CURRENT STATUS OF THE WATER QUALITY OF VERDE ISLAND PASSAGE IN LOBO, BATANGAS PROVINCE, PHILIPPINES

May Anne L. Briones, Rubie Ann R. Cataga & Cristela A. Cueto[1]
Ivy Fides R. Perez[2], Erma B. Quinay[3]

[1]Student, Civil and Environmental and Sanitary Engineering Department, (*CEAFA)*
[2]Science Research Specialist and [3]Professor, Faculty Member of CEAFA
Batangas State University, Batangas City, Philippines

ivyfidesperezp@gmail.com, ebquinay@yahoo.com

ABSTRACT

The study aimed to assess the current status of water quality of Verde Island Passage in Lobo. The researchers evaluated the water quality of Verde Island Passage in terms of 14 parameters such as color, turbidity, pH, temperature, DO, BOD, tss, oil and grease, nitrate, phosphate, copper, lead, mercury and total coliform which were determined using the Standard Methods for Examination of Water and Wastewater (SMEW). Composite water samples were taken from approximately one kilometer from the shoreline of the five sampling stations namely Brgy. Banalo, Brgy. Masaguitsit and Fabrica, Brgy. Lagadlarin and Olo-olo, Brgy. Sawang and Soloc, and Malabrigo of Verde Island Passage of Lobo. These parameters were analyzed by an accredited Analytical Testing Laboratory of Department of Environment and Natural Resources (DENR). Results of this study were compared per sampling stations, based on the standards criteria set by the DENR and to the results the study conducted in 2009 by Gonzales et al. Results showed that the physico-chemical properties in terms of color, phosphate, copper and mercury values are the same for the five sampling stations. While the values of turbidity, temperature, tss, pH, DO, oil and grease, BOD, nitrate, lead and total coliform varied. Based on the analysis of the 14 parameters, Verde Island Passage along Lobo Coast did not conform the standards set by DAO 34-90 for Class SB. The value of oil and grease in 2009 was improved as compared to its present values for each sampling station. Verde Island Passage along Lobo Coast was polluted in terms of lead.

Keywords: Lobo Coast, physico-chemical, total coliform

1 INTRODUCTION

Coastal water pollution is one of the nation's problems which resulted from man's utilization of natural resources. The activity in coastal areas, combined with pollutants flowing from streams far inland and others carried through the air at great distances from their source, are the primary causes of nutrient enrichment, hypoxia, harmful algal blooms, toxic contamination, sedimentation, and other problems that plague coastal waters. Not only do degraded waters cause significant ecological damage, they also lead to economic impacts due to beach closures, curtailed recreational activities, and additional health care costs. Reducing water pollution will result in cleaner coastal waters, healthy habitats that support aquatic life, and a suite of economic benefit (Ocean Commission Policy, 2001).

Lobo Coast is a part of Verde Island Passage, considered as the "Center of the Center of Marine Fish Biodiversity" (American Smithsonian Institute). It is also part of the

navigational water of the Philippines and also as one of the busiest waterways of Batangas wherein its water are plied daily by oil and chemical carriers that many ships sail through the passage. Its shoreline is highly populated and commercialized with a miniport and lot of beaches and resorts. It is also near to a petrochemical industry. Kaingin and copper mining stress its adjacent terrestrial ecosystem. The activities within the Lobo Coast and adjacent terrestrial ecosystems may threaten its ecological balance, which may eventually affect its biodiversity.

In 2009, a study entitled "Coastal Water Quality Assessment along Lobo Coast of Verde Island Passage," was conducted by Gonzales et al. Based on the result of the study, oil and grease polluted Verde Island Passage due to the oil and gasoline used by the motor boats and ships. After four years, this study was conducted to determine the status of the water quality of Lobo Coast and served as baseline information for its sustainable protection and effective management.

2 OBJECTIVES

This study aimed to assess the current status of water quality of Verde Island Passage in Lobo during the wet season.

Specifically, it sought to answer the following questions:

1. What are the properties of water along the Verde Island Passage in Lobo in terms of:
   1.1. physico-chemical properties; and
   1.2. microbial properties?
2. Compare these properties among five sampling stations.
3. Determine the classification of the coastal water of Lobo based on the criteria set by the Department of Environmental and Natural Resources for fresh water.

3 MATERIALS AND METHODS

3.1 Research Design

The researchers utilized the experimental method to evaluate the coastal water quality of Verde Island Passage in Lobo. The study considered 14 parameters: such as color, turbidity pH, temperature, dissolved oxygen (DO) biochemical oxygen demand (BOD_5), total suspended solids (TSS), oil and grease, nitrate, phosphate, copper, lead, mercury and microbiological property in terms of total coliform count for the analyses of water samples.

3.2 Sampling Location

The researchers utilized five sampling stations. Station I, located at Barangay Banalo; Station II, located at Barangay Masguitsit and Fabrica; Station III, located at Barangay Lagadlarin and Olo-olo; Station IV, located at Barangay Sawang and Soloc; and Station V, located at Barangay Malabrigo.

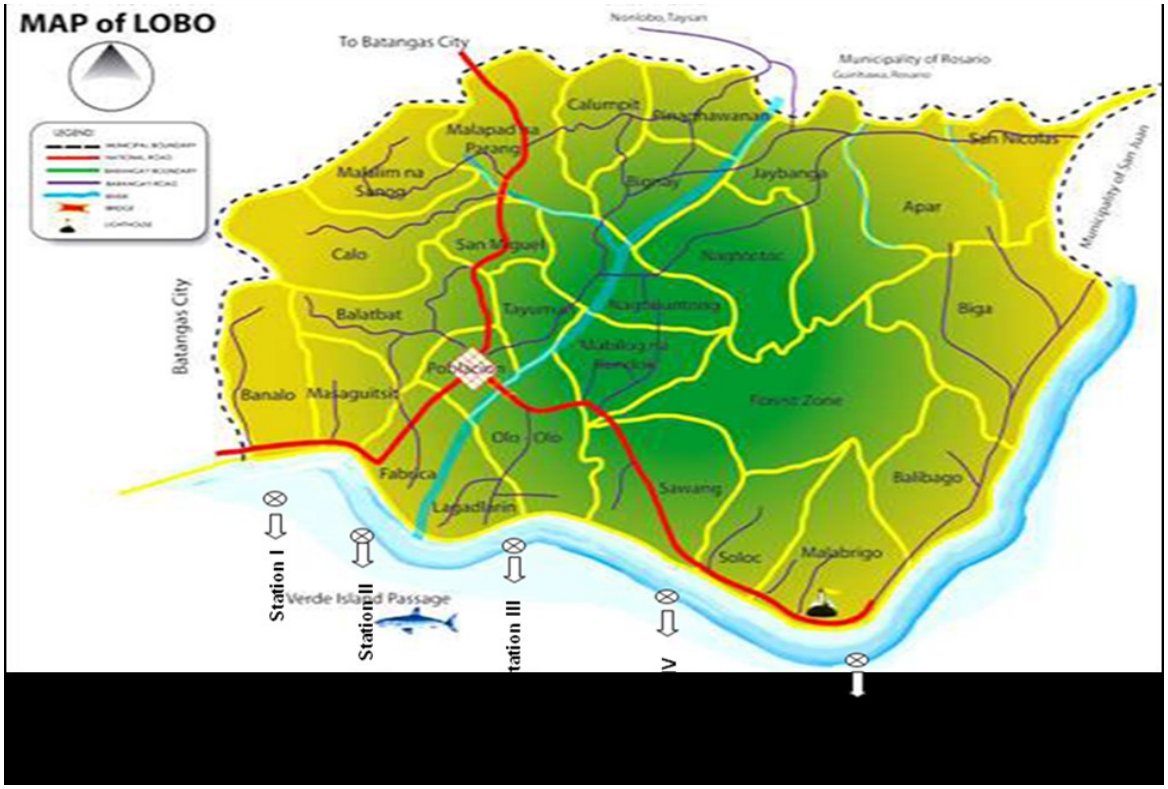

Figure 1: Sampling Stations

Global Positioning System (GPS) was used to locate the exact locations of the sampling stations. Station I was located in 13º 38.16 N, 121º 11.05 E, Station II was located in 13º 37.26 N, 121º 11.28 E, Station III was located in 13º 37.03 N, 121º 12.38 E, Station IV was located in 13º 36.59 N, 121º 13.7 E and Station V was located in 13º 36.07 N, 121º 14.69 E.

Water Sampling

The researchers used composite sampling in the course of their sample collection. A composite sample was collected from three sampling sites of each station. An empty four bottles of mineral water with a capacity of 2 L was used as sample container. The bottles were washed and rinsed vigorously for the elimination of the particles inside the bottles and the removal of other surface dirt before filing them with water samples. The sampling and on-site analysis of the samples was performed from 6:00 am to 11:00 am of January 8, 2013.

All samples were taken from four to six feet deep from the respective stations. In each sampling stations, three composite samples were taken. Temperature, pH and dissolved oxygen (DO) determination were done on-site in every sampling station. The collected samples were stored at a water cooler filled with ice approximately 4^0C during the period of collection until these were brought to the laboratory for analysis.

3.3 Analysis of Samples

The analyses were conducted by an accredited Analytical Testing Laboratory of Department of Environment and Natural Resources (DENR) based on the Standard Methods for the Examination of Water and Wastewater, 1998, DENR Administrative Order 34 Series of 1990 and Philippine National Standards for Drinking Water.

3.4 Statistical Treatment

The validity of the null hypothesis was tested using One Way Analysis of Variance and Independent t-Test. The Analysis of Variance (ANOVA) is a method of dividing the variation observed into different parts, each part as assignable to a known source, cause or factor. One way F test or factor ANOVA is called as such because there is only one factor being studied as an independent of variable. The independent t-test is used to compare two sample means when the two samples are independent of one another.

4 RESULTS AND DISCUSSION

Water samples were analyzed for physical, chemical and microbiological properties. Table 1 shows the physical, chemical and microbiological properties of coastal water along the Verde Island Passage in Lobo.

Table 1: Physico-chemical and microbiological properties of coastal water along Verde Island Passage in Lobo, Batangas

Parameter	DENR STANDARD	Mean Value per Station				
		Station I	Station II	Station III	Station IV	Station V
Color (PCU)		< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Turbidity (NTU)	5	0.41	0.2	0.24	0.27	0.36
Temperature (°C)	3 (max. rise in °C)	26.8	27	27	27.1	27.2
TSS (mg/L)	Not more than 30mg/l	11	11	5	7	5
pH	6.0-8.5	8.14	7.99	7.98	7.91	7.93
DO (mg/L)	5(minimum)	6.52	6.32	6.71	6.62	6.23
Oil and Grease (mg/L)	2	< 0.5	< 0.5	< 0.5	0.7	< 0.5
BOD (mg/L)	5	2.19	3.1	2.07	4.01	2.71
Nitrate * (mg/L)	50*	0	0.02	0	0	0.04
Phosphate^ (mg/L)	0.2^	0	0	0	0	0
Copper (mg/L)	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Lead (mg/L)	0.05	0.3	0.36	0.35	0.37	0.32
Mercury (mg/L)	0.002	< 1	< 1	< 1	< 1	< 1
Total Coliform (MPN/100 mL)	1,000	49	460	23	2	<1.8

*compared to PNSDW 2007 for drinking water
^compared to DAO 90-34 (class B) for fresh water

In assessing water quality, three properties are considered: physical, chemical and microbial properties. Physical properties that are measured are temperature, total suspended solids, turbidity and electrical conductivity. Commonly measured chemical parameters include pH, alkalinity, hardness, nitrates, nitrites and ammonia, ortho- and total phosphates, dissolved oxygen and biochemical oxygen demand. Microbial property is assessed by measuring the total coliform content of the water.

The findings showed that the value of color, which is < 5.0, was constant for the five sampling stations. The highest value of turbidity, which is 0.41NTU, was observed in Station I while the lowest value, which is 0.20 NTU, was observed in Station II. The highest value of

temperature, which is 27.10 °C, was obtained in Station IV while the lowest value, which is 26.80 °C, was obtained in Station I. The highest TSS value, which is 11.0 mg/L, was obtained in Stations I and II while the lowest TSS which is 5 mg/L was obtained in Station III and Station V. The highest pH value, which is 8.14, was obtained in Station I while the lowest pH value, which is 7.91, was obtained in Station IV.

The highest value of DO, which is 6.71 ppm, was observed in Station III while the lowest value of DO, which is 6.23 ppm, was observed in Station V. The highest value of Oil and Grease, which is 0.7 mg/L, was shown in Station IV while the lowest value, which is < 0.5 mg/L, was shown in Station I, II, III and V. Station IV shows the highest value of BOD, which is 4.01 mg/L while Station III shows the lowest value of BOD which is 2.07 mg/L. The highest value of Nitrate, which is 0.04 mg/L, was obtained in Station V while the lowest value of Nitrate which is 0 was obtained in Stations I, III and IV.

The coastal water from all the sampling stations yielded the same values for Phosphate, which is 0. Copper content for coastal water was the same for all stations which amounted to < 0.01 mg/L was obtained in Stations I, II, III, IV and V. While Stations I, II, III, IV and V obtained a constant value of Mercury, which is <1.

The highest value of Lead, which is 0.37 mg/L, was obtained in Station IV while the lowest value of Lead, which is 0.30 mg/L, was obtained in Station I. The highest value of total coliform was obtained in Station II and the lowest value was obtained in Station V.

Table 2 shows the summary of the computed F-values and p-values for the comparison of the water quality of Verde Island Passage in Lobo among the five sampling stations in terms of physical and chemical properties.

Table 2: Computed F values and p-values for the comparison of water quality among sampling stations of Verde Island Passage along Lobo Coast in terms of physical and chemical properties

Parameter	p-values	Computed	Decision on Ho	Verbal Interpretation
	5% significant	F-values		
Turbidity	0	45.17	Reject	Significant
TSS	0	32.6	Reject	Significant
pH	0	58.02	Reject	Significant
DO	0.001	13.29	Reject	Significant
BOD	0.84	0.35	Failed to Reject	Not Significant
Oil and Grease	0.15	2.13	Failed to Reject	Not Significant
Nitrate	0.15	2.16	Failed to Reject	Not Significant
Lead	0.2	1.81	Failed to Reject	Not Significant

P≤0.05 suggests there no significant difference

The f-values obtained for turbidity, TSS, and pH and all with p-values of 0 were 45.17, 32.6 and 58.02, respectively. Hence, the null hypotheses for the above parameters were rejected. Likewise, DO has an f-value of 13.29 and a p-value of 0.001, the null hypothesis was rejected while BOD has an f-value of 0.350 with a p-value of 0.840, the null hypothesis was accepted. The f-value for Oil and Grease was 2.130 with a p-value of 0.150 and the null hypothesis was accepted. Nitrate has an f-value of 2.160 and a p-value of 0.150 and the null hypothesis was accepted. The f-value for Lead was 1.81 and the p-value was 0.20, the null hypothesis was accepted.

Color, Temperature, Phosphate, Copper and Mercury had no difference observed on their values, and the null hypothesis was accepted.

The parameters that conformed with the standards set by DAO 34-90 for the classification of Class SB for coastal water in terms of Color, Temperature, TSS, pH, DO, Oil and Grease, BOD, Copper, Mercury and Total Coliform. It also conformed to the standard set by DAO 34-90 for the classification of Class B for fresh water in terms of Phosphate. And it also conformed to the standards set by PNSDW 2007 for drinking water in terms of Turbidity and Nitrate.

Lead was the parameter that did not conform to the standard for coastal water for all the five sampling stations.

5 CONCLUSIONS

Based on the findings of the study, the following conclusions were drawn:

The Physico-chemical properties of the Verde Island Passage indicate that color, phosphate, copper and mercury values are the same for the five sampling stations. While the values of Turbidity, Temperature, TSS pH, DO, Oil and Grease, BOD, Nitrate, Lead and Total Coliform varied.

Verde Island Passage along Lobo Coast was polluted in terms of Lead. Based on the analysis of the 14 parameters, Verde Island Passage along Lobo Coast did not conform the standards set by DAO 34-90 for Class SB.

REFERENCES

Alley, RE. (2007), *Water Quality Control Handbook*, 2nd Edition.

APHA-AWWA. (1998). Standard method for Examination of Water and Wastewater 20th edition.

Department of Environment and Natural Resources Administrative (DENR). Order No.34 Series of 1990.

Gonzales, MKL et.al. (2009), *Coasal Water Quality Assessment along Lobo Coast of Verde Island Passage*, Batangas State University, 2009.

Lenntech, BV. (2011), *Major Water Pollutants*.

Merritts, D, DeWet, A & Menking, K (1998), *Environmental Geology: An Earth System Science Approach*, W.H. Freeman and Company. New York, NY. Ocean Commission Policy, 2001.

Realuyo, ZM (1998), *Today's Basic Concept in Earth Science*, Goodwill Trading Company Inc. Sta. Cruz Manila.

Rubin, K. (2007), *Sources of Water Pollution*.

Philippine National Standards for Drinking Water. (2007).