ISSN 1996-3343

Asian Journal of Applied Sciences

http://knowledgiascientific.com

Knowledgia SCIENTIFIC
A Place to Publish Outstanding Research

OPEN ACCESS

Asian Journal of Applied Sciences

ISSN 1996-3343
DOI: 10.3923/ajaps.2018.135.139

Research Article
Biometric Relationships of Pratiqueira *Mugil curema* Valenciennes, 1836 Captured on Pesqueiro Beach, Marajó Island, Pará, Brazil

Jean Michel Corrêa

Institute of Marine Sciences, Federal University of Ceará, 60165-081, Fortaleza, Brazil

Abstract

Background and Objective: The relationships among the morphometric measurements of fish provide valuable information about the speciation phenomena induced by abiotic and biotic factors. Considering the importance of *Mugil curema* as a fishery resource and the scarcity of studies about Pratiqueira at the marajoara region, four experimental trawls were performed on Pesqueiro Beach in June 2008 aiming to determine the biometric relationships of Pratiqueira. **Materials and Methods:** A trawl net was used with the following specifications: length 48.12 m, height 2.37 m, mesh 25 mm, distance between opposite nodes 50 mm, distance between buoys 94 cm and distance between the sinkers 94 cm. **Results:** A total of seven specimens of *Mugil curema* were captured. The linear regression analysis revealed that both the height-total length ($r^2 = 0.8109$, $p<0.05$) and fork length-total length ($r^2 = 0.7886$, $p<0.05$) relationships showed negative allometry, with values b = 0.33 and 0.70, respectively. **Conclusion:** The present study revealed that the species in this study developed some structure in its body to develop a determined function.

Key words: Linear regression, *Mugil curema*, allometry, marajoara region, trawl net, height-total length

Citation: Jean Michel Corrêa, 2018. Biometric relationships of pratiqueira *Mugil curema* valenciennes, 1836 captured on Pesqueiro beach, Marajó island, pará, Brazil. Asian J. Applied Sci., 11: 135-139.

Corresponding Author: Jean Michel Corrêa, Institute of Marine Sciences, Federal University of Ceará, Post Code 60165-081, Fortaleza, Brazil

Competing Interest: The author have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The Marajó archipelago has strategic and privileged position, being the largest fluvial-marine archipelago of the world. It is located near the equator, which runs almost parallel to the north. Its geographic coordinates are between the parallel 0°10'S-1°48'S and longitudes 48°22'W-50°49'W. In its northwestern portion, receives fresh and muddy water from the mouth of the Amazon River while receives northward the marine waters of the Atlantic Ocean. It receives northeast fresh and muddy water from Marajó Bay and receives southern fresh and muddy water from Pará River[1,2].

The fishing is one of the most important and traditional activities of the island, given its importance in the food requirements of populations and in the economic activity that represents[3]. The mullets are a group of fishes of economic importance[4] in the Marajó Island.

Pratiqueira or mullet, *Mugil curema* lives in tropical and subtropical waters of the Atlantic and Pacific Oceans[5] with few populations in African waters[6,7] and occur throughout the Brazilian coast[8]. It is a pelagic species that lives in the water column or in the surface, being that the juveniles occur in the estuary[9] and even in freshwater[10], inhabit quiet, sheltered and food-rich environment, until their gonads begin maturing. Their spawning occurs in offshore, but an estuarine phase is mandatory for juveniles, which follows the reproductive migration period to the sea[11].

In fish, size is more biologically relevant than age, mainly because several ecological and physiological factors are more size-dependent than age-dependent. Consequently, variability in size has important implications for diverse aspects of fisheries science[12]. The knowledge of growth parameters such as length is pivotal for studies on population dynamics[13].

The relationships among the morphometric measurements of fish provide valuable information about the speciation phenomena induced by abiotic and biotic factors[14]. Moreover, it has been useful for separating species, populations and races, being of vital importance to identify the study population in order to understand its dynamics[15].

The relationship between the same unit of measure is isometric when the regression coefficient is equal to 1.0. When the values are statistically higher or lower than 1.0, indicating an allometric relationship, i.e., the distinct growth of a feature in relation to another[16]. This coefficient indicates any changes in shape over ontogeny[17].

The correlation or degree of association among the characteristics is a very important parameter in the evaluation of a biometric feature[18]. The usage of regression analysis to explain the biometric relationships are found to be most suitable[19] being necessary for the description of species[20].

Considering the importance of *Mugil curema* as a fishery resource and due to little information about the biology of this species in the marajoara region, this survey intended to determine the biometric relationships of Pratiqueira caught by trawl net on Pesqueiro beach.

MATERIALS AND METHODS

Study area: The Pesqueiro beach was located 8 km east far from the town of Soure, situated in the Marine Extractive Reserve of Soure. This area was dominated by mangroves and sand dunes that spread throughout most of its length. During winter, the estuarine volume surpasses the amount of sea water leaving little saline the beach. In the summer the force changes and the beach becomes salted due to influence of Atlantic Ocean (Fig. 1).

Four experimental trawls with a total time of 2 h 33 min were carried out on Pesqueiro beach on Wednesday, 11 June 2008. Specification of trawls as well as their geographic coordinates were specified in Table 1.

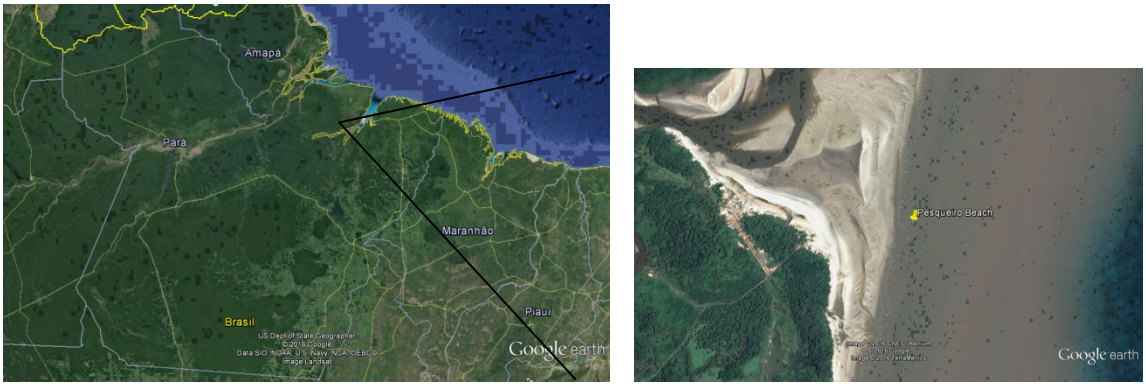

Fig. 1: Study area
Source: Google Earth (2008)

Table 1: Specification of trawls and their geographic coordinates

Start time	Final time	Initial coordinates	Final coordinates
15:19	15:46	00°39.576'S and 48°28.702'W	00°39.366'S E 48°28.665'W
16:00	16:19	00°39.327'S and 48°28.649'W	00°39.204'S E 48°28.605'W
16:31	17:02	00°39.190'S and 48°28.592'W	00°39.005'S E 48°28.542'W
17:18	17:52	00°39.004'S and 48°28.556'W	00°39.209'S E 48°28.654'W

Experimental design: It was used in each trawl as fishing gear a trawl net with the following specifications: length 48.12 m, height 2.37 m, mesh 25 mm, distance between opposite nodes 50 mm, distance between buoys 94 cm and distance between sinkers 94 cm. The trawls were made at ebb tide, being the last performed at flood tide.

In the biometry were collected height measurements (H) that included the dorsal and ventral contour of body on the direction of the pectoral fin, total length (TL), which runs from snout to the caudal tip and fork length (FL) comprising the snout tip and the caudal fork. The instrument used for these measures was a 5 m measuring tape.

Data analysis: The biometric data underwent to descriptive statistic and to a simple linear regression analysis with significance level of 5%, according to the following equations:

$$H = a + bTL \quad (1)$$

and

$$FL = a + bTL \quad (2)$$

where, H is body height (cm), FL is fork length (cm), TL is total length (cm), a is regression constant and b is regression coefficient.

Statistical analysis was performed using the programs BioEstat 5.0[21] and Microsoft Excel for Windows, version 2007.

RESULTS AND DISCUSSION

Overall seven fishes were caught in trawls, being two on the first, one on the second and four on the third trawl. The largest individual caught showed 29 cm TL while the smallest specimen had 25 cm total length (TL). Data in Table 2 showed the statistical values of the biometric parameters in this work.

The maximum total length found in this study agreed with the value found by Rocha *et al.*[22]. The authors analyzed the growth frequency in length of *Mugil curema* and found that the largest individual presented 28 cm TL.

It was recorded in this survey the value of mean total length 26.73 cm, which did not coincide with the findings of Szpilman[8]. The author report that the average body size of this species is 30 cm. On the other hand, Oliveira *et al.*[23] found the value of mean total length 24.9 cm in coastal waters of Rio Grande do Norte State, Brazil. It is important to highlight that the value found in the present survey referred to populations of estuarine environment, which was consistent with the use of the estuary both by adults and juveniles in the fattening stage, therefore, smaller sizes than the general average of the species. Thereby, Pesqueiro beach offers adequate conditions for the development and survival of juveniles.

Table 2: Descriptive statistic of biometric parameters

Parameters	Mean±SE	Median	Variance	Minimum	Maximum
Height	5.93±0.58	6.00	0.33	5.30	7.00
TL	26.73±1.58	26.20	2.49	25.00	29.00
FL	25.73±1.26	26.00	1.58	24.00	28.00

TL: Total length and FL: Fork length

The most likely fact that the average body size shown here be lower than that recorded in the literature may also be related to a beginning of overexploitation of this species in the region or other environmental factors, which would need a management plan for this commercial species. In general, any of the assumptions made require more detailed studies.

The linear regression analysis revealed significant differences between the parameters ($p = 0.0064$) showing that the height-total length relationship presented negative allometry, with value $b = 0.33$. In this study, the value of r^2 explained 81.09% of the height increased with the variation in the TL (Fig. 2).

The fork length-total length relationship showed statistically significant difference ($p = 0.0082$), showing negative allometric growth, with value $b = 0.70$, being the value of r^2 explaining 78.86% the increase in the FL with the variation of TL (Fig. 3).

An accurate interpretation of the allometry coefficients obtained allowed to say that for every 1% increase in total length, there was an increase of 0.3291% in height and increase of 0.7081% in the fork length.

It was found that both biometric relationships showed negative allometry. Indeed, this result revealed that the both height and fork length grew more slowly than the total length. This fact was confirmed by Fonteles-Filho[24], which proposed that both negative and positive allometry could mean the highlight of a body part to perform a determined function.

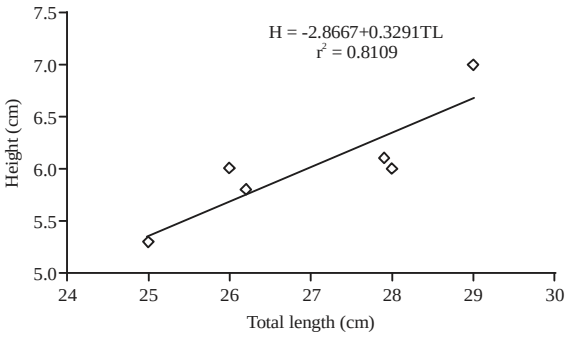

Fig. 2: Height-total length relationship of *Mugil curema* caught on Pesqueiro beach

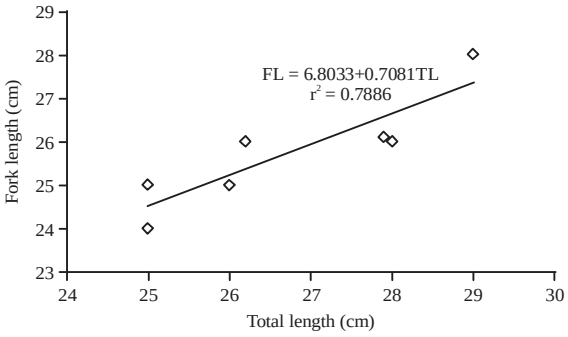

Fig. 3: Fork length-total length relationship of *Mugil curema* caught on Pesqueiro beach

The value of the allometry coefficient found in the fork length-total length relationship in this survey was in agreement with Araujo and Silva[25]. The authors studied the fork-length length relationship of fish species captured in the Vaza Barris River estuary, Sergipe State, Brazil and reported negative allometric growth for *Mugil curema* (b = 0.77).

In contrast to the present study, Ibanez-Aguirre *et al*.[15] identified the isometric growth on population of *Mugil curema* located in the Gulf of Mexico. This fact was due to the length and height parameters in fishes to be influenced by the reproductive period, food availability and set of abiotic factors of each environment, which may affect the estimated values of biometric relationships and consequently the change in regression coefficient.

Verreth[26] declared that the allometric growth of fish accurately reflected the change in the functional requirement related to changes in environmental hydrodynamics. This implied the early development of head, eyes, brain, gill arches as well as the recruitment and growth of muscle fibers to food consumption. Nevertheless, in the present survey adult Pratiqueira showed a late growth. The most likely cause can be the local environmental conditions which not require major functionality of the morphometric structures, providing thereby a smaller gain in height and fork length.

CONCLUSION

The present study reported that both the height-total length and fork length-total length relationship showed negative allometric growth for individuals of *Mugil curema*, revealed that the species in this study developed some structure in its body to develop a determined function.

SIGNIFICANCE STATEMENT

The present study reported for the first time the biometric relationships about specimens of *Mugil curema* on Pesqueiro Beach, Marajó Island. The importance of these findings is not restricted to knowledge of the biology of fishes, but has its practical and fundamental side to show the possibility of further studies in other areas of this region in order to determine parameters that allow an accurate study of the species.

REFERENCES

1. Cruz, M.E.M., 1987. Marajo, Essa Imensidao de Ilha [Marajo, this Immensity of Island]. 1st Edn., Parma Editora Ltd., Sao Paulo, Pages: 111.
2. Nascimento, F.P., T.C.S. Avila-Pires, I.N.F. Santos and A.C.M. Lima, 1991. Reptiles of Marajo and Mexiana, Para, Brazil. Literature review and new records. Bol. Mus. Para. Emilio Goeldi Zool. Ser., 7: 25-41.
3. Correa, J.M. and J.M. Penafort, 2010. Determination of ichthyofauna captured by trawl net on pesqueiro beach, marajo Island, Para, Brazil. Encicl. Biosfera, 6: 1-7.
4. Gonzaga, J., A. Anderson, N. Richardson, J. Nocillado and A. Elizur, 2010. Cloning of IGF-I, IGF-II and IGF-IR cDNAs in mullet (*Mugil cephalus*) and grouper (*Epinephelus coioides*): Molecular markers for egg quality in marine fish. Asian J. Biol. Sci., 3: 55-67.
5. Cabral-Solis, E., E. Espino-Barr, M. Gallardo-Cabello and A. Ibanez-Aguirre, 2007. Fishing impact on *Mugil curema* Stock of multi-species gill net fishery in a tropical lagoon, Colima, Mexico. J. Fish. Aquatic Sci., 2: 235-242.
6. Aguirre, A.L.I. and M. Gallardo-Cabello, 2004. Reproduction of *Mugil cephalus* and *M. curema* (Pisces: Mugilidae) from a coastal lagoon in the Gulf of Mexico. Bull. Mar. Sci., 75: 37-49.
7. Heras, S., M. Roldan and M. Gonzalez-Castro, 2009. Molecular phylogeny of mugilidae fishes revised. Rev. Fish Biol. Fish., 19: 217-231.

8. Szpilman, M., 2000. Peixes Marinhos do Brasil: Guia Pratico de Identificacao [Marine Fish from Brazil: A Practical Guide to Identification]. Mauad Editora Ltd., Rio de Janeiro, Brazil, Pages: 288.
9. Froese, R. and D. Pauly, 2011. FishBase, version (02/2011). World Wide Web Electronic Publication. http://www.fishbase.org
10. Harrison, I.J. and G.J. Howes, 1991. The pharyngobranchial organ of mugilid fishes; its structure, variability, ontogeny, possible function and taxonomic utility. Bull. Br. Mus. Nat. Hist. Zool., 57: 111-132.
11. Bizerril, C.R.S.F. and P.A.S. Costa, 2001. Peixes Marinhos do Estado do Rio de Janeiro [Marine Fish of the State of Rio de Janeiro]. Foundation for Marine Studies, Rio de Janeiro, Brazil, Pages: 234.
12. Erzini, K., 1994. An empirical study of variability in length-at-age of marine fishes. J. Applied Ichthyol., 10: 17-41.
13. Uckun, D., E. Taskavak and M. Togulga, 2006. A preliminary study on otolith-total length relationship of the common hake (*Merluccius merluccius* L., 758) in Izmir Bay, Aegean Sea. Pak. J. Biol. Sci., 9: 1720-1725.
14. Leis, J.M., 1981. Didontidae. In: FAO Species Identification Sheet for Fishery Purposes Eastern Central Pacific Fisheries Areas 34 and Part of 47, Fischer, W., G. Bianchi and W.B. Scott (Eds.). Vol. II, Food and Agriculture Organization, Rome, Italy.
15. Ibanez-Aguirre, A.L., E. Cabral-Solis, M. Gallardo-Cabello and M.E. Espino-Barr, 2006. Comparative morphometrics of two populations of *Mugil curema* (Pisces: Mugilidae) on the Atlantic and Mexican Pacific coasts. Scient. Marina, 70: 139-145.
16. Ricker, W.E., 1979. Growth Rates and Models. In: Fish Physiology, Bioenergetics and Growth, Hoar, W.S., D.J. Randall and J.R. Brett (Eds.). Academic Press, New York, pp: 677-743.
17. Dos Santos, A.L.B., A.L.M. Pessanha, M.R. da Costa and F.G. Araujo, 2004. Length-weight relationship of *Orthopristis ruber* (Cuvier) (Teleostei, Haemulidae) in the sepetiba bay, Rio de Janeiro, Brazil. Rev. Bras. Zool., 21: 185-187.
18. Da Rocha, M.A., E.L.D.A. Ribeiro, I.Y. Mizubuti and L.D.D.F. da Silva, 2002. Growth parameters and their correlations from ages 60 to 240 days in the carp (*Cyprinus carpio*). Semina: Cianc. Agrarias, 23: 29-34.
19. El-Sayed, A.E.H., F.A.A. Razek, M.M. Abou-Zaid and S.M. Taha, 2011. Measures of allometric growth of black-lip pearl oyster *Pinctada margaritifera* (Linnaeus, 1758) Red Sea, Egypt. Int. J. Zool. Res., 7: 201-211.
20. Hajjej, G., A. Hattour, A. Hajjej, H. Allaya, O. Jarboui and A. Bouain, 2011. Biometry, length-length and length-weight relationships of little tuna *Euthynnus alletteratus* in the Tunisian waters. J. Fish. Aquat. Sci., 6: 256-263.
21. Ayres, M., M. Ayres Jr., D.L. Ayres and A.S.S. Santos, 2007. BioEstat: Aplicacoes Estatisticas Nas Areas das Ciencias Bio-Medicas [BioEstat: Statistical Applications in the Biomedical Sciences Area]. Mamiraua Civil Society, Belem, Pages: 364.
22. Rocha, D.F., R. Novelli and A.A.L. Deus, 2007. Frequency distribution of growth in length of parati *Mugil curema* valenciennes, 1836 in Acu Lagoon. Proceedings of the 8th Ecology Congress of Brazil, September 23-28, 2007, Caxambu, Brazil, pp: 1-2.
23. Oliveira, M.R., A.L.S. Morais, A.M. Silva, J.T.A.X. Lima, M.M. Carvalho, N.T. Chellappa and S. Chellappa, 2015. Reproductive strategies of seven fish species from the coastal waters of Rio Grande do Norte, Brazil. Holos, 31: 107-122.
24. Fonteles-Filho, A.A., 1989. Recursos Pesqueiros: Biologia e Dinamica Populacional [Fishery Resources: Biology and Population Dynamics]. Ceara Press, Fortaleza, Brazil, Pages: 296.
25. Araujo, A.R. and F.D. Silva, 2013. Aspects of the fishery and biology of mullet, *Mugil curema* (Osteichthyes: Mugilidae), in the Vaza Barris river estuary, Sergipe state, Brazil. Arquiv. Cienc. Mar. (Brazil), 46: 29-38.
26. Verreth, J.A.J., 1995. Growth and feeding metabolism in fish larvae. In: Erasmus Course. Fish Culture and Fisheries Group, Wageningen, pp: 1-26.