INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 16, No. 2, p. 523-528, 2020

RESEARCH PAPER OPEN ACCESS

Effect of feeding frequency on food consumption and growth of goldfish (*Carassius auratus*) in man-made pond at Kb Ahmad Shah Nasarn District, Pishin, Balochistan

Rehmat Ullah[1], Dr Ghulam Dastagir[1], Syed Umair Ahmad*[2], Amara Qadus[4], Zia Wali Shah[3], Syed Inam Ullah[1]

[1]*Department of Zoology, University of Balochistan, Quetta, Pakistan*

[2]*Department of Bioinformatics, Hazara University, Mansehra, Pakistan*

[3] *Centre for Human Genetics, Hazara University, Mansehra, Pakistan*

[4]*Department of Bioinformatics and Biotechnology, International Islamic University, Islamabad, Pakistan*

Key words: Length-weight relationship, Artificial and Natural environment

http://dx.doi.org/10.12692/ijb/16.2.523-528 Article published on February 28, 2020

Abstract

The length-weight relationships associated with physico-chemical parameters are important in biological studies. The aim of this study was to determine the effect of natural and artificial feed on fish growth. Slightly Noticeable difference in the values of temperature, pH, transparency and DO were observed throughout the year and as per standards for aquatic biota. Goldfish (*Carassius auratus*) species was reared in aquarium from January 2018 to December 2018. Fish measurement was quarterly recorded from both natural pond and artificial Aquarium. Our result revealed that the (b) value for pond was 3.10 which are positive algometric, while value of (b) for aquarium was 2.9 which are negative algometric. Thus goldfish species grow much batter in natural pond than in an artificial environment.

* **Corresponding Author:** Syed umair Ahmad ✉ ahmadumair927@gmail.com

Introduction

In fisheries biology, LWR data are beneficial to determine the weight of an individual fish of known length or total weight from length-frequency distribution (Froese, 1998; Koutrakis & Tsikliras, 2003). It is also helpful in local and interregional, morphological and life historical comparisons in species and populations (Kara & Bayhan, 2008; Erguden *et al.*, 2011; Erguden, 2016). The length weight relationship has extensive importance in fishery research especially in fish population dynamics and growth (Mathur and Bhatra, 2007). Length–weight relationship (LWR) of fishes are an important aspect of fishery biology and have a number of applications in fish stock assessment. LWR for fish was originally used to obtain information on the condition of fish and to determine whether somatic growth was isometric and/or allometric (Le Cren, 1951; Ricker, 1975). Little record is available on fresh water fishes of Balochistan, Pakistan. This research study aimed to study the LWR of (*Carassius auratus*) with their corresponding ecosystem of the Pishin district.

The Physico-chemical and biological parameters have significant role in fitness of aquatic ecosystem (Venkatesharaju, 2010). For testing the status of Markanday spring in Hamirpur District of Himachal Pradesh several physico-chemical parameters such as Total Dissolved Solids (TDS), Dissolved Oxygen (DS), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), hardness, chloride and pH were examined (Kumar and Nath, 2013). The study of biological parameters particularly physico-chemical analysis of water are used for productive potential. The factor such as chemicals and physical greatly effects the abundance of species productivity and species composition of any water body (RK Singh *et al.,* 1980). Among these factors temperature greatly influences the aquatic life, considered as an essential parameter for aquatic life and their metabolic activities. (Anderson RO and RM Neumann 1996). pH is also an essential factor for life in water. It also effects the productivity and growth of fishes (GM Carr *et al.*, 2008). Transparency/ turbidity chiefly influences the aquatic ecosystem it directly effects the feeding activities of fishes due to presence of particles in water (RK Singh *et al.,* 1980). The discovered oxygen also has limnolological important it is considered as one of the significant parameter for metabolic activities of aquatic fauna. It effects on productivity, growth, nutrients intake and fecundity of fishes. In summer season the level of DO drops due to higher temperature and vice versa in colder months (SS Ali *et al.,* 1999).

Feed quality, quantity, composition and ingredient size, and feeding frequency are among the most important. (Sampath K and Pandian TJ, 1984; Jobling M, 1998). Though frequent feeding improves fish growth (Andrews JW and Pages JW 1975; Chua TW, Teng S (1978). Increasing feeding frequency beyond a particular level may lead to feed wastage and increase production costs (Marian MP *et al.*, 1982). Entirely vital foods are necessary for suitable growth of fish quality and quantity (Ghosh, K., 2005). Development of an individual can be Well-defined as a modification in the size (length and weight) at the age of period. The growth amount in the fishes is greatly adaptable and rest on many ecological influences. Quality of diet and accessibility is one of the central factor effects growth amount of fish (Khanna SS, 1996).

Material and method

Sampling location

The sampling location was tehsil Karazat district Pishin situated in the northwest of Balochistan province of Pakistan, with Lititude (3034'59.880"N) and Longitude is (670'000"E). The pond which was selected for this study with an average depth of five feet and average area of 1874 sqt.

Sampling period and collection

The sampling period was from January 2018 to December 2018. After each three months the samples were collected by using holes automatic fishing net was used 16 holes 95cm. The weight in grams (g) were determined in an analytical balance and the length (L) in centi meter (cm) was measured by putting the fish on a translucent petri dish put on a graph paper and measurement scale was used.

A total of 55 goldfish was procured from the same pond weight on average each (15) and was placed in the fish Aquarium. The standard anova aquarium with (3"x2.5") with 110 liter water carrying capacity. For aeration standard filter was fitted in aquarium. After each three months the fish were collected by using small net (8x8 cm). To measure length and weight above method was used. A standard commercial Aquarium fish food was offered once in a day.

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

Where the values of 'log a' and 'n' were calculated by the formula.

The relationship was established using linear regression analysis, LnW vs LnL, where as the intercept of the regression curve (coefficient related to body form) and 'b' the regression coefficient (exponent indicating isometric growth when equal to 3).

Result and discussion

Water quality parameters

Temperature

Temperature is very vital factor for several of organism in optimum range. The analyzed data of this study research showed that the rang of temperature in pond was in the month of January and august (2°C-26°C) while in aquarium its range was recorded as in January and august (4°C-28°C).

Transparency and Turbidity

Turbidity is considered as a significant phenomenon for life in water because it directly influence the growth in higher turbidity, which turbid water effect on size, growth and other aspects of fish fauna. The observed range of turbidity in this research work showed in pond in month of January and March (46, 84), while in aquarium during the month of January and November (28, 53).

pH

pH is an important and determining factor for aquatic life. The observed data revealed that the lowest pH was recorded in pond in month of august (7.3) and aquarium in June (7.0) and the highest pH was reported in pond in January (8.2) while in aquarium in month of February (8.7).

Salinity

The result showed that salinity ranges in pond of lowest in month of July (0.1 g/lit) and highest June, February and September (0.3g/lit), while in aquarium the lowest result was in June (0.1g/lit) and highest in months of January, April and November (0.4g/lit).

Table 1. Physico-chemical Analysis of Aquarium water samples.

Month	Water Temp ℃	Transparency cm	PH	Salinity g/liter	Conductivity us	TDS ppm	DO mg/liter
January	4	28	7.2	0.4	290	297	9
February	6	30	8.7	0.2	185	261	7
March	11	35	7.4	0.3	243	242	8
April	16	39	7.1	0.4	255	310	7
May	21	41	7.0	0.3	317	439	6
June	24	49	7.0	0.1	375	488	3
July	26	46	8.2	0.2	338	463	2
August	28	50	7.8	0.3	287	240	7
September	20	56	7.3	0.2	216	422	6
October	16	46	7.8	0.3	184	406	10
November	13	53	7.8	0.4	190	141	8
December	6	50	8.1	0.3	144	344	13

Table 2. Physico-chemical Analysis of Pond water samples.

Month	Water Temp ℃	Transparency cm	pH	Salinity g/liter	Conductivity us	TDS ppm	DO mg/liter
January	2	46	8.2	0.2	211	278	11
February	4	52	7.9	0.3	190	249	9
March	9	84	7.7	0.2	247	231	7
April	13	78	7.4	0.1	261	399	6
May	19	72	7.8	0.2	321	428	4
June	22	63	8.0	0.3	380	478	2
July	24	60	8.1	0.1	341	450	3
August	26	76	7.3	0.2	290	427	6
September	18	68	7.6	0.3	221	410	8
October	14	62	8.1	0.2	190	395	11
November	7	61	7.8	0.3	171	302	13
December	4	73	8.0	0.2	150	332	15

Conductivity (us)

The analyzed data exhibited that the range for conductivity in pond during the month of December and June (150-380), while in aquarium it ranged in month of December and June (144-375).

TDS (Total dissolved solids)

The observed data determined that the range of TDS varies from month to month in observed range in pond of month of March and June (231-478), while in aquarium it was ranged in November and June (141-488).

Dissolved oxygen (DO)

DO is also considered as a growth and determining factor for aquatic life.

The analyzed data revealed that (Do) in pond was ranged during the month of June and December (2-15mg/lit). While in aquarium its range was during the month of July and December (2-13mg/lit).

Result for Length and weigh in aquarium

The result of observed and recorded data from aquarium exhibited that the highest length and weight was reported during the months of October, November and December (13.1cm, 31.2g), while the lowest length and weight was observed during the months of January, February and March as (10.33cm, 15.33g).

Table 3. Quarterly Length and Weight Relationship of Aquarium (January, February & March).

S. No	Length (cm)	Weight (g)	Log L	Log L²	Log W	logL xLog W
1.	11	17	1	1.084499	1.230449	1.2813805
2.	10	15	1	1	1.176091	1.1760913
3.	12	19	1.079181	1.164632	1.278754	1.3800069
4.	11	17	1.041393	1.084499	1.230449	1.2813805
5.	10	15	1	1	1.176091	1.1760913
6.	12	18	1.079181	1.164632	1.255273	1.3546665
7.	11	17	1.041393	1.084499	1.230449	1.2813805
8.	10	15	1	1	1.176091	1.1760913
9.	9	12	0.954243	0.910579	1.079181	1.0298006
10.	8	10	0.90309	0.815572	1	0.90309
Average	10.33	15.33	1.010942	1.024935	1.178042	1.1953999
Total	104	155	10.13987	10.30891	11.83283	12.039979

Table 4. Quarterly Length and Weight Relationship of Aquarium (April, May & June).

S. No	Length (cm)	Weight (g)	Log L	Log L²	Log W	logL xLog W
1.	10	15	1	1	1.176091	1.1760913
2.	12	18	1.079181	1.164632	1.255273	1.3546665
3.	11	17	1.041393	1.084499	1.230449	1.2813805
4.	10	15	1	1	1.176091	1.1760913
5.	13	22	1.113943	1.24087	1.342423	1.4953828
6.	10	15	1	1	1.176091	1.1760913
7.	12	19	1.079181	1.164632	1.278754	1.3800069
8.	11	17	1.041393	1.084499	1.230449	1.2813805
9.	13	22	1.113943	1.24087	1.342423	1.4953828
10.	11	17	1.041393	1.084499	1.230449	1.2813805
Average	11.3	17.7	1.051043	1.10645	1.243849	1.3097854
Total	113	177	10.5104	11.0645	12.4385	13.0979

Table 5. Quarterly Length and Weight Relationship of Aquarium (July, August & September).

S. No	Length (cm)	Weight (g)	LogL	Log L²	Log W	logL xLog W
1.	11	18	1.04139	1.0845	1.25527	1.30723
2.	12	20	1.07918	1.16463	1.30103	1.40405
3.	11	19	1.04139	1.0845	1.27875	1.33168
4.	13	25	1.11394	1.24087	1.39794	1.55723
5.	11	17	1.04139	1.0845	1.23045	1.28138
6.	10	17	1	1	1.23045	1.23045
7.	12	21	1.07918	1.16463	1.32222	1.42691
8.	14	30	1.14613	1.31361	1.47712	1.69297
9.	11	18	1.04139	1.0845	1.25527	1.30723
10.	13	23	1.11394	1.24087	1.36173	1.51689
Average	11.8	20.8	1.0698	1.14626	1.31102	1.4056
Total	118	208	10.698	11.4626	13.1102	14.056

Table 6. Quarterly Length and Weight Relationship of Aquarium (October, November & December).

S. No	Length (cm)	Weight (g)	Log L	Log L²	Log W	logL xLog W
1.	12	24	1.07918	1.16463	1.38021	1.4895
2.	14	34	1.14613	1.31361	1.53148	1.75527
3.	10	20	1	1	1.30103	1.30103
4.	15	38	1.17609	1.38319	1.57978	1.85797
5.	12	25	1.07918	1.16463	1.39794	1.50863
6.	15	41	1.17609	1.38319	1.61278	1.89678
7.	15	42	1.17609	1.38319	1.62325	1.90909
8.	16	43	1.20412	1.44991	1.63347	1.96689
9.	12	24	1.07918	1.16463	1.38021	1.4895
10.	10	21	1	1	1.32222	1.32222
Average	13.1	31.2	1.11161	1.2407	1.47624	1.64969
Total	131	312	11.1161	12.407	14.7624	16.4969

Result for length and weight in pond

The total observed and analyzed data showed as compared to aquarium the highest length and weight ware reported during the month of October, November and December as (15.5 cm, 64.5g), while the lowest of length and weigh were recorded in month of January, February and March as (11.5cm, 23g)

Table 7. Quarterly Length and Weight Relationship of Pond (January, February & March).

S. No	Length (cm)	Weight (g)	Log L	Log L²	Log W	logL xLog W
1.	11	23	1.041393	1.084499	1.361728	1.4180934
2.	12	24	1.079181	1.164632	1.380211	1.4894981
3.	11	22	1.041393	1.084499	1.342423	1.3979892
4.	10	21	1	1	1.322219	1.3222193
5.	14	27	1.146128	1.313609	1.431364	1.6405261
6.	14	27	1.146128	1.313609	1.431364	1.6405261
7.	10	20	1	1	1.30103	1.30103
8.	12	23	1.079181	1.164632	1.361728	1.4695511
9.	11	23	1.041393	1.084499	1.361728	1.4180934
10.	10	20	1	1	1.30103	1.30103
Average	11.5	23	1.05748	1.120998	1.359482	1.4398557
Total	115	230	10.5748	11.20998	13.59482	14.398557

Table 8. Quarterly Length and Weight Relationship of Pond (April, May & June).

S. No	Length (cm)	Weight (g)	Log L	Log L²	Log W	log L xLog W
1	10	23	1	1	1.361728	1.3617278
2.	12	26	1.079181	1.164632	1.414973	1.5270127
3.	11	28	1.041393	1.084499	1.447158	1.5070598
4.	10	25	1	1	1.39794	1.39794
5.	12	24	1.079181	1.164632	1.380211	1.4894981
6.	11	22	1.041393	1.084499	1.342423	1.3979892
7.	15	30	1.176091	1.383191	1.477121	1.7372294
8.	14	28	1.146128	1.313609	1.447158	1.6586284
9.	14	27	1.146128	1.313609	1.431364	1.6405261
10.	12	24	1.079181	1.164632	1.380211	1.4894981
Average	12.1	25.7	1.078868	1.16733	1.408029	1.520711
Total	121	257	10.78868	11.6733	14.08029	15.20711

Table 9. Quarterly Length and Weight Relationship of Pond (July, August & September).

S. No	Length (cm)	Weight (g)	Log L	Log L²	Log W	Log L xLog W
1.	12	26	1.079181	1.164632	1.414973	1.5270127
2.	13	25	1.113943	1.24087	1.39794	1.557226
3.	11	23	1.041393	1.084499	1.361728	1.4180934
4.	19	103	1.278754	1.635211	2.012837	2.5739228
5.	18	100	1.255273	1.575709	2	2.510545
6.	16	65	1.20412	1.449905	1.812913	2.1829652
7.	15	62	1.176091	1.383191	1.792392	2.1080162
8.	14	46	1.146128	1.313609	1.662758	1.9057334
9.	14	47	1.146128	1.313609	1.672098	1.9164382
10.	16	67	1.20412	1.449905	1.826075	2.1988132
Average	14.8	56.4	1.164513	1.361114	1.695371	1.9898766
Total	148	564	11.64513	13.61114	16.95371	19.898766

Table 10. Quarterly Length and Weight Relationship of Pond (October, November & December).

S. No	Length (cm)	Weight (g)	Log L	Log L²	Log W	log L xLog W
1.	16	67	1.20412	1.449905	1.826075	2.1988132
2.	15	64	1.176091	1.383191	1.80618	2.1242325
3.	19	105	1.278754	1.635211	2.021189	2.5846031
4.	14	48	1.146128	1.313609	1.681241	1.9269177
5.	16	69	1.20412	1.449905	1.838849	2.2141949
6.	18	104	1.255273	1.575709	2.017033	2.5319265
7.	13	27	1.113943	1.24087	1.431364	1.5944582
8.	11	25	1.041393	1.084499	1.39794	1.4558045
9.	15	32	1.176091	1.383191	1.50515	1.7701937
10.	18	104	1.255273	1.575709	2.017033	2.5319265
Average	15.5	64.5	1.185119	1.40918	1.754205	2.0933071
Total	155	645	11.851186	14.091799	17.542054	20.933071

The value in fish LWR can be used as indicator of growth pattern and intake of food. Generally LW is represented by slope (b) that ranges from 2.5–4.0. The Total obtained result from the present research study of natural and artificial aquarium in addition with its effect on length & weight of Gold fish (*Carassius auratus*) in fresh water bodies revealed that the slope (b) lies within 2.9 for Aquarium which is allometric but near to isometric and 3.12 for pond which suggest that weight is isometric. When the value is greater or less than "3" the weight is allometric. (b>3) positive allometery, while (b<3) show negative allometery. The slop (b) may be differ according to provided environment especially biotic and abiotic factors such as light, temperature and nutrients availability. which indicates that conditions are near to ideal but not suitable as pond where fishes are feed with their natural feeding and the value of (b) in the pond was observed as (3.2) which clearly indicates that the fish (*Carassius auratus*) can grow more actively in extensive pond as compared to intensive (Artificial aquarium). Thus to conclude that the goldfish in its natural environment can gain sufficient length and weight as compared to artificial environment.

Table 11. Estimated parameters of LWR.

S. No	Type of feed	A	b	R²
1	Artificial feed	-1.8707	2.990781	0.9535
2	Natural feed	-1.9262	3.107515	0.999924

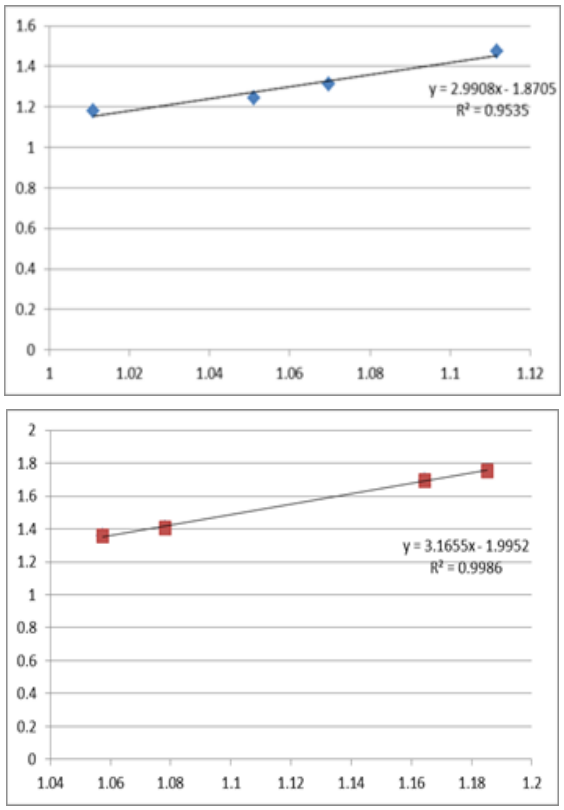

Fig. 1. y and x values of Aquarium showing Negative relationship.

Fig. 2. y and x values of Pond showing Positive Allometric relationship.

Conclusion

The current comparative research study investigated the length weight relationship of gold fish (*Carassius auratus)* from both natural and artificial water bodies in District pishin. The result revealed that natural environment is quite sustainable in contrast to the artificial environment. Therefore, it is concluded that the physiochemical parameters of water are quite satisfactory in the targeted study area which also indicates that the extensive fish farming could be successful and profitable practice in this region.

References

Anderson RO, Neumann RM. 1996. Length weight and associated structural indices. In fisheries techniques, 2nd B. R. Murphy and D. W. Willis (Eds). American Fisheries Society, Bethesda, MD, USA pp. 447-482.

Andrews JW, Pages JW. 1975. The effects of frequency of feeding on culture of catfish. Transactions of the American Fisheries Society **104,** 317-321.

Chua TW, Teng S. 1978. Effects of feeding frequency on the growth of young estuary grouper Epinephelus tauvina (Forskal) cultured in floating net cages. Aquaculture **14,** 31-47.

Erguden D, Turan C, Gurlek M, Turan F, Erguden SA. 2011. Length–weight and Length–length relationships of the Mediterranean Shad Alosa agone (Scopoli, 1786) from the North-Eastern Mediterranean coast of Turkey. African Journal of Biotechnology **10(33),** 6332-6336.

Erguden SA. 2016. Length-weight relationships for six freshwater fish species from the Seyhan Reservoir (south-eastern Anatolia, Turkey). Journal of Applied Ichthyology **32(1),** 141143.

Froese R. 1998. Length-weight relationships for 18 less studied fish species. Journal of Applied Ichthyology **14,** 117-118.

Carr GM, JP. 2008. Neary, Water Quality for Ecosystem and Human Health **29,** 78-81.

Ghosh K, Sen SK, Ray SK. 2005. "Feed utilization efficiency and growth performance of rohu, (Labeo rohita, Hamilton-1822), fingerling feed yeast extract supplemental diets". Acta ichthylogica et piscatorial **35(2),** 111-117.

Jobling M. 1998. Feeding and nutrition in intensive fish farming. Sheffield Academic Press, USA.

Kara A, Bayhan B. 2008. Length-weight and length-length relationships of the bogue Boops boops (Linneaus, 1758) in Izmir Bay (Aegean Sea of Turkey). Belgian Journal of Zoology **138,** 154-157.

Khanna SS. 1996. "An introduction to fishes. Central book department". Allahabad, India.

Koutrakis ET, Tsikliras AC. 2003. Length-weight relationships of fishes from three northern Aegean estuarine systems (Greece). Journal of Applied Ichthyology **19,** 258-260.

Kumar N, Nath S. 2013. Analysis of Physico-Chemical Properties of water from Markanday Spring in Hamirpur District of Himachal Pradesh A Novel Report. International Journal of Current Research **5(01),** 056-058.

LeCren ED. 1951. The Length-weight relationships and seasonal cycle in gonad weight and condition in perch (*Perca fluviatilis*). Journal of Animal Ecology **20,** 210-219.

Marian MP, Ponniah AG, Pitchairaj R, Narayanan M. 1982. Effect of feeding frequency on surfacing activity and growth in air breathing fish, Heteropneustes fossilis. Aquaculture **26,** 237-244.

Mathur N, Bhatara M. 2007. Length-weight relationship and relative condition factor (Kn) of Cirrhinus mrigala (Ham.) from two lakes of Ajmer Zone, Rajasthan. Eco. Env. Cons **13(2),** 225-230.

Singh RK, Srivastava NP Desai VRJ. 1980. Inl. Fish Soc. India 12-100.

Ricker WE. 1975. Computation and interpretation of biological statistics of fish populations. Bulletin of the Fisheries Research Board of Canada **191,** 382.

Ali SS, Freshwater Fishery Biology. 1st Ed. (1999) 108. 8. A. S. Gupta and T.R. Chandreshekharan. Inland Fish. J. Soc. India, **12** (1980) 1.

Sampath K, Pandian TJ. 1984. Interactions of feeding frequency and density on feed utilization in air-breathing murrel, Channa striatus. Proceedings of Indian Academy of Scineces **93,** 445-453.

Venkatesharaju K, Ravikumar P, Somashekar RK, Prakash KL. 2010. Physico- chemical and Bacteriological investigation on the river Cauvery of Kollegal Stretch in Karnataka, Journal of Science Engineering and Technology **6 (1),** 50-59.