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Seasonal assessment of some water quality parameters in experimental fish ponds located at Tarai region of Uttarakhand

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Abstract
The present study was undertaken to assess the seasonal changes in some water quality parameters in two experimental earthen ponds using two different batches of male and female amur carp, *Cyprinus carpio haematopterus* with body weight of 100-170gm and 330-450gm. The water parameters include water temperature, pH, dissolved oxygen (D.O), free carbon dioxide (free CO_2) and total dissolved solids (TDS). Among the observed parameters, TDS and D.O shows significant variation with t (11) = -6.63 and -11.1 (p <0.05) respectively. Temperature, pH and CO_2 shows non-significant difference between the two ponds. CO_2 has the maximum *CV* of 31.1% followed by temperature, TDS, D.O, pH with 22.5%, 9.01%, 4.8% and 4.29% respectively. The Tarai belt was found suitable for culture of amur common carp species with very little to no change in water quality parameters when located in close proximity.

Keywords: seasonal, water quality, amur carp

Introduction
Water quality parameters has a paramount importance in the well-being and physiological function of aquatic organism including fish. It is imperative to understand the biological phenomenon where water quality parameters and its hydro-biological chemistry plays an important role in the aquatic ecosystem [5]. The physical, chemical and biological properties determines the water quality in an aquatic ecosystem [17] each having a significant number of water quality variables [4] and were certainly affected by the quantity and quality of the sources [1]. The magnitude of these parameters determines the acceptability of the proposed uses of the particular water quality which are often governed by regulations [6]. The occurrence and abundance of species are also associated with the physico-chemical properties of the water [13]. The term water quality was initially developed to determine the suitability for use [20]. There has been extensive research in the area of water quality analysis depending upon the goals, samples and sites as stated by the number of methods proposed or developed [18, 3]. Aquaculture and experimental pond certainly defer from the natural ecosystem due to the species culture, quantum of stocking, management regimes etc. One of the most significant effects of fish farming is the enrichment of aquatic bodies with inorganic and organic matter [7] which sometimes causes detrimental changes to the water quality.
The aim of the present study was to assess the seasonal changes of water quality in experimental earthen ponds stock with two different lots of amur carp (*Cyprinus carpio haematopterus*).

Material and methods
Fish husbandry and maintenance
Male and female amur carp, *Cyprinus carpio haematopterus* were collected and segregated from hatchery breed amur carp from experimental fish pond of College of Fisheries, G.B. Pant University of Agriculture & Technology, Pantnagar (Uttarakhand) and held together in two separate earthen pond, Pond A (100-170gm) and in Pond B (330-450gm) from January 2017. The fishes were fed once daily @ 3% body weight with supplementary pelleted diet containing 25% protein till July from college feed mill after which 1:1 ratio soya bran and mustard oil cake at the same ratio due to unavailability of pelleted feeds.

Agro-climatic conditions of the experimental site

The experimental site is located inside the farm facility of College of Fisheries, G.B. Pant University of Agriculture & Technology, Pantnagar (Uttarakhand) situated at the latitude 29.01° N, longitude 79.3° E with altitude of 344 metres above mean sea level (MSL) in Tarai region of Shivalik range of the Himalayas. It has a sub-tropical climatic condition characterized with very hot, humid and dry summer and very cold winter. The monsoon period falls between mid of June till the end of September. Four different types of seasons prevails in Pantnagar viz. spring season (March–May), summer season (June–August), autumn season (September-November) and winter season (December–February).

Data collection

The observations on water temperature, pH, dissolved oxygen (DO), total dissolved solids (TDS) and carbon dioxide (CO_2) analysis were recorded on weekly basis. DO and CO_2 were analysed using titrimetric method [2] temperature, TDS (accuracy ±2%) and pH (accuracy 0.01) using digital meter.

Statistical analysis include descriptive analysis of the two ponds averaging the weekly observations on seasonal basis for mean, standard deviations, sample variance, kurtosis, skewness, range and co-efficient of variation. A paired (two-tailed) t-test ($P < 0.05$) of individual parameter of the two ponds having normal distributions were analysed. Skewness and kurtosis value of <1.96 were used to determine the distribution of sample mean [12].

Results

The annual mean water temperature for pond A (n = 12) was (±*SD*) 24.65±*5.54* ^{0}C with maximum (30.63 ^{0}C) and minimum (14.88 ^{0}C) temperatures recorded during May and January respectively having range of 15.75 ^{0}C and co-efficient of variance (*CV*) of 22.47%. Similarly the annual mean water temperature for pond B (n = 12) was 24.35±*5.49* ^{0}C with maximum (30.52 ^{0}C) and minimum (14.72 ^{0}C) temperatures recorded during May and January having a range of 15.8 ^{0}C and *CV* of 22.56%. There is statistically non-significant effect in the annual mean water temperature between pond A and B with t (11) = 1.77, p = 0.103.

Pond A has the maximum annual mean D.O (n = 12) of 6.9±*0.31* ppm with maximum (7.22 ppm) and minimum (6.32 ppm) D.O levels occurring during January and May respectively having range of 0.9 ppm and *CV* of 4.52%. Similarly the annual mean D.O for pond B (n = 12) was 7.3±*0.35* ppm with maximum (7.75 ppm) and minimum (6.58 ppm) D.O levels during January and May respectively with range of 1.17 ppm and *CV* of 4.87%. There is statistically significant effect in the annual mean D.O between pond A and B with, t (11) = -11.1, p <0.05 with pond A having slightly lower D.O than pond B.

The annual mean pH for pond A (n = 12) was 7.5±*0.32* pH with maximum (8.04 pH) and minimum (7.11 pH) levels during December and August respectively having range of 0.93 pH and *CV* of 4.29%. Similarly the annual mean pH for pond B (n = 12) was 7.5±*0.28* pH with maximum (7.96 pH) and minimum (7.18 pH) levels during December and May respectively having range of 0.78 pH and *CV* of 3.75%. There is statistically non-significant effect in the annual mean pH between the two ponds with t (11) = 0.046, p = 0.963.

The annual mean free CO_2 for pond A (n = 12) was 1.14±*0.35* ppm with maximum (1.77 ppm) and minimum (0.81 ppm) levels during December and May respectively having range of 0.95 ppm and *CV* of 31.1%. Similarly the annual mean free CO_2 for pond B (n = 12) was 1.103±*0.1* ppm with maximum (1.21 ppm) and minimum (0.80 ppm) levels during December and May respectively having range of 0.41 ppm and *CV* of 9.83%. There is statistically non-significant effect in the annual mean free CO_2 between pond A and B with, t (11) = 0.42, p = 0.677.

The annual mean TDS for pond A (n = 12) was 208.68±*18.71* ppm with maximum (241.25 ppm) and minimum (183.25 ppm) levels during July and May respectively having range of 58 ppm and *CV* of 8.96%. Similarly the annual mean TDS for pond B (n = 12) was 221.02±*19.92* ppm with maximum (255.25 ppm) and minimum (192.75 ppm) levels during July and May respectively having range of 62.5 ppm and *CV* of 9.01%. There is statistically significant effect in the annual mean TDS between pond A and B with, t (11) = -6.63, p < 0.05 with pond B having more TDS content than pond A.

Table 1: Pond A

Seasons	Temperature (^{0}C)	D.O (ppm)	pH	CO_2 (ppm)	TDS (ppm)
Spring	26.69±*3.27*	6.61±*0.28*	7.32±*0.14*	0.86±*0.06*	186.41±*2.65*
Summer	29.49±*0.51*	6.79±*0.27*	7.23±*0.11*	0.86±*0.008*	229.75±*11.96*
Autumn	25.87±*2.25*	7.11±*0.008*	7.55±*0.24*	1.35±*0.22*	217.58±*5.51*
Winter	16.54±*1.25*	7.12±*0.11*	7.91±*0.11*	1.48±*0.29*	201±*5.07*

Table 2: Pond B

Seasons	Temperature (^{0}C)	D.O (ppm)	pH	CO_2 (ppm)	TDS (ppm)
Spring	25.84±*3.53*	6.95±*0.41*	7.34±*0.17*	0.98±*0.13*	194.75±*1.42*
Summer	29.26±*0.28*	7.29±*0.1*	7.31±*0.06*	1.12±*0.02*	240.75±*10.89*
Autumn	25.81±*2.39*	7.55±*0.05*	7.48±*0.21*	1.12±*0.05*	232.83±*4.31*
Winter	16.48±*1.35*	7.61±*0.11*	7.87±*0.07*	1.17±*0.04*	215.75±*8.35*

Discussion

Temperature has inverse correlation with both the gases (D.O and CO_2). The seasonal variation in the water temperature may be attributed due to strategic location of extreme hot (air and sunshine) and cold climate of the Tarai region, since solar radiation accounts for 50% of all energy transferred to heated ponds [15]. Usually there is close correlation between air temperature and pond water temperature in which the later does not fluctuate drastically as air temperature [14]. Common carp has a wide temperature range of 3-35^{0}C [9] which is ideally suited in the present experimental condition for amur common carp species. The spring season of the Tarai belt is found to be optimum for reproduction as temperature of 20-25^{0}C were favourable for growth and propagation of common carp [8]. TDS followed by D.O has less sample variances or minimal variations of water quality parameters in pond B as compared to pond A which may be due to slightly larger pond size and volume of water. Overall health and physiological

conditions are best if the dissolved oxygen is kept closer to saturation [16] and the mean seasonal D.O level in both the ponds are close to the saturation level. Also, TDS and D.O have significant differences while the remaining parameters have non-significant observations in both the ponds. This may be evident due to close proximity of the two ponds located side by side and similar management regimes. Also the factors that influences the D.O in pond water is complicated and were relative to different seasons, sampling time and location (including depth), wind speed and the pond water depth and surface area [10]. Change in D.O and CO_2 slightly correlates with TDS showing reverse pattern while pH and TDS has direct correlation. The acidity of both the ponds increases with increased in CO_2 content and has a direct correlation with pH and the native gases. Fish has an average blood pH of 7.4 and pond water should have pH close to that of fish blood (i.e., 7.0 to 8.0) [21]. The pH range of both the ponds throughout the seasons were well within the desirable (6.5 to 9.5) and acceptable (5.5 to 10) range [19, 11]. There is no radical variations during the study since the observations were taken as mean average on a monthly basis and no separate monthly or seasonal comparison has been made.

Conclusion

The present study reveals that when two ponds are located in close proximity and having similar water sources and management regimes especially in the Tarai belt, the water quality parameter in fish culture ponds do not vary significantly and also holds true when compared on seasonal basis and maintaining different **s**tocks of amur carp.

References

1. Alobaidy AHMJ, Abid HS, Maulood BK. Application of water quality index for assessment of Dokan lake ecosystem, Kurdistan region, Iraq. Journal of water resource and protection. 2010; 2(09):792.
2. APHA. Standard Method for Water and Wastewater Examination, 17th edn. American Public Health Association, Washington, D.C, 1992.
3. Boyacioglu H, Boyacioglu H. Surface water quality assessment by environmetric methods. Environmental monitoring and assessment, 2007; 131(1):371-376.
4. CCME. Canadian Council of Ministers of the Environment. An assessment of the application and testing of the water quality index of the Canadian Council of Ministers of the Environment for selected water bodies in Atlantic Canada. National indicators and reporting office, 2004.
5. Deshmukh JU, Ambore NE. Seasonal variations in physical aspects of pollution in Godavari River at Nanded, Maharashtra. Indian J. Aquaculture Biology. 2006; 21:93-96.
6. EPA. United States Environmental Protection Agency. Water Quality Standards Handbook, 2nd ed, 1994.
7. Fabbiano dos Santos Simões F, Moreira AB, Bisinoti MC, Gimenez SMN, Yabe MJS. Water quality index as a simple indicator of aquaculture effects on aquatic bodies. Ecological indicators, 2008; 8(5):476-484.
8. FAO. 2018. (http://www.fao.org/fishery/affris/species-profiles/common-carp/common-carp-home/en/)
9. Froese R, Pauly D. FishBase. World Wide Web electronic publication, 2011. version (02/2011) (available at: www.fishbase.org/summary/speciessummary.php;
10. Guo LX, Deng CH. Prediction model for dissolved oxygen in fish pond based on fuzzy neural network. Journal of Fisheries of China. 2006; 30(2):225-229.
11. Kamal D, Khan AN, Rahman MA, Ahamed F. Study on the physico chemical properties of water of Mouri River, Khulna, Bangladesh. Pakistan journal of biological sciences. 2007; 10(5):710-717.
12. Kim HY. Statistical notes for clinical researchers: assessing normal distribution (2) using skewness and kurtosis. Restorative dentistry & endodontics, 2013; 38(1):52-54.
13. Kiran BR. Physico-chemical characteristics of fish ponds of Bhadra project at Karnataka. Rasayan J. Chem. 2010; 3(4):671-676.
14. Kutty MN. Site selection for aquaculture: Physical features of water. FAO, 1987.
15. Lamoureux J, Tiersch TR, Hall SG. Pond heat and temperature regulation: Modeling temperature and energy balances in earthen outdoor aquaculture ponds. Aquacultural engineering, 2006; 34(2):103-116.
16. Mallya YJ. The effects of dissolved oxygen on fish growth in aquaculture. The United Nations University fisheries training programmer, Final project, 2007, 30.
17. Sargaonkar A, Deshpande V. Development of an overall index of pollution for surface water based on a general classification scheme in Indian context. Environmental monitoring and assessment, 2003; 89(1):43-67.
18. Simeonov V, Einax JW, Stanimirova I, Kraft J. Environmetric modeling and interpretation of river water monitoring data. Analytical and bioanalytical chemistry, 2002; 374(5):898-905.
19. Stone NM, Thomforde HK. Understanding your fish pond water analysis report. Cooperative Extension Program, University of Arkansas at Pine Bluff, US Department of Agriculture and county governments cooperating, 2004.
20. Vaux HJ. Water Quality (Book Review), Environment, 2001; 43(3):39.
21. Wurts WA, Durborow RM. Interactions of pH, carbon dioxide, alkalinity and hardness in fish ponds, 1992.