

**ASSESSMENT ON WATER QUALITY AND BIODIVERSITY WITHIN
SUNGAI BATU PAHAT**

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*Hanya yang istimewa buat
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“In the name of God, the most gracious, the most compassionate”

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ABSTRAK

Sungai Batu Pahat sedang mengalami kemerosotan kualiti air dan banyak tumbuhan disekitarnya telah musnah. Kajian ini tertumpu kepada penentuan status Sungai Batu Pahat berdasarkan analisis kualiti air dan kepelbagaian biologi secara kualitatif dan kuantitatif. Terdapat enam parameter utama yang diambil kira dalam kajian ini iaitu oksigen terlarut (DO), permintaan oksigen biokimia (BOD), permintaan oksigen kimia (COD), nitrogen ammonia ($\text{NH}_3\text{-N}$), pepejal terampai (SS) dan pH. Manakala parameter biologi pula terdiri daripada ikan, zooplankton, phytoplankton, macrobenthos dan tumbuhan tebing sungai. Kualiti air yang didapati menunjukkan tahap yang seragam dengan kualiti air yang kurang memuaskan di mana berdasarkan DOE-WQI, di hilir dan hulu sungai, data menunjukkan kualiti air di kelas III tetapi menurun ke kelas IV di tengah sungai. Ini mungkin disebabkan oleh aktiviti guna tanah di kawasan tebing sungai seperti aktiviti kuari dan penempatan penduduk. Jika dilihat pada data kepelbagaian biologi, terdapat banyak anak ikan yang mempunyai nilai komersial yang tinggi yang masih hidup kerana kepekatan DO yang didapati melebihi 2 mg/L dan juga kualiti makanan yang tinggi yang diperolehi dari tumbuhan di tebing sungai. Secara umumnya, taburan hidupan plankton dan macroinvertebrata di kawasan kajian sangat dipengaruhi oleh pasang-surut air dan juga pokok bakau. Kepelbagaian biologi didapati tertumpu di kawasan hulu sungai dan bilangannya berkurangan di hilir dan tengah sungai kemungkinan disebabkan oleh aktiviti guna tanah yang aktif. Kebanyakan kepelbagaian biologi yang dijumpai adalah dari spesis yang tidak sensitif pada kepekatan oksigen terlarut dan pH yang rendah. Kesan ketara akibat kemerosotan kualiti air boleh dilihat pada habitat macrobenthos yang dijumpai sewaktu kajian dilakukan di mana, macrobenthos hampir pupus dan hanya yang tinggal adalah dari spesis yang tidak sensitif kepada pencemaran. Walaubagaimanapun, terdapat juga banyak kepelbagaian biologi (zooplankton dan phytoplankton) yang sensitif kepada pencemaran di kawasan kajian dan ini memberi erti bahawa Sungai Batu Pahat masih lagi mampu untuk menampung hidupan akuatik kerana ia menyediakan tempat tinggal, tempat membiak dan makanan yang berkualiti tinggi walaupun kualiti air menunjukkan sebaliknya.

ABSTRACT

Sungai Batu Pahat is undergoing poor condition in term of water quality and riverbank vegetation. This study was focus on determining the status of Sungai Batu Pahat due to quantitative and qualitative of water quality and biodiversity analysis. There are six major water quality parameter that considered in this study which are dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), ammoniacal nitrogen (NH₃-N), suspended solid (SS) and pH. Biodiversity parameter consists of fish, zooplankton, phytoplankton, macrobenthos and riverbank vegetation. Water quality shows a consistent level with low quality of water which is class III at upstream and downstream but dropped to class IV at middle stream according to DOE-WQI. This could be a consequence of riverbank landuse activities such as quarry and settlement. If based on biodiversity data, the juvenile commercial fish still exist correspond to >2 mg/L of DO concentration and quality food supply from riverbank vegetation. Generally, the distribution of planktonic life and macroinvertebrates within study area was tidal and mangrove dependent. Biodiversity was found abundance at downstream and present with low number and species at upstream and downstream probably because lands use activities. Biodiversity that mostly found within study area is tolerant species to low dissolved oxygen concentration and pH. The impact of water quality can clearly be seen with respect to macrobenthos habitat. Macrobenthos almost disappeared during study event and only tolerant species was present. However, the abundance of high demanding biodiversity (zooplankton and phytoplankton) giving the good result that Sungai Batu Pahat still can support aquatic life due in term of shelter, feeding and breeding area even, the quality of water shows otherwise.

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LIST OF ABBREVIATIONS

APHA	American Public Health Association
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
DOE	Department of Environment
FSS	Fixed Suspended Solid
GPS	Geographical Positioning System
INWQS	Interim National Water Quality Standard
IUCN	International Union for Conservation of Nature and Natural Resources
MEDS	Microbial Easily Degradable Substrate
MPBP	Majlis Perbandaran Batu Pahat
SS	Suspended Solid
UM	Universiti Malaya
USEPA	United State Environmental Protect Agency
VSS	Volatile Suspended Solid
WQI	Water Quality Index

LIST OF SYMBOLS

km	Kilometer
mg/L	Milligram per liter
kg/m ³	Kilogram per cubic meter
µm	Micrometer
cm	Centimeter
ind/m ³	Individu per cubic meter
L	Liter
N	North
E	East
C	Carbon
P	Phosphorus
H'	Shannon-Weiner's Index
J'	Pielous's Index
D'	Margalef's Index
<i>sp.</i>	Species
%	Percentage
°C	Degree Celsius
CO ₂	Carbon Dioxide
H ₂ O	Water
NO ₃	Nitrate
O ₂	Oxygen
NO ₂ ⁻	Nitrite
NH ₃	Ammonia
H ₂ S	Hydrogen Sulfide
FeS ₂	Iron Sulfide
PO ₄	Phosphate
H-NH ₃	Nitric Acid

Fe	Iron
Pb	Lead
Cu	Copper
Cd	Cadmium
Zn	Zink
Mn	Manganese
Hg	Mercury

CHAPTER I

INTRODUCTION

1.1 Introduction

River is one of valuable country asset and need to put more attention to rehabilitate it from time to time. It should be well cared and concerned of its importance without any enforcement. By maintaining and well managing the river, the aesthetic value may increase as well as rate of country economic generation may improve tremendously. Mangroves are intertidal marine plants, mostly trees, and thrive in saline conditions and daily inundation between mean sea level and highest astronomical tides. Mangroves are not a monophyletic taxonomic unit. Fewer than 22 plant families have developed specialized morphological and physiological characteristics that characterize mangrove plants, such as buttress trunks and roots providing support in soft sediments and physiological adaptations for excluding and expelling salt (Schaffelke *et al.*, 2005).

For swampy area like Sungai Batu Pahat, the mangrove plants require certain heavy metals as essential nutrients; however an excess in these nutrients may potentially have adverse, ecotoxicological consequences for mangrove communities. Each mangrove plant species has specific adaptation systems, which may control their behavior towards pollutants. A study by previous experiment reveals that in urban area, there are no obvious differences between samples collected in swamps located upstream and downstream. (Marchand *et al.*, 2005).

1.2 Site Description

The main river in the study area is Sungai Batu Pahat which forms from the joining of two rivers namely Sungai Simpang Kiri and Sungai Simpang Kanan about 3.5 km northwest of the town of Batu Pahat. From the point where Sungai Simpang Kiri and Sungai Simpang Kanan joins to form Sungai Batu Pahat, the river flows for approximately 12 km on a south and southwesterly course before draining into the straits of Melaka near Tanjung Api and Minyak Beku. A few tributaries which are connected to the river were identified such as Sungai Peserai, Sungai Benang, Sungai Gudang, Sungai Kajang, Sungai Tambak and Parit Gantong. Within study area, there are a lot of land use activities such as urban area, quarry, barter-trade jetties and pig farm as shown in Figure 1.1.

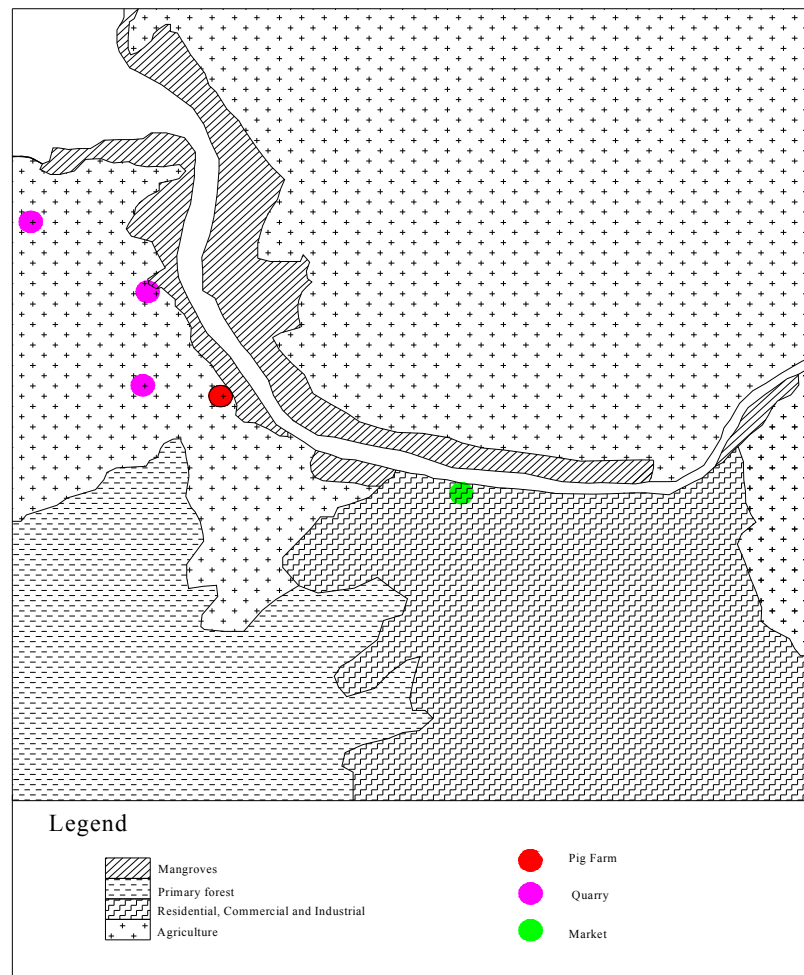


Figure 1.1: Major land use that had been identified around Sungai Batu Pahat (Low, 2007)

1.3 Objective of Study

The objectives of this study are;

- (i) To determine the trends of water quality of Sungai Batu Pahat as consequence of land use activities;
- (ii) To identify the distribution pattern of planktonic life and macrobenthos due to dissolved oxygen, pH and riverbank vegetation;
- (iii) To identify the status of Sungai Batu Pahat based on water quality and biodiversity analysis.

1.4 Scope of Study

The boundary of this study is from the upstream of Sungai Batu Pahat ($1^{\circ} 51' 35.2''$ N, $102^{\circ} 55' 23.8''$ E) to the adjacent coastal water of Sungai Batu Pahat, i.e. Straits of Melaka ($1^{\circ} 47' 52.1''$ N, $102^{\circ} 53' 30.1''$ E). The considering parameter for this study are water quality parameters which consist of Dissolve Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), pH (Acidity and Alkalinity), Suspended Solid (SS) and Ammoniacal Nitrogen ($\text{NH}_3\text{-N}$), and biological parameters such as fish, zooplankton, phytoplankton, macrobenthos and river bank vegetation. The sampling of water quality is taken at seven stations with six times of frequency for both tides (study period is within August 2006 and September 2006).

The data of biodiversity quantity in term of zooplankton, phytoplankton and macrobenthos was taken twice at five stations within August and September, 2006. Fisheries sampling also was taken twice which two times during high tide and two times during low tide within study period while riverbank vegetations was measured once within study period because the condition of river bank vegetation is not change

from actual observation. Only the patches of vegetation from both side of the river is considering in this study.

1.5 Needs of Study

Generally, Water Quality Index (WQI) is used to determine the classification and pollutant status of particular water bodies. However, rely solely on WQI is not strong enough to define and justify either the aquatic habitat may survive in the water bodies or vice versa. Instead of using physicochemical parameters, another strong influenced factor is via biological survey. Aquatic habitat may have bad impact causes by deteriorating of water quality. Another reason of fish survival is because of the existing of feeding and breeding area (riverbank vegetation). Beside, there would be a Second port development within study area (Mukim Peserai). Therefore, this study is conducted to determine the existing quality of this river and represent as a baseline data in order to achieve sustainable development.