Bioaccumulation Of Heavy Metal Zinc (Zn) And Copper (Cu) And Histology Of Grouper (*Epinephelus Suilus*) In Coastal Panceng Waters Of Gresik Regency

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ABSTRACT: This study aims to determine the content of heavy metals Cu and Zn and histology of Grouper (Epinephelus suilus). Survey research methods with technique of data collection on a 3-point sampling station. Data were analyzed descriptively. The results showed an average content of Cu and Zn at estuaries station is 0:05 mg / L. marine station and pond station that was equal to 0.02 mg / L and 0.04 mg / L. Zn content in estuaries station is 0:15 mg / L, pond of 0.1 mg / L and marine station of 0.08 mg / L. The content of Cu and Zn in the sediment that obtained at each station showed ponds station of 1.45 mg / g, marine station, and the estuaries stationthat is equal to 1.42 mg / g and 1.08 mg / g. Zn content in ponds station is 6.9 mg / gram. While in the estuary of 4.55 mg and 6.5 mg marine station. The content of Cu and Zn in fish in ponds station of 0.46 mg / k, marine station and the estuaries station that was equal to 0.31 mg / kg and 0.35 mg / kg. Content of Zn obtained the highest Zn concentrations of metals found in estuariesstation that was 2,85 mg / kg. pond of 2.5 mg / kg and marine station in the amount of 1.52 mg / kg. Histological damage on gill tissue, liver and kidneys found any histological changed that gill hyperplasia and fusion lamela. On liver histology found degeneration, edema and some necrosis, whereas in the kidneys was found edema and necrosis.

Keywords: Heavy Metal, Cu, Zn, Grouper, Panceng Waters, Histology

1. INTRODUCTION

Panceng waters located in Panceng District, Gresik, East Java Province, an area of great potential for various forms including fisheries sectors such as aquaculture. Total area of the Panceng District in that area of 24.77% or 4708.7 ha were ponds, industrial, residential rest was agricultural land. It is among others also can be seen from the many activities of coastal communities who carry out farming's in Panceng, one of which is a Grouper (*Epinephelus suilus*). But this time Gresik waters were polluted. Gresik water pollution was diverse with various indicators of research institutions (1). Industrial waste containing heavy metal compounds toxic to plants, animals and humans (2). Zn and Cu Copper is one of the heavy metals are classified into heavy metal essential, meaning that although it is a toxic heavy metal, the metal element is very needed by the body even in small amounts.

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In the preliminary test showed levels of Cu and Zn in the ponds, marine, and estuarine respectively 0,049 ppm, 0.2137 ppm and 0.1352 ppm. Given the high interest of the community to consume fish Grouper and the dangers of excessive Cu and Zn to health, this research needs to be done. With known levels of Cu and Zn in Grouper in Panceng waters, Gresik, can be determined safety for consumption (foodsafety). Besides knowing the levels of Cu and Zn in water and sediment ponds, it can be beneficial for Gresik government and related agencies: Department of Marine and Fisheries, Bappedal, the Environment Agency and industry in the management of B3 waste. The purpose of this research is to know the content of heavy metal concentrations of copper (Cu) and zinc (Zn) contained in water, sediment and fish and organ histology at the gills, liver and kidney of Groupers (*E. suilus*) in Panceng waters of Gresik Regency.

2. MATERIALS AND METHODS

The research was conducted in October-November 2014 at Panceng waters, Gresik. Data were collected at three stations: station I (ponds), station II (sea) and the station III (estuary). Analysis of the levels of Cu and Zn in the water, fish and sediment conducted at the Laboratory of Environmental Chemistry, Faculty of Science, University of Brawijaya. Observations sediment samples were analyzed at the Laboratory of Soil Chemistry, Faculty of Agriculture, University of Brawijaya. While the fish samples for histological observation of the gill, liver and kidney in Anatomy-Histology Laboratory, Faculty of Medicine, UB. Materials research using Grouper fish, water and sediment ,, HCl, HNO3 and distilled water solution. Parameter study include: the data content of Cu and Zn in water, sediment and fish were analyzed by quantitative descriptive. Water quality data included temperature, water pH, salinity, and oxygen content (DO). As well as histological analysis of gills, liver and kidney Groupers .

3. RESULTS

3.1 Water Quality Water's Panceng

Of water quality data retrieval was done at 3 stations namely ponds, seas and estuaries. Water quality measurements performed in situ at each observation station. Results mean water quality measurements taken at the three stations can be seen in Table 1:

Table 1. *The average value of water quality parameters at each observation station, Panceng waters, Gresik.*

No	Parameter	Unit	Station			Quality Standards
			Pond	Sea	Estuary	
1	pH	-	7,8	8,1	8	7-8,5
2	DO	ppm	4	3,8	3,9	>5
3	Temperature	°C	29	30,6	31	28-32
4	Salinity	‰	34	35	35	sd/34

Based on the table showed that results of measurements at all stations water temperature between 29 ° C-31 ° C. Value was still below the quality standard range. (3). The highest temperature at estuaries station was 31 ° C. The high temperature at all stations associated with the location of existing settlements in the coastal area and the waste caused by the influence of wastes around. The degree of acidity in the water system affected the concentration of heavy metals in waters. In the body of water that has a degree of acidity (pH) near normal or in the pH range 7-8, the solubility of these compounds tend to be stable (4). PH range obtained within the limits of tolerance for a live fish. Dissolved oxygen at all stations range between 3.8 to 4 ppm. This is in accordance with the needs of the DO recommended quality standard (> 5 ppm). The highest levels of dissolved oxygen in ponds station is 4 ppm. Low levels of dissolved oxygen in the estuary station caused by many organic and inorganic pollutants that fall into these waters so that the organic waste will be subject to degradation and decomposition by aerobic bacteria that will cause dissolved oxygen levels will be reduced. In addition the value of dissolved oxygen in the water was due to temperature variations during the measurement, the difference Kountur depth, content of nutrients and water movement. Value range derived salinity is 34-35 ‰. At the pond station obtained a value of 34 ‰ and in the marine station at 35 ‰. While at the estuaries station 35 ‰. It caused by factors that affect the value of salinity was the tide, the water circulation patterns, evaporation, precipitation and river flow.

3.2 Content of Copper (Cu) and zinc (Zn) in Water

Based on the results of heavy metal content measurements of Cu in water obtained at each station showed that the estuary station has exceeded the quality standard limits of Kep.MENLH No. 51 of 2004 (0.005 mg / L). Analysis of the concentration of Cu in Cu station dengang highest concentrations found in estuariesstation is 0:05 mg / L. While at sea stations and station pond that was equal to 0.02 mg / L and 0.04 mg / L. Pollution of heavy metals Cu in Panceng waters can be derived from waste products such as waste waters around household waste, waste fuels and waste ship about people around that when dissolved into water. Results of measurement of heavy metal content each observation stations can be seen Table 2:

STATION	Content of Copper (Cu) in Water
Estuary	0,05
Sea	0,02
Pond	0,03

Results of measurement of heavy metal content Zn each observation stations can be seen **Table 3**:

STATION	Content of Zinc (Zn) in Water
Estuary	0,15
Sea	0,08
Pond	0,1

Analysis of the concentration of Cu at the station with the highest concentrations found in estuaries station was 0:05 mg / L. While at sea stations and station pond that was equal to 0.02 mg / L and 0.03 mg / L. The high concentration of heavy metals Cu in Panceng waters can be derived from waste products wastes surrounding waters such as household waste, waste fuels around the ship as well as industrial waste waters from the river toward Panceng waters. The low value of the marine station and the pond because there has been a dilution by sea water so that the concentration of heavy metals is reduced. While the results of the measurement of Zn in the water found in estuaries and ponds station has exceeded the quality standard LH Decree No. 51 of 2004 (0.1 mg / L) compared to the marine station. Analysis of the concentration of Zn metal with the highest concentrations of Zn metal was found in estuaries station was 0:15 mg / L. While the pond was 0.1 mg / L and marine station is nearing the threshold value is equal to 0.08 mg / L. It is also because the sea water in the area of research was likely to shift due to the influence of currents and tides. The open sea can easily carry dissolved metals into other areas that could contaminate other locations. Low levels of heavy metals in seawater, it did not mean no negative impact on the water, but more due to the ability of water to dilute the contaminant material that was high enough (7)

3.3 Content of Copper (Cu) and zinc (Zn) in sediments

Based on the results of measurements of heavy metal content of Cu in the sediments obtained at each station showed the highest Cu concentrations found ponds station of 1.45 mg / gram. While at sea station and the estuaries station that was equal to 1.42 mg / g and 1.08 mg / g. Pollution of heavy metals Cu in Panceng waterscan be derived from waste products such as waste waters around household waste, waste fuels and waste ship about people around who dissolved into water (8). Results of measurement of heavy metal content each observation stations can be seen in **table 4**:

Station	Cu
Pond	1,45
Sea	1,42
Estuary	1,08

The content of Cu in sediments tend to be high, this is because by the nature of heavy metals in the water column that settles within a certain period, and then accumulated in the bottom sediment waters. Precipitation occurred because of heavy metals higher than the density of water (9). So that the heavy metal content in the sediment to be higher than in the water, because of the influence of the physics, chemistry, and biology that occured naturally in the waters. While the results of the measurement of the concentration of Zn in the sediments obtained the highest Zn metal found in ponds station was 6.9 mg / gram. While in the estuary of 4.55 mg and 6.5 mg sea station. The high value of Zn concentration of heavy metals caused by the activity of household sewage, agricultural waste, waste fertilizer use pesticides that accumulate in water and cause increased zn content. Zinc metal ions tend to form if it is in the water. The tendency of increase in the concentration of heavy metals in sediments caused by high concentrations of heavy metals in the water which constantly undergo precipitation. Results of measurement of heavy metal content each observation stations can be seen **Table 5**:

Station	Zn
Pond	6,9
Sea	6,57
Estuary	4,55

3.4 Content of Copper (Cu) and zinc (Zn) In Fish

Based on the results of measurements of heavy metal content of Cu in fish that at all stations heavy metal content of Cu in the body Grouper that live in Panceng waters has not exceeded the preset threshold is the maximum limit allowed in seafood FAO in 1972 amounted to 1.0 mg / kg obtained at each station showed. Analysis found the highest concentrations of Cu ponds station of 0.46 mg / kg. While at sea station and the estuaries station that was equal to 0.31 mg / kg and 0.35 mg / kg. Pollution of heavy metals Cu in Panceng waterscan be derived from waste products such as waste waters around household waste, waste fuels and waste ship about people around who dissolved into the water. Results of measurement of heavy metal content each observation stations can be seen **Table 6**:

Station	Cu
Pond	0,46
Sea	0,31
Estuary	0,35

While the measurement results obtained fish Zn in the Zn metal concentrations are highest at estuariesstation that was 2,85 mg / kg. While the pond is 2.5 mg / kg and marine station in the amount of 1.52 mg / kg. Results of measurement of heavy metal content each observation stations can be seen **Table 7**:

Station	Zn
Pond	2,5
Sea	1, 52
Estuary	2,85

The average metal content of Zn in fish samples turned out not exceed the limits set. However, eating fish contaminated by heavy metals need to watch out given the nature of the metal that can accumulate in organs if consumed in large quantities and is relatively long. Metal Zn has a higher maximum concentration limit of Cu because Zn contained in many enzymes used in the process of metabolism, helps the growth and increase fertility and sperm production in men (10).

3.5 Histology picture of Groupers Gill

Histological damage the gills of fish obtained from direct observation of fish gills mikroanatomy structure used a microscope magnification 100x. The value of the degree of damage fish gills Grouper 's Panceng on station in the waters of the estuary, sea station and pond station presented in **Figure 1**.

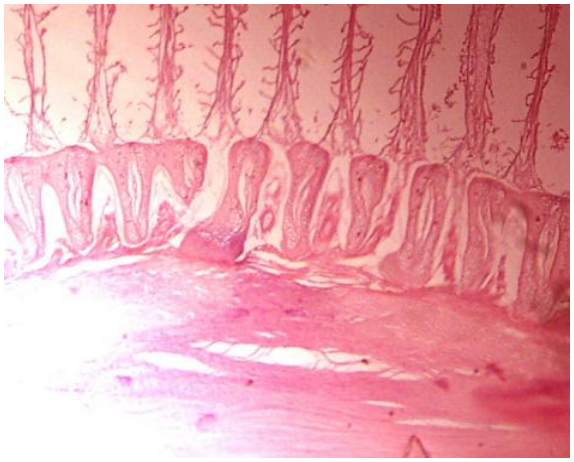

Figure a. *Histology of Gill fish in Sea Station*

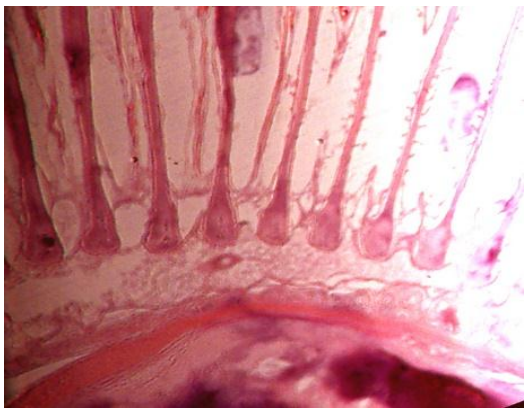

Figure b. *Histology of Gill fish in Estuary Station*

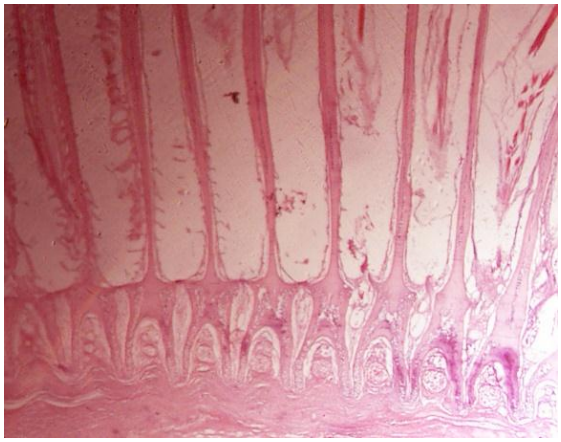

Figure c. *Histology of Gill fish in Pond Station*

Based on the results of scoring gill's histological damage levels in the Panceng waters were presented in Figure 1, the value of the station at 4.67 estuaries, ponds station at 3.67 and sea station of 2.67. Observations preparations gill histology was found that there was a changed in the form of edema, hyperplasia (enlargement of cells) and fusion in the secondary lamella on gills organs. The change began in the Grouper that live in the Panceng waters at all stations began to show changed in edema and hyperplasia histology and cell necrosis caused by chemical pollutants and heavy metals. Tanjung (1982) classify the damage gill hyperplasia is associated with toxic materials as damage. Hyperplasia is usually accompanied by an increase in the number of cells at the base lamela mucus and cause fusion lamella.

3.6 Liver

Damage to fish liver histology obtained from direct observation of fish liver mikroanatomy structure using a microscope magnification 100x. Value extent of liver damage Grouper in the waters of the estuary's Panceng in station, sea station and pond station presented in **Figure 2**.

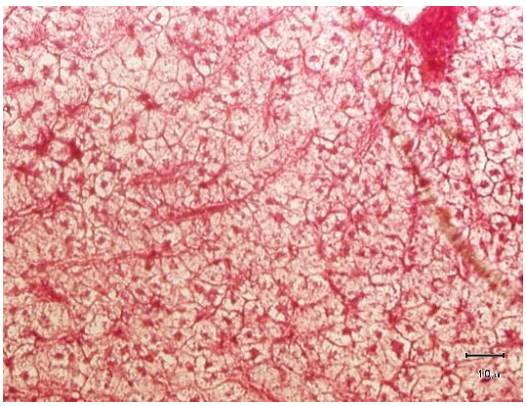

Figure a*. Histology of Fish Liver in Pond Station*

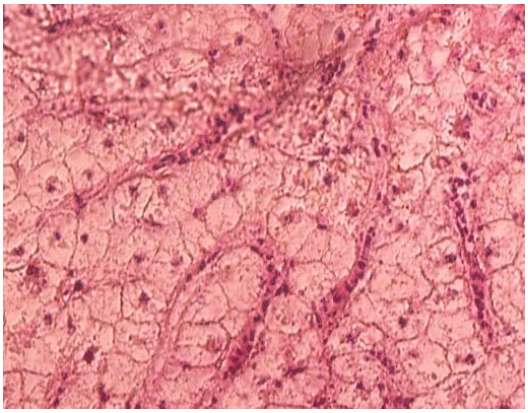

Figure b*. Histology of Fish Liver in Estuary Statio*

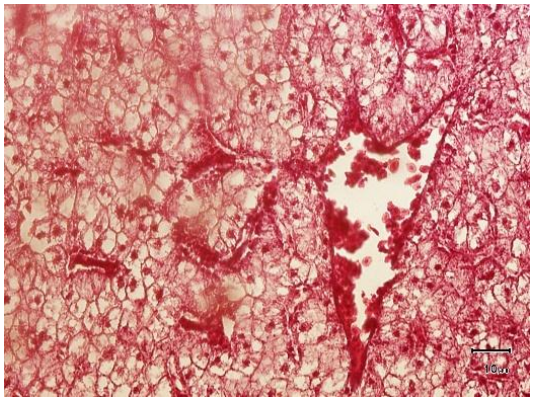

Figure c. *Histology of Fish Liver in Sea Station*

Scoring based on the extent of damage in liver histology's were presented in Figure 2, the value of the estuaries station of 5.00, 4.33 and ponds station sea station of 2.67. Comparison of the level of damage liver observations at each station with normal liver under the microscope it was found that a changed in liver histology form of degeneration, edema, necrosis. Histological changed above the result of toxic substances into the body of the fish environment. The presence of toxic substances in fish can affect the structure of fish liver histology. Instability in the cells pump Na + ions out of the cell led to increased fluid from outside the cell to enter the cell so that the cell was not able to pump enough sodium ions (11). This results in cell swelling (edema) and loss of membrane integrity, so that the cells will secrete the cell material out and then going on to cell death or necrosis.

3.7 Kidney

Kidney damage fish histology obtained from direct observation of the structure of the kidney mikroanatomy fish used 100x magnification microscope. Based on the results of scoring histological kidney damage levels in Panceng waters presented in Figure 3,

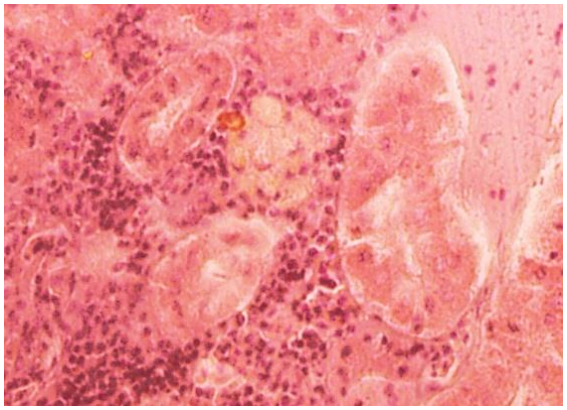

Figure a. *Histology of Fish Kidney in Sea Station*

Figure b. *Histology of Fish Kidney in Estuary Station*

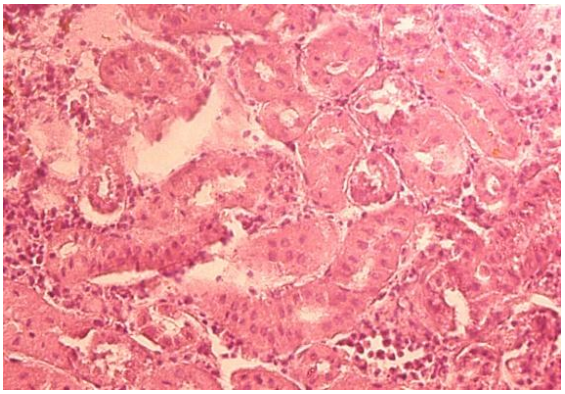

Figure c *Histology of Fish Kidney in Pond Station*

The value of the station at 5.67 estuaries, ponds station at 4.67 and 3.67 for the sea station. Renal histological changed experienced by Grouper in the Panceng waters in the form of damage to hypertrophy (swelling) tubular cells and glomerular hypertrophy. Tubular cell damage and lead to a reduction in glomerular filtrate cavity, cell lysis, cell necrosis, edema (swelling of the cell), and fibrosis (12). Hypertrophy characterized by tissue damage increase organ size due to increasing cell size so that the cells with each other independent of each other. Characteristics of hypertrophy can be seen by narrowing the lumen of the tubular and enlargement of tubular cells. Glomerular hypertrophy occurs due to blockage of compounds that are toxic, although the concentration was low but long enough in the body of contaminated fish (13).

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