a correlation coefficient close to 1 ( $r^2 = 0.8$ ) while in

*Hoplobatrachus occipitalis* the correlation is positive but low ( $r^2 = 0.5$ ) (fig. 5, and fig. 6). From edible frog lengths point of view (fig.7), *Xenopus* individuals are smallest. Between the total length and the weight (fig. 8, fig. 9 and fig.

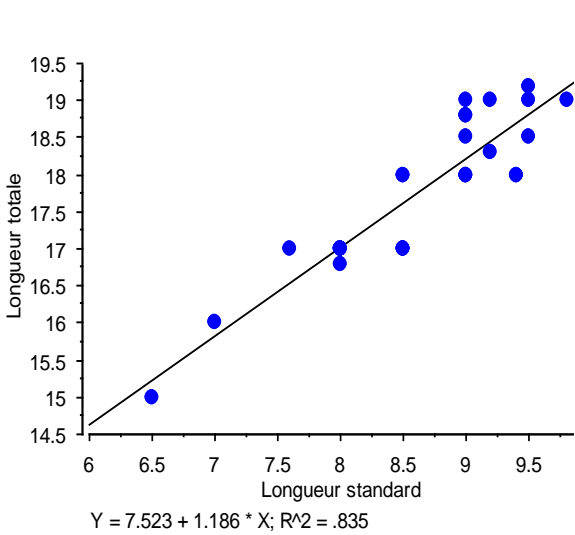
10), the correlation is still very high with *A. subsigillata* ( $r^2 = 0.6$ ) while it is very low with *H. occipitalis* ( $r^2 = 0.06$ ) and *Xenopus* individuals ( $r^2 = 0.01$ ).



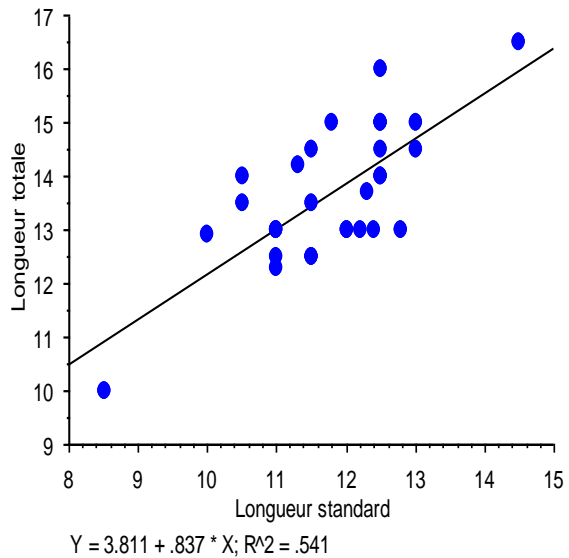
**Figure 3: Comparison of morphometric variables of edible frog species in Ouémé Valley**



**Figure 4: Weight of edible frog species in Ouémé Valley**



**Figure 5: Relation between standard length (SVL) and total length in *A. subsigillata* individuals**



**Figure 6: Relation between standard length (SVL) and total length in *H. occipitalis* individuals**

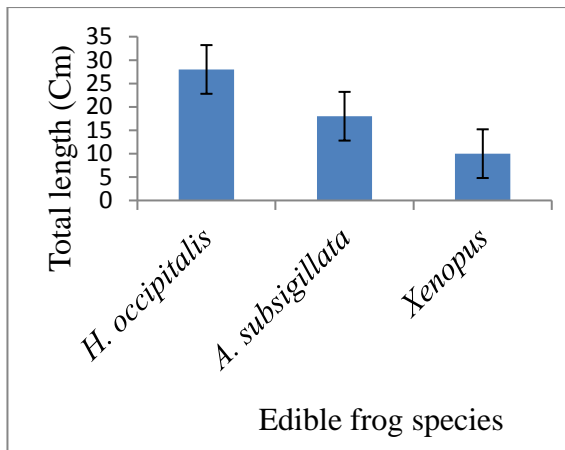


Figure 7: Total length of edible frogs in the Ouémé Valley in Benin

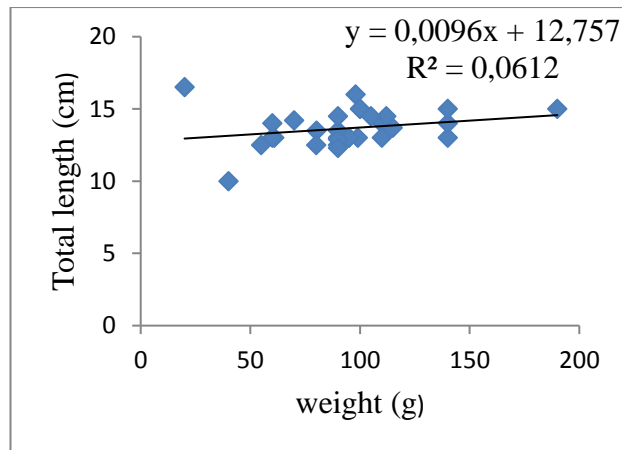


Figure 8: Relation weight – total length in *H. occipitalis* individuals in Ouémé Valley in Benin

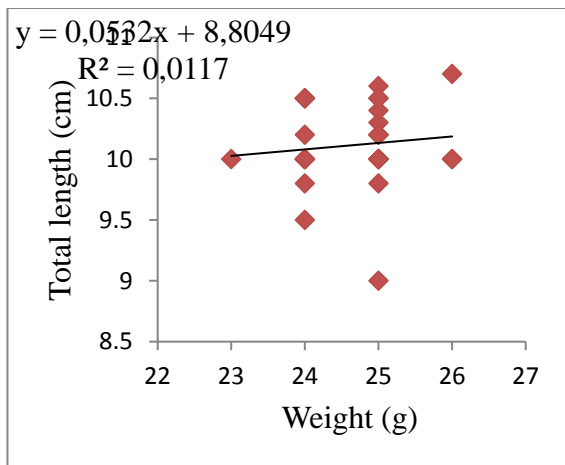


Figure 9: Relation weight – total length in *Xenopus* individuals in Ouémé Valley in Benin

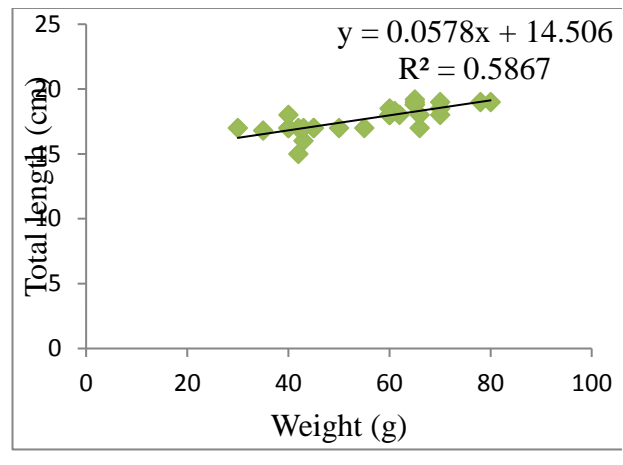


Figure 10: Relation weight – total length in *Aubria subsigillata* individuals in Ouémé Valley in Benin

**DISCUSSION**

*Hoplobatrachus occipitalis* is the largest edible frog in the Ouémé Valley in terms of Snout to Ventral length among the frog species consumed (SVL= 117 ± 0.8 mm). Indeed Güther (1858), in describing this species for the first time, demonstrated that *H. occipitalis* is a large, flat species. The Snout to Ven (SVL) length of the largest females measured in the Comoé National Park was 65 mm while the SVL length of adult males was between 52- and 104-mm. Perret (1966) noted that the SVL length of males was between 68 and 110 mm while that of females was between 110 and 135 mm. The average SVL length measured during this study for *H. occipitalis* species is within the range of sizes measured by Perret during his description of this species. However, it should be noted that the SVL length reported in this study is an average recorded from

measurements taken in both males and females of *H. occipitalis*. Similarly, considering the average weight of the species consumed, *H. occipitalis* is the species with the highest average weight 93.8 ± 33 g (fig. 4). This average weight remains higher than that of *A. subsigillata* by a difference of 32 g (Pvalue < 0.001) and higher than the average weight of *Xenopus fishbergi* and *tropicalis* by a difference of 69 g (Pvalue < 0.001). Güther (1858) noted that the weight in females is between 20 and 132 g while in males the weight is between 24 and 84 g. Thus, a maximum weight of 132 g seems to be collected by Güther (1858). However, it would also be wise to consider the sampling method used to obtain such a weight. Indeed, in this present study, the captured frogs are not weighed in the field, but are brought back to the laboratory and left for a day in order to empty their stomach before taking the real

weight. This species of frog, which is more appreciated in the Ouémé Valley, has just proved by its size and weight that it has impressive zootechnical performances. Moreover, the size and weight performances recorded in *H. occipitalis* are close to those of *Rana angolensis* exploited in Congo, Angola, Burundi, Uganda and Tanzania, where the average SVL length of the adult is 10 cm and the live weight varies, depending on the environment, between 60 and 170 g (Munyuli, 2002). The performance of *H. occipitalis*, on the other hand, is inferior to that of the goliath frog consumed in Cameroon and Equatorial Guinea whose maximum total length is 32 cm with a maximum body weight of 3.5 kg and of *Rana catesbeiana* marketed in Brazil and Mexico whose size can reach up to 20 cm in length from snout to tail with a weight of 800 g (FAO, 2006). *A. subsigillata* is the second largest frog in size after *H. occipitalis*. The SVL length observed during this study is  $95 \pm 0.9$  mm and this length is greater than the SVL length recorded by Duméril (1856) which was 84 mm. However, the maximum size that this author noted is 92 mm, which is close to 95 mm. Similarly, the tibia length recorded by Duméril (1856) was 30.8 mm which is similar to the tibia length recorded in this study (31 mm).

From the point of view of the relationship between total length and SVL length in a hand and other hand total length and individual weight of the species, *Aubria subsigillata* is the only species with a strong positive allometry (fig. 5, fig. 10). This means that it is the only species whose growth is proportional between the different body limbs and weight. As for *H. occipitalis* the positive allometry is only between total length and standard length (SVL) (fig. 6). This means that the length of the body from the muzzle to the tip of the urostyle develops in proportion to the length of the hind legs. The *Xenopus tropicalis* and *X. fishbergi*

individuals observed in Ouémé Valley is 4.5 cm. This SVL length observed is very similar to the maximum SVL length of females of this species (4.5 cm) noted by Perret (1966) in Cameroun while he was describing this family of frog. From correlation point of view (fig. 9), almost no correlation between weight and total length is observed. This could be explained by the fact that *Xenopus* individuals are very small anurans and the double wooden decimeter is not the suitable equipment for collecting data on this species. A magnifying glass use could give much more information on this species size.

### CONCLUSION

The study on the growth parameters of frog species consumed in the Ouémé Valley indicated that two frog species have impressive sizes and weights. These are *Hoplobatrachus occipitalis*, which is the largest frog species in terms of size among the four edible frog species, followed by *Aubria subsigillata*, which is the second largest frog. *A. subsigillata* is the only one species among edible frog species in Ouémé Valley whose weight increases proportionally to its length. So, its growth is much more predictable.

### RECOMMENDATION

Considering the performances of edible frog species in Ouémé Valley in Benin, the authors of this study suggests the development of the raniculture of *Hoplobatrachus occipitalis* and *Aubria subsigillata*. They also recommend the use of other criteria such as economic considerations for identifying species of interest for raniculture.

### Acknowledgements

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