International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
DOI: 10.22192/ijarbs Coden: IJARQG(USA) Volume 3, Issue 9 - 2016

Research Article

DOI: 10.22192/ijarbs.2016.03.09.003

Length-Weight Relationship and Condition of Climbing perch *Anabas testudineus* Bloch population in Kuttanad, Kerala

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Abstract

The length-weight relationship and condition factor of climbing perch *Anabas testudineus* from Kuttanad waters of Kerala was calculated to assess the significance of allometric factor and the well being. The study was carried out using fishes belonging to different size categories during January to March 2015. A total of 246 specimens of *Anabas testudineus* were used for the analysis. The total length of the fishes analysed ranged from 7.7 cm to 18.4 cm with a mean length of 12.73 cm and the total weight ranged from 10.42 g to 117.27 g with an average weight of 46.21 g. The length – weight relationship calculated for the total fishes was $W = 0.0002980\ L^{2.8452}$. The slope value was lower than the critical isometric value of 3 exhibiting negative allometric growth in smaller length groups whereas 'b' exhibits positive allometric growth in largest forms. The condition factor of *Anabas testudineus* observed ranges from 1.45 to 3.08 with a mean value of 2.06 implicating that the fishes are in a good condition in the habitat.

Keywords: Length-weight relationship, condition factor, *Anabas testudineus*.

Introduction

Data on length and weight of fish are generally analysed to yield biological information and such analysis has become one of the standard methods in fishery biology. The morphometric relationship between length and weight of fish is a suitable index for understanding growth, survival, maturity, reproduction, general well being, and it enables conversion of one variable to another (Bagenal and Tesch, 1978; Pauly, 1983; 1993). The length-weight relationship study is widely applied in fisheries management and it provides information on stock condition spatially and temporally.

The length-weight relationship can be extended for the estimation of fish condition assuming that a heavier fish of a given length is in a better condition. The condition factor of a fish reflects physical and biological circumstances and fluctuations by interactions among feeding condition and physiological factors (Le Cren, 1951). This also indicates the changes in food reserve and therefore an indication of the general well being of the individuals and the estimated values are generally used in three cases: (1) comparison of two or more co- specific populations living in similar or different conditions of food, density or climate (2) determination of the period and duration of gonad maturation and (3) observation of the increase or decrease in feeding activity or population changes, possibly due to modification in food resources (Weatherly and Gill, 1987).

The climbing perch *Anabas testudineus*, (Bloch, 1792) belongs to the family Anabantidae and order

Perciformes is regarded as a highly esteemed food fish for its fine flavour, restorative values and prolonged freshness out of water. The species is naturally distributed in India, Bangladesh, Pakistan, Burma, Ceylon, Thailand, China, Philippines and Malaysia(Talwar and Jhingran, 2001; Rahman,2005).It inhabits both fresh and brackish waters and occurs mainly in low lying water bodies like swamps, marsh lands, lakes, canals, ponds, paddy fields, pools, main river channels and estuaries. *Anabas* species possess a special accessory air breathing labyrinthine organ, situated just above the gills in a large extension on the upper part of each gill chamber, which facilitates the utilization of atmospheric air for their respiration (Graham, 1997) and can live out of water for extended periods of time. It is a very hardy fish, can thrive in oxygen depleted waters and is of considerable fisheries interest. They are also well known for their ability to migrate between ponds over land (Davenport and Abdul Matin, 1990). They are chiefly predatory and carnivorous, mostly consumes invertebrates and their larvae and the species is also been reported as one of the successful biological control organisms in controlling mosquitoes in sewage waters (Chandra *et al*., 2008).

Morphometric relationships of length and weight have been determined in several species of fishes. However, limited information is available on air breathing fish species. Therefore, the present study was undertaken to determine the length-weight relationship and condition factor of *Anabas testudineus* inhabiting the Kuttanad wet land ecosystem of Vembanad Lake, Kerala.

Materials and Methods

Kuttanad wet land popularly called the 'Rice bowl' of Kerala is located in the fertile, low-lying areas of Vembanad lake, the largest Ramsar site in Kerala state, India. It is a deltaic formation of mainly four river systems Achenkovil, Pampa, Manimala and Meenachil where rice is cultivated. Samples of *Anabas testudineus* for the present study were obtained from the Kidangara and Muttar villages of Kuttanadu taluk in the upper Kuttanad area during January- March 2015. A total of 246 specimens of the species were brought to the laboratory and total length to the nearest mm and total weight to the nearest 0.01g of individual fishes were measured using a measuring board and sensitive weighing balance respectively.

Length-weight (log-transformed) relationships were determined by linear regression analysis using the data analysis package in MICROSOFT EXCEL. It was calculated for each 3 cm length category and for the total fishes collected. The length-weight relationship was worked out as per cube law given by Le Cren (1951)

$$W=aL^b$$

Where, W = weight of fish (g), L = the observed total length (cm), 'a' is the rate of change of weight with length (regression intercept) and 'b'is the weight at unit length (regression slope). The logarithmic transformation of the formula is

$$\text{Log } W = \log a + b \log L$$

When 'b' is equal to 3 isometric pattern of growth occurs, but when 'b' is not equal to 3, allometric pattern of growth occurs, which may be positive if >3 or negative if <3.Bailey's t- test (Snedecor and Cochran, 1967) was employed to determine if regression coefficients differed significantly from the isometric value of 3 following the formula,

$$t = b\text{-}3/Sb,$$

where

b = regression coefficient of log transformed data and Sb= standard error of b

Condition factor (K), a measure of the well-being or plumpness of fish, was calculated following the equation proposed by Fulton (1904), assuming that the weight of a fish is proportional to the cube of length.

$$K=100 \text{ X } (W/L^3)$$

Where,

W = body weight of the fish and L= total length of the fish.

Results and Discussion

The total length and weight of *Anabas testudineus* used in the present study varied from 7.7 cm to 18.4 cm and 10.42 g to 117.27 g respectively. Table I shows the data on length and weight of *Anabas testudineus* collected for the study and Table II represents the size related variations in the length - weight relationship and condition factor of the fish. Correlation coefficient shows high correlation between total length and total weight in all size categories of *Anabas testudineus* studied.

Table I Data on length and weight of *Anabas testudineus*

Length groups(cm)	Mean length (cm)	SD of length	Mean weight(g)	SD of weight
7- 10	9.24	0.61	20.09	4.02
10- 13	11.31	0.88	32.46	5.12
13- 16	13.33	0.26	39.37	4.09
16 19	17.00	0.56	89.07	8.92
Total	12.73	0.43	46.21	4.81

Table II Regression parameters and Condition factor of *Anabas testudineus*

Length groups(cm)	a	b	r^2	Condition factor	
				Range	Mean
7- 10	-3.1558	2.6328	**0.8742**	2.03-3.08	2.52
10- 13	-3.3219	2.6862	**0.8965**	1.77-2.78	2.25
13- 16	-4.0914	3.1362	**0.9531**	1.45-1.97	1.66
16 19	-3.5247	3.2012	**0.9603**	1.68-2.00	1.81
Total	-4.4742	2.8452	**0.9556**	1.45-3.08	2.06

The value of 'b' remains constant at '3'in an ideal fish (Allen, 1938), but under natural conditions the value of 'b' usually ranges between 2.5 and 4 (Hile, 1936; Martin, 1949). In the present study 'b' varied between 2.6328 and 3.2012 in the various size categories. When b=3, the growth is isometric and the increase in weight is proportional to the cube of length. When the value of b varies from 3, weight increase is said to be allometric. The slope value was lower than the critical isometric value of 3 in smaller length groups which indicates that the species is slender when the fish is younger whereas the 'b' value higher than 3 in large sizes indicates that the species become heavier for its weight as it grows longer. 't' Stat indicated that the growth was significantly allomertric only in smaller size groups whereas the allometric growth observed in the largest size category observed was not statistically significant. The results of the present study is in conformity with the views of Le Cren (1951), Wootton (1992), Khan *et al*. (2011), Myla *et al*. (2012), Kuldeep Kumar *et al*. (2013) and Preetha G Nair *et al*. (2015) that the fish normally does not retain the same shape or body outline throughout their life span and specific gravity of tissues may not remain constant and the actual relationship may depart significantly from the cube law. Variations in the slope mostly reflect the change in the body form when the weight of the fish gets affected by environmental factors like temperature, food supply, spawning conditions and other factors like life stages, sex, fishing area, fishing time and sample size variations (Ricker,1973; Bagenal and Tesch,1978; Kleanthids *et al*., 1999). Boverton and Holt (1957) opined that any indication in biological events could be recorded by allometric law since 'a 'and 'b' of allometric formula might vary within a wide range for very similar data and very sensitive to even slight variations in various factors. Weatherly and Gill (1987) found that higher metabolic activity with spawning season lowers the 'b' value while less metabolic activities, accumulation of fat, weight of gonad etc. during the pre-spawning period increases the values. The closeness of 'b' values to 3 also suggests a healthy environment for the fishes with respect to feeding and growth. Fig. 1 illustrates the length-weight relationship in *Anabas testudineus* (pooled) of Kuttanad wetland ecosystem.

The length-weight relationship obtained for the various categories are

7-10 cm : $W = 0.001432\ L^{2.6328}$, $\log W = -3.1558 + 2.6328 \log L$
10-13 cm : $W = 0.002098\ L^{2.6862}$, $\log W = -3.3219 + 2.6862 \log L$
13-16 cm : $W = 0.0001234\ L^{3.1362}$, $\log W = -4.0914 + 3.1362 \log L$
16-19 cm : $W = 0.003347\ L^{3.2012}$, $\log W = -3.5247 + 3.2012 \log L$
Total : $W = 0.0002980\ L^{2.8452}$, $\log W = -4.4742 + 2.8452 \log L$

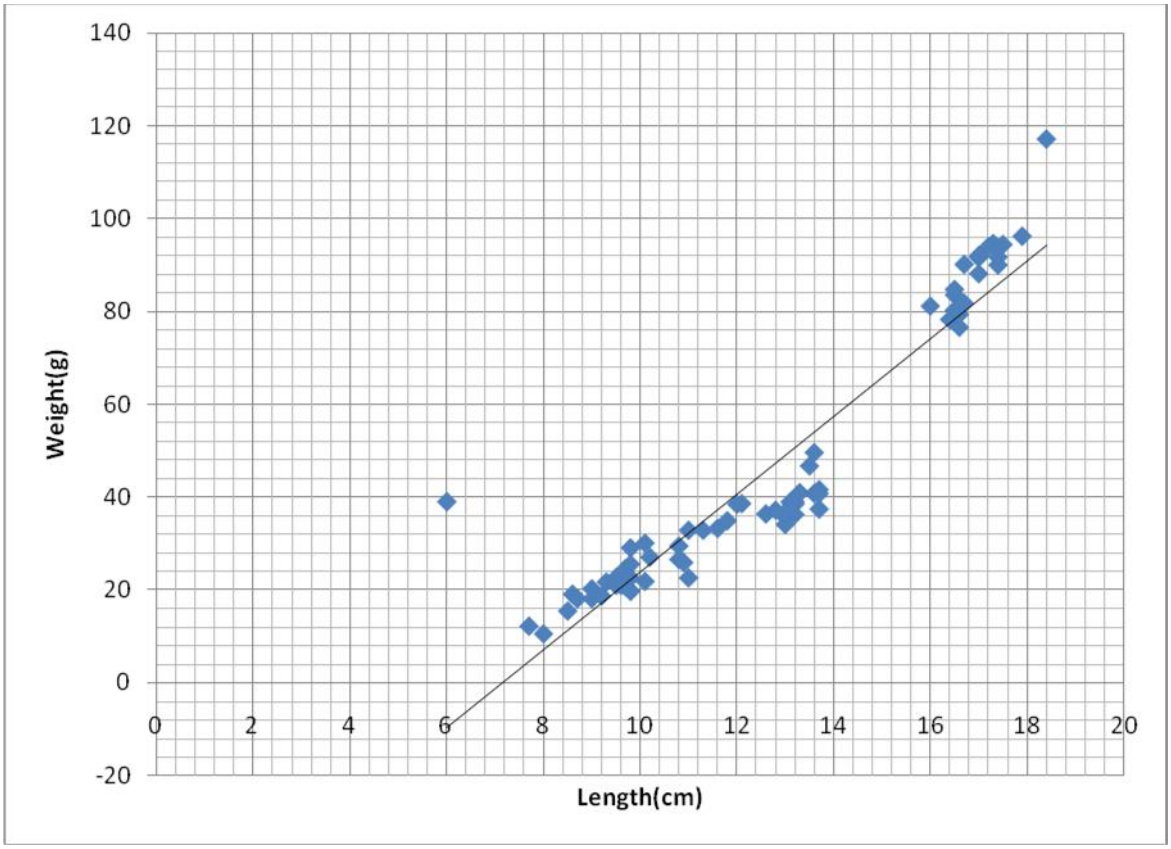

Fig. 1 Length- weight relationship in *Anabas testudineus* of Kuttanad wetland ecosystem

Condition factor basically represents the quality of fish, which is actually the result of the interactions between biotic and abiotic factors and their effect on the physiological condition of the fish. However, variations in fish's condition factor primarily reflect its state of sexual maturity and degree of nourishment. Fluctuations in condition factor of many fishes were observed in relation to their reproductive cycle, feeding rhythms, physico- chemical factors of the environment, age, physiological state or some other environmental factors (Kurup and Samuel, 1987; Kurup, 1990; Kalita and Jayabalan, 1997; Alex Nehemia *et al*. 2012).Condition factor of a fish reflects recent physical and biological circumstances which fluctuates by interactions among feeding conditions, parasitic infections and physiological factors. When condition factor value is higher it means that the fish has attained a better condition. The condition factor observed for *Anabas testudineus* in the present study was greater than one which suggests that the fish was in a good condition. The values of condition factor fluctuate from 1.45 to 3.08. The maximum value (mean) of K recorded was in the lowest size group (7-10 cm) and the lowest value (mean=1.66) in 13-16 cm size category. The K value obtained for *Anabas testudineus* by Kuldeep Kumar *et al*. in different culture systems were 1.85 to 2.29. The variations in condition factor in the different size groups can be attributed to factors like life stages, sample size variations, faster growth rate of the younger ones, changes in food reserves and food preferences etc.

Based on the length-weight relationship and condition factor estimated, the study reveals that *Anabas testudineus* population inhabiting the Kuttanad wetland ecosystem of Kerala are in a better condition. The study supports the theory that the growth is allometric in *Anabas testudineus*.The higher size groups show insignificant positive allometric growth while the lower size groups exhibits significant negative allometric growth.

Acknowledgments

The authors are grateful to the Principal and Management, Kuriakose Gregorios College, Pampady for providing the required facilities and necessary support for the effort.

References

Alex Nehemia, Justin D Maganira and Cyrus Rumisha, 2012, Length-weight relationship and condition factor of tilapia species grown in marine and fresh water ponds, Agriculture and Biology Journal of North America, 3(3); 117-124

Allen,K.R. 1938 Some observations on the biology of the trout(Salmotrutta) in Windermere, *J.Anim.Ecol*., 7:333-349

Bagenal, T.B. and W. Tesch, 1978 Age and Growth. In: *Methods for the assessment of fish production in fresh waters*, 3rd ed. Blackwell Scientific Publication, pp101-136

Biswas, B. And M.S. Shah 2009, Taxonomic comparison of local and Thai Koi (*Anabas testudineus*, Bloch) from Khula, Bangladesh. SAARC J. Agriculture 7(1):19-28

Beverton,R.J.H. and S.J.Holt, 1957, On the dynamics of exploited fish populations. *Fish. Invest. Agric. Fish. Food.G.B.* 19:533-545

Chandra,G, I. BBhattacharjee, S.N.Chattarjee and A. Ghosh, 2008, Mosquito control in larvivorous fish. *IndianJ. Med.Res*. 127: 13-27

Davenport,J. And A.K.M. Abdul Martin, 1990, Terrestrial locomotion in the climbing perch *Anabas testudineus*, Bloch(Anabantidea, Pisces), *Journal of Fish Biology*, 37: 175-184

Fulton, T.W., 1904, The rate of growth of fishes. *Twenty- second Annual report, Part III Fisheries Board of Scotland, Edinburgh*, pp 141-241

Graham, J.B. 1997, *Air-breathing fishes: Evolution, diversity and adaptation*, Academic Press, London, UK

Hile, R.1936, Age and growth of the Cisco, *Lieucichthys artedi* (Le Sueur)in the lakes of the North eastern high lands, Wiscorsin. *Bull.U.S.Bur.Fish*. 48:211-317

Hughes,G.M. and B.N.singh 1970, Respiration in an air breathing fish, the climbing perch *Anabas testudineus*, Bloch, *Journal of expiremental biology*, 53 :265-280

Kalita, N. And N. Jayabalan, 1997, Age and growth of the Karangid *Alepes para* (class: Osteichthyes) from Mangalore coast, *IndianJ Mar. Sci*., 26: 107-108

Khan,S., M.A. Khan, K. Miyan and M. Mubark, 2011, Length-weight relationship for nine fresh water teleosts collected from River Ganga, India. *International Journal of Zoological Research*, 7(6):401-405.

Kleanthids, P.K., A.I. Sinis and K.I.Stergion, 1999, Length-weight relationship of fresh water fishes in Greece. *Naga ICLARM* Q 22: 37-41

Kuldep Kumar,P.L., Lalrin Sanga, Mianaski Sahoo, U.L.Mohanthy, Rajesh Kumar and A.K. Sahu, 2013, Length-weight relationship and condition factor of *Anabas testudineus* and *Channa* species under different culture systems, *World J Fish and Marine Sci*., 5(1): 74-78

Kurup, B.M. 1990, Population characteristics, bionomics and culture of *Labeo dussumieri*(Val).*Final report submitted to Indian Council of Agricultural Research*,108 pp

Kurup, B.M. and C.T. Samuel, 1987, Length-weight relationship and relative condition factor in *Daysciaena albida*(Cuv.) and *Gerres filamentoses* (Cuv.), *Fishery Technology* 24: 88-92

Le Cren, E.D. 1951, The length – weight relationship and seasonal cycle in gonad- weight and conditions in the perch (*Perca fluviatilis* L) *J.Anim.Ecol*., 20: 201-219

Martin,W.R. 1949, The mechanics of environmental control of body form in fishes. *Publ. Ont. Fish. Res.Lab*. 70: 1-91

Myla.S. Chakravarty,B. Pavani and P.R.C Ganesh 2012, Length-weight relationship of ribbon fishes: *Trichiurus lepturus*(Linnaeus,1758)and *Lepturacanthus savala*(Cuvier, 1829) from Visakhapatnam coast, *J.Mar.Biol.Ass.India*, 54(2): 99-101

Pauly,D. 1983, Some simple methods for the assessment of tropical fish stocks. *FAO Fisheries Technical Paper (234)* FAO,Rome, Italy, 52pp

Pauly,D. 1993, *Fish population dynamics in tropical waters*: a manual for use .ICLAM. Stud. Rev.8: 325pp

Preetha G. Nair, Shoji Joseph and V.N. Pillai, 2015, Length-weight relationship and relative condition factor of *Stolephorus commersonii* (Lacepede, 1803) exploited along Kerala coast. *J.Mar.Biol. Ass.India*, 57(2):27-31

Rahman, A.K.A. *2005, Freshwater fishes of Bangladesh*. The zoological society of Bangladesh, Dhaka, 284-286

Ricker,W.E. 1973, Linear regression in fishery research, *Journal of the Fisheries Research Board of Canada*, 30: 409-434

Snedecor, G.W. and W.G.Cochran, 1967, Statistical *Methods*. The Iowa State University Press, Ames, Iowa

Talwar, P.K. and A.G. Jhingran 1991, *Inland fisheries of India and adjacent countries* Vol.2 AA Balkema, Rotterdam

Weatherly, A.H. and H.S. Gill, 1987. *The biology of fish growth*, Academic Press London. 433pp.

Wootton, R.J. 1992, *Fish ecology*, tertiary level biology. London Backie Scientific

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DOI:10.22192/ijarbs.2016.03.09.003	

How to cite this article:
K.S. Anila Kumary and Smrithy Raj. (2016). Length-Weight Relationship and Condition of Climbing perch *Anabas testudineus* Bloch population in Kuttanad, Kerala. Int. J. Adv. Res. Biol. Sci. 3(9): 21-26.