Journal of Aquatic Biology & Fisheries | 2023 | 11(1) | pp. 179-182
ISSN 2321–340X
OPEN ACCESS
http://www.jabf.in/
University of Kerala, INDIA

Length-weight and length-length relationships of seven ponyfish species from the Southwest coast of India

Sheela, H.M. and Biji, G.D.*

Department of Zoology, Nesamony Memorial Christian College, Marthandam,
Affiliated to Manonmaniam Sundaranar University, Tirunelveli – 627 012, Tamil Nadu, India
**E.mail: gdbiji66@yahoo.co.in*

ABSTRACT

Scanty information is available on the Length-Weight Relationship (LWR) and Length-Length relationship (LLR) of ponyfishes from Kanniyakumari to Vizhinjam coast, in Southwest cost of India. In this study, we determine the Length-Weight Relationship (LWR) and Length-Length relationship (LLR) of some fishes of the Family Leiognathidae. The samples were collected from the fish landing centres on Southwest coast of India (Kanniyakumari to Vizhinjam) for three years (July 2018 to December 2020). The ponyfishes studied were *Leiognathus berbis* (55), *L. brevirostris* (07) *L. leuciscus* (7), *L. lineolatus*, (136), *Gazza minuta* (14), *Secutor insidiator* (704) and *Karalla dussumieri* (86). The LWR was estimated using the exponential equation $W=a L^b$ for all seven species. The LMR was analyzed for *L. berbis* for as $W=0.02965L^{2.6601}$. *L. brevirostris as* $W=0.0267L^{2.1737}$, *L. leuciscus* $W=0.07991 L^{2.2918}$, *L. lineolatus* $W=0.0189L^{2.823}$, *Gazza minuta* $W=0.01256L^{3.0538}$, *Secutor insidiator* $W=0.0461L^{2.4672}$, and *K.dussumieri* $W=0.01191L^{3.1110}$. The growth of *B. berbis*, *B. brevirostris*. *B. leuciscus*, *B. lineolatus* and *S. insidiator* were allometrically negative. The 'b' value of *Karalla dussemieri* is positive allometric and *G. minuta* indicates the isometric growth. The LLR between TL, SL, FL and BD were all linear and highly correlated ($r^2>0.9$). These analyzed parameters help determine the relative condition of fish species management and stock assessment.

ARTICLE HISTORY

Received on: 29-06-2023
Revised on: 27-10-2023
Accepted on: 04-12-2023

KEYWORDS

Leiognathus berbis, *K. dussemieri*, *L. brevirostris*, *L. leuciscus*, *L. lineolatus*, Biometric, Isometric, Allometric

1. Introduction

Ponyfish (Perciformes: Leiognathidae) are a diverse group of small planktivorous fishes distinguished by the following characters: body compressed, body depth 1.7–1.9 times in standard length, gill rakers short and fleshy, body depth 1.7–1.9 times in standard length, mouth pointing downward when protracted, head and breast scaleless, and tubed scales on lateral lines 61–66, the colour of adults are belly silvery and many parallel close-set faint bars on back, back greyish, margin of soft dorsal fin black, axil of pectoral fins grey to black, pelvic, pectoral, and anal fins yellowish or colourlesss, closely arranged, membrane between anal-fin spines conspicuously yellow, and snout dotted black (Soars and Leis, 2010; Ju *et al*., 2017). These fish are prevalent in shallow coastal, brackish, estuaries, and mangrove areas (Staunton-Smith *et al*., 1999). They belong to Order Perciformes; the family Leiognathidae comprises ten genera and 54 species (Sharifuzzaman *et al*., 2021). Ponyfish is widely distributed in tropical and sub-tropical regions ranging from southeast Asia through the Indian subcontinent to East Africa (Gao *et al*., 2019).

Length-weight relationship analysis has several uses for comparing the biography and morphology of populations residing in various zones. The LWR is of great importance in fish biology, physiology, ecology, and fishery assessment, and it is also very important for the proper exploitation and management of the fish population of fish species (Qamar *et al*., 2017). The LWR is important in fishery science, especially to raise length frequency samples to total catch, estimate biomass, observe length, and evaluate fish growth (Martin *et al*., 2016). It is also remarkable in fishery biology because it allows the estimation of the average weight of fish at a given length group by establishing a statistical relationship between two parameters. The LWR establishes the mathematical relationship between the length and weight of the fish. It is also needed to establish the taxonomic character of the fish species of the family Leiognathidae and analyse the fish stock from the marine environment. The length-length relationship and length-weight relationship have been used for basic analyses to make fish population and fish stock assessments (Ricker, 1968). In fish, size is more biologically relevant than age, mainly because physiological and ecological factors are more size-dependent than age-dependent. Consequently, length-weight regressions were applied to determine weight from length because direct weight measurements can be time-consuming in the field (Sinovcic *et al*., 2004). The length-weight relationship of fish is influenced by gonad maturity, sex, available nutrient sources, stomach fullness, health, season and habitat. Ponyfish is one of the most economically important fish species in fishery industries due to the high quantity of its bone and fatter flesh that provides plenty of calcium and protein sources (Khanali *et al*., 2021). The main objective of the study is to analyze the length-weight and length-length relationship of seven ponyfishes from the southwestern coast of India.

2. Materials and Methods

The fish sample was collected for three years from 2018-2020 from the fishing landing centres lying between Kanniyakumari (Latitudes 8°05 and '20.0" N and longitude 77°32) and Vizhinjam (Kerala) (8°22 and '32.0" N 76°59 and '17.4" E). Fishes were collected from seven fish landing centres (Kanniyakumari, Thengapatnam, Kollachal, Rajakamangalam, Inayam, Iraumenthurai, Poovar, and Vizhinjam (Kerala). The collected fish were observed, and systematic identification was carried out as per the FAO system based on morphology. A total of 1009 fishes from seven different species of the family Leiognathidae were subjected to morphometric analysis. Length-weight

Regression analysis was used to estimate weight from the length profile of fish.

A total of 20 parameters were measured for the seven fish species collected of genera *Leiognathus*, *Secutor* and *Gazza* using a Vernier calliper and a digital weighing balance. After biometric data analysis, the belly of each sample was cut open and the sex was identified. All the linear measurements were made in the median longitudinal axis. The fish length was measured to the nearest centimetre (cm) using a digital Vernier Calliper and the weight was measured using a digital balance (g). The total length (TL) of each fish was measured from the cap of the snout to the longest ray of the caudal fin. The standard length (SL) was calculated from the snout to the terminal of the Vertebral column, and the Fork length (FL) was measured from the point of the snout to the finale of the central caudal-fin rays. The body depth (BD) was determined from the maximum distance between the dorsal and ventral sections of the fish. Linear Regression applied for LLR analysis comprising TL and SL, TL and FL, SL and FL, TL and BD and LWR was calculated by using the exponential regression equation ($W=a\ L^{b}$), Where, W=Total weight (g), L=Total Length (cm), a-the Intercept, and b the slope of Log-transformed linear regression. The parameters a, b and coefficient determination (r^2) with 95% confidence intervals (cl) were assessed. The LLR between Total Length (TL), Standard Length (SL), Fork Length (FL) and Body Depth (BD) were estimated using linear regression analysis TL= a+b SL, TL= a+b FL, SL= a+bFL and TL= a+bBD.

3. Results and Discussion

3.1. Length-weight relationship of ponyfishes

The length-weight relationship of a total of 1009 fish samples of Leiognathids was determined and illustrated in Table 1. The LWR and LLR of the seven fish species of Family-Leiognathidae are given in Table 1 and the regression on Log-transformed data was highly significant (r^2=0.9). The growth of *L. berbis*, *L. brevirostris*, *L. leuciscus*, *L. lineolatus* and *Sec.insidiator* were allometrically negative and the b values of *K. dussemieri* were positive allometric and *Gazza minuta* indicated the growth was isometric. The LLR between TL, SL, FL and BD were all linear and correlated significantly. Batcha and Badrudeen (1992) reported the isometric growth of *L. brevirostris* and the reported 'b' value was 3.004 surveyed at Palk Bay, India. The 'b' value varied (2.5939-3.1629) based on the stages in *Gazza minuta* and was reported previously by Jeyabalan and Krishna Bhat (1997). Qamar *et al*. (2017) reported the length-weight relationships of eight ponyfish in the northern Arabian Sea. The observed correlation coefficient was high for all eight fish species and the r2 value ranged between 0.90 and 0.99. A length–length–length relationship–length–weight relationship was calculated for ponyfishes in the Persian Sea, Iran.

3.2. Isometric, allometric and positive allometric growth of bonyfishes

Isometric growth was determined in deep pug-nose ponyfish (*Secutor ruconius*), common ponyfish (*Leiognathus equulus*), and ornate ponyfish (*Equulites lineolatus*), negative allometric growth were observed in orangefin ponyfish (*Photopectoralis bindus*), and decorated ponyfish (*Nuchequula gerreoides*) and positive allometric growth was observed in *Aurigequulafasciata* (Deyrestani *et al*., 2015). In the present study, the value of `b' for *L. berbis*, *L. brevirostris*, *L. leuciscus*, *L. lineolatus* and *Sec. insidiator* were 2.6601, 2.1737, 2.29131, 2.823 and 2.4672, respectively indicated the growth was allometrically negative (b<3.0). The `b' value of *K. dussemieri* was 3.11105, showing the growth was positive allometric (b>3.0) and *G. minuta* was (b=3.0); therefore, LLR is important in fisheries management for comparative growth studies. The LLR expressed that the value of the correlation coefficient (r^2) was highly reciprocal and the maximum values were greater than 0.9 so it is highly significant. The 'r' value of the LWR of Leiognathidae fish species was comparatively high and the high correlation revealed a strong relationship between the length and weight of Leiognathidae fish species. The relationships of weight and size of otoliths with weight and length and body mass of fishes were analyzed for 4 ponyfishes (*Photopectoralis bindus*, *Nuchequula gerreoides*, *Deveximentum ruconius*, and *Aurigequula fasciata*) from Oman Sea and Persian Gulf. These four ponyfishes showed a positive relationship (r^2>0.71) between fish weight vs. otolith weight, fish length vs. width and otolith length (Khanali *et al*., 2021). On the west coast of India, Muddula-Krishna *et al*. (2015) studied the relationship of length-weight of *Secutor insidiator* collected from the Visakhapatnam coast; the estimated LMR value for males was W = 0.00000352 L 2.8920, whereas the female was W = 0.00000369 L2.7976. The results revealed that the value of correlation coefficient (r^2) (Table 2 – 5) of the LLR values between the four length measurements (TL vs SL, TL and FL SL and FL and TL and BD) were >0.9 and was highly correlated (r^2>0.9).

Table 1. Descriptive Statistics and analysed Morphometric parameters of length-Weight Relationships of seven pony fish species captured from South West Coast of Indiacypermethrin

S.No	N	TLrange (cm)	Wrange(g)	a	95% of CL of a	b	95% 0f CL b	SE (b)	r2
L. berbis	55	8.8-14.6	9.94-37.3	0.2965	0.0183-0.047	2.6601	2.4549-2.865	0.1023	0.9259
L. brevirostris	07	9.6-12.8	18.02-34.56	0.1269	0.0231-0.697	2.1737	1.4721-2.875	0.2729	0.9269
L. leuciscus	07	9-11.5	12.1-23	0.0799	0.0234-0.277	2.2918	1.7719-2.811	0.2022	0.9625
L. lineolatus	136	5.2-11.5	2.85-18.43	0.0189	0.0140-0.025	2.8231	2.6712-2.976	0.0771	0.9096
S. insidiator	704	6.7-11.6	4.83-20.21	0.0461	0.0358-0.059	2.4672	2.3557-2.578	0.0567	0.7290
G. minuta	14	10.5-14	17.34-40.77	0.0125	0.0042-0.037	3.0538	2.6209-3.486	0.1986	0.9516
K. dussmieri	86	8-12.6	8.4-39.37	0.0119	0.0074-0.001	3.1110	2.9100-3.312	0.1010	0.9185

n-number of samples, a-intercept, b-slope, r^2-Regression coefficient of determination. cl-confidence intervals, TL-Total length, and W-weight

Table 2. LLR comparison between Total Length (TL) and Standard Length (SL) for Leiognathidae fish species from South West Coast of India

S. No	Name of fish Species	No of fish	T L Range	S L Range	Equation TL= a+b SL	R^2
1	*L. berbis*	55	8,8-14.6	6.9-12.5	TL=15885+1.0402 SL	0.9862
2	*L. brevirostris*	07	9.6-12.8	8-10.2	TL=0.1315+1.4401SL	0.9674
3	*L. leuciscus*	07	9-11.5	7.5-9.5	TL=0.0383+1.5853 SL	0.8318
4	*L. lineolatus*	136	5.2-11.5	4.5-9.5	TL=0.7644+1.2534 SL	0.9168
5	*G. minuta*	14	10.5-14	8.5-11.7	TL=1.5867+1.0497 SL	0.9804
6	*S. insidiator*	704	6.7-11.6	5-9.9	TL=3.0747+0.8217 SL	0.7130
7	*K. dussumieri*	86	8-12.6	6.5-11	TL=0.6822+1.1029 SL	0.93

Table 3. LL Relationship between Total Length (TL) and Fork Length (FL) for Leiognathidae fish species from Coastal Zones of –Kanniyakumari District, Tamil Nadu.

S. No	**Name of fish Species**	**No of fish**	**T L Range**	**F L Range**	**Equation TL =a+b FL**	**R^2**
1	*L. berbis*	55	8.8-14.6	7.9-13.5	TL=0.7789+1.0220FL	0.9948
2	*L. brevirostris*	07	9.6-12.8	8.7-11.7	TL=0.4044+1.0573FL	0.9994
3	*L. leuciscus*	07	9-11.5	8.1-10.3	TL=0.6798+1.1512FL	0.9972
4	*L. lineolatus*	136	5.2-11.5	4.8-10.3	TL=0.1816+0.8845FL	0.9200
5	*G. minuta*	14	10.5-14	9.6-12.5	TL=0.2139+0.8771FL	0.9072
6	*Sec.insidiator*	704	6.7-11.6	5.7-10.6	TL=0.7603+0.9249FL	0.9526
7	*K. dussumieri*	86	8-12.6	7-11.5	TL=0.9589+0.8981FL	0.9184

Table 4. LLR comparison between Standard Length (SL) and Fork Length (TL) for Leiognathidae fish species from Coastal Zones of –Kanniyakumari District, Tamil Nadu

S. No	**Name of fish Species**	**No of fish**	**S L Range**	**F L Range**	**Equation SL= a+b FL**	**R^2**
1	*L. berbis*	55	6.9-12.5	7.9-13.5	SL=0.5007+0.9732FL	0.9896
2	*L. brevirostris*	07	8-10.2	8.7-11.7	SL=0.1020+1.3600 FL	0.9651
3	*L. leuciscus*	07	7.5-9.2	8.1-10.3	SL=0.0676+1.3996 FL	0.8616
4	*L. lineolatus*	136	4.5-9.5	4.8-10.3	SL=0.7622+1.1447 FL	0.9309
5	*G. minuta*	14	8.5-11.7	9.6-12.5	SL=1.6017+0.9211 FL	0.8902
6	*S. insidiator*	704	5-9.9	5.7-10.6	SL=2.1357+0.8130 FL	0.7507
7	*K. .dussumieri*	86	6.5-11	7-11.5	SL=0.4338+1.0062 FL	0.8812

Table 5. LLR comparison between Total Length (T L) and Body depth (BD) and for Leiognathidae fish species from Coastal Zones of –Kanniyakumari District, Tamil Nadu

S. No	**Name of fish Species**	**No of fish**	**T L Range**	**B D Range**	**Equation TL+ a+b BD**	**R^2**
1	*L. berbis*	55	8.8-14.6	3-5.2	TL=1.3952+2.4610 BD	0.9153
2	*L. brevirostris*	07	9.6-12.8	4-5.7	TL=2.2088+1.8565 BD	0.9815
3	*L. leuciscus*	07	9-11.5	3.4-4.4	TL=2.7826+2.0192 BD	0.9685
4	*L. lineolatus*	136	5.2-11.5	1.8-4.2	TL=0.4309+0.4533 BD	0.9114
5	*G. minuta*	14	10.5-14	3.5-5.1	TL=3.0178+2.0163 BD	0.9082
6	*S. insidiator*	704	6.7-11.6	2.8-5	TL=1.3038+0.2725 BD	0.5309
7	*K. dussumieri*	86	8-12.6	3-5.1	TL=2.3767+1.9572 BD	0.9449

4. Conclusion

The present study shows information for the guidelines of LWR and LLR of these fish growth and stocks. LLR is also significant in fisheries administration to analyze the growth pattern, morphological features, and distinct species of Leiognathidae in the coastal waters of the southwestern coast of India for further biological research. All sorts of length measurements were substantial and highly coincident.

5. References

Batcha, H. and Badrudeen, M. 1992. Length weight relationship and relative condition of *Leiognathus brevirostris* (Valenciennes) from the Palk Bay. *Journal of the Marine Biological Association of India*, 34:269-270; http://krishi.icar.gov.in/jspui/handle/123456789/58089.

Deyrestani, A., Alavi-Yeganeh, M.S. and Sadeghizadeh, M. 2015. Length–weight and length–length relationships of six ponyfish species from the Persian gulf. *Croatian Journal of Fisheries: Ribarstvo*, 73(2): 67-69; https://doi.org/10.14798/73.2.800.

Gao, B., Song, N., Li, Z., Gao, T. and Liu, L. 2019. Population genetic structure of Nuchequula mannusella (Perciformes: Leiognathidae) population in the Southern Coast of China inferred from complete sequence of mtDNACyt b gene. *Pakistan Journal of Zoology*, 51(4):1527-1535.

Jayabalan, N. and Bhat, C.K. 1997. Length-weight relationships in the ponyfishes *Leiognathus splendens* (Cuv.) and *Gazza minuta* (Bloch) of Parangipettai. *Indian Journal of Fisheries*, 44(3):291-294.

Ju, Y., Song, N., Chen, G., Sun, D., Han, Z. and Gao, T. 2017. A new record of ponyfish *Deveximentum megalolepis* (Perciformes: Leiognathidae) in Beibu Gulf of China. *Journal of Ocean University of China*, 16:468-472; https://doi.org/10.1007/s11802-017-3185-z.

Khanali, F., Alavi-Yeganeh, M.S. and Nasri, M. 2021. Relationship between otolith measurements against length and weight body of four ponyfish species. *Thalassas: An International Journal of Marine Sciences*, 37(2):701-704; https://doi.org/10.1007/s41208-021-00342-z.

Muddula Krishna, N., Govinda Rao, V., Joseph Uday, R.T., Siva Reddy, K.V. and Ramesh Babu, K. 2015. Length-Weight Relationship of Pugnose Pony Fish *Secutor insidiator* (Bloch, 1787)(Family: Leiognathidae) from the Visakhapatnam Coastal Waters, North East Coast of India. *Research Journal of Animal and Veterinary and Fishery Sciences*, 3(5):1-4.

Qamar, N., Farooq, N., Panhwar, S.K. WARYANI, B. (2017). Length weight relationships estimated for eight ponyfishes (Teleostei: Leiognathidae) from the northern Arabian Sea coast. *Iranian Journal of Ichthyology*, 4(4):384-387; 10.22034/iji.v4i3.211.

Ricker, W.E. 1968. *Methods for assessment of fish production in freshwaters.* Oxford, UK: Blackwell Scientific Publications.

Sharifuzzaman, S.M., Rubby, I.A., Habib, K.A., Kimura, S., Rasid, M.H., Islam, M.J., Neogi, A.K. and Hossain, M.S. 2021. Annotated checklist of ponyfishes (Perciformes: Leiognathidae) from Bangladesh, the northern Bay of Bengal. *Journal of Fish Biology,* 99:2044–2051, https://doi.org/10.1111/ jfb.14890.

Sinovcic, G., Franicevic, M., Zorica, B. and Ciles Kec, V. 2004. Length-weight and length-length relationships for 10 pelagic fish species from the Adriatic Sea (Croatia) *Journal of Applied Ichthyology,* 20:156–158. https://doi.org/10.1046/j.1439-0426.2003.00519.x

Soars, N.A. and Leis, J.M. 2010. Larval development of the Common Ponyfish, *Leiognathus equulus* (Teleostei: Leiognathidae). *Ichthyological Research* 57:263–271. https://doi.org/10.1007/s10228-010-0163-5.

Staunton-Smith, J., Blaber, S.J.M. and Greenwood, J.G. 1999. Interspecific differences in the distribution of adult and juvenile ponyfish (Leiognathidae) in the Gulf of Carpentaria, Australia. *Marine and Freshwater Research,* 50(7):643-653.https://doi.org/10.1071/MF99007