Trop J Nat Prod Res, July 2025; 9(7): 3398 - 3403 **ISSN 2616-0684 (Print)**
ISSN 2616-0692 (Electronic)

Tropical Journal of Natural Product Research

Available online at https://www.tjnpr.org

Original Research Article

Length - Weight Relationship and Condition Factor of Daisy Stingray, *Fontitrygon margarita* off Lagos Coastal Waters, Nigeria

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ARTICLE INFO

Article history:
Received 06 May 2025
Revised 06 June 2025
Accepted 18 June 2025
Published online 01 August 2025

ABSTRACT

The daisy stingray, *Fontitrygon margarita*, is a West African coastal species declining due to overfishing and habitat loss. A study of the length-weight relationship (LWR) and condition factor of the daisy stingray, *Fontitrygon margarita*, was conducted using data from six landing sites in the coastal areas of Lagos State, Nigeria. A total of 1012 specimens of *Fontitrygon margarita* used for this study were collected from the landing sites of local fishermen (monthly) from February 2023 to July 2024. The disc width of each specimen was measured to the nearest centimeter using a tape, and the weight was measured to the nearest gram on a digital balance. The linear regression equation for females, males, and combined sexes using log-transformed disc width-weight relationship revealed a positive allometric growth (b>3) for all the sexes. The condition factor analysis of *F. margarita* ranged from 3.09 to 4.47 for the female, 3.24 to 3.97 for the male, and 3.20 to 4.47 for the combined sexes. The highest k values were observed in larger size classes 27.5-29.4, 31.5-33.4 for the female, male, and combined sexes, respectively. The lowest K value (3.09) was recorded in size class 17.5-19.4 for the female. The increase in weight with disk width follows a positive allometric growth pattern, with larger individuals exhibiting superior condition, possibly due to enhanced feeding efficiency and reproductive maturity. These findings provide baseline data for stock assessment, conservation, and development of sustainable management strategies for *F. margarita* in Nigerian coastal ecosystems.

Keywords: Length-weight Relationship, Condition Factor, *Fontitrygon margarita*, Lagos Coastal Waters

Introduction

Stingray plays a vital role in the coastal waters of West Africa. They are commonly encountered in both artisanal and industrial fisheries as either incidental by-catch or targeted catch. Fishing gears such as demersal trawls, bottom-set longlines, gillnets, and trammel nets frequently capture stingrays, reflecting their wide distribution and availability across different depths and habitats. Their geographical range spans from the eastern central to the Southeastern Atlantic Ocean, from Mauritania down to Angola.[1,2] Among these species, the daisy stingray *Fontitrygon margarita* belonging to the order Myliobatiformes and the family Dasyatidae, is of particular interest. It is a demersal species endemic to the marine and brackish environment of West African coastal waters, including the Nigerian coastline. In recent years, however, *F. margarita* has become increasingly uncommon in landings across the Eastern Central Atlantic region. According to [3,] the species is declining in abundance, likely due to intensive fishing pressure, habitat degradation, and other anthropogenic activities. Hence, *F. margarita* has been classified as endangered by the International Union for Conservation of Nature (IUCN), [4,] signalling a pressing need for targeted research and conservation strategies.

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Citation: Igwegbe AN, Soyinka OO, Sifau MO. Length-weight relationship and condition factor of daisy stingray, *Fontitrygon margarita* off Lagos coastal waters, Nigeria. Trop J Nat Prod Res. 2025; 9(7): 3398 – 3403 https://doi.org/10.26538/tjnpr/v9i7.68

Official Journal of Natural Product Research Group, Faculty of Pharmacy, University of Benin, Benin City, Nigeria

Despite its ecological significance, there remain substantial gaps in scientific knowledge of the biology, population dynamics, and growth patterns of *F. margarita* off Lagos coastal waters, Nigeria. Length-weight relationship is a vital tool in providing baseline data for the sustainability of overexploited elasmobranch fishes.[5] Information on length and weight is essential for the assessment of growth, length, and age of fish. Studying the length-weight relationship (LWR) is essential for estimating the state of wellness and growth characteristics of organisms. The condition factor evaluates the state of health of a fish, and it assumes that bigger fish are well adapted to their habitat.[6] The study, therefore, assessed the length-weight relationship and condition factors of *Fontitrygon margarita* in Lagos coastal waters, Nigeria. The findings will provide much-needed data to inform rational exploitation strategies and support the conservation of this vulnerable stingray fish.

Materials and Methods

Description of Study Area

The study began in Ibeju Lekki Local Government Area and extended to Apapa Local Government of Lagos State, Nigeria. It is located between longitudes $6^0$26'N, $6^0$27'N and latitudes $3^0$23'E to $3^0$58'N. The climate is made up of rainforest, mangrove, freshwater swamp, a long duration of rainy season (April to October), and a short dry season (November to March). The most insulation received is modified by absorption, selective scattering, cloud cover, rainfall, and harmattan haze. The mean daily temperature is about 28 °C throughout the year. The vegetation is made up of mangrove. The most common vegetation on the southern edges close to the sea is coconut (*Cocos nucifera*), giant reeds (*Paspalum vaginatum*), and *Spore bolus virginicus*

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

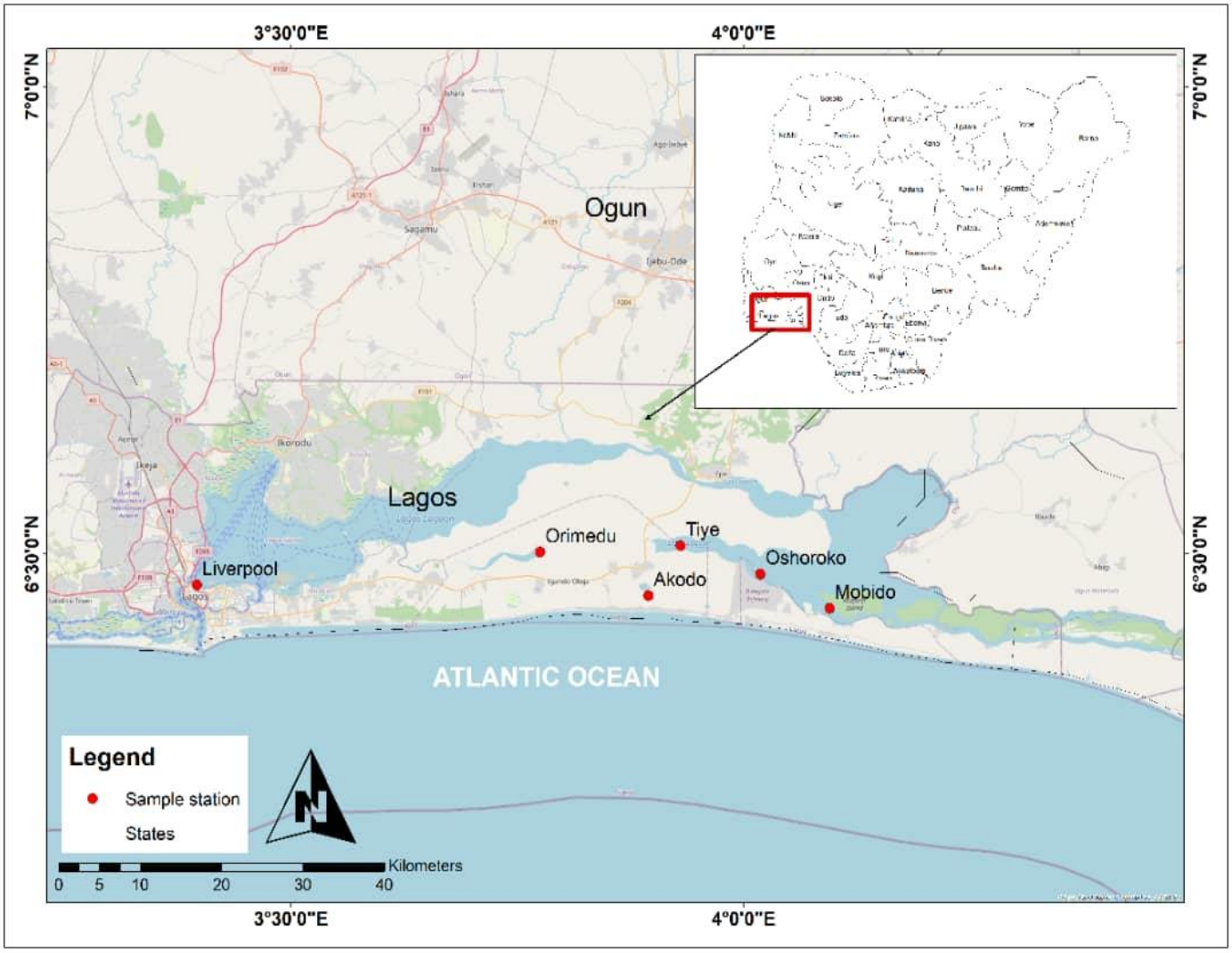

Figure 1: Map of Fish landing sites off Lagos coastal waters, Nigeria.

Sample Collection

One thousand and twelve samples of *Fontitrygon margarita* used for this study were obtained from six landing sites of local fishermen (monthly) from February 2023 to July 2024. Selection of samples was done randomly. *F. margarita* were immediately preserved in an ice chest and transported to a deep freezer in the laboratory. Individual samples were grouped into male or female in the laboratory. Measurement of each disc width was carried out to the nearest centimeter with a tape, and the weight was measured to the nearest gram on a digital balance.[7] Disc width weight relationships were estimated using the equation log W = log a + b log DW, where W is the weight, DW is the disk width, a is the intercept, and b is the slope. Condition factor (k) was calculated based on size and sex of the fish using the formula reported by [8] as follows: K 100w/DW^3, where k = Condition factor, W fish weight in grams, and DW = Disc width in centimeter.

Statistical analysis

Data analysis was carried out using descriptive statistics and graphical representations to identify patterns and trends. Microsoft Excel (2019) and SPSS (Version 28) were employed for data analysis.

Ethical Standards

This research was done under the supervision and guidance of the Health Research Ethics Committee of the College of Medicine, University of Lagos, Nigeria Registration number: CMUL/ACUREC/08/23/1255

Results and Discussion

Log Disk Width / Log Weight Distribution

The relationship between disk width and weight of *F. margarita*. The log disk width and log weight relationships are below:

Female: Log TW = -1.9669 + 3.3828 Log DW----------Equation 1
n = 570, R^2 = 0.9536, r = 0.97652
Male: Log TW = -1.6363 + 3.1368 Log DW----------Equation 2
n = 442, R^2 = 0.8826, r = 0.9395
Combined sexes: Log TW = -1.8884 + 3.3243 Log DW-----Equation 3
n = 1012, R^2 = 0.9367, r = 0.9679

b > 3 = positive allometric growth (the species grow faster in weight than in Disc width)

F. margarita showed a positive allometric growth pattern for all sexes, indicating that weight increases at a proportionally faster rate than disk width. The functional regression b value ranges from 3.1368 to 3.3828. The high coefficient of determination (R^2) signified a strong correlation between these variables, implying that disk width is a reliable predictor of weight in this species. This growth pattern aligns with a previous study in the central Mediterranean Sea by [9] who reported a b value of 3.303, 3.229, and 3.262, respectively, for the male, female, and combined sexes of *Dasyatis Pastinaca*. Similar observation was made in Arafura Sea, Indonesia, by [10] who reported b values of 3.436, 3.462, and 3.458 for *Neotrygon annotate*, *Himantura uarnak* and *Pateobatis jenkinsi* respectively. However, this result contradicts the report of [11]

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

whose study showed that the b value for *Fontitrygon garouaensis* studied from the Lokoja section of the river Niger were - 3.7826, 1.3639 and 1.3479 for both sexes and the combination respectively. Several factors, such as temperature, sample size, presence or absence of food, habitat suitability, and gonadal maturity,[12] can cause variation in the value of b.

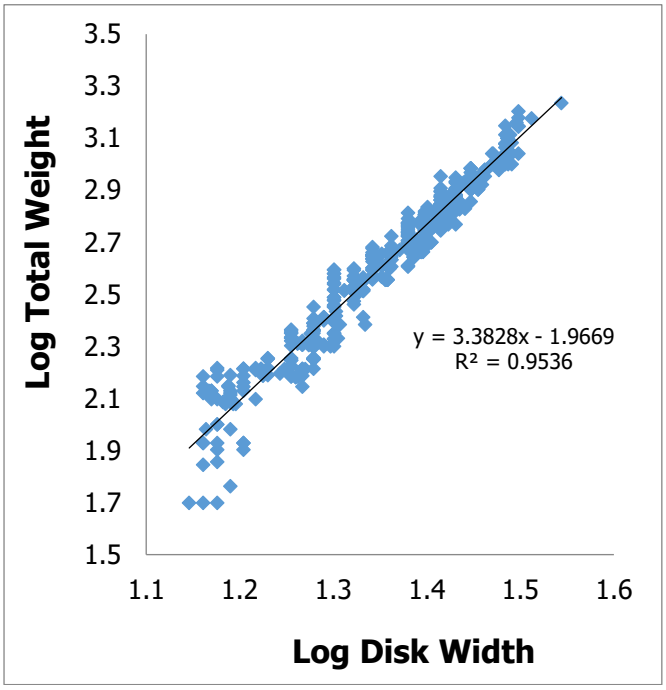

Figure 2: Log Disk Width – Log Weight Relationship of the female Daisy Stingray, *Fontitrygon margarita* off Lagos Coastal Waters, Nigeria (February, 2023 – July, 2024)

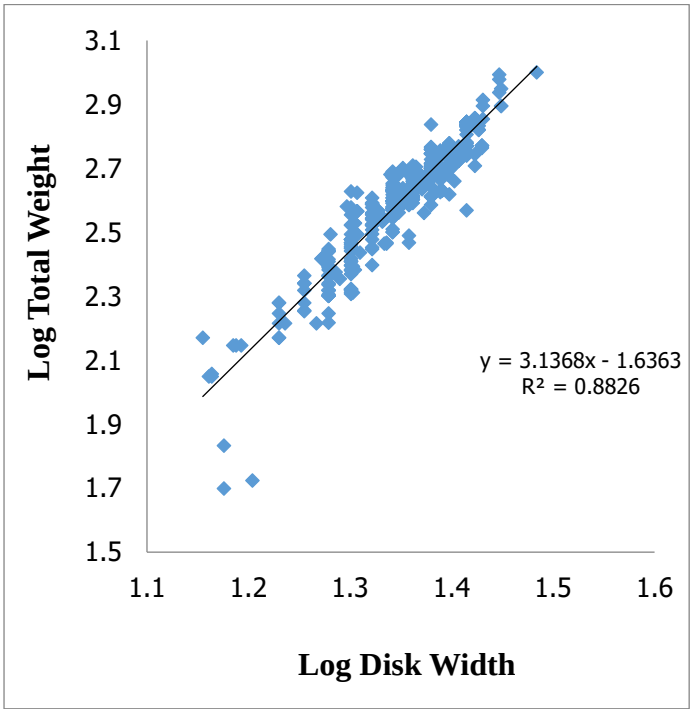

Figure 3: Log Disk Width – Log Weight Relationship of the male Daisy Stingray, *Fontitrygon margarita* off Lagos Coastal Waters, Nigeria (February, 2023 – July, 2024)

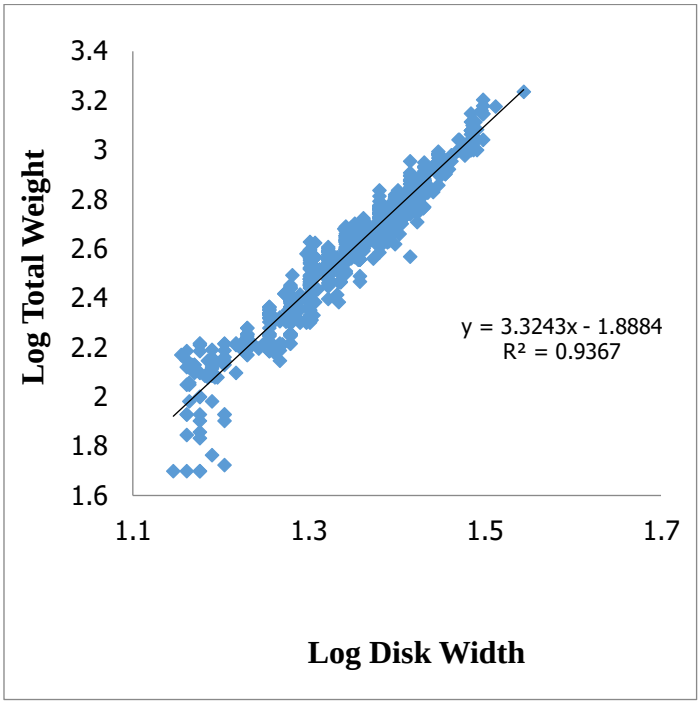

Figure 4: Log Disk Width – Log Weight Relationship of the combined sexes of Daisy Stingray, *Fontitrygon margarita* off Lagos Coastal Waters, Nigeria (February, 2023 – July, 2024)

Condition factor (K) of Fontitrygon margarita

The condition factor analysis of female *F. margarita* from Lagos Coastal Waters reveals key insights into their growth and well-being (Table 1). The female condition factor value is from 3.09 to 4.47, with higher values observed in larger size classes, indicating better physiological status and energy reserves in mature individuals. Similarly, the relative condition factor (K_n) remained relatively stable, suggesting consistent growth conditions and habitat suitability. The lowest K_F (3.09) was recorded in the 17.5–19.4 cm class in the female, potentially reflecting growth constraints or resource allocation differences. The value for the male condition factor (K_F) is 3.24 to 3.97 (Table 2), with the highest values observed in larger specimens (27.5–29.4 cm), indicating better somatic condition in mature individuals. The relative condition factor (K_n) remained relatively stable, suggesting overall good health and growth conditions across size classes.In terms of combined sex, the condition factors (K_F and K_n) of *F. margarita* off Lagos Coastal Waters indicated variations in the health and well-being of individuals across different size classes (Table 3). The Fulton condition factor (K_F) ranged from 3.20 to 4.47, with higher values observed in larger individuals, particularly those within the 31.5–33.4 cm class (K_F = 4.47), suggesting better body condition and possible energy accumulation for reproduction. The relative condition factor (K_n) remained relatively stable, (0.08–0.10), indicating a consistent physiological state across size classes. *F. margarita* exhibited relatively high condition factor values in all sexes, suggesting that environmental factors in Lagos coastal waters provide favorable conditions for the species, particularly in later developmental stages, which may have implications for fisheries management and conservation strategies. [13] reported condition factors of 3.86 for *Schilbe mystus* from Ogun state coastal estuary which is similar to the result of this study. [14] also reported a high K-value for *M. cephalus* in Lagos Lagoon, which is in agreement with this study. The condition factor, k, of fish varies due to factors such as seasonality, food availability, growth, maturity, and stomach fullness.

ISSN 2616-0684 (Print)
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Table 1: Condition Factors of Female Daisy Stingray, *Fontitrygon margarita* off Lagos Coastal Waters, Nigeria (February, 2023 – July, 2024)

Class (cm)	Number of Organism	Disk Width (cm)	Weight (g)	Fulton condition factor ($K_{F)}$	Relative condition factor (Kn)
13.5-15.4	27	14.83	111.35	3.41	0.09
15.5-17.4	29	16.11	137.03	3.28	0.08
17.5-19.4	68	18.58	198.5	3.09	0.07
19.5-21.4	62	20.36	302.82	3.59	0.08
21.5-23.4	63	22.34	407.46	3.65	0.08
23.5-25.4	96	24.63	545.7	3.65	0.08
25.5-27.4	136	26.3	690.63	3.80	0.08
27.5-29.4	50	28.15	861.23	3.86	0.08
29.5-31.4	31	30.4	1128	4.02	0.08
31.5-33.4	7	31.64	1415.86	4.47	0.09
33.5-35.4	1	35	1720	4.01	0.07

Table 2: Condition Factors of Male Daisy Stingray, *Fontitrygon margarita* off Lagos Coastal Waters, Nigeria (February, 2023 – July, 2024)

Class (cm)	Number of Organism	Disk Width (cm)	Weight (g)	Fulton condition factor ($K_{F)}$	Relative condition factor (Kn)
13.5-15.4	8	14.83	110.5	3.39	0.12
15.5-17.4	9	16.76	152.56	3.24	0.11
17.5-19.4	40	18.78	225.13	3.40	0.12
19.5-21.4	73	20.4	308.53	3.63	0.13
21.5-23.4	130	22.53	422.34	3.69	0.13
23.5-25.4	125	24.55	520.15	3.52	0.12
25.5-27.4	50	26.14	629.74	3.53	0.12
27.5-29.4	6	28.05	876.67	3.97	0.13
29.5-31.4	1	30.5	1000	3.52	0.11

Table 3: Condition Factors of the Daisy Stingray, *Fontitrygon margarita* (Combined sexes) off Lagos Coastal Waters, Nigeria (February, 2023 – July, 2024)

Class (cm)	Number of Organism	Disk Width (cm)	Weight (g)	Fulton condition factor ($K_{F)}$	Relative condition factor (Kn)
13.5-15.4	35	14.83	111.15	3.41	0.10
15.5-17.4	38	16.27	140.71	3.27	0.09
17.5-19.4	108	18.67	208.36	3.20	0.08

19.5-21.4	135	20.38	306.3	3.62	0.09
21.5-23.4	193	22.47	417.48	3.68	0.09
23.5-25.4	221	24.59	530.76	3.57	0.09
25.5-27.4	186	26.26	674.26	3.72	0.09
27.5-29.4	56	28.14	862.88	3.87	0.09
29.5-31.4	32	30.40	1124	4.00	0.09
31.5-33.4	7	31.64	1415.86	4.47	0.10
33.5-35.4	1	35.00	1720	4.01	0.09

Conclusion

This study provides valuable insights into the disc width weight relationship and condition factor of the daisy Stingray (*Fontitrygon margarita*) inhabiting the Lagos coastal waters. The log-transformed relationship between disk width and weight indicated a strong positive correlation, where weight increases more rapidly than disk width. The condition factors suggest overall good health and growth conditions across all size classes. The findings contribute to the biological understanding of *F. margarita*, offering baseline data essential for effective species management, conservation, and sustainable exploitation. Further research should focus on reproductive biology and environmental influences affecting population structure and growth dynamics.

Conflict of Interest

Authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

Acknowledgements

The unrelenting effort of Professor O.O. SOYINKA of the Marine Sciences department, University of Lagos during the conduct of this research is greatly appreciated.

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