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Correlation between Physics-Chemical Water Parameters and Existing *brotia testudinaria* in Wangi River Bujeng village Beji district Pasuruan regency.

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ABSTRACT

Rivers are part of a freshwater ecosystem possessing an important role for living organism residing within. The main problem of water resources is the decrease of water quality. This leads to habitat destruction and disruption of organisms that depend on water resources. One of the living organisms living in the riverbeds is gastropods. This study was conducted from November to December 2016. T *Brotia testudinaria* samples were taken using a 1 x 1 m transect. Research result exhibited an average abundance of *B. testudinaria* which amounted to 259.14 ind / m2. Parameters affecting the existence of *B. testudinaria* include temperature, DO, COD, BOD, pH, nitrate, and phosphate. Based on the previous research, it can be concluded that the value of physics-chemical parameters in Wangi River is in good condition which is in accordance with PP RI. 28/2001 on Water Quality Management and Water Pollution Control. The lowest physics-chemical parameter values are generally located at Station 1 and the highest is in Station 7. This is due to parameter contents accumulation in Station 7 which is the last station downstream which caused high content of BOD, COD, nitrate, and phosphate values. Physical-chemical parameters influencing abundance value of *Brotia testudinaria* include temperature, DO, COD, BOD, pH, nitrate and phosphate.

Keywords: *gastropod, Brotia testudinaria, water physics-chemical parameters, Wangi River Pasuruan*

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INTRODUCTION

Background of the Study

River is one of the water resources that is very beneficial for community and living creatures residing in the vicinity. Indonesian Republic Government Regulation no. 35 Year 1991 on river, mentioned that river is places, containers, and water drainage network from a water spring to an estuary. It's left and right sides, as well as its flow, are bound by borderline. River can also be interpreted as a part of the earth's surface located lower than surrounding land and into where fresh water flows into the sea, lake, swamp or to another river (Tarigan, 2013).

Wangi River flows into Bangil river, Pasuruan, is a stream that comes from the Prigen River. This river is affected by pollution in 2014 coming from household waste, industrial waste, market waste disposal, and erosion process. Pollution occurred in Wangi River has caused a negative effect on the environment. The river flow that previously could be used by surrounding people for daily activities began to change. Based on the evaluation results beginning in 2012, people could sense the environmental change. Starting from river water color which sometimes turns red or dark brown and emits odor (Adam and Maftuch, 2015).

Benthic animals are creatures living on riverbeds. One of them is macrozoobenthos. The diversity of macrozoobenthos living in the river is very influential on the diversity level of other river animals. Macrozoobenthos tends to dwell at the bottom of the waters. They rarely perform movements or migrations. Changes in the aquatic environment, especially in physical and chemical properties will greatly affect water quality and its abundance and diversity (Ramly, 2016).

One of the macrozoobenthos possessing a large number of species in Indonesia is *Brotia testudinaria*. *B. testudinaria* is a snail belonging to the Pachychilidae Family and the Brotia Genus. This species is commonly found in waters with high current velocities. They stick to the rocks in the river with sand and gravel substrate. This snail has a wide spread area because it has a higher endurance compared to other species in its genus (Marwoto and Isaningsih, 2012). The spread of *Brotia testudinaria* begins from all freshwater habitat, both lotic and lentic waters at a maximum altitude of 1500 mdpl, on Java island and small islands in the vicinity to South Sumatra. Although it is a common type, several studies, such as those held in East Java in 1999 and Bogor Botanical Gardens, suggest that populations of these species are threatened with extinction due to pollution occurring in their habitats (Köhler and Glaubrecht, 2001).

One of the river utilization conducted by the community is as the location of waste disposal. Ongoing waste disposal will have a negative impact on the water quality of the river. Disposal from human activities, both household and industrial, can cause disruption of existing ecosystems in the river. It would kill a large number of organisms, changes water color and smell, and can interfere with human health. River pollution characteristics can be seen from the condition of physics, chemistry, and biology. Ministry of Environment (2003), states that the water quality of a river is said to decrease should water in the river could not be used in accordance with the status of water quality normally. The status of water quality is the level of water quality condition which indicates its condition, whether polluted or normal, in a water source within a certain time by comparing with set water quality standard.

Water quality can be determined by measuring the value of physical, chemical and biological parameters in the waters. Measurements using physical and chemical parameters provide only an instantaneous quality of the environment and tend to produce results with interpretations in wide range. On the other hand, biological parameters can be used to monitor on an ongoing basis. This is because aquatic biota population spend their life in the environment, therefore pollution will be accumulated by nature.

Research Objective

The purpose of this study is to determine value of *Brotia testudinaria* abundance and physics-chemical parameters of waters in Wangi River

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Research Time and Location

The research was conducted from November to December 2016 in two sites. Field research was conducted in Wangi River Pasuruan and laboratory research was conducted at Fish Cultivation Laboratory of Reproduction Fish Division, Faculty of Fisheries and Marine Science Universitas Brawijaya.

Figure 1. Research Site Map

MATERIALS AND METHODS

Research Method

Field data was collected from November to December 2016 at Wangi River Pasuruan. Water sample collection and measurement was conducted three times with a span of one week each, which is intended to get a picture of the data representing waters condition. Physical-chemical parameters measured were temperature, DO, COD, BOD, pH, nitrate, and phosphate. The method used is Purposive Random Sampling. The technique used in getting *Brotia testudinaria* sample is by using a 1 x 1 m transect. Transects are placed at each point of the research location. *B. testudinaria* within the transect is then collected and placed into a labeled plastic. The plastic is filled with a 7% formalin solution to preserve it. Sampling is done once at each point of research location. Physical-chemical parameters are measured in situ and exsitu manners.

The analysis of *B. testudinary* abundance was calculated using the following formula:

$$D = \frac{Ni}{A}$$

D = type abundance (ind/m^2)
Ni = *Brotia testudinaria* total individual
A = total area (m^2)

RESULTS AND DISCUSSION

Physics-Chemical Parameter of Wangi River

The results of the Wangi River Physics-Chemical parameter measurement during the study are presented in Table 1 below

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Table 1. Physical-Chemical Parameter Value on each Station

PARAMETER	Station						
	1	2	3	4	5	6	7
Suhu (°C)	28.00	28.33	29.33	28.67	28.67	29.11	29.00
DO (ppm)	7.55	7.49	7.12	7.38	7.35	7.46	7.28
COD (ppm)	42.67	46.33	48.67	50.27	51.79	56.00	57.67
BOD (ppm)	30.33	34.67	38.67	38.63	40.36	43.33	45.50
pH	6.84	7.00	6.92	6.91	6.92	6.78	6.98
Nitrat (ppm)	1.43	1.63	1.56	1.64	1.68	1.75	1.83
Fosfat (ppm)	0.39	0.43	0.41	0.43	0.44	0.45	0.47

The temperature value has a negative correlation with DO value due to the rise in temperature value will be followed by a decrease in DO value. The temperature range at the study site was 28.00 to 29.33 ° C with the highest value being in Station 3 and the lowest value at Station 1. The temperature values at the study sites generally had the same temperature. The temperature at the research location is still classified in good condition because it is still in the range of values in PP RI No. 82 of 2001. Water temperature is a physical parameter of water capable of affecting aquatic biota life due to the level of oxygen solubility, aquatic biota respiration process, and pollutant degradation speed. (Monoarfa, 2002).

The DO values in the study sites ranged from 7.12-7.55 ppm. The highest value is in Station 1, while the lowest value is in Station 3. The DO range in this research location is generally in similar value range. DO value in the research location is very good because of its abundant presence and in accordance with the range of values in PP RI. 82 Year 2001. One of the water chemical parameters that contribute to the life of aquatic biota is dissolved oxygen. Decreasing dissolved oxygen can reduce the efficiency of oxygen uptake for aquatic biota thereby decreasing its ability to live normally (Monoarfa, 2002).

The research location has COD content of 42.67-57.67 ppm. Station 7 has the highest value, while Station 1 has the lowest value. The COD value can still be tolerated because it is below the maximum value stated in PP RI no. 82 Year 2001. COD (chemical oxygen demand) or chemical oxygen demand, is the amount of oxygen required by organic waste to be oxidized through chemical reactions. Organic waste will be oxidized by potassium bichromate ($K_2Cr_2O_7$) as a source of oxygen that will become CO_2 and H_2O gasses, as well as some chromium ions. COD value is a measure of pollution meter caused by organic matter (Nurhasanah, 2009).

BOD content in the study sites ranged from 30.33 ppm to 45.50 ppm. The highest value is in Station 7 and the lowest value is in Station 1. BOD content in the research location is bad because it exceeds the quality standard threshold in PP RI statement no. 82 Year 2001. Biological Oxygen Demand is biological oxygen requirement or amount of oxygen required by microorganisms in water environment to break down (degrade) organic waste in the environment (DPU, 1990).

The pH values at the study sites ranged from 6.84-7.00. The highest value is in Station 2, whereas the lowest value is in Station 1. The pH range at this study site are generally in similar value. The pH value at the research location is considered very good because it is in accordance with the range of values in PP RI. 82 Year 2001 at 6-9. One of the water chemical parameters that contribute to the life of aquatic biota is dissolved oxygen. Decreasing dissolved oxygen can reduce the efficiency of oxygen uptake for aquatic biota thereby decreasing its ability to live normally (Monoarfa, 2002).

Water samples at the study sites had nitrate content between 1.43-1.83 ppm with the highest value at Station 7 and the lowest at Station 1. The nitrate content of the study site did not differ much. Nitrate value is good because it is far below the water quality standard threshold expressed in PP RI. 82 Year 2001. Nitrate is the main form of nitrogen in natural waters. Nitrate is one of the important nutrient compounds in the plant synthesis and animal proteins. Nitrate in aquatic environments is the most widely needed nutrient and usually limits the biomass in algae and aquatic plants (Welch, 2001 in Herlianti et al., 2016).

The research location has a phosphate value of 0.39-0.47 ppm. Station 7 has the highest value, while Station 1 has the lowest value. The phosphate value is still tolerable because it is below the maximum value stated in PP RI no. 82. Phosphate is different from nitrate as it is absorbed by soil particles and does not moved easily by ground water. Phosphate is not required for large amounts of growth, but phosphate is one of the limiting elements in soil and fresh water. (Goldman, 1983 in Rachmawati, 2012).

Based on water physics-chemical parameters values which have been translated with reference to PP RI No. 82 of 2001 on Water Quality Management and Water Pollution Control, Wangi River is still in good condition. The lowest physics-chemical parameter values are generally located at Station 1 and the highest in Station 7. This is due to the accumulation of these parameter contents in Stasun 7 which is the last station downstream and causes high BOD, COD, nitrate and phosphate values. Agustiningsih et al (2012) stated that there is a decrease in water quality from upstream to downstream due to the addition of pollutant contents from activities around the river that will accumulate along with the movement of water from upstream to downstream.

***Brotia testudinaria* abundance in Wangi River**

The results of the calculation of *B. testudinaria* abundance can be seen in Table 2 below.

Table 2. Abundance of Brotia testdinaria at Each Station

Station	Abundance (ind/m²)
1	162
2	950
3	134
4	150
5	145
6	153
7	120

Table 2 exhibits that the highest abundance values are in Station 2 with a value of 950 ind / m2. This is due to the presence of a riverside basin containing large number of rocks used by *B. testudinaria* to attach. In addition, the suitability of environmental conditions such as temperature, DO and pH also strongly support *B. testudinaria* life at Station 2. The lowest abundance value is at Station 7. Station 7 has the worst physical-chemical parameter values compared to other stations and results in low number of *B. testudinaria*.

Waters physical-chemical factors greatly affect the existence of *B. testudinaria*. This is due to *B. testudinaria* tendency to attach itself onto the rocks and rarely move. A change in physics-chemical parameters value will affect the existence of *B. testudinaria*. *B. Testudinaria* abundance found in the study sites was due to *B. testudinaria* ability to adapt. It is parallel to Marwoto and Isaningsih's research result (2012) which states that *B. testudinaria* has a wide dispersal area because it has a higher endurance than other species in its genus (Marwoto and Isaningsih, 2012).

CONCLUSION

Based on the research result, it can be concluded that the value of physics-chemical parameters Wangi River waters is still in good condition and in accordance with PP RI. 28/2001 on Water Quality Management and Water Pollution Control. Parameter values affects the abundance of *Brotia testudinaria*. Physical-chemical factors affecting *B. Testudinaria* abundance are temperature, DO, COD, BOD, pH, nitrate and phosphate with a respective range of 28.00-29.33 ° C; 7.12-7.55 ppm; 42.67-57.67 ppm; 30.33-45.50 ppm; 6.84-7.00; 1.43-1.83 ppm; and 0.39-0.47 ppm. The high tolerance and survival of B. *testudinaria* against changes in the aquatic environment resulted in the high value of *B. testudinaria* abundance in the study sites.

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REFERENCES

[1] Adam, M. A dan Maftuch. 2015. *Evaluasi Pengoptimalan Instalasi Pengolahan Air Limbah terhadap Pencemaran Sungai Wangi di Pasuruan*. Journal of Environmental Engineering & Sustainable Technology 2 (1): 1-5

[2] Agustiningsih, D., Setia B. S., dan Sudarno.2012. *Analisis Kualitas Air dan Strategi Pengendalian Pencemaran Air Sungai Blukar Kabupaten Kendal*. Jurnal Presipitasi 9 (2): 64-71

[3] DPU. 1990. *Departemen Pekerjaan Umum. Kumpulan SNI Bidang Pekerjaan Umum Mengenai Kualitas Air*. Standar II – Metode Pengujian Kualitas Air. Ed Akhir. Jakarta. Halaman 1 – 29.

[4] Herlianti, J., Suryanti, dan Prijadi S. 2016. *Hubungan antara Kandungan Nitrat, Fosfat Dan Klorofil-A di Sungai Kaligarang, Semarang*. Diponegoro Journal Of Maquares 5 (1): 69-74

[5] Kementerian Lingkungan Hidup. 2003. *Keputusan Menteri Negara Lingkungan Hidup Nomor 115 Tahun 2003 Tentang Pedoman Penentuan Status Mutu Air*. Jakarta.

[6] Köhler, F. dan Glaubrecht M. 2001. *Toward a systematic revision of the southeast Asian freshwater gastropod Brotia H. Adams, 1866 (Cerithioidea: Pachychylidae): An account of species from around the South China Sea*. Journal of Molluscan Studies 67: 281-318.

[7] Marwoto, R. M. dan Nur R. I. 2012. *The Freshwater Snail Genus Sulcospira Troschel, 1857 from Java, With Description of a New Species from Tasikmalaya, West Java, Indonesia (Mollusca: Gastropoda: Pachychilidae*). The Raffles Bulletin of Zoology 60(1): 1–10.

[8] Monoarfa, Winarni. 2002. *Dampak Pembangunan bagi Kualitas Air di Pesisir Pantai Losari*, Makassar. Sci &Tech 3 (3)

[9] Nurhasanah. 2009. *Penentuan Kadar COD (Chemical Oxygen Demand) pada Limbah Cair Pabrik Kelapa Sawit, Pabrik Karet dan Domestik*. Universitas Sumatera Utara: Medan.

[10] Rachmawati, D. A. 2012. *Studi Keanekaragaman Jenis Fitoplankton untuk Mengetahui Kualitas Perairan Di Telaga Jongge Kecamatan Semanu Kabupaten Gunungkidul Yogyakarta*. Universitas Negeri Yogyakarta: Yogyakarta.

[11] Ramly, N. 2016. *Diversity and Characteristics of Macrozoobenthos in the Water of Tompe River (A Study from Indonesia)*. International Journal of ChemTech Research 9 (11): 71-79

[12] Tarigan, Y. F. 2013. *Kandungan Kadmium (Cd) pada Air Sungai dan Ikan Mas* (Cyprinus Carpio Linnaeus) *di Sungai Code Kota Yogyakarta*. Yogyakarta: Universitas Atma Jaya Yogyakarta.