

# Physico-chemical Analysis of Fish Pond Water in Candaba, Pampanga, Philippines

Khristine L. Sandoval<sup>1,3</sup>, Kristel Joy S. Cada<sup>1</sup>, Ryan V. Labana<sup>1</sup> and Julieta Z. Dungca<sup>1,2</sup>

## ABSTRACT

The study of physico-chemical parameters in fish ponds in Candaba, Pampanga was conducted to determine the quality of water for fish pond from July to August, 2014. Water samples were tested in-situ using probe meter: Thermo Orion Model A920. The results showed variation in the observed parameters at the different sampling stations and two sampling dates. Temperature ranged from  $29 \pm 16.74$  to  $35.23 \pm 1.01$  °C. pH values were  $8.70 \pm 5.02$  to  $9.57 \pm 1.11$ . Dissolved oxygen values were  $5.20 \pm 3$  to  $7.57 \pm 0.77$  mg/L. Electrical conductivity ranged from  $220 \pm 0.01$  to  $489 \pm 0.57$   $\mu$ S/cm. The values for temperature and DO were higher than accepted values for fish culture while those of other parameters favored for good fish production. The observations in this study suggest that fish production in some fish ponds of Candaba, Pampanga could be practiced without adverse effects posed by the quality of water.

## KEY WORDS :

Physico-chemical parameters  
Fish pond  
Freshwater  
Desirable limit

## INTRODUCTION

Water is an essential habitat of fish and its quality is one of the most overlooked aspects in pond management until it affects fish production. The quality of water generally means the component of water which must be present for optimum growth of aquatic organisms (Ehiagbonare and Ogundiran, 2010). Water quality is made up of physical, chemical and biological factors which influence the use of water for fish farming purposes. These factors include pH, dissolved oxygen, temperature and conductivity.

Aquaculture, a rapidly expanding business in the Asia-Pacific since 90s (Stanley et al., 2003), has been an important source of food security and employment in the Philippines. Tilapia (*Oreochromis niloticus*) is a widely-cultured species in the ponds of the country, while the province of Pampanga is a large producer of Tilapia (BFAR, 2014). Fish productivity depends on the physico-chemical characteristics of the water body (Huct, 1986).

The intensive production of fish can cause a poor quality of pond water (Shoemaker et al, 2006). This is a serious problem concerning both aqua culturists and consumers. Hence, it

is important to understand the quality of water to avoid incidence of aquaculture degradation.

Fish ponds in Candaba, Pampanga play vital role in fisheries to supply the much needed animal protein to the people inhabiting such areas. There is scarcity of information on production of fish from ponds in Pampanga especially from fish ponds. It is therefore important to know about the water quality parameters and their management which have influence on the growth and survival of aquatic organisms. The purpose of the present investigation was to provide data on water quality of fish ponds in the selected barangay of Candaba, Pampanga as well as to determine any increase of certain parameters that may affect healthy fish production.

## MATERIALS AND METHODS

**Study Site:** Barangay Lanang, Candaba, Pampanga was chosen for assessment of water quality in fish ponds. Candaba, Pampanga is a first class municipality in Pampanga and the lowest point in Central Luzon. According to Global Positioning System (GPS), it is located between N:  $15^{\circ}5'36''$  and E:  $120^{\circ}49'42''$ . It is located in 60 km northeast of Manila (Fig. 1). The climate of this area is characterized by wet season (May-October) where the entire area becomes fishpond and dry season (November to April) where it is changed to farmland by the locals.

**Assessment of Pond Water:** The pH, Dissolved Oxygen (DO), conductivity ( $\mu$ S/cm) and temperature (°C) were de-

<sup>1</sup> Graduate School, and

<sup>2</sup> College of Science and Technology, Centro Escolar University–Manila, 9 Mendiola Street, San Miguel, Manila, Philippines.

<sup>3</sup> Correspondence: [sandoval.khristine@gmail.com](mailto:sandoval.khristine@gmail.com)

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terminated with probe meter: Thermo Orion Model A920. One sampling per month in three ponds was carried out from July to August 2014, for 2 months between 0900H and 1600H. Sampling processes were conducted in triplicate depths (such as surface, middle, bottom) in consistent manner. The data were recorded at the time of sample collection.

**Statistical Analysis:** The data obtained were subjected to Mean values and Standard deviation Statistical Analysis System User's Guide (SAS, 1999). Correlation was performed to compare the means of the stations at  $P = 0.05$  level of significance.

## RESULTS AND DISCUSSION

The results of this study are presented in Fig. 2. A total of four different physico-chemical parameters were analyzed. The analysis showed that the highest mean temperature of  $35.23 \pm 1.01^\circ\text{C}$  was observed in Pond 3 area (2<sup>nd</sup> sampling), while the lowest temperature of  $29 \pm 16.74^\circ\text{C}$  was obtained in Pond 3 also (1<sup>st</sup> sampling). The highest mean pH of  $9.57 \pm 1.11$  was observed in Pond 2 (1<sup>st</sup> sampling) while the lowest value of  $7.76 \pm 1.08$  was recorded in Pond 3 (2<sup>nd</sup> sampling). Electrical conductivity level of  $489 \pm 0.57\mu\text{S}/\text{cm}$  was observed in Pond 1 (1<sup>st</sup> sampling) while the lowest mean of  $220 \pm 0.01\mu\text{S}/\text{cm}$  was for Pond 2 area (1<sup>st</sup> sampling). Highest DO level of  $7.57 \pm 0.77$  was obtained from Pond 2 while  $5.20 \pm 3$  was observed in Pond 3 (DO was recorded in 1<sup>st</sup> sampling only).

Significant variations were observed for the different parameters in the fish ponds ( $P < 0.05$ ).

Water is essential for the cultivation of fish; it will not give maximum production if the physico-chemical parameters are not appropriate for fish and other aquatic organism. Water temperature, an important parameter in this study, influences the onset of fish spawn, aquatic vegetation growth and the biological demand for oxygen in ponds. As water temperature increases, it holds less oxygen. Also, flora and fauna use more oxygen due to increased respiration. These factors normally result in less available oxygen for fish in water. The observed water temperature in ponds in these study are higher compared to the standard value set by the following criteria – DAO 2016-08:  $25\text{--}31^\circ\text{C}$ , WHO (1986):  $<35^\circ\text{C}$ , and desirable limit (Boyd, 1990):  $20\text{--}30^\circ\text{C}$ . On the other hand, according to Abdullahi et al. (2014) prefers a temperature between  $31\text{--}36^\circ\text{C}$  as a suitable temperature for fish farming. Afzal et al. (2007), recommends a water temperature ranging between  $25$  to  $32^\circ\text{C}$ . The result of the present study reads a temperature ranging from  $29\text{--}35.23^\circ\text{C}$  and is still acceptable whichever among the two previous findings is precise.

Water pH affects metabolism and physiological processes of fish. All areas are within the standard value of DAO 2016-08

and desirable limit, except for the Pond 1 and 2 (1<sup>st</sup> sampling). Generally, the pond water in all areas appeared to be in alkaline condition with the pH values of 7.76 to 8.71 and the desirable range for fish production is 6.5 to 9.0 (Lawson, 1995; Tarazona & Munoz, 1995). Based on Bhatnagar and Devi (2013), Huet (1972), and Boyd (1982), fish grows well and fast in a pond water with a pH ranging from 6.5 to 9.0. In addition to their findings fish growth is limited in water of  $\text{pH} < 6.5$ , reproduction ceases and fry can die at  $\text{pH} < 5.0$ . Seasonal fluctuations of pH are small indicating good buffering capacity. It has been suggested that the high pH is normally associated with a high photosynthetic activity in water (Goel et al., 1986; Wani & Sulba 1990).

The content of the electrical conductivity was highest with  $489 \pm 0.57\mu\text{S}/\text{cm}$  in Pond 1 (1<sup>st</sup> sampling). Other areas had average levels of  $220 \pm 0.01$  to  $355 \pm 0.17\mu\text{S}/\text{cm}$ . These results revealed the high level of nutrient contents in all ponds. The observed values of the parameter fall within the WHO (1986) and Desirable limit (Boyd, 1990):  $200\text{--}1500\mu\text{S}/\text{cm}$  for good water for fish pond culture. Verhuest (1997) reported that electrical conductivity can be used as an indication of primary production and thus fish production.

Oxygen is needed for the body activities of the fish. Through photosynthesis by aquatic green plants and dissolved oxygen from the air, oxygen is introduced into the pond. The three ponds had the values of  $5.20 \pm 3$  to  $7.57 \pm 0.77\text{ mg/L}$  of oxygen. This is far above the standard limit of the desirable range of  $5.0\text{ mg/L}$  (DAO 2016-08; Boyd, 1990; Welch, 1948). These values also agree with the minimum DO of  $5.0\text{mg/L}$  reported for tropical fishes by Saloom and Duncan (2005). Dissolved oxygen is a measure of the amount of gaseous oxygen dissolved in an aqueous solution that plays a significant role in the biology of aquatic organisms (Dhawan & Karu, 2002; Ehiagbonare & Ogundiran, 2010). The pond water tested in this research during the first sampling showed a high range of DO in all ponds. However, due to unexpected defect of probe meter, the researchers were not able to determine the DO level of any pond during the second sampling.

## CONCLUSIONS

This study observed that fish ponds in the investigated areas used alkaline water for fish production which is good for fish farming and higher level of water conductivity which implies a good level of nutrients in the pond water, while water temperature and DO levels were fairly high. There is the desirable need to analyze the pond water at regular intervals. Farmers should be educated on better management practices bordering on feeding practices, pond management, good water exchange practice to reduce organic load and waste accumulation. This will ensure

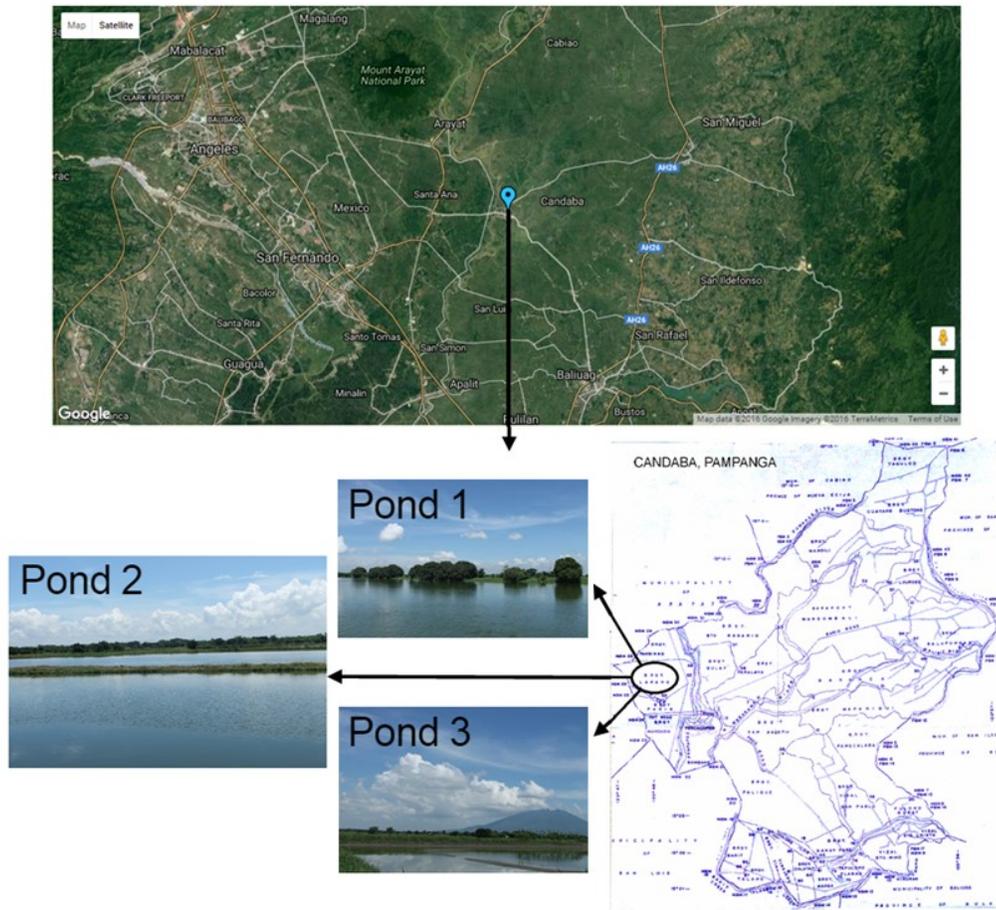


Fig. 1: Map of fish ponds showing its location in Candaba, Pampanga, Philippines and the locality of three sampling sites in Barangay Lanang.

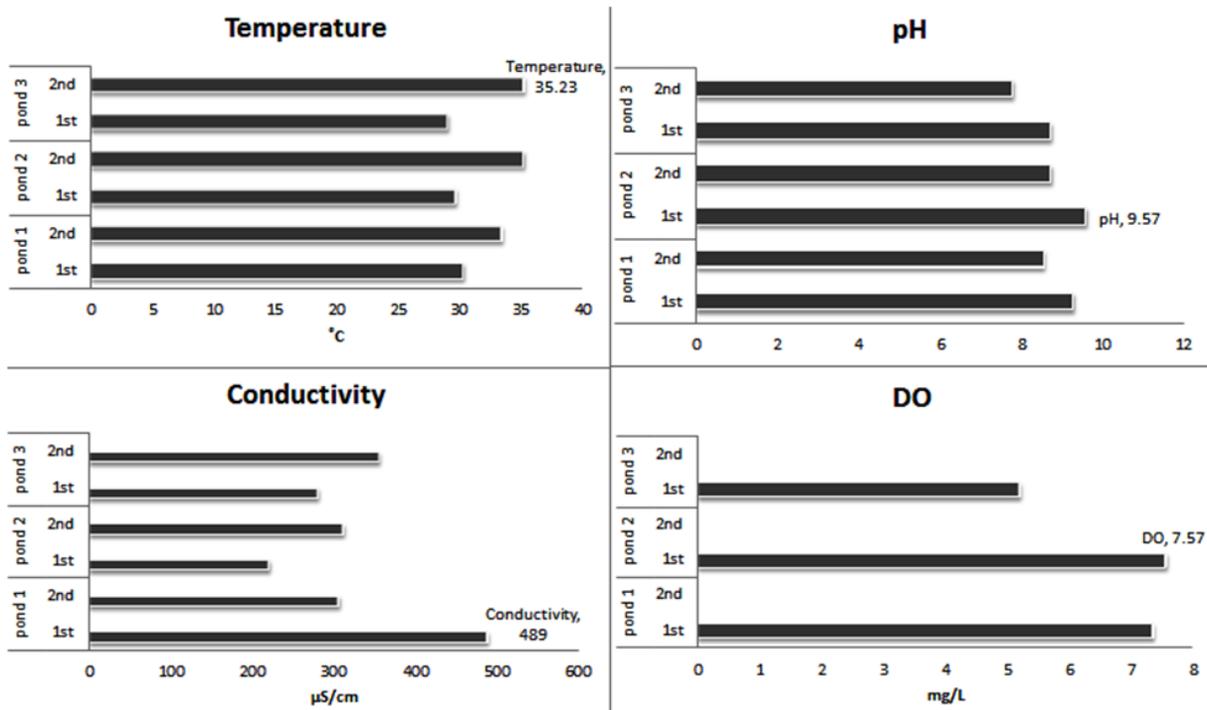


Fig. 2: Physico-chemical parameters in Candaba, Pampanga, Philippines.

that some of the parameters in this study will not exceed levels that could be harmful to fish in the aquatic environment. Such a measure will guarantee the safety of the aquatic ecosystem, humans and environment for good and healthy production of fish for consumption.

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