Indian Journal of Geo Marine Sciences
Vol. 54 (01), January 2025, pp. 21-27
DOI: 10.56042/ijms.v54i01.15803

Research Article

Biometric analysis of Whipfin silverbiddy, *Gerres filamentosus* Cuvier, 1829 from Ratnagiri coast of Maharashtra, India

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Received December 07, 2024; revised 20 January 2025

The Whipfin silverbiddy, *Gerres filamentosus* Cuvier, 1829 is exploited by beach seines, bottom trawls, long lines, stake nets and gillnets at Ratnagiri in Maharashtra. Morphometric characters, Length-Weight Relationship (LWR) and condition factor of the *G. filamentosus* were studied from 506 specimens comprising 242 males, 229 females and 35 indeterminants. The coefficient of correlation of total length against other morphometric characters of *G. filamentosus* ranged between 0.807 (*vs.* snout length) to 0.994 (*vs.* standard length). All morphometric measures had a high and moderate degree of correlation with total length. The LWR indicated positive allometric growth. The coefficient of correlation (*r*) for the LWR was estimated at 0.9824, 0.9760, 0.9839 and 0.9826 for the males, females, indeterminants and pooled data, respectively. Furthermore, the condition factor indicated that the species remained in good condition throughout the year for both sexes, except during August.

[**Keywords**: Arabian Sea, *Gerres filamentosus*, Length-weight relationship, Morphometrics**]**

Introduction

The family Gerreidae (Order: Perciformes) includes 8 genera and approximately 54 species collectively referred to as mojarras, silver biddies, or purse mouths[1-3]. They are widely distributed along the Atlantic, Pacific, and the Indian Ocean[4-7]. In the Western Indian Ocean, 16 species of gerreids have been documented[8]. They are found in shallow waters, typically at depths up to 40 m, inhabiting sandy tidal creeks, lagoons, coral reefs, and estuarine areas; although some species are known to migrate into the freshwater[5]. Along the Indian coast, nine gerreid species belonging to the genera *Gerres* and *Pentaprion* have been identified, namely *Gerres erythrourus*, *G. filamentosus*, *G. oyena*, *G. acinaces*, *G. lucidus*, *G. oblongus*, *G. poieti*, *G. rappi*, and *Pentaprion longimanus*[8-10]. Gerreids are commercially important and are commonly caught using various fishing gears, including beach seines, bottom trawls, longlines, cast nets, gillnets, stake nets and traps[11,12]. Gerreids are consumed both fresh and dried, contributing to local food security and livelihoods[13,14]. The whipfin silverbiddy, *Gerres filamentosus*, is one of the economically important species found along the Ratnagiri coast of India.

Morphometrics involves the analysis of body shape or the shape of different morphological features based on various body measurements or parts. They are fundamental for species identification, as well as understanding habitat-specific variations within the same species[2,15]. Morphometric characteristics are especially useful in situations where differences are influenced by environmental conditions rather than genetic variation[16]. Additionally, Length-Weight Relationships (LWRs) are vital for stock assessments, enabling the estimation of weight from length and providing insights into the condition of fish populations[17]. Comparing LWRs across different habitats and regions can also highlight population-level differences[17,18]. The condition factor represents the well-being of a fish population, assuming that fish growing under optimal conditions maintain a proportional relationship between length and weight[15], and it also describes the deviation of an individual's

weight from the average weight corresponding to its length[18].

Very few studies have been conducted on reproductive biology[19,20] population dynamics[1,14,17,21,22] and food and feeding[5,12] of *G. filamentosus*. However, there is no report on the study of morphometrics, LWR, and condition factor from the Ratnagiri coast, even though the species contributes significantly to the brackish water landings in the region, and the data-deficient nature of the brackish water fishery necessitates this study to generate baseline information on *G. filamentosus* from the Ratnagiri waters.

Materials and Methods

The present study was conducted on 506 specimens of *G. filamentosus* with the total length ranging from 6 to 22.7 cm, including 242 males, 229 females, and 35 indeterminants. Specimens were collected weekly from the Mirkarwada fishing harbour (16°59'42" N and 73°16'14" E) between September 2023 to August 2024. The samples were caught mostly from stake nets, trawl nets (depth about 10 – 20 fathom), hand lines, cast nets and gill nets. The total length (TL) of each specimen, measured from the tip of the snout to the tip of the caudal fin, was recorded to the nearest 1 mm using a standard measuring board. Body weight was measured to the nearest 0.5 g using an ACZET analytical balance (Model CY223). The LWR was estimated using the expression: $W = a\,L^b$, where W is the weight (g), L is the total length (mm), 'a' is the intercept of the regression and 'b' is the slope[23,24]. The significance of the slope (b) was evaluated using a t-test by comparing it with the theoretical value of 3.0 representing isometric growth. The value of Kn was calculated following Le Cren (1951)[23], Relative condition Factor $Kn = \frac{W}{Wc}$, where, W = observed weight of fish, and W_c = calculated weight of fish. Seventeen morphometric characters were measured for biometric analysis: Total length (TL), Fork Length (FL), Standard Length (SL), Head Depth (HD), Head Length (HL), Post Orbital Length (POL), Snout Length (SnL), Eye Diameter (ED), Body Depth (BD), Pre-dorsal length (PdL), Dorsal fin base length (DFBL), Anal fin base length (AFBL), Pelvic fin base length (PFBL), Caudal peduncle depth (CPD), Pre-anal length (PaL), Pre-pelvic length (PvL) and Pre-pectoral length (PpL) (Fig. 1). The relationships between morphometric variables were expressed using the linear equation: $Y = a + bX$.

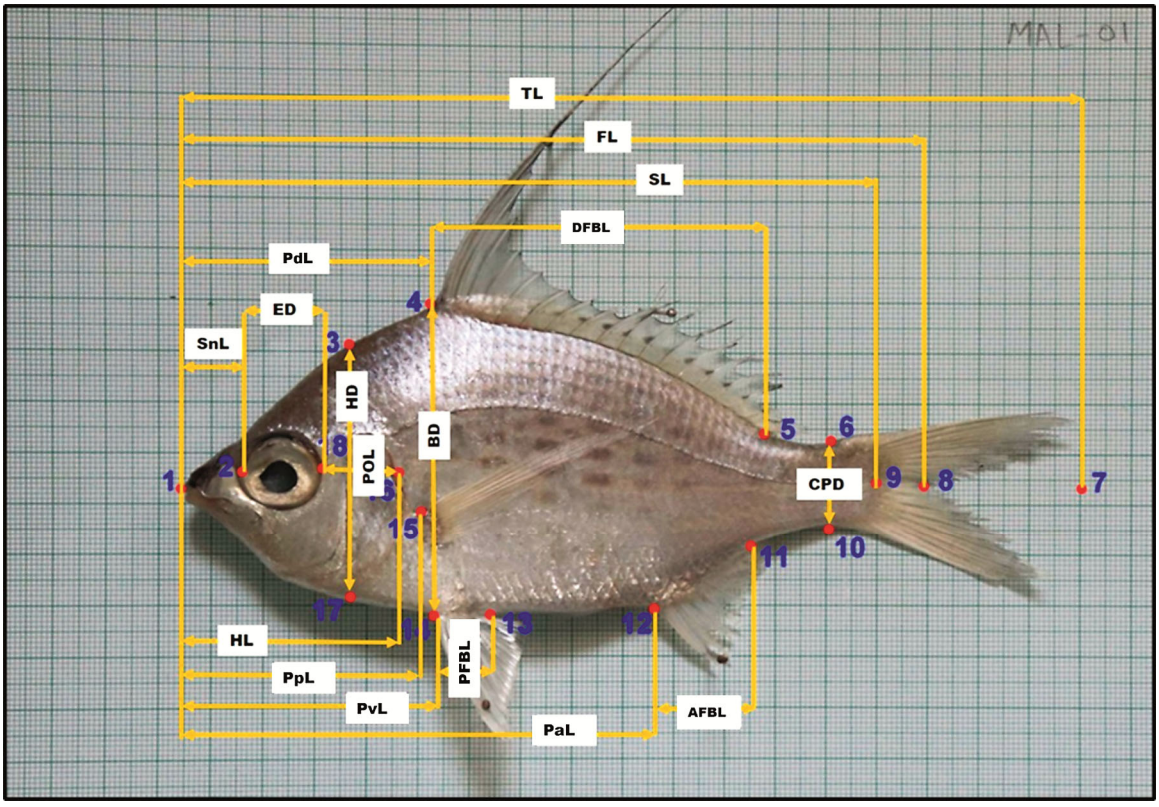

Fig. 1 — Morphometric characters of *Gerres filamentosus*

Results

A total of 506 specimens were analysed to determine the length-weight relationships, comprising 229 females (TL = 7.8 – 18 cm; weight = 7.52 – 200.5 g), 242 males (TL = 7 – 22.7 cm; weight = 5.8 – 224.07 g) and 35 indeterminants (TL = 6 – 12.5 cm; weight = 6.7 – 66.67 g). The estimated '*b*' value indicated positive allometric growth in males, females, indeterminants, and pooled individuals ($P < 0.05$). The relationship between length-weight was established as: $W = -2.0606L^{3.2599}$ for females, $W = -1.9906L^{3.1961}$ for males, and $W = -2.046L^{3.2466}$ for indeterminants. Analysis of covariance showed no significant difference in the length–weight relationship between sexes at both 1 % and 5 % significance levels; therefore, a pooled equation was derived as $W = -1.9995L^{3.2038}$ (Fig. 2).

The relative condition factor (K_n) of *G. filamentosus* was studied with respect to different months (Fig. 3). The month-wise condition factor revealed the highest values in April (1.09 for males & 1.12 for females) and the lowest values in August (0.78 for males & 0.88 for females) for both sexes. A total of sixteen morphometric characters of *G. filamentosus* were regressed against TL and are presented in Table 1. The relationship between TL and other morphometric characters indicate the strongest correlation between: TL and standard length SL ($r = 0.994$) and TL and snout length SnL ($r = 0.807$).

Discussion

Most of the previous studies on LWR of *G. filamentosus* from different geographic regions have reported both isometric and allometric growth patterns (Table 2). However, the regression coefficient obtained in the present study for pooled data ($b = 3.2038$) is comparable with values reported from Parangipettai waters[24], Peninsular Malaysia[25], Oman Sea[14] and Kerala[26]. Exponent value '*b*' of LWR equation provides important information about the

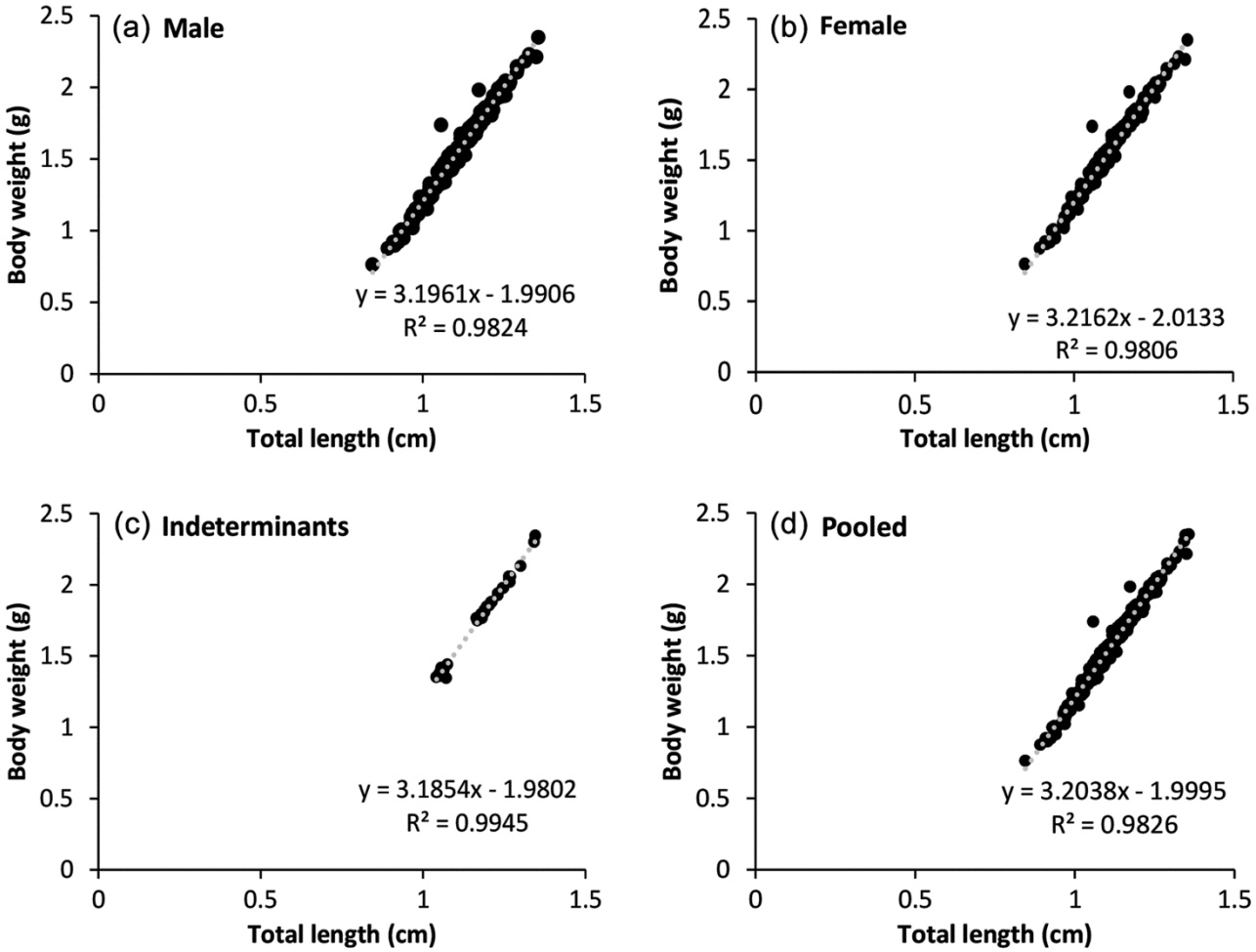

Fig. 2 — Length-weight relationship of *Gerres filamentosus*: a) Males, b) Females, c) Indeterminants, and d) Pooled individuals

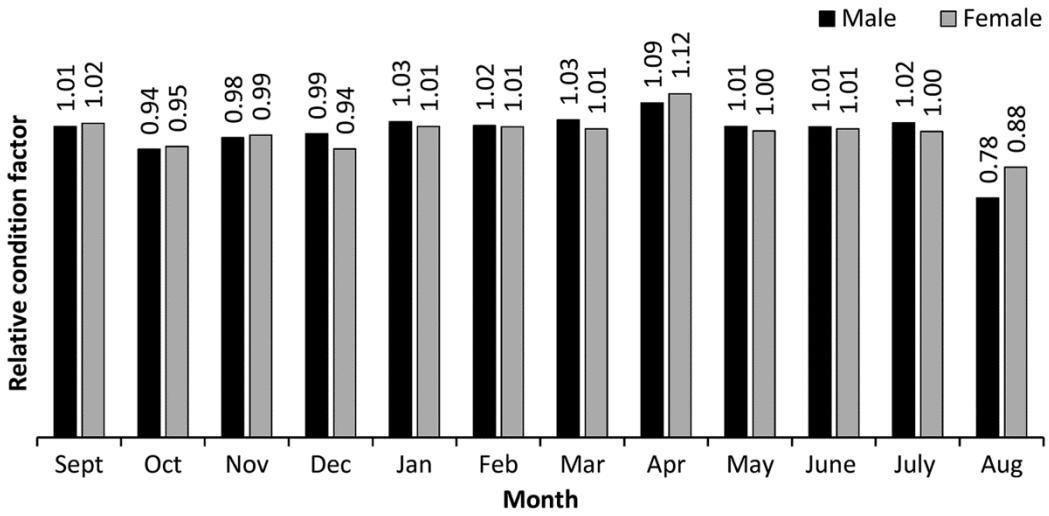

Fig. 3 — Monthly variation in condition factor of *Gerres filamentosus*

Table 1 — Relationship between different morphometric characters of *Gerres filamentosus*
**a: intercept, b: slope, r: correlation coefficient, -A: negative allometric growth*

Parameter	Times in TL	*a*	*b*	*Y = a + bX*	*r*	Slope (*b*)
FL	1.319	0.449	0.734	0.449+0.734X	0.973	-A
SL	1.143	0.422	0.845	0.442+0.845X	0.994	-A
HL	4.029	1.167	0.166	1.167+0.166X	0.926	-A
SnL	14.062	-0.065	0.077	-0.065+0.077X	0.807	-A
ED	6.823	-0.233	0.165	-0.233+0.165X	0.941	-A
BD	6.261	-0.122	0.17	-0.122+0.17X	0.923	-A
PvL	5.474	-1.997	0.334	-1.997+0.334X	0.94	-A
PaL	5.742	-0.177	0.189	-0.177+0.189X	0.926	-A
PpL	2.447	-0.623	0.449	-0.623+0.449X	0.98	-A
DFBL	7.407	0.811	0.078	0.811+0.078X	0.834	-A
POL	3.198	-0.694	0.37	-0.694+0.37X	0.938	-A
AFBL	2.804	-0.509	0.396	-0.509+0.396X	0.959	-A
HD	6.346	-2.428	0.347	-2.428+0.347X	0.938	-A
PFBL	5.632	0.278	0.16	0.278+0.16X	0.846	-A
PdL	2.548	0.574	0.357	0.574+0.357X	0.908	-A
CPD	10.056	-0.005	0.101	-0.005+0.101X	0.963	-A

growth pattern of fish. Generally, when the exponent value b = 3, it indicates that fish weight increases cubically with respect to its length[9]. In the present study, the value b was greater than three, suggesting that the fish tends to become relatively broader as it grows. Variations in the 'b' values may result from several factors, including geographical location, ecological conditions, physiological status, environmental influences, and other biological factors[9,24-28].

The monthly fluctuation in condition factor exhibited a seasonal trend likely linked to the reproductive cycle, showing peak values in April before the onset of spawning and lower values in August following the completion of spawning in both males and females[21]. The K_n for *G. filamentosus* along the Mangalore coast, reporting the highest monthly mean values in December (1.1186) and lowest in September (0.8871) for females, while for males, the highest value was recorded in March (1.0630) and the lowest in September (0.6977)[27]. The average condition factor recorded was higher in females (1.14) from Azhikode estuary, Kerala[26]. Abu El-Nasr[1] has reported K_n values of 1.49, 1.47, and 1.51 for males, females, and pooled data, respectively from Egypt[1]. While 'K' values for males and females were recorded to peak during the months of August to October[20]. The K_n value is influenced by various

Table 2 — Values of *a* and *b* of *Gerres* species from different geographical locations

Species	Sex	*a*	*b*	Region/Locality	Reference
G. filamentosus	Female	-1.2874	2.8381	Cochin coast, Kerala	Kurup & Samuel, 1987
	Male	-l.32244	2.8740		
	Indeterminants	-0.8167	2.2558		
	Female	-4.8405	3.0017	Sharavati estuary, Karnataka	Golikatte, 2002
	Male	-5.1929	3.1657		
	Indeterminants	-4.5945	2.8220		
	Female	0.007	3.247	Parangipettai, southeast coast, India	Sivashanthini, 2008
	Male	0.007	3.264		
	Unsexed	0.008	3.203		
	Pooled	0.006	3.285		
	Unsexed	1.849	2.989	Pakistan, Arabian sea	Hussain *et al*., 2010
	Female	-1.728	2.883		
	Female	0.000069	3.0017	Central west coast of India	Renuka & Bhat, 2011
	Male	0.000001	3.1657		
	Indeterminants	0.000039	2.8220		
	Unsexed	0.0086	3.2441	Peninsular Malaysia,	Isa *et al*., 2012
	Unsexed	0.0088	3.21	Iran, Oman sea	Hashemi *et al*., 2012
	Female	0.0341	3.7227	Azhikode estuary, Kerala	Aziz *et al*., 2013
	Male	0.0478	2.5868		
	Pooled	0.0330	2.7316		
	Unsexed	0.0050	3.130	Visakhapatnam, India.	Krishna *et al*., 2015
	Unsexed	0.001	2.14	Bay of Bengal, India	Martin *et al*., 2016
	Female	0.0146	2.9543	Egypt, Hurghada sea	Abu El-Nasr, 2017
	Male	0.0143	2.9564		
	Pooled	0.0144	2.9597		
	Female	0.0146	2.9543	Mangalore coast, Karnataka	Narasimhaiah *et al*., 2020
	Female	-1.7716	2.9511		
	Male	-1.7526	2.9364		
	Indeterminants	-1.8343	2.9720		
	Pooled	-1.8521	3.0165		
G. abbreviatus	Female	0.010	3.119	Parangipettai, southeast coast, India	Sivashanthini, 2008
	Male	0.011	3.095		
	Unsexed	0.012	3.037		
	Pooled	0.009	3.178		
G. oblongus	Female	0.015319	3.126119	Sri Lanka, Palk Bay	Sivashanthini & Adeyrami, 2003
	Male	0.01127	2.958295		
	Pooled	0.01135	3.095936		
G. acinaces	Unsexed	0.0826	2.59	Guam, Philippine Sea	Kamikawa *et al*., 2015
G. filamentosus	Male	1.9906	3.1961	Ratnagiri, Maharashtra, India	Present study
	Female	2.0606	3.2599		
	Indeterminants	2.046	3.2466		
	Pooled	1.9995	3.2028		

factors like environmental conditions, feeding intensity, food type, amount of fat or muscular development, breeding cycle, age, sex and the developmental stages of fish gonads[20,30-33].

Morphological traits of fishes represent one of the most fundamental sources of information for taxonomic and evolutionary studies[10,23,34]. Furthermore, the relationships among various morphometric characters can be employed to detect possible variations among unit stocks and to evaluate the overall health condition of individuals. In the present study, the correlation coefficient (*r*) of total length against all other morphometric characters of *G. filamentosus* from Ratnagiri coast ranged from

0.807 to 0.994. A significant relationship was observed between total length and various morphometric characteristics in the species. The '*r*' of total length against other morphometric characters of *G. filamentosus* from Egypt ranged from 0.9976 to 9294(ref. 1). A high level of uniformity was observed within the population. Fish stocks can be identified based on morphometric characteristics of species[10,22,23]. The identification of distinct stocks would be helpful in developing appropriate management strategies based on the biological characteristics of the stock[10,13,35]. The study of morphometric relationships would prove helpful for the comparison of the populations of *G. filamentosus* from other geographical areas.

In conclusion, the present study provide valuable baseline information for understanding fish population dynamics which will aid in developing effective management and conservation strategies for this species.

Acknowledgements

The authors gratefully acknowledge the authorities of the College of Fisheries, Ratnagiri, for providing the necessary facilities for this research. The authors also thank the fishermen of Ratnagiri for their assistance in providing fish samples.

Conflict of Interest

Authors declare that they do not have any conflict of interest.

Author Contributions

MBS & HGS: Conceptualization, writing-original draft, editing; MMB: Formal analysis and methodology; and VHN & SSG: Supervision, writing-review.

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