Metallothionein analysis and cell damage levels on the liver and gill Of *Barbonymus gonionotus* In Brantas River, Indonesia

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Abstract

This study aimed to analyze the levels of metallothionein and damage to hepatocytes and gills of *Barbonymus gonionotus* in the Brantas River (upstream and downstream), and the correlation levels of metallothionein in the gills and liver of *Barbonymus gonionotus* with different sampling time variation (March, June, and September 2016). Fishes were caught using trawl in two stations (Karangkates Reservoir and the Kali Jagir river). Fish gills and livers were taken for histopathological analysis and levels of metallothionein were measured by ELISA method. Gills histopathological analysis showed that the highest damage in Karangkates reservoir dan Kali Jagir river is hyperplasia. Liver histopathological analysis in Karangkates reservoir showed normal hepatocytes meanwhile necrosis is highest damage found in Kali Jagir river. Metallothionein levels of fish in Karangkates reservoir for March, June, and September were 0.18 ng/mL; 0,18 ng/mL; and 0.2 ng/mL (gills fish); 0,18 ng/mL; 0,34 ng/mL; and 0,21 ng/mL (liver fish) respectively. Metallothionein levels of fish in Kali Jagir river for March, June, and September were 0,26 ng/mL; 0,18 ng/mL; and 0,18 ng/mL (gills fish); 0,2 ng/mL; 0,45 ng/mL; 0,19 ng/mL (liver fish) respectively. We conclude that the damage to the gills and liver of *Barbonymus gonionotus* was mostly found in Kali Jagir River and the highest metallothionein level of *Barbonymus gonionotus* also presented in Kali Jagir River.

Keywords: Brantas River, *Barbonymus gonionotus*, histopathology, Karangkates reservoir, Kali Jagir river, metallothionein.

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Introduction

Water pollution disrupt and decrease biota diversity. Environmental damage as response to water pollution has become the main concern in recent years (Authman et al., 2013). Brantas River is the second longest river in East Java, after Bengawan Solo River. Brantas River watershed is beneficial for water debit control, irigation, hydroelectric power plant (PLTA), drinking water, fishery, and recreation (Usman., 2003). Increasing number of human population in the riverbank of Brantas River and waste disposal from industrial activity contribute to higher level of pollution (Hayati et al., 2017). Brantas River is polluted by heavy metal elements (Pb, Cu, Cr, and Cd) which can be absorbed by organism and bind the receptor in the cell (Hayati et al., 2017).

Metallothionein (500-14000 Da) is localized in golgi apparatus membrane. It able to bind high amount of heavy metals through thiol group (Sulfhyhydryl, -SH) from cysteine residue due to high amount of amino acid Cys (Sigel, 2009). Metallothionein induction depends on the amount of oxidative heavy metals and glucocorticoids in the body. In general, high amount of metallothionein is synthesized in liver and kidney as scavanger in the cell due to the existence of cysteynil thiolate group (Nedeckey et al., 2013).

Fish are relatively sensitive to environmental changes, have relatively long life, and have risk of heavy metal accumulation in their body (Wangboje et al., 2013). Heavy metal absorption in aquatic organism increases with increasing trophic level in ecosystem (Soegianto., 2008). Fish that are mostly found in Brantas River is *Barbonymus gonionotus*, and this kind of fish is consumed by people (Priatna et al., 2016). Heavy metal concentration (Pb, Cr, Cu, and Cd) in the water of the upstream (Karangkates Reservoir) and the downstream (Kali Jagir River) has reached more than 0.03 ppm (Hayati et al., 2017), which means it exceeds the maximum limit allowed by the Regulation of Health Minister No. 492/2010. The cell should keep the homeostatic in the fish body to prevent any free radicals that may lead to oxidative stress (Annabi et al., 2013).

However, few studies were conducted on histopathology and metallothionein level of *Barbonymus gonionotus* habitated in the upstream (Karangkates Reservoir) and downstream (Kali Jagir River), so further observation study was needed to analyze the histopathology and metallothionein levels in the gill, liver, and meat of *Barbonymus gonionotus* taken from the upstream (Karangkates Reservoir) and downstream (Kali Jagir River, Surabaya). It is also beneficial to acknowledge the quality of *Barbonymus gonionotus* in Karangkates Reservoir and Kali Jagir River because this fish is highly consumed.

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Method

Agreement on Code Ethic

Not done in this research

Sampling

The sample of *Barbonymus gonionotus* was taken on March to September 2016 using trawl net. For each station, 2 fishes were taken (on March, June, September), so the total number of fishes from the upstream and downstream were 12. Then, fishes were dissected for their

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