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Aspects of the Biology of African Moony, *Monodactylus sebae* from Badagry Creek, Lagos, Nigeria.

Lawson Emmanuel O.* Akinde-Peters Oluwakemi and George Aderonke Omobolaji
Department of Fisheries, Faculty of Science, Lagos State University, P.O. Box 001 LASU Post office Box Lagos Nigeria.
*E-mail of the corresponding author: ollulawson66@yahoo.com

Abstract
The present study investigates some aspects of the biology of African Moony, *Monodactylus sebae* (Cuvier 1831) from Badagry Creek, Lagos, Nigeria. Diurnal fish collections were carried out from the creek between May 2012 and April 2013. Fish were caught with cast (mesh size: 12-22 mm) and gill nets (mesh size: 18-45 mm). Specimens were preserved in 10% formaldehyde. Data on total length (L) and body weight (W) measurements were obtained from standard measuring board and Sartorius weighing balance respectively. The length frequency distribution was determined from Petersen's method, the growth coefficient parameters 'a' and 'b' of length-weight relationship (LWR) was obtained from the equation: $W= aL^b$, and condition factor from the expression: $K= 100W/L^3$. Sexes were differentiated by macro and microscopically examinations of the gonads after making slit from the vent to operculum region of the fish. Ratio of numbers of males to females were determined from equation: $\chi^2 = (O-E)^2/E$. A total 267 individuals were from the Creek, the specimens measured from 56-163 (111.16±19.30) mm TL, and weighed between 5.6 and 151.7 (44.80±24.46)g body weight. The LWR was LogW = -1.444 + 2.918 LogL, K varied from 2.04-6.25 (3.00±0.56). Sex ratio was 1 male:1.17 female. The findings show that the species exhibited a negative allometric growth (b=2.918) in the creek, the value which was within the expected range of 2-4 recommended for normal growth of tropical fish. The K factor was higher in females than males while the sex ratio was insignificantly different (*P>0.05*) from the expected or theoretical 1male:1female ratio ($X^2_{cal}=1.66 < X^2_{tab(n=1,\ \alpha=0.05)}=3.84$).
Key words: Allometric growth, Condition factor, Length-weight relationship, Monodactylidae, Sexual differentiation.

1. Introduction

African moony, *Monodactylus sebae* is a member of the Family Monodactylidae (Cuvier 1829). It is a sub tropical fish found along the coasts, estuaries and mangroves of West Africa and commonly referred to as monos, moonyfishes or fingerfishes. The family contains six extant species in two genera *Monodactylus* and *Schuettea*. They are distributed along the coastlines of Africa, India, and Southern Asia, and Australia, sometimes entering rivers. Species of *Monodactylus* in particular commonly occur in estuaries. All are laterally compressed with an approximately diamond shaped body with long anal and dorsal fins. *M. sebae* can be taller than it is long, measuring up to 25 cm from the tip of the dorsal fin down to the tip of the anal fin. These long, scaly fins have given them the name 'finger fishes'.
It is economically important as food and commerce. Limited information is available on members of the family Monodactylidae.
Some reviews on fishes and fisheries of Badagry Creek include that of Solarin & Kusemiju (1991), Lawal-Are & Kusemiju (2000), Chukwu & Kuton (2001), Lawal-Are (2001), Ajado & Edokpayi (2003), Kumolu-Johnson (2004), Akintola (2007) and Soyinka *et al*., (2010).
Currently, there is dearth of documented information on African Moony, *Monodactylus sebae* in Badagry Creek. Therefore, a need for this study to provide scientific evaluation of some biological aspects of this species in Badagry Creek.

2. Materials and Methods

2.1. Study area: Badagry Creek (Figure 1) is located in Lagos, Nigeria. It lies within longitude 2°42'E and 3°42'E and stretches between latitude 6°22'N and 6°42'N, sharing boundary with Republic of Benin. It directly connects with Nigeria's 960 km of coastline bordering the Atlantic Ocean in the Gulf of Guinea, a maritime area of 46,500 km^2 with depth of up to 50 m and an Exclusive Economic Zone of 210,900 km^2. The creek is important for both artisanal and commercial fisheries, and as well as transportation, recreation and domestic purposes. It serves as a mean of livelihood for fishermen and women. The creek separates the mainland sedimentary basin from the Atlantic coastline. It exhibits relatively high species richness, which might possibly due to succession of species temporarily using the environment for feeding, spawning and shelter. Its high biological diversity of fish species shows the need for good management and conservation practices especially with the locals. The fish population from the creek exhibits relatively high diversity, species richness and a high

biological productivity than many other comparable water bodies in West Africa. Thus, the potential of Badagry Creek for great fishery resources cannot be over emphasized and the need for future aquaculture on this water body may not be out of place.

2.2. Field procedures: A total 267 specimens of *Monodactylus sebae* were collected from Badagry Creek between May 2012 and April 2013. They were collected using cast nets (mesh sizes: 12-22mm) for collecting fish from 0-5 m depths and gill nets (mesh size: 20- 45 mm) for specimens at depths exceeding 5 m. Diurnal collections from the gears were carried out through the services of motorized local artisanal fishermen. The specimens were preserved in 10% formaldehyde buffer solution.

2.3. Laboratory procedures: In the laboratory, the specimens were identified to species level following Olaosebikan & Raji (1998), Froese & Pauly (2013) and Wikipedia (2012). Data such total length (TL) and body weight (BW) measurements were obtained for individual fish. Total length was taken as measurement of horizontal distance between snout and tip of caudal fin. The standard measuring board was used to determine TL with fish snout facing left and Sartorous balance (model: 1106) for BW. TL was measured to nearest cm and BW nearest 0.01g.

2.4. Length Frequency Distribution: The length frequency distribution of the species was represented by percentage length frequency histograms at intervals of 1cm. Thus: 5, 6, 7…16 cm total length.

2.5. Length-Weight Relationship (LWR): The length-weight relationship (LWR) was derived from equation: $W=aL^b$. (LeCren, 1951; Jones, 2002)

The logarithm transformation of the equation was expressed as:

Log W= Loga+bLogL *L* (LeCren, 1951; Koutrakis & Tsikliras, 2003). This equation is sometimes known as the length-weight key (Biswas, 1993). Where, W=fish's body weight in grams, L=fish's total length in centimeters, a=intercept or constant and b=slope or length exponent and r=correlation coefficient. The "a" and "b" and "r" values were calculated from linear regression of the fish length and weight measurements. The determination of coefficient r was used as indicator of the quality of the linear regressions (Scherrer, 1984).

Growth was regarded as isometry when the value of b=3.0 and allometry when less or greater than 3. The student's t-tests were used to verify whether the parameter b were significantly different from the expected b=3.Thus,

$$t_s=(b-3)/s_b \text{ (Zar, 1984).}$$

Where t_s=student's t test, b=slope, s_b=standard error of the slope.

$$s_b = \sqrt{\frac{[(sW/sL)-b^2]}{(n-2)}}$$

Where sW=variance of body weight, sL= variance of total length, n=sample size.

2.6. Condition Factor (K): Condition factor calculated using the equation:

$$K = \frac{100W}{L^3} \text{ (Pauly, 1993)}$$

Where K = condition factor, W = body weight (in gram) and L = total length (in centimeter).

Calculations were made separately for male and female.

2.7. Sex ratio: The sex was determined by making incisions from the vent through the throat or chest of the fish to reveal gonads. The gonads were examined microscopically and by naked eyes for sex differentiation. All the discernable gonads were differentiated as males or females. The sex ratio was expressed in terms of the total numbers of males to females. The Chi-square (X^2) test of fitness was applied to determine a departure from the expected of theoretical 1male:1female ratio. Thus :

$$X^2 = \sum_{i=1}^{} \frac{(O - E)^2}{E}$$

Where, O = number observed and E = number expected.

2.8. Statistical analyses: The statistical analyses were considered at significance level of 5 % ($P<0.05$). The Statistical Package for Social Sciences (SPSS, version 16) and Microsoft Office Excel software were also implored in this study.

3.0. Results

3.1. Length Frequency Distribution: Figure 1 presents histograms of length frequency distribution in *M. sebae* from Badagry Creek. The specimens showed three (3) size group: small (5-8), medium (9-14) and large (15-16) cm TL constituting 11.99, 85.39 and 2.62 % of the total catch respectively. The histograms exhibited binomial distribution. Specimens that were 10 cm long constituted 22.85%, while those that were 5 cm constituted 0.38% of the fish population.

3.2. Length-Weight Relationships: The relationships between total length and body weight measurements of *M. sebae* from Badagry Creek are presented as follow:

i. All specimens: TL of all specimens ranged from 5.6-16.3 (11.12±1.93) cm and body weights from 5.6-151.7(44.80±24.46) g respectively. The log transformation of the LWR is presented in Figure 3 and expressed as:

LogW= -1.444 + 2.918 LogTL (n=267, r=0.911).

ii. Males: The TL measurements of males varied from 5.6-16.3(10.72±1.81) cm, weighing 5.6-131.1(39.73±20.77) g respectively. The log transformation of the length-weight relationship is expressed as:

LogW= -1.490 +2.960 LogTL (n=123, r=0.931) Figure 4.

iii. Females: Female specimens ranged from 6.6-16 (11.46±1.97) cm TL and 10.2-151.7 (49.20±26.48) g body weight. The log transformation of the length-weight relationship in presented Figure 5 and expressed as:

LogW= -1.388+2.868 LogL (n=144, r=0.889).

Negative allometric growth (b<3) existed among the fish. The growth exponential values of b = 2.918, 2.960 and 2.868 were exhibited by all specimens, males and females respectively. High correlation coefficient values of r =0.911, 0.931 and 0.889 were respectively shown by all specimens, males and females.

3.3. Condition factor (K): Table 1 presents Condition factor in *M. sebae* from Badagry Creek. The overall K values were 2.04-6.25(3.00±0.56). The K values for males ranged from 2.04-4.39 (2.97±0.44) and females from 2.08-6.25 (mean = 3.03±0.65).

3.4. Sex Ratios: Sex ratios in *M. sebae* from Badagry Creek are presented in Table 2. Of 267 specimens, 123 individuals were males while 144 females. These represented 46.07 and 53.93% of total catch respectively, giving the overall sex ratio of 1 male : 1.17 females. The sex ratio was in favour of female individuals. The overall Chi–square test revealed insignificant departure (*P>0.05*) from the expected or theoretical ratio of 1male to 1 female (X^2_{cal}=1.66< $X^2_{tab(n=1,\alpha=0.05}$ =3.84).

4.0. Discussion

In the present study the length frequency distribution showed three size groups (small, medium and large) of *M. sebae* in Badagry Creek. The group was dominated by medium size individuals or juveniles and few small and large/adult fish. Presence of few adult and large numbers of juveniles may be related to its migratory nature and suggest that the Creek serves as a veritable spawning, breeding or feeding ground for some fish.

The specimens measured between 5.6 and 16.3cm TL and weighed 5.6 and 151.7g BW respectively. The growth exponential values (b) obtained from the relationship $W = aL^b$ (2.918 for all specimens, 2.960 for males and 2.868 for females) showed negative allometry. These were within the expected range of 2-4 that was recommended by Bagenal & Tesch as adequate for tropical fish. It is necessary to know that growth is isometric when b = 3, values greater or less than 3 are allometric. The negative allometry (b<3) is an indication that the fish are lighter than their body weights while positive allometry (b>3) indicates that fish are heavier than their lengths. However isometric growth when b=3 indicates the fish is neither too heavy nor light for their sizes. The values of b from this study agreed with reviews of Lawson (2010) who documented b=2.806 (males) and 2.915 (females) in the mudskipper (*Periophthalmus papilio*) from Lagos lagoon, Lawson & Jimoh (2010) accounts of 2.968 (males) and 2.929 (females) in the grey mullet (*Mugil cephalus*) from Lagos lagoon, Lawson & Aguda (2010) reports of 2.27 in ten pounder (*Elops lacerta*) from Ologe lagoon. Lawson *et al*. (2010) recorded 2.48 (males) and 2.91(females) in sickle fin mullet (*Liza falcipinnis*) from Badagry Creek. In Giant African threadfin, *Polydactylus quadrifilis*, b=2.27(males) and 2.92 (females) were reported from Badagry creek (Lawson & Olagundoye, 2011).

Differences in parameters “b” of LWR may be attributed to several factors which include season, habitat, gonad maturity, sex, diet, stomach fullness, health, preservation techniques and annual differences in environmental conditions (Bagenal & Tesch 1978). In addition, growth increment, differences in age, stage of maturity, food, temperature, salinity and seasonality can also affect the value of b for some species (Weatherley & Gill, 1987). Age, maturity and sex (Hossain, 2010); feeding, reproduction and fishing activities (Bayhan *et al*., 2008); environmental changes, individual metabolism, sexual maturity and age (Franco-Lopez *et al*., 2010) are also some factors that affect values of b.

High correlation coefficient (r =0.911, 0.931 and 0.889 exhibited by all specimens, males and females respectively) are indications of increase in total length with corresponding increase in body weight. These are in agreement with earlier studies of Fagade & Olaniyan (1972), Fagade (1983), Laléyé (2006), Ayoade & Ikulala (2007) and Lawson & Aguda (2010).

The present study indicates higher value of K in females (between 2.04-4.39 (2.97±0.44) for males and 2.08-6.25(3.03±0.65) for females). This parameter may vary from species to species and change according to morphology, sex, age, reproductive state associated with gonadic maturity stages variations (Frederick &

Thomas, 1987; Wootton, 1998). Variations may be indicative of food abundance, adaptation to environment and gonad development of the fish (King, 1995). Low values of K indicate that the fish are light for their length which might be due to low feeding intensity and spawning activity. High values are assumption of high feeding intensity and gradual increase in accumulated fat that suggests preparation for a new reproductive period (Braga & Gennari-Filho, 1990).

The overall sex ratio of 1male:1.17 females in *M sebae* shows the male fish were fewer than the females i.e females as dominant sex. This ratio was not significantly different (*P>0.05*) from the expected and theoretical ratio of 1male:1female. The variation is also an indication that the sex was in favour of females. The spawning activities may contribute to male to female ratio. Sex ratio in favour of female is an indication of reproductive success of fish. This was strongly supported by Lawson *et al,* (2010) who reported a sex ratio of 1 male: 1.13 females in *Liza falcipinnis* from Badagry creek. Sex ratio could be influenced by the availability of food (Nikolsky, 1963). When food is abundant, females predominate with the situation inverting in regions where food is limited.

5.0. Conclusion

Conclusively, length frequency distribution of *M. sebae* in Badagry creek was in favour of medium size, the species population was mostly juvenile. Negative allometric growth was also exhibited in the creek. However, the condition facor and sex ratio were in favour of females. Therefore, the present study examines some biological aspects of African Moony, *Monodactylus sebae* and provides first documented information in respect to its length frequency distribution, length-weight relationship, condition factor and sex ratio in Badagry Creek. The information further provide useful tool for sampling programs, to estimate growth rates and other components of fish stock assessment.

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Figure 1: Map of Lagos State, Nigeria showing Badagry Creek

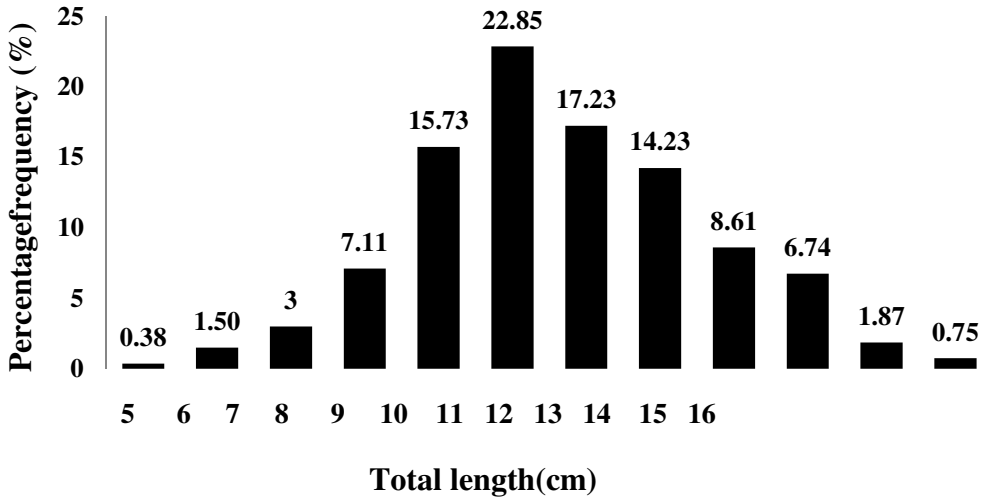

Figure 2: Histograms of length frequency distribution in *Monodactylus sebae* from Badagry Creek, Lagos.

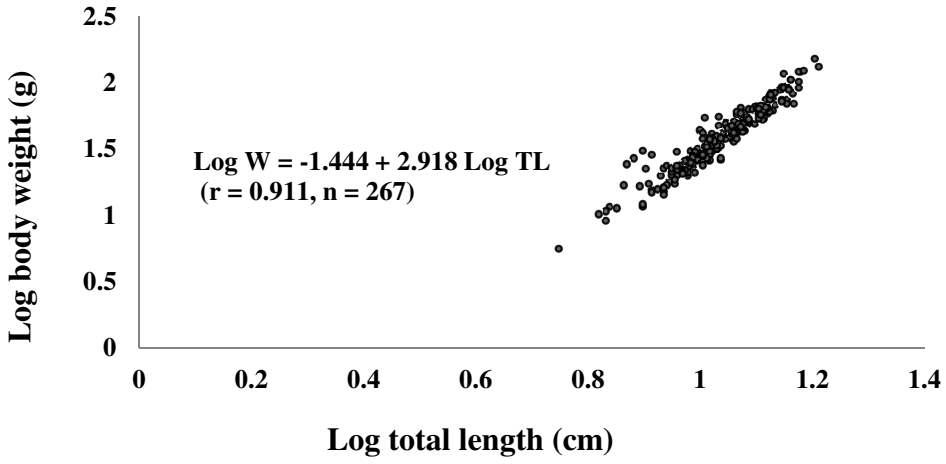

Figure 3. Log total length-Log body weight relationship in *Monodactylus sebae* (all specimens) from Badagry Creek, Lagos.

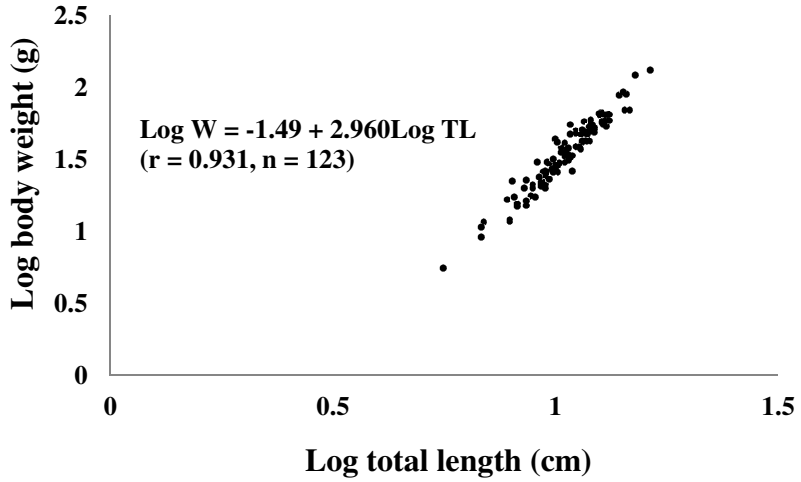

Figure 4. Log total length- Log body weight relationship in males *Monodactylus sebae* from Badagry Creek, Lagos.

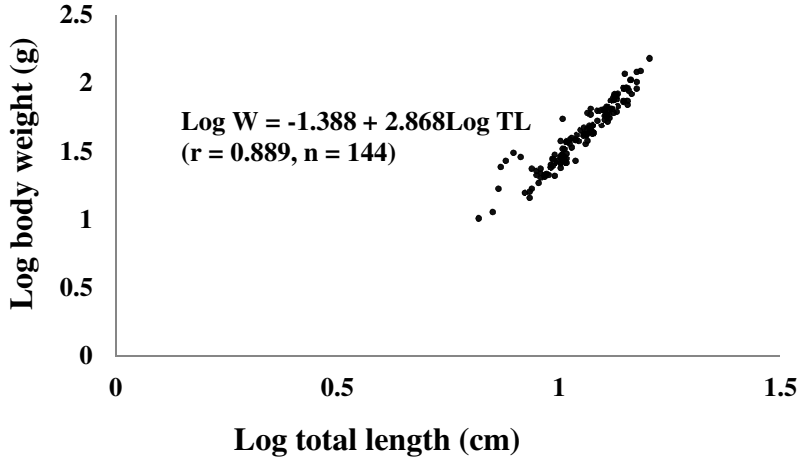

Figure 5. Log total length- Log body weight relationship in females *Monodactylus sebae* from Badagry Creek Lagos.

Table 1: Condition factor (K) in *Monodactylus sebae* from Badagry Creek.

Sex	Sample size	Range (cm)		Mean±SD
		Minimum	Maximum	
All specimens	267	2.04	6.25	3.00±0.56
Male	123	2.04	4.39	2.97±0.44
Female	144	2.08	6.25	3.03±0.65

±SD=plus/minus standard deviation

Table 2: Sex ratios in *Monodactylus sebae* from Badagry Creek, Lagos, Nigeria.

Size interval (cm)	Number of males	Number of females	Sex ratio Male : Female	Chi- Square test (X^2)
5.0 – 5.9	1	0	1 : 0	1.0
6.0 – 6.9	3	1	1 : 0.33	1.0
7.0 – 7.9	3	5	1 : 0.67	0.5
8.0 – 8.9	11	8	1 : 0.73	0.48
9.0 – 9.9	24	18	1 : 0.75	0.86
10.0 – 10.9	30	31	1 : 1.03	0.02
11.0 – 11.9	20	26	1 : 1.3	0.78
12.0 – 12.9	20	18	1 : 0.9	0.1
13.0 – 13.9	5	18	1 : 3.6	7.34
14.0 – 14.9	4	14	1 : 3.5	5.56
15.0 – 15.9	1	4	1 : 4	1.8
16.0 – 16.9	1	1	1 : 1	0.0
Total	123	144	1 : 17	1.66