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Reproduction of frog (*Hylarana albolabris,* Hallowell 1856) from Banco National Park (Ivory Coast)

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Ivory Coast

Abstract

Anuran amphibians constitute a great diversity of reproductive strategies which can vary from family to another family.
The reproduction of *Hylarana albolabris* was studied in the Banco National Park (Ivory Coast) from February 2018 to January 2019 in order to know the life traits as well as the reproduction period of this species of frog in the Banco National Park (BNP). The size at first sexual maturity assessed in male specimens is 49.56 mm against 53.86 mm in females. The smallest male and female specimens measure 38 mm and 43 mm respectively. In this species, males reach maturity at 58.9 mm compared to 61.7 mm for females. The overall sex ratio is in favor of male specimens (1: 0.21). Males of *Hylarana albolabris* continue to reproduce. Females of this frog breed all year round with the exception of August and September. These females lay an average of 1592 ± 615 oocytes with an average oocyte diameter of 1.21 ± 0.22mm. The oocytes are homogeneous, the coefficient of variation determined is 18.41%.

Keywords: *Hylarana albolabris***,** reproduction, banco national park, Ivory Coast.

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1. Introduction

The anuran amphibians (Toads, Frogs, and Tree Frogs) constitute the most widespread group with an almost global distribution [12]. The life cycle of anuran amphibians is dependent on water. In addition, that amphibians occupy a considerable place in the dynamics of food webs and are very essential in the balance of humid habitats. Despite this importance, it is clear that today amphibians are experiencing real decline on a global scale. At worldwide, several anuran species are edible. In addition, their thighs are sold in pet stores and even in supermarkets. They are a real source of animal protein for humans. Some species such as *Hoplobatrachus occipitalis*, *Ptychadena mascareniensis* et *P. pumilio* which are highly valued at the culinary level have been the subject of much research [13]; [9]; [8]; [14]; [17]; [18]; [15]; [22], [6]. As for *Hylarana albolabris*, this species of frog whose skin is prized in surgery and in leather goods, the only data available on its ecology in Africa is from [2] which reveals that it is consumed in Masako in the province of Kinsangani (Congo). To date, no data is yet available on this species in our country. Also, this work would be a judicious contribution to the knowledge of the life traits of this species in Ivory Coast.

2. Material and methods

2.1 study environment

The works were carried out in the Banco National Park located inside the vast Abidjan agglomeration between 5 ° 21' and 5 ° 25' North latitude and between 4°1' and 4 °5' of West longitude with an altitude between 0 and 113 [4]. This Park has an estimated area of 3000 hectares [3] and is surrounded by the urban areas of the communes of Attécoubé in the south, Adjamé in the east, Yopougon in the west and Abobo in the south north. The Banco National Park area is characterized by a tropical and humid climate [7]; [5]. This region is dominated by four seasons including two rainy seasons and two dry seasons. The long rainy season runs from April to July and the short rainy season covers the months of October and November. The long dry season lasts four months (December, January, February and March) and the short dry season runs from August to September. The annual precipitation is 2000 mm. The annual average temperature is 26 ° C.

2.2- Evaluated parameters

2.2.1- Size of first sexual maturity

The size at first sexual maturity or the size at first reproduction or L50 is the average standard length from which 50% of individuals are able to reproduce [1]. It is established from size classes based on Sturge's formula [20].

$$\text{class Interval} = \frac{\text{Maximal size} - \text{Minimal size}}{\text{Number of class}} \quad (1)$$

There are three categories of individuals according to size [16]

- L0: size below which no individual is mature;
- L50: size from which there are as many mature individuals as there are immatures;
- L100: size at which all individuals are mature

2.2.2- Sex-ratio (SR)

The sex ratio is the proportion of male or female individuals sampled within a species. Its mathematical expression according to [10] is as follows

$$SR = \frac{F}{M+F} \times 100 \quad \text{or} \quad SR = \frac{M}{M+F} \times 100 \quad (2)$$

SR = sex ratio

M = number of males
F = number of females

2 .2.3 - Gonado somatic report

This is the ratio of the weight of the gonads to the weight of the specimen expressed as a percentage. Its formula is as follows

$$\text{Gonado Somatique Report} = \frac{\text{Gonad weight}}{\text{Frog weight}} * 100 \qquad (3)$$

For this parameter, we used the weight of the eviscerated specimen which has the advantage of eliminating the weight of the gonads, that of the digestive tract and its contents. A very high ratio indicates an advanced state of gonad maturation. On the other hand, sexual rest or immaturity of the specimens results in a low ratio.

2 .2.4- Absolute fertility and oocyte diameter

In the laboratory, the oocytes are removed from their envelopes using forceps and are spread in the kneading dishes. Measurement of the diameter of 30 oocytes per gonad. As for absolute fertility, it was determined by counting all the oocytes actually present in the ovary using a manual particle counter. The coefficient of variation was used as a test of homogeneity to assess the diameters of the oocytes. Its formula is as follows.

$$CV = \frac{\text{Ecartyp}}{\text{Average}} * 100 \qquad (4)$$

CV = Coefficient of variation

If CV <2%, the structure is said to be very homogeneous
If 2% <CV <30%, the structure is homogeneous.
If CV> 30%, the structure is heterogeneous

2.3 Result

2.3.1- First maturity size

The sizes at first sexual maturity assessed in male and female specimens of *Hylarana albolabris* are shown in Figure 1. The L50 determined in males is 49.56 mm (Figure 1 A) against 53.86 mm for females (Figure 1 B). As for the smallest mature individuals sampled, they measure 38mm in males and 43mm in females. All mature male and female individuals have respective sizes of 58.9mm and 61.7mm.

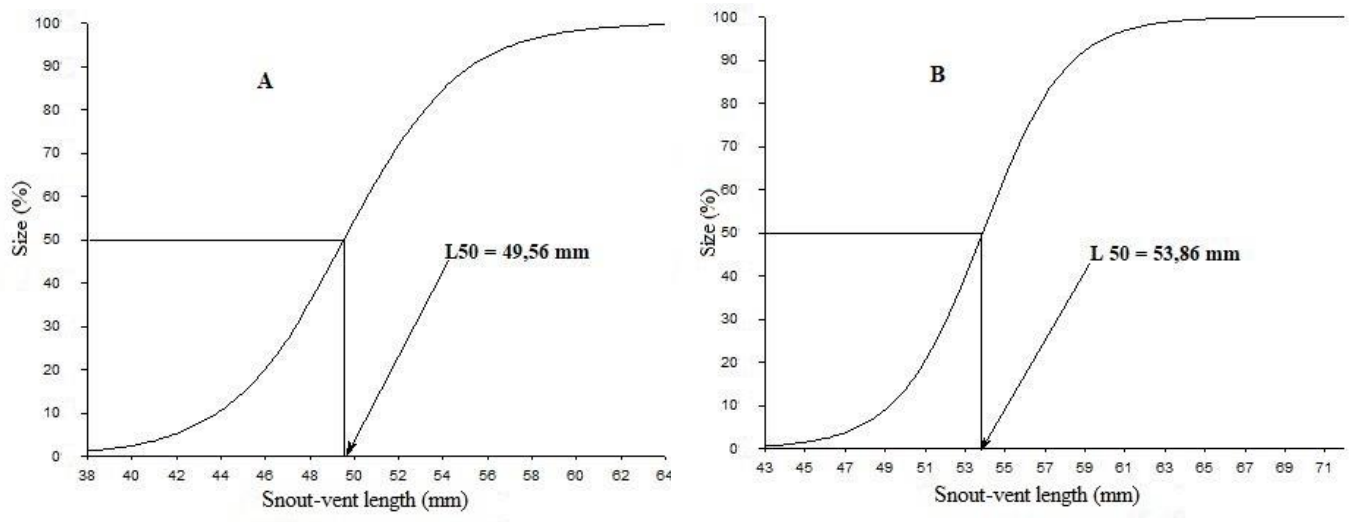

Fig 1: Size at first sexual maturity in *Hylarana albolabris*; (A): male; (B): female

2.3.2. Sex – ratio

Figure 2 illustrates the monthly variations in the proportions of the two sexes in this anuran species in Banco National Park. The sex ratio evaluated is in favor of males (1 / 0.21).

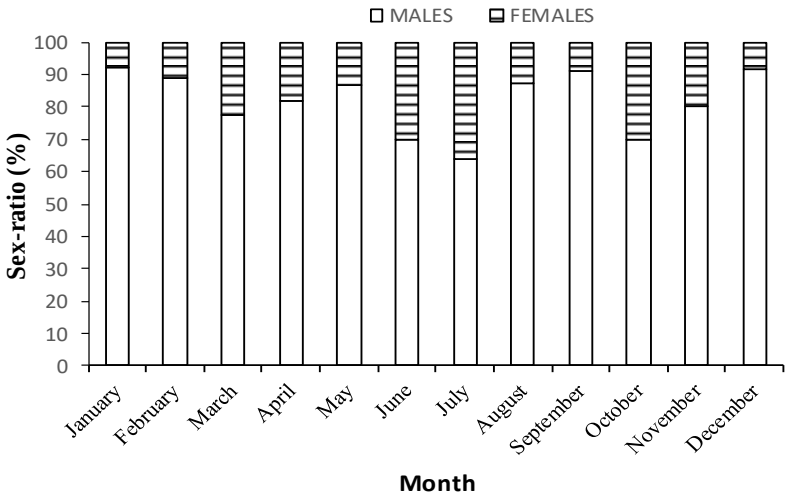

Fig 2: Monthly variation of the sex ratio in *Hylarana albolabris* in Banco National Park

Figure 3 below represent two pairs of *Hylarana albolabris* sampled in the Banco National Park

. Fig 3: Couple of *Hylarana albolabris* of Banco National Park; (A): lateral view; (B) dorsal view

2.3.3 - Gonadal index

Figure 4 illustrates the annual variations in the gonado-somatic report (GSR) in male and female specimens of *Hylarana albolabris* in the forest of Banco National Park.

In females (Figure 4A), significant deviations of the GSR were recorded in June (16.76 to 27.05%) then in July (14.98 and 32.95%). On the other hand, the lowest GSR are observed during the months of August and September with respective values of 2.75% and 3.76%. However, the annual median values of the gonado-somatic report are statistically different (Kruskal-Wallis test; p = 0.0171).

With regard to the males of *Hylarana albolabris* (figure 4 B) there is a variability in the gonado somatic ratio over the whole year. The highest GSR was recorded during the months of June and July with respective variabilities ranging from 0.13 to 0.25% and 0.12 to 0.24% followed by the months of May (0.10 at 0.14%), October (0.11 to 0.15%) and November (0.12 to 0.16). In addition, during the month of August a variability ranging from 0.10 to 0.13% was recorded. On the other hand, small variations in the gonad somatic report were recorded during the month of December (0.12 to 0.13%), January (0.13 to 0.14), followed by February (0, 12 to 0.14%), then in March (0.13 to 0.14%). Moreover, low gonado-somatic report values were also observed during the months of April and September with respective variabilities ranging from 0.12 to 0.14% and 0.13 to 0.15%. However, whatever the month considered, the median values of the gonado-somatic report of males of *Hylarana albolabris* in the banco forest do not differ significantly over the year (Kruskal-Wallis test; p = 0.20).

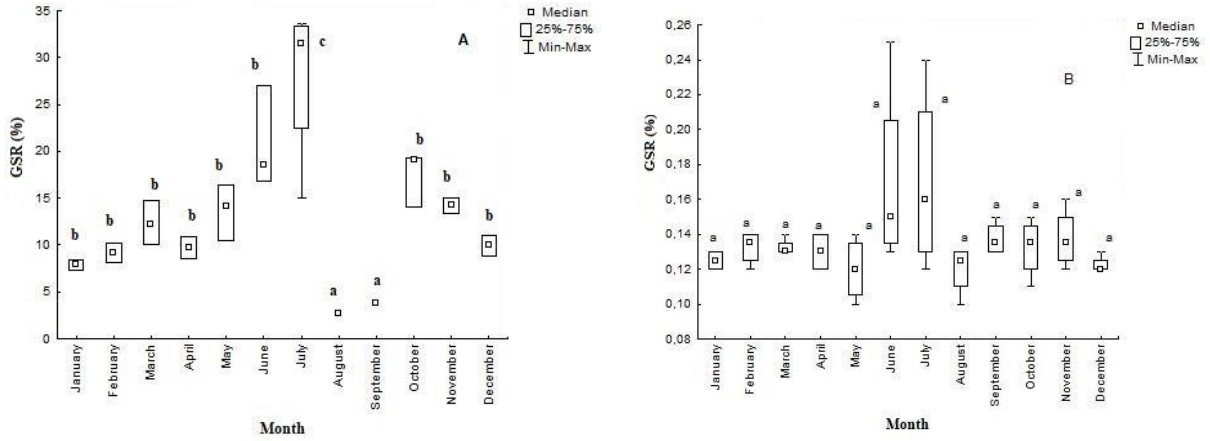

Fig. 4: Monthly variation of the GSR of females (A) and males (B) of *Hylarana albolabris* from Banco National Park.

The medians of box plots sharing the same letter (a, b or c) for the same GSR do not differ significantly

2.3. Oocyte diameters and absolute fertility

The diameters of 840 oocytes from 28 ovaries (30 oocytes per female specimen) were measured. The different characteristics of reproduction are listed in Table I.

Table I: Characteristics of reproduction parameters in females of *Hylarana albolabris* in Banco National Park.

parameters	Female specimens
Number of eggs	634 - 3012
Average Eggs	1592 ± 615
Average egg diameter	1.24 ± 0.22 mm
Coefficient of variation	18.41%

The Figure 5 illustrates the absolute fecundity / individual body weight relationships (figure 5 A) and absolute fecundity / snout-anus length (figure 5 B).
In females of *Hylarana albolabris*, absolute fecundity is strongly correlated with body weight (r = 0.797) and snout anus length (r = 0.871).

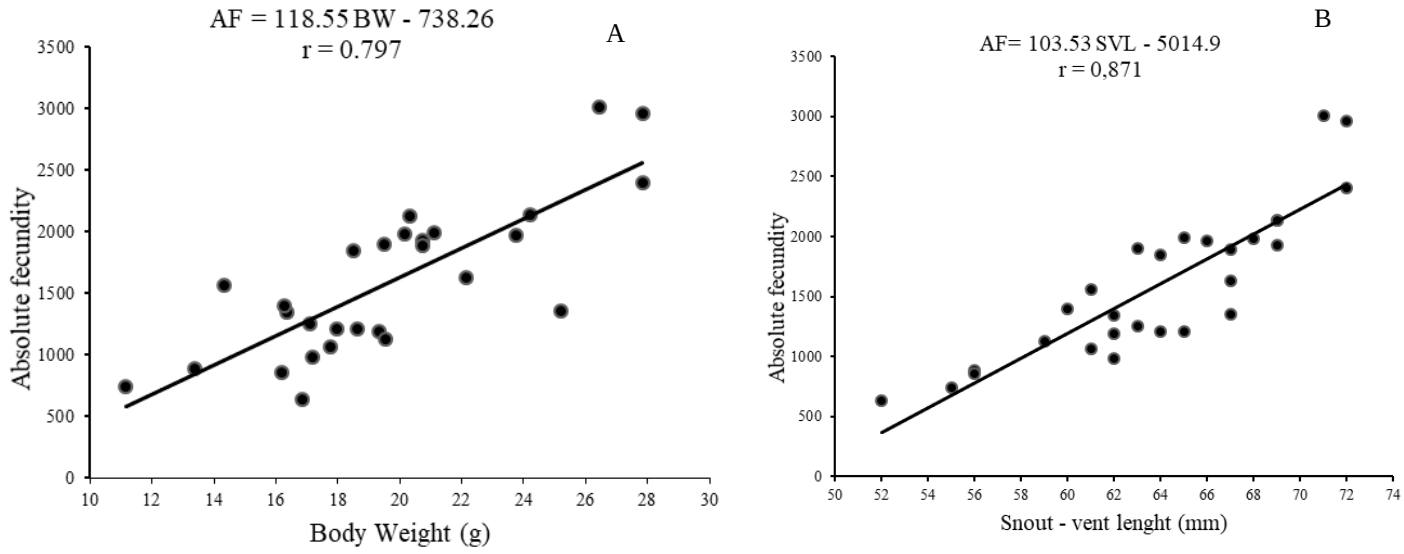

Fig. 5: Relationship between absolute fecundity and gonad weight (A) and between absolute fecundity and snout anus length of female specimens of *Hylarana albolabris* in Banco National Park (BNP).

The variations in body weight as a function of the weight of the gonads on the one hand and the weight of the liver on the other hand are shown in figure 6. There is a strong correlation (r = 0.841) between body weight and body weight gonad (Figure 6A). As for body weight and that of the liver (Figure 6 B), there is also a strong correlation in the species studied (r = 0.761).

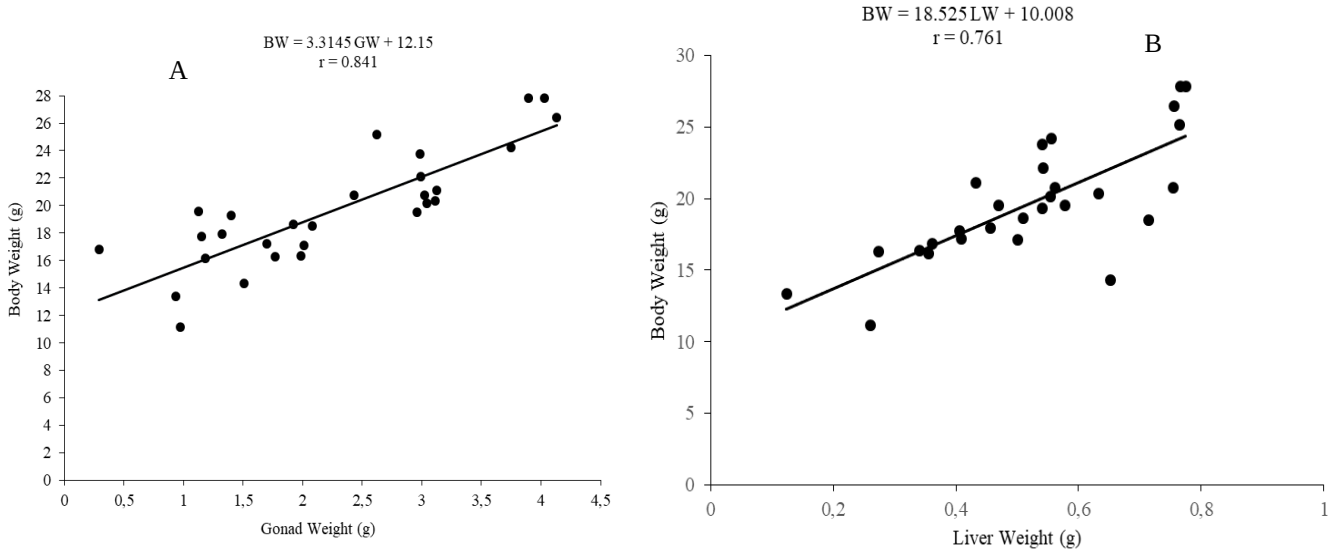

Fig.6: Relationship between body weight and gonad weight (A) and between body weight and liver weight (B) of female specimens of *Hylarana albolabris* in Banco National Park (BNP)

3.4- Discussion

The results on the reproduction of *Hylarana albolabris* in the Banco National Park revealed that the smallest mature male individuals have a size of 38 mm against 43 mm in females. Moreover, the size at first sexual maturity in male specimens is 49.56 mm and 53.86 mm in females. In this species of frog, all specimens considered mature have a size of 58.9 mm in males and 61.7 mm in females. These results can be explained by the fact that in this species, the males are smaller (precocious) than the females. The sex ratio evaluated in specimens of *Hylarana albolabris* is in favor of males (1 / 0.21). The number of males is higher than that of females regardless of the time of year. This large number of male specimens is explained by the fact of their perceptibility thanks to the croaks they emit, which would encourage captures. Similar remarks have been made among the *Hyperolius* by [11]; [19].These authors obtained a significant number of males than females at the sampling site. Nevertheless, [21] recorded in species of the genus *Ptychadena* a sex- ration in favor of

females. Indeed for this author, there is territorialism among anurans. Thus, during the breeding phase, the croaking of a male individual attracts females thus marking his territory against other males therefore favoring a large number of females on the breeding site. The gonado somatic ratio (GSR) determined in females of *H. albolabris* in Banco National Park changes from October to July. During the months of August and September, females of this species are not fit to reproduce. This period could correspond to sexual rest in females of *H. albolabris* in BNP. Females of *Hylarana albolabris* lay between 634 and 3012 eggs. In addition, the average absolute fertility evaluated is 1592 oocytes with an average oocyte diameter of 1.24 mm. The coefficient of variation determined during this study is 18.41%. This suggests that the gonads of this species have a homogeneous structure, therefore, spawning is unique in female specimens of *H. albolabris* in Banco National Park. For males, the results of the gonado-somatic ratio show the presence of mature gonads throughout the year. The presence of mature gonads in males of *H. albolabris* could be explained by the fact that these individuals are ready at any time of the year to receive females. Males of *H. albolabris* are therefore believed to be continuously reproducing. Regarding the correlation, our results indicate that there is a relationship between absolute fertility and body length and weight. In addition, the weight of frogs is positively correlated with the weight of the gonads and the liver.

4- Conclusion

This study on the reproduction of *Hylarana albolabris* in the Banco National Park allowed to know the life traits and the reproduction period of this species. In this species of frog, males are more abundant than females before. The reproduction is continuous for males and discontinuous for females. The months of August and September correspond to the period of sexual rest in the female *H. albolabris*. It would be important to undertake strict measures within the banco forest to avoid extinction of this species of frog in the banco national park.

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