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Assessment of Horse Shoes Lake (Oxbow) Conservation Assessment of Rantau Baru Village, Pelalawan Regency, Indonesia

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ABSTRACT

The damage to oxbow lakes in various places in Indonesia has not been managed properly, so it is feared that its existence will disappear. Whereas the function of the Oxbow Lake, among others, is as a provider of water and fishery resources. Realizing the importance of the oxbow lake, this study was conducted on two lakes in Rantau Baru, Pelalawan Regency based on the land cover method and the Water Quality Index (WQI) calculation method. Water samples were taken at three points from the two observed lakes. WQI is calculated based on ten parameters, namely pH, conductivity, dissolved oxygen (DO), Depth, Total Phosphate, Ortho-phosphate, Total Nitrogen, Nitrate as N (NO3), Nitrite as N (NO2), Ammonia as N (NH3). The results showed that the lake Sepunjung half of its water body is covered with water hyacinth (Eichhornia crassipes) and the WQI value is classified as good. Teluk Bederas lake on the outskirts of the lake contains oil palm and plantations and from the WQI value it can be concluded that it is in poor condition.

Key words: *Oxbow Lake, Land cove, Water quality, WQI*

Introduction

Rantau Baru Village is one of the areas located in the administrative area of Pangkalan Kerinci District, Pelalawan Regency, Riau Province. This village has an area of about 10,000 hectares which is a lowland area, swamps and peatlands with a typical peat forest which is overgrown by plants and animals typical of peatlands. Rantau Baru Village also has several rivers and lakes including; Kampar River, Bokoboko, Kiyap, Pebadaran, Seluk Kuras, Badagu, and other small rivers. Lakes and rivers become fishing areas for the people of Rantau Baru Village, most of whom work as fishermen.

Peat rivers and lakes in Rantau Baru Village have a diversity of resources, both fish and other economic biota. So that the life of the fishing community is highly dependent on the quality of the ecosystem in the peat swamp area. Wildayana *et al.* (2018) stated that peatlands are widely used by the community to meet their daily food needs, so this area has been developed into an agricultural area with high productivity. More than half of the surrounding peat forest exploits the existing resources in the area.

Wetlands are defined as 'intermediate lands between terrestrial and aquatic ecosystems where the groundwater table is usually at or near the surface or the soil is covered by shallow water (Mitsch and Gosselink, 2000). The value of the world's wetlands

is gaining increasing attention because they contribute to a healthy environment in many ways. They retain water during dry periods, thereby keeping the water level high and relatively stable. During periods of flooding, they reduce flooding and trap suspended solids and adhering nutrients. Thus, a river flowing into a lake through a wetland area will transport less suspended solids and nutrients to the lake than if it flows directly into the lake. The elimination of such wetland systems due to urbanization or other factors usually causes lake water quality to deteriorate. In addition, wetlands are important feeding and breeding grounds for wildlife and provide shelter and shelter for waterfowl. As with other natural habitats, wetlands are important in supporting species diversity and have complex wetland values.

Communities in the peat swamp and horseshoe lakes relate their lives to these areas. Especially for widowed women who do not have jobs. The fishermen can sell the results of resource exploitation directly through traditional markets, so that profits are obtained faster. Thus, they make a living by catching fish and processing it into several simple fishery products, such as smoked fish, salted fish and other foods derived from fish raw materials obtained from daily fishing operations.

Materials and Methods

This research was conducted in Rantau Baru, Pelalawan Regency in October 2021. Two horseshoe lakes (oxbow) were used as research objects, namely Sepunjung lake and Bederas Bay lake (Figure 1). The two oxbow lakes were originally part of the Kampar river, located at positions 101°46'30" - 101°48'30"E and 0°1'60" – 0°17'30" N. This is part of the waters of the Kampar river, mostly covered by aquatic macrophytes during the month -dry months or dry season.

The research method used is a survey. The first survey carried out in the field was to collect monograph data from the research area. Village monographs are used to find out the population, livelihood, gender and so on. Regional monographs were obtained at the Rantau Baru village office. Sample collection and water physicochemical analysis of Lake Sepunjung and Teluk Bederas lakes were determined by 3 sampling points. The first station is located at the mouth of the lake (where river water enters), the second station is located in the middle of the lake, and the third station is located at the mouth

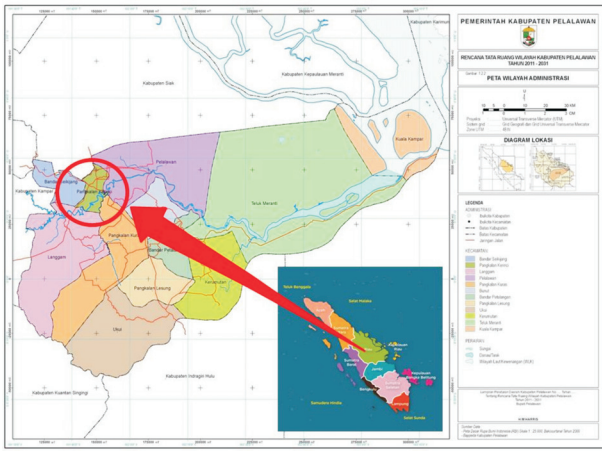

Fig. 1. Rantau Baru Village.

of the water coming out of the lake back into the river.

The water quality measured in the field was pH, electrical conductivity, DO and depth, while for orthophosphate, total phosphate, total nitrogen, nitrate, nitrite, and ammonia were analyzed at the Environmental Laboratory of the Sumatran Ecoregion Development Control Center, Pekanbaru. Aquatic plants (hydrophytes) were observed directly in the field and photos were also taken with a camera.

The calculation and formulation of WQI involved the following steps (Alobaidy, *et al.*, 2010):

1). In the first step, each of the ten parameters is assigned a weight (AWi) ranging from 1 to 4 depending on the collective expert opinion drawn from various sources (Table 1).

2) In the second step, the relative weight (RW) is calculated using equation (1) where, RW = relative weight, AW = assigned weight of each parameter, n = number of parameters. The value of the relative weight (RW) calculated from each parameter is given in Table 2.

$$RW = \frac{AW_i}{\sum_{i=1}^{n} AW_i} \qquad (1)$$

3) The third step, the quality assessment scale (Qi) for all parameters except pH and DO is determined by dividing the concentration in each water sample by each standard according to the drinking water guidelines recommended by WHO, or Indonesian water standards, the result is then multiplied by 100 Meanwhile, the quality

of pH or DO is calculated based on equation (2).

$$Q_i = \left[\frac{C_i}{S_i}\right] \times 100 \quad .. (2)$$

$$Q_{pH,DO} = \left[\frac{C_i - V_i}{S_i - V_i}\right] \times 100 \quad .. (3)$$

4) Finally, to calculate WQI, the sub-index (SIi) is first calculated for each parameter, and then used to calculate WQI as in the following equation:

To calculate WQI, the sub-index (SIi) is first calculated for each parameter, and then used to calculate WQI as in the following equation:

$$SI_i = RW \times Q_i \quad .. (4)$$

$$WQI = \sum_{i=1}^{n} SI_i \quad .. (5)$$

The calculated WQI value can be classified as <50 = Excellent; 50-100 = Good; 100-200 = Bad; 200-300 = Very poor; >300 = Not suitable [41].

Results and Discussion

Two horseshoe lakes in the Kampar watershed of Rantau Baru village were selected as research sites. Horseshoe lakes offer several research benefits. The two lakes are separated from the Kampar river although there is still a connection with the river, but the horseshoe lake has a closed system. The two selected lakes are Lake Sepunjung and Lake Teluk Bederas (Figure 2 and 3).

Lake Sepunjung is located at position N 0016'0" – 0016'40" and E 101048'0" – 101048'20" and Teluk Bederas lake is at position N 0016'50" – 0017"10" and E 101040'20" – 101040 '46" (Figure 3 and 4). The characteristics of the two lakes are almost the same,

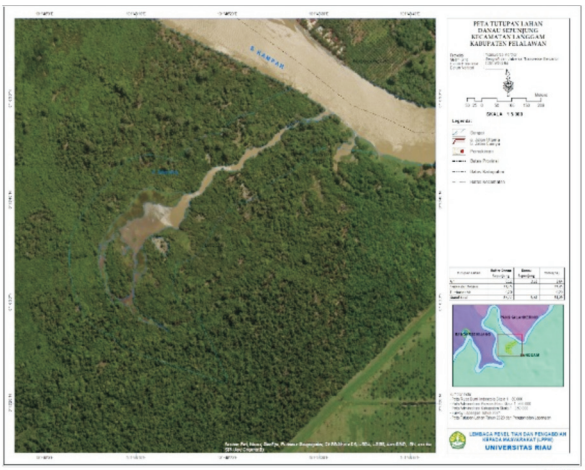

Fig. 2. Sepunjung oxbow

the bottom is muddy, the edge of the lake is overgrown by macrophytes (water hyacinth – *Eichhornia crassipes*).

The land cover area of Lake Sepunjung is 6.58 ha, consisting of 3.52 ha of open water and 3.06 ha of plants. Teluk Bederas Lake has an area of 5.74 ha with a surface that is not covered by 5.66 ha of aquatic plants and 0.08 ha of aquatic plant cover (Table 1 and Figures 5 and 6).

The water quality parameters observed and analyzed were pH, electrical conductivity (DHL), oxygen solubility (DO), depth, orthophosphate, total phosphate, total nitrogen, nitrate, nitrite, and ammonia. Quality and Sepunjung and Teluk Bederas lakes can be seen in Tables 3 and 4.

The condition of the water quality of the two lakes does not appear to be significantly different. To see if there are differences between the two lakes, an assessment of the quality of the two oxbow lakes was carried out using the water quality index (WQI).

Table 1. Q, RW, and SI values for the Sepunjung Oxbow

No.	PARAMETER	Unit	Avarage	Q	RW	SI
1	pH	-	6.03	10.47	0.14	2,6639
2	Conductivity	µS/cm	29.83	67.74	0.68	45,888
3	DO	mg/l	1.77	121.07	0.04	4,8566
4	Depth	m	3.00	6.81	0.07	0,464
5	Orthophosphate	mg/l	0.02	0.04	0	1,43
6	Total Phosphate	mg/l	0.04	0.1	0	9,89
7	Total Nitrogen	mg/l	2.03	4.62	0.05	0,2131
8	Nitrat as N (NO3-N)	mg/l	1.15	2.62	0.03	0,0685
9	Nitrit as N (NO2-N)	mg/l	0.12	0.26	0.003	0,001
10	Amonia sebagai N (NH3-N)	mg/l	0.05	0.11	0.001	0,0001
	TOTAL		44.04			54,1556

Fig. 3. Sepunjung Oxbow

Table 2. Land cover of Lakes Sepunjung and Teluk Bederas .

Land cover	BDS	BDTB	DS	DTB	Grand Total
Water	0.12	0.37	3.52	5.66	9.66
Meadow		2.70			2.70
Oil Palm Plantation		4.50			4.50
Shrubs and Thickets	27.45	10.98			38.44
Open Land	0.20				0.20
Aquatic Plant			3.07	0.08	3.15
Grand Total	27.77	18.55	6.58	5.74	58.64

Keterangan: **BDS** = Buffer of Danau Sepunjung, **BDTB** = Buffer of Danau Teluk Bederas, **DS** = Danau Sepunjung, dan **DTB** = Danau Teluk Bederas.

Table 3. Q, RW, and SI values for the Teluk Bederas Oxbow

No.	PARAMETER	UNIT	AVARAGE	Q	RW	SI
1	pH	-	6,43	0,1415	0,1415	11,6082
2	Conductivity	µS/cm	31,10	0,6848	0,6848	1,3696
3	DO	mg/l	2,57	100,0278	0,0565	100,0842
4	Depth	m	2,50	0,055	0,0551	0,1101
5	Orthophosphate	mg/l	0,02	0,0004	0,0004	0,0009
6	Total Phosphate	mg/l	0,10	0,0021	0,0021	0,0043
7	Total Nitrogen	mg/l	1,63	0,356	0,356	0,0719
8	Nitrat as N (NO3-N)	mg/l	0,90	0,0198	0,0198	0,0396
9	Nitrit as N (NO2-N)	mg/l	0,12	0,0026	0,0026	0,00053
10	Amonia as N (NH3-N)	mg/l	0,05	0,0011	0,0011	0,0022
	TOTAL		45,42			113,2893

The WQI formula approach follows what Alobaidy *et al.* (2010).

The usefulness of the water quality index, as an indicator of water pollution, for the assessment of spatial-temporal changes and classification of river water quality is verified. As a case study, the water quality index was used to evaluate the spatial and temporal changes in water quality in the Sepunjung

horseshoe lake and the Teluk Bederasmdi lake. Conservation of this lake really needs to be rushed. Fishing activities are very intensive while maintenance is not enforced. The result allows capital owners to fish without considering the sustainability of the lake.

Looking at the results of the WQI analysis, Sepunjung lake is classified as a good lake, while Teluk Bederas lake is classified as a nutrient-poor condition. This indeed strengthens the previous assumption because in the area 100 m from the lake, a lot of land has been used for oil palm plantations and other crops. Judging from the results achieved with WQI, it is very interesting to use it to assess the condition of a lake or river.

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