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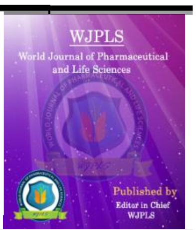

MERISTOMETRICALLY GROWTH STUDY OF FRESH WATER FISH *CHANNA GACHUA* (Ham. 1822)

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INTRODUCTION

The metric and meristic studies can be represented by a mathematical expression called a power or scaling equation West *et al.* (1997); Harte *et al.* 1999). The scaling laws has also been used further to body temperature, biological clocks, ontogenetic growth, home ranges of animals and species diversity patterns West *et al.* (2001); Enquist *et al.* (2002). Both single cause and multiple cause explanations of positive correlation have been debated at length (West *et al.*(2003) and these debates are far from being settled. In this paper, efforts have been made to establish scallometric relationships in a freshwater Scaling equation simply describe how a system's feature changes in proportion to the scale of the system. In biology, scaling equations describe a variety of allometric relationships. The general equation of positive correlation is given by, $Y = {}_{a}X^{b}$ (1) Where, 'Y' is a dependent variable, 'a' is normalization constant, 'X' is the independent variable, and 'b' is the scaling exponent. Taking the logarithms of both sides of this equation gives the expression for a straight line: X log b a log Y log + = (2) Thus, the statistics of linear regression can be used to fit scaling functions to maintained data. The exponent b is of particular interest as it can depict two important outcomes. Firstly, whether X and Y are related as expected by Euclidian geometry, i.e. are they must be isometric, for instance whether mass scales as cube of length, area as square of length, etc. Secondly, while comparing two variables belonging to same scalar quantity, for example, length of head and length of body, mass of brain and mass body etc. Variables grows more rapidly than the other ($b > 1$), less rapidly than the other ($b < 1$) or grows in proportion ($b = 1$). Studies in positive correlation have attracted both ecologist and evolutionary biologists for a variety of reasons. Ecologists have used allometric relationships to characterize growth patterns in organisms. For instance, especially in fish, the allometric relationship between length and weight is used for determining the conditioning factor, a measure of well being of the live stock in the given environment (Peck *et al.* 2005). Evolutionary significance of positive correlation has focused on identifying universal scaling laws, which can explain fundamental structural, metabolic and physiological rules that span over 21 orders of magnitude in size of biological diversity (West et.,al., 2005). Current research on positive correlation laws is influenced by three schools of thoughts that have emerged from observations on scaling between basic metabolic rate (BMR) and mass (M) of an organism (West et.,al., 2005). Both these schools rely on single cause explanations of scaling exponent. The third school of thought suggests that there are multiple causes for the scaling exponent and that the exponent is not a fixed value but rather a follows a distribution selected evolutionarily based on the metabolic activities of the organism. Interestingly, all three claims are supported experimentally under different sets of conditions. Present study addresses two major concepts, first, how do various tissues change with increase in conjunction and growth of the fish. Second, how do tissues associate with reproductive organs and shows seasonal growth as per the reproductive cycle, scale with the body parameters. In the present study, it shows that the scaling exponents of characters directly related to the reproductive success shows non-isometric relationships, probably due to their selection for maximum reproductive output.

While scaling exponents of characters that are not directly related to reproductive success with scale, isometrically. There may be any probable reasons that lead to the selection of non-isometric relations in the allometric scaling. If a system is self-similar, there exists some feature constant on all scales (Kharat *et al.* 2008).

Channa gachua (Male)

Channa gachua (female)

RESULTS AND DISCUSSIONS

Table 1: Length-Weight Relationship In *Channa Gachua* -2008.

Length of fish cm X	weight of fish gm Y	X2	Y2	XY	Log/L	Log/W	r-value	Regression equation.
13.7	40.3	187.69	1624.09	552.11	1.1367	1.6053	0.58	w=67.9 L 2.009
13.7	40.3	187.69	1624.09	552.11	1.1367	1.6053	0.58	w=67.9 L 2.010
13.7	40.3	187.69	1624.09	552.11	1.1367	1.6053	0.58	w=67.9 L 2.011
13.7	40.3	187.69	1624.09	552.11	1.1367	1.6053	0.58	w=67.9 L 2.012
13.7	40.3	187.69	1624.09	552.11	1.1367	1.6053	0.58	w=67.9 L 2.013
13.7	40.3	187.69	1624.09	552.11	1.1367	1.6053	0.58	w=67.9 L 2.014
13.7	40.3	187.69	1624.09	552.11	1.1367	1.6053	0.58	w=67.9 L 2.015
13.7	40.3	187.69	1624.09	552.11	1.1367	1.6053	0.58	w=67.9 L 2.016
13.7	40.3	187.69	1624.09	552.11	1.1367	1.6053	0.58	w=67.9 L 2.017
13.7	40.3	187.69	1624.09	552.11	1.1367	1.6053	0.58	w=67.9 L 2.018
16	29.6	254	876.16	473.6	1.2041	1.4713	0.58	w=67.9 L 2.019
16	29.6	254	876.16	473.6	1.2041	1.4713	0.58	w=67.9 L 2.020
16	29.6	254	876.16	473.6	1.2041	1.4713	0.58	w=67.9 L 2.021
16	29.6	254	876.16	473.6	1.2041	1.4713	0.58	w=67.9 L 2.022
16	29.6	254	876.16	473.6	1.2041	1.4713	0.58	w=67.9 L 2.023
16	29.6	254	876.16	473.6	1.2041	1.4713	0.58	w=67.9 L 2.024
16	29.6	254	876.16	473.6	1.2041	1.4713	0.58	w=67.9 L 2.025
16	29.6	254	876.16	473.6	1.2041	1.4713	0.58	w=67.9 L 2.026
16	29.6	254	876.16	473.6	1.2041	1.4713	0.58	w=67.9 L 2.027
16	29.6	254	876.16	473.6	1.2041	1.4713	0.58	w=67.9 L 2.028
17	36.1	289	1303.21	613.7	1.2304	1.5575	0.58	w=67.9 L 2.029
17	36.1	289	1303.21	613.7	1.2304	1.5575	0.58	w=67.9 L 2.030
17	36.1	289	1303.21	613.7	1.2304	1.5575	0.58	w=67.9 L 2.031
17	36.1	289	1303.21	613.7	1.2304	1.5575	0.58	w=67.9 L 2.032
17	36.1	289	1303.21	613.7	1.2304	1.5575	0.58	w=67.9 L 2.033

17	36.1	289	1303.21	613.7	1.2304	1.5575	0.58	w=67.9 L 2.034
17	36.1	289	1303.21	613.7	1.2304	1.5575	0.58	w=67.9 L 2.035
17	36.1	289	1303.21	613.7	1.2304	1.5575	0.58	w=67.9 L 2.036
17	36.1	289	1303.21	613.7	1.2304	1.5575	0.58	w=67.9 L 2.037
17	36.1	289	1303.21	613.7	1.2304	1.5575	0.58	w=67.9 L 2.038
18.5	49	342.25	2401	906.5	1.2672	1.6902	0.58	w=67.9 L 2.039
18.5	49	342.25	2401	906.5	1.2672	1.6902	0.58	w=67.9 L 2.040
18.5	49	342.25	2401	906.5	1.2672	1.6902	0.58	w=67.9 L 2.041
18.5	49	342.25	2401	906.5	1.2672	1.6902	0.58	w=67.9 L 2.042
18.5	49	342.25	2401	906.5	1.2672	1.6902	0.58	w=67.9 L 2.043
18.5	49	342.25	2401	906.5	1.2672	1.6902	0.58	w=67.9 L 2.044
18.5	49	342.25	2401	906.5	1.2672	1.6902	0.58	w=67.9 L 2.045
18.5	49	342.25	2401	906.5	1.2672	1.6902	0.58	w=67.9 L 2.046
18.5	49	342.25	2401	906.5	1.2672	1.6902	0.58	w=67.9 L 2.047
18.5	49	342.25	2401	906.5	1.2672	1.6902	0.58	w=67.9 L 2.048
19.5	76	350.25	5698	1497.6	1.29	1.8808	0.58	w=67.9 L 2.049

Avg. Length=20.0 Avg. Weight=80.0 t-test=0.05 *

Table 2: Length-Weight Relationship In *Channa Gachua* – 2009.

Length of fish cm X	**Weight of fish gm Y**	**X2**	**Y2**	**XY**	**Log/L**	**Log/W**	**r-value**	**Regression equation**
11.9	26.65	169	710.4	346.45	1.0755	1.4257	0.7	W=2.96L2.101
11.9	26.65	169	710.4	346.45	1.0755	1.4257	0.7	W=2.96L2.102
11.9	26.65	169	710.4	346.45	1.0755	1.4257	0.7	W=2.96L2.103
11.9	26.65	169	710.4	346.45	1.0755	1.4257	0.7	W=2.96L2.104
11.9	26.65	169	710.4	346.45	1.0755	1.4257	0.7	W=2.96L2.105
11.9	26.65	169	710.4	346.45	1.0755	1.4257	0.7	W=2.96L2.106
11.9	26.65	169	710.4	346.45	1.0755	1.4257	0.7	W=2.96L2.107
11.9	26.65	169	710.4	346.45	1.0755	1.4257	0.7	W=2.96L2.108
11.9	26.65	169	710.4	346.45	1.0755	1.4257	0.7	W=2.96L2.109
12	21.41	141.6	458.3	254.7	1.0792	1.3306	0.7	W=2.96L2.110
12	21.91	144	480	262.9	1.0792	1.3406	0.7	W=2.96L2.111
12	21.41	141.6	458.3	254.7	1.0792	1.3306	0.7	W=2.96L2.112
12	21.91	144	480	262.9	1.0792	1.3406	0.7	W=2.96L2.113
12	21.41	141.6	458.3	254.7	1.0792	1.3306	0.7	W=2.96L2.114
12	21.91	144	480	262.9	1.0792	1.3406	0.7	W=2.96L2.115
12	21.41	141.6	458.3	254.7	1.0792	1.3306	0.7	W=2.96L2.116
12	21.91	144	480	262.9	1.0792	1.3406	0.7	W=2.96L2.117
12	21.41	141.6	458.3	254.7	1.0792	1.3306	0.7	W=2.96L2.118
12	21.91	144	480	262.9	1.0792	1.3406	0.7	W=2.96L2.119
12	21.41	141.6	458.3	254.7	1.0792	1.3306	0.7	W=2.96L2.120
12	21.91	144	480	262.9	1.0792	1.3406	0.7	W=2.96L2.121
12	21.41	141.6	458.3	254.7	1.0792	1.3306	0.7	W=2.96L2.122
12	21.91	144	480	262.9	1.0792	1.3406	0.7	W=2.96L2.123
12	21.41	141.6	458.3	254.7	1.0792	1.3306	0.7	W=2.96L2.124
12	21.91	144	480	262.9	1.0792	1.3406	0.7	W=2.96L2.125
12	21.41	141.6	458.3	254.7	1.0792	1.3306	0.7	W=2.96L2.126

12	21.91	144	480	262.9	1.0792	1.3406	0.7	W=2.96L2.127
13	46.07	225	2122.4	691.05	1.1139	1.6634	0.7	W=2.96L2.128
13	21.5	143	462.25	256	1.1139	1.3324	0.7	W=2.96L2.129
13	46.07	225	2122.4	691.05	1.1139	1.6634	0.7	W=2.96L2.130
13	21.5	143	462.25	256	1.1139	1.3324	0.7	W=2.96L2.131
13	46.07	225	2122.4	691.05	1.1139	1.6634	0.7	W=2.96L2.132
13	21.5	143	462.25	256	1.1139	1.3324	0.7	W=2.96L2.133
13	46.07	225	2122.4	691.05	1.1139	1.6634	0.7	W=2.96L2.134
13	21.5	143	462.25	256	1.1139	1.3324	0.7	W=2.96L2.135
13	46.07	225	2122.4	691.05	1.1139	1.6634	0.7	W=2.96L2.136
13	21.5	143	462.25	256	1.1139	1.3324	0.7	W=2.96L2.137
13	46.07	225	2122.4	691.05	1.1139	1.6634	0.7	W=2.96L2.138
13	21.5	143	462.25	256	1.1139	1.3324	0.7	W=2.96L2.139
13	46.07	225	2122.4	691.05	1.1139	1.6634	0.7	W=2.96L2.140
13	21.5	143	462.25	256	1.1139	1.3324	0.7	W=2.96L2.141

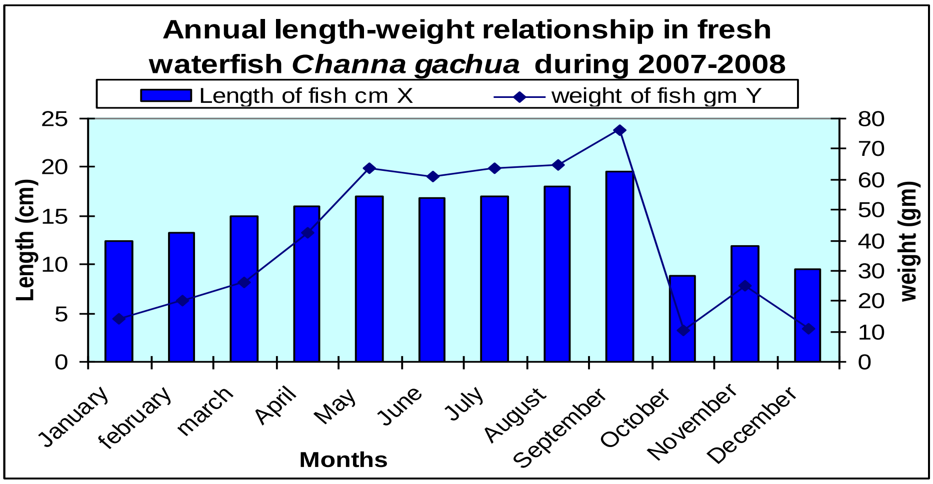
Avg. Length=12.2 Avg. Weight= 23.0 t-test=0.05 *

Table 3: Length-Weight Relationship In *Channa Gachua* -2010.

Length of fish cm X	Weight of fish gm Y	X2	Y2	XY	Log/L	Log/W	r-value	Regression equation
8.9	10.1	100	102.1	101	0.94939	1.004321	0.62	W= 56.8 L 2.002
9.8	9	79.21	81	80.1	0.991226	0.954243	0.62	W= 56.8 L 2.003
5.9	11	79.21	121	107.8	0.770852	1.041393	0.62	W= 56.8 L 2.004
6.5	1.8	34.81	3.24	10.62	0.812913	0.255273	0.62	W= 56.8 L 2.005
7.3	3.3	42.25	4	13	0.863323	0.518514	0.62	W= 56.8 L 2.006
9.5	10.9	90.25	118.81	103.55	0.977724	1.037426	0.62	W= 56.8 L 2.007
5.8	9.2	81.5	84.64	85.5	0.763428	0.963788	0.62	W= 56.8 L 2.008
10	2.5	33.64	6.25	14.5	1	0.39794	0.62	W= 56.8 L 2.009
8.9	10.1	100	102.1	101	0.94939	1.004321	0.62	W= 56.8 L 2.010
9.8	9	79.21	81.00	80.1	0.991226	0.954243	0.62	W= 56.8 L 2.011
5.9	11	79.21	121	107.8	0.770852	1.041393	0.62	W= 56.8 L 2.012
6.5	1.8	34.81	3.24	10.62	0.812913	0.255273	0.62	W= 56.8 L 2.013
7.3	3.3	42.25	4	13	0.863323	0.518514	0.62	W= 56.8 L 2.014
9.8	9	79.21	81	80.1	0.991226	0.954243	0.62	W= 56.8 L 2.015
9.5	10.9	90.25	118.81	103.55	0.977724	1.037426	0.62	W= 56.8 L 2.016
9.3	10	64	36	48	0.968483	1	0.62	W= 56.8 L 2.017
9.2	10.2	64	81	72	0.963788	1.0086	0.62	W= 56.8 L 2.018
9.8	9	79.21	81	80.1	0.991226	0.954243	0.62	W= 56.8 L 2.019
9.5	10.9	90.25	118.81	103.55	0.977724	1.037426	0.62	W= 56.8 L 2.020
9.3	10	64	36	48	0.968483	1	0.62	W= 56.8 L 2.021
9.2	10.2	64	81	72	0.963788	1.0086	0.62	W= 56.8 L 2.022
9.8	9	79.21	81	80.1	0.991226	0.954243	0.62	W= 56.8 L 2.023
9.5	10.9	90.25	118.81	103.55	0.977724	1.037426	0.62	W= 56.8 L 2.024
9.3	10	64	36	48	0.968483	1	0.62	W= 56.8 L 2.025
9.2	10.2	64	81	72	0.963788	1.0086	0.62	W= 56.8 L 2.026
9.8	9	79.21	81	80.1	0.991226	0.954243	0.62	W= 56.8 L 2.027
9.5	10.9	90.25	118.81	103.55	0.977724	1.037426	0.62	W= 56.8 L 2.028

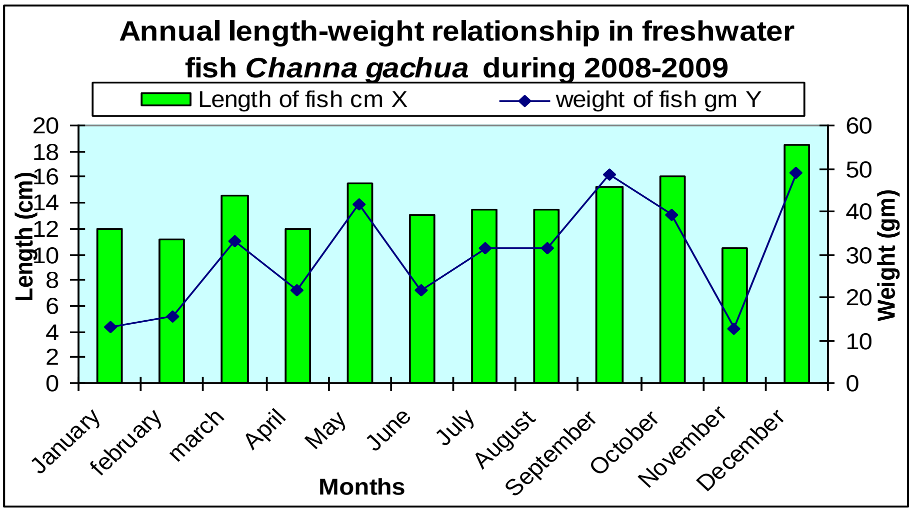
9.3	10	64	36	48	0.968483	1	0.62	W= 56.8 L 2.029
9.2	10.2	64	81	72	0.963788	1.0086	0.62	W= 56.8 L 2.030
9.8	9	79.21	81	80.1	0.991226	0.954243	0.62	W= 56.8 L 2.031
9.5	10.9	90.25	118.81	103.55	0.977724	1.037426	0.62	W= 56.8 L 2.032
9.3	10	64	36	48	0.968483	1	0.62	W= 56.8 L 2.033
9.2	10.2	64	81	72	0.963788	1.0086	0.62	W= 56.8 L 2.034
9.8	9	79.21	81	80.1	0.991226	0.954243	0.62	W= 56.8 L 2.035
9.5	10.9	90.25	118.81	103.55	0.977724	1.037426	0.62	W= 56.8 L 2.036
9.3	10	64	36	48	0.968483	1	0.62	W= 56.8 L 2.037
9.2	10.2	64	81	72	0.963788	1.0086	0.62	W= 56.8 L 2.038
8	5	30.25	8.41	40	0.90309	0.69897	0.62	W= 56.8 L 2.039
5.5	4	64	18.889	17.6	0.740363	0.60206	0.62	W= 56.8 L 2.040
6.3	4.3	37.21	25	22.77	0.799341	0.633468	0.62	W= 56.8 L 2.041
6.9	3.2	39.67	16	42.25	0.838849	0.50515	0.62	W= 56.8 L 2.042

Avg. Length= 9.5 Avg. Weight=10.0 t-test=0.05 *



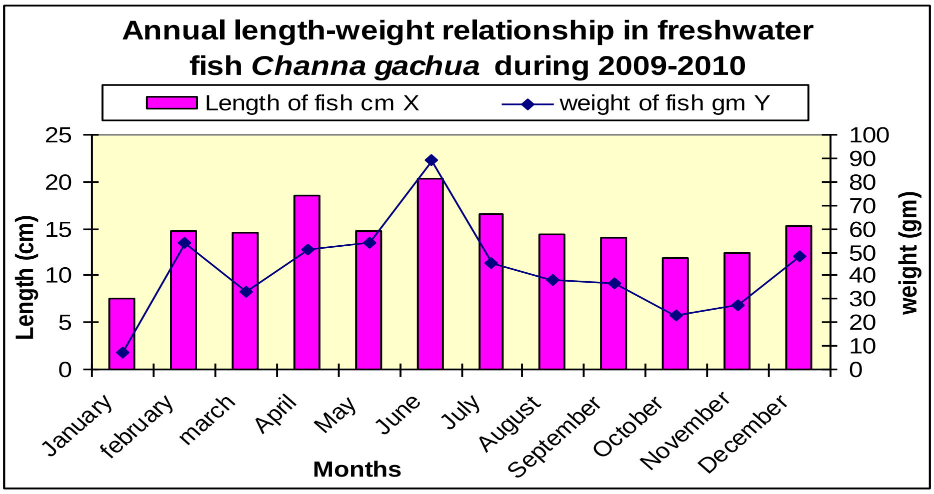
Avg. Length= 15.5 Avg. Weight=55.0 t-test=0.05 *

Fig.1 Shows annual study of growth in weight (gm) measurements during 2007-2008.



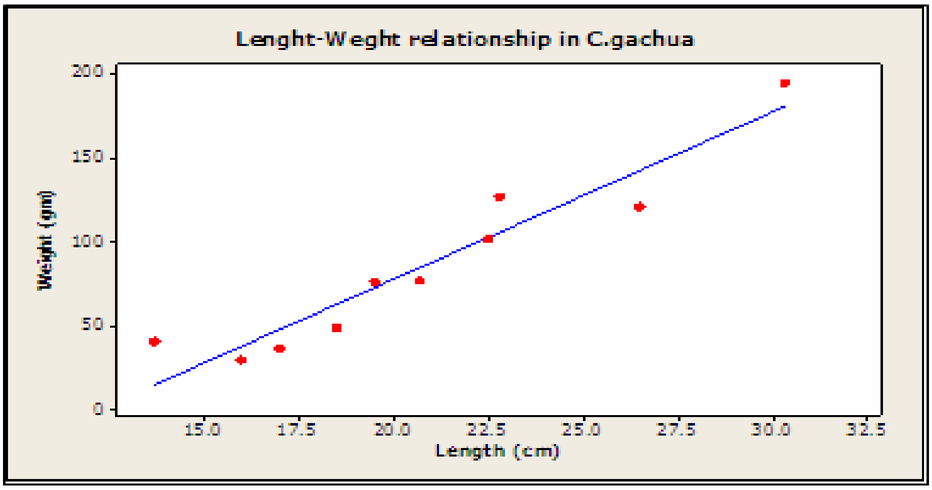
Avg. Length= 16.5 Avg. Weight=45.0 t-test=0.05 *

Fig.2 Shows annual study of growth weight (gm) measurements during 2008-2009.



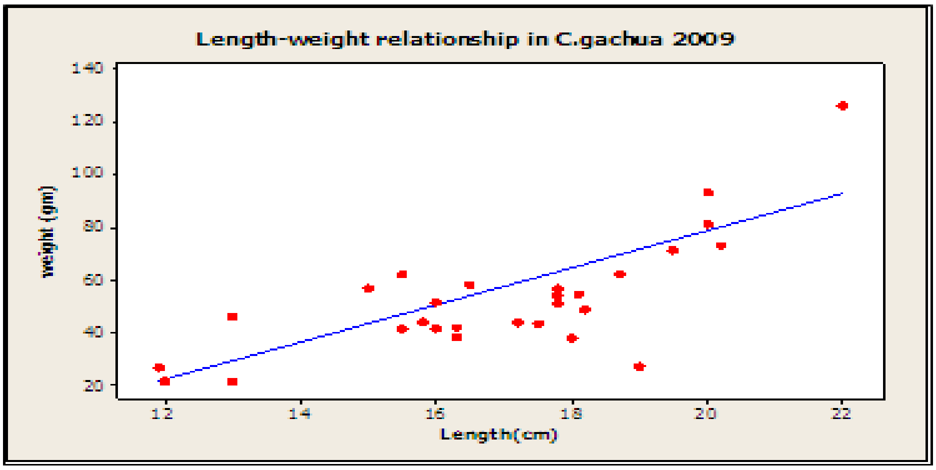
Avg. Length= 18.5 Avg. Weight=65.0 t-test=0.05 *

Fig.3 Shows annual study of growth weight (gm) measurements during 2009-2010.



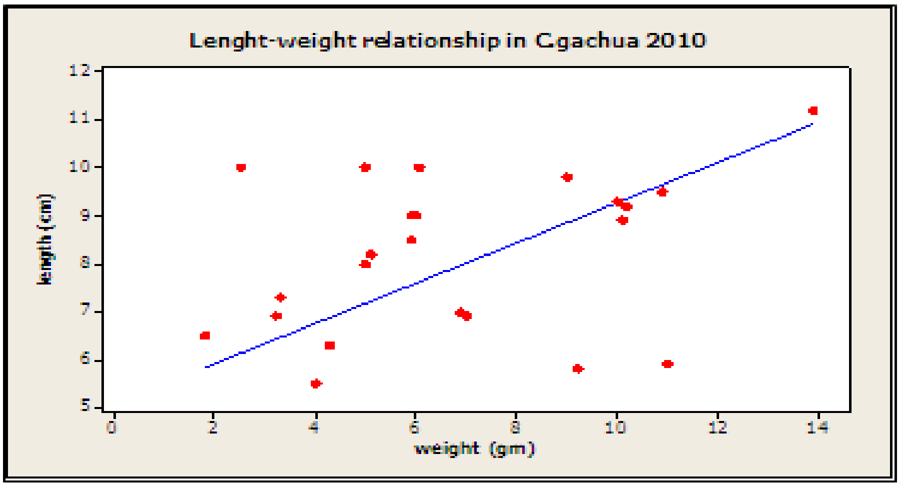
Avg. Length=10.1 Avg. Weight=160.0 t-test=0.05 *

Fig.4 Length-Weight Relationship In *Channa Gachua* 2008.



Avg. Length=18.0 Avg. Weight= 60.0 t-test=0.001 *

Fig. 5 length-weight relationship in *channa gachua* 2009



Avg. Length=8.5 Avg. Weight= 10.0 t-test=0.05 *

Fig. 6 length-weight relationship in *channa gachua* 2010.

For a constant density, the mass and weight of fish is expected to scale as cube of length as per the Euclidian geometry. Thus, the exponent b in a length-weight relationship should be close to value of its cube 3. However, the length-weight relationship in *Channa gachua*, for the pooled data of three year showed a best fit curve defined by the equation, W = $_{0.2823}$ L$^{2.8567}$re 1., r = 0.8296, $p < 0.001$). This exponent 2.8567 (SE 0.2541) is far lesser than the expected cubic value.

Monthly growth in term of length-weight relationship during circannual cycle (2007-08) is average length=12.0 and average weight= 29.4 and regression equation W=2.00L3.00, t-test=0.05 * (table no.1), Average length= 13.8, average weight= 20.6 and regression equation is W=2.00L3.93, t-test=0.05 * (table no. 2), Average length= 16.7 average weight=51.3 and regression equation W=2.00L2.40 with t-test=0.01* * (table no3). Average length= 14.2 average weight= 45 and regression equation =12.00L2.39 with t-test = 0.05* (table no 4) .Average length= 16.1, average weight= 60 and regression equation W= 51.9 L 2. 43 with t-test = 0.05* (table no.5).Average length= 17.2 average weight=65 and regression equation is W= 57.3 L 2.41, with t-test=0.05 *(table no.6). Average length=13.0 average weight=25.0 regression equation W=67.9 L 2.49, with t-test=0.05 * (table no.7).Average length=20.0 average weight=80.0 regression equation W=67.9 L 2.049 with t-test=0.05 * (table no.8).

Average length=13.2, average weight=19.4 regression equation W = 543.L 2.48 with t-test=0.05 * (table no.9).Average length=7.1average weight=8.2, regression equation W = 56.8 L 2.128 with t-test=0.05 * (table no. 10).Average length=8.0, average weight=5.0, regression equation W = 32.7L 2.47 with t-test=0.05 *. (Table no.11)Average length=8.2, average weight= 10.0, regression equation W = 56.8 L 2.172 with t-test=0.05 * (table no.12). Length-weight relationship during circannual cycle (2008-2009) is average length=13.1 and average weight= 19.5 and regression equation W=3.00L3.41, t-test=0.05 * (table no.13), Average length= 12.1, average weight= 18.8 and regression equation is W=2.00L3.93, t-test=0.05 * (table no. 12), Average length= 15.8 average weight=39.1 and regression equation W=2.96L2.40with t-test=0.05* * (table no13). Average length= 14.8 average weight= 45.7 and regression equation W=2.96L2.139 with t-test = 0.05* (table no 14).

Average length= 15.8, average weight= 39.1 and regression equation W=2.96L2.40with t-test = 0.05* (table no.15). Average length= 14.8 average weight=45.7 and regression equation is W=2.96L2.139 with t-test=0.05 *(table no.16).Average length=15.5 average weight=35.0 regression equation W=2.96L2.41 with t-test=0.01 * (table no.17). Average length=12.2 average weight=23.0 regression equation W=2.96L2.141 with t-test=0.05 * (table no.18). Average length=13.5, average weight=35.2 regression equation W=0.1L2.51 with t-test=0.01 * (table no.19). Average length=14.4 average weight=35.0, regression equation W=25.1L2.41with t-test=0.01 * (table no. 20).Average length=15.2, average weight=48.1, regression equation W=23.9L283 with t-test=0.01 *. (Table no. 21).

Average length=15.4, average weight= 45.0, regression equation W=35.2L 2.41 with t-test=0.05* (table no.22). Average length= 10.2, average weight= 13.5 regression equation W=24.6L 2.49 with t-test=0.05* *(table no.23). Average length= 17.8, average weight= 54.0 regression equation W= 43.2 L 2.43 with t-test=0.05* *(table no.24)

Length-weight relationship during circannual cycle (2009-2010) is average length=8.5 and average weight= 9.4 and regression equation W=24.4 L 2.49, t-test=0.05 * (table no.25), Average length= 13.9 , average weight= 38.1 and regression equation is W= W= 34.9L 2.42, t-test=0.05 * (table no. 26), Average length= 18.5 average weight=50.0 and regression equation W=36.1 L 2.41 with t-test=0.05* * (table no.27).Average length= 14.5 average weight= 33.1 and regression equation W=54.2 L 2.41with t-test = 0.01* (table no 28). Average length= 18.2, average weight= 74.1and regression equation W= 23.1 L 2.41 with t-test = 0.05* (table no.29). Average length= 15.1 average weight=35.1and regression equation is W= 32.1 L 2.74 with t-test=0.01 *(table no.31).Average length=14.3 average weight=35.0 regression equation W= 36.2 L 2.50 with t-test=0.01 * (table no.32). Average length=11.5 average weight=23.1 regression equation W= 21.1 L 2.43 with t-test=0.01 * (table no.33).

Average length=12.9, average weight=28.8regression equation W= 54.2 L 2.45 with t-test=0.01 * (table no.34). Average length=15.2 average weight=45.0, regression equation W= 54.9 L 2.47 with t-test=0.01 * (table no. 35). Average length=9.5 average weight=10.0, regression equation W= 56.8 L 2.042 with t-test=0.01 *.(Table no.36).

Turkmen *et al.* (2001) has argued the exponent b in fish differ according to the species, sex, age, season and fish feeding. While, Moutopoulos et.al., (2002) attributed the variation in exponent b from its expected cubic value to differences in the number of specimen examined to area or season and differences in the observed length ranges of the specimen caught.

Darveau *et al.* (2002) however argued that, the positive correlation exponents can show deviation from universal exponents depending upon the state of the organism leading to an additive effect of allometric cascades. Their point was severely criticized by West *et al.* (2003) and Banavar *et al.*(2003)

In the length-weight relationship study exponent b show a normal distribution on both sides of the cubic value with little deviation. Peck *et al.*(2005) has shown the effect of ontogenic changes on the possitive corelation of mass and length relationship in a fish *Sprattus sprattus*. We, however, suspect that the major factor, which affects the exponent *b* in *Channa gachua* , could be the degree of sexual maturity of the fish, and found value at 2.234, Figure 43 (a) is an additive effect of high variation in gonad weight during various stages of sexual maturity. To substantiate this argument we plotted the exponent *b* for the data of one year, Figure 43 (b). If the weight scaled as cube of length in post spawning seasons, it will scale more than cube in pre-spawning and spawning period, due to the weight of the gonads. This may lead to hampered moment of fish, as the streamline structure of the fish will be distorted. Thus, the adaptation of the fish to a smaller exponent during the post-spawning months not only renders it rapid moments in post-spawning months but also with the advent of the pre-spawning and spawning period. The exponent approached cube or slightly more than the cube, making it possible that the fish maintains streamline body for the upstream migration during spawning. as the scale of the body increases the relationship depicting change in lengths of two tissues should show an exponent of one and the relationship depicting change in length versus weight should show an exponent of 1/3 or 0.33, in Euclidian geometry.

These isometric relationships suggest that tissues are not under the pressure of selection for maximum reproductive efficiency, the relationships can follow Euclidian geometry. To study the scaling laws during reproductive phase of the fish, 100 gravid fully ripped females were considered. The length-weight relationship of these females had an exponent of more than 3 as per our expectation figure 43 (b).

The length-weight relationship was given by the equation logW= 2.234logL2.876, r = 0.8217. If it is assumed that, the eggs are tightly packed in the ovary and have a constant volume Veg., then the total volume of the ovary Vo will be equal to, Vo = Veg. × F, where, F is the fecundity. The observed relation is F = 2.4058Wo 3.011 Figure 44 (a), r = 0.5536, p <0.01, SEE 0.1020) which is statistically different from unity.

Most interestingly, the literature survey on the relation of F and Wo in other fish showed marked deviation from the unity. Such information found suitable while calculating the gross estimate of fecundity.

In the present study, it can argue that the deviation of exponent from unity in this relationship probably could be attributed to the error incorporated during this sub-sampling method. It is less likely that, lower than unity exponent in this relationship is an outcome of selection. If we expect that the ovary grow in proportion to the body growth, isometric suggests that Wo should scale as cube of L (length) and as unity with W (weight). However, the found relationships are Wo = 0.5933×10 –6L2.931, Figure 44 (b), r = 0.8818, p < 0.001, SEE 1.2240) and Wo = o.2969W 2.245 Figure 44 (c), r = 0.8497, p < 0.001, SEE 0.2208).

These relations further observed among the relationship between F, L and W by the equations F = 0.7324×10–8 L 2.767, Figure 44 (d), r = 0.511, p < 0.001, SEE 0.6023) and F = 0.3584 W 50.52 (Figure 44 (e), r = 0.698, p < 0.001, SEE 0.7234). The non-isometric growth of ovary as compared to somatic tissues can have evolutionary significance. Our relationship concludes that the weight of ovary scales 1.400 times the weight of the body. That is, with increment of ovary unit in body weight and increase in ovary weight is drastic. This arrangement suggests that the fish devotes its entire abdominal space for the growing ovary. We suspect that; adaptation could be an outcome of maximization of fitness in terms of reproductive output, because with unit increment in the body weight the weight of ovary that is carried by the female increases by a factor 1.2., such adaptations will not give universal scaling exponent because each fish will differ in its reproductive cycle and r and K selection during respective seasons. The scaling exponent for relationship between F and L or F and W is variable in different fish species. Their inferences are based mainly on the relationship between metabolic rate and body mass and the factorial like geometry of the organisms (West *et al.* 1997). Along with other reports of deviation from allometric relationships that the positive correlation can show deviations from universal exponents (Peck *et al.* 2005). Furthermore, Kozlowski and Konarzewski (2005) have criticized the single cause explanation a pluralistic approach to scaling, founded-on the life history theory, can explain the scaling relationships. Our findings supports Kozlowski and Konarzewski's (2005),claim by suggesting that the scaling exponent are subject to change from isometry depending on the reproductive cycle, r and K selection and the selection pressure on characters from the point of view of maximizing reproductive outcome. Positive correlation will be subject to selection especially if it is directly relevant for the reproductive efficiency of the organism.

In study, it is observed that isometric relationship, which could be fairly constant, between parameters, which are not directly relevant in the reproduction of the fish. Interestingly we observed a non-isometric exponent in the relationship between L and W. In *Channa gachua* that migrate up-streams for the reproduction, maintaining the streamline structure is an essential and thus the non-isometric exponent could be an adaptation as described before. In case of other gonadal tissues that are associated with the reproductive behavior of the fish, observed a non-isometric exponents, which are also not universal in other fish species. The relationship between Wo and L that gives extraordinary high deviation from the cubic value clearly indicates that the gonadal tissues are subject for selection towards high reproductive efficiency. Further more, a relationship showed isometric exponent reproduction and related parameters could be between Wo and F suggests all parameters are under the same selection pressure.

CONCLUSION

In study, it is observed that isometric relationship, which could be fairly constant, between parameters, which are not directly relevant in the reproduction of the fish. Interestingly we observed a non-isometric and isometric exponent in the relationship between L and W. In *Channa gachua* that migrate up-streams for the reproduction, maintaining the streamline structure is an essential and thus the non-isometric exponent could be an adaptation as described before. In case of other gonadal tissues that are associated with the reproductive behavior of the fish, observed a non-isometric exponents, which are also not universal in other fish species. The relationship between Wo and L that gives extraordinary high deviation from the cubic value clearly indicates that the gonadal tissues are subject for selection towards high reproductive efficiency. Furthermore, a relationship showed isometric exponent reproduction and related parameters could be between Wo and F suggests all parameters are under the same selection pressure.

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