CONTAMINATION OF Pb, Cd, Cu, Zn IN BLACK POMFRET (*Formio niger*) AND TONGUE SAND (*Cynoglossus lingua*) FISH CAUGHT FROM THE WESTERN PART OF MADURA STRAIT AND ITS SAFE LIMITS CONSUMPTION

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ABSTRACT

Contamination of Pb, Cd, Cu, Zn in the flesh on the two types of fish consisting pelagic fish include Black pomfert (Formio niger) whereas among other demersal fish include Tongue sand (Cynoglossus lingua), was conducted in March-December 2013, which was taken from the western part of Madura Strait (Gresik-Ujung pangkah, Surabaya-Kenjeran, and Sidoarjo-Sedati). Pb, Cd, Cu, and Zn detected using AAS (Atomic Absorption Spectrometry) brand Shimadzu AA-6200. The highest content of heavy metals, namely Pb in Cynoglossus lingua from the Sedati (5.63ppm±0.05), while a low of Cd in Formio niger from the Ujung pangkah (0.20ppm±0.004). The results show that there is a correlation between heavy metal with fish but not significantly. The content of Pb, Cd, Cu, Zn in 2 fish species originating from all locations stated below the exposure limits for consumption. Safe limit fish consumption of Formio niger is based on the WHO PTWI of 347.43 grams / week and Cynoglossus lingua 191.25 grams / week.

Key words: *Pelagic fish, Demersal fish, Black pomfert* (*Formio niger), Tongue sand(Cynoglossus lingua), Pb, Cd, Cu, Zn, Western part of Madura Strait*

INTRODUCTION

Indonesia consists of ± 17.000 islands, of which is the Java and Madura Island. Both of these islands are connected with the Madura Strait. Madura Strait has a potential of 156.150 tons per year so it is possible to export a very large (DKP, 2004). The area is located at the western end of Madura Strait is Gresik, Surabaya and Sidoarjo. Currently the region has become an industrial area of household scale to multinational scale. Waste from industrial activity is discharged into rivers that empty into the Madura Strait so that contamination will occur. Pollutants that come empties into the sea can contaminate the fish that live in it. It can also lower the public health by eating fish (Purnomo and Muchyiddin, 2011).

The metal contamination in aquatic systems are usually in the form of dissolved or in the form of suspension and eventually sank to the bottom or is picked up by organisms (Soegianto and Supriyanto, 2008). Contamination is pollution in the water caused by industrial waste.

According to Kristanto (2002) there are 6 types of metals that are harmful to humans and often polluting arsenic (As), mercury (Hg), cadmium (Cd), lead (Pb), copper (Cu), and zinc (Zn). Metals are known to accumulate in the body of an organism and remain in the body for a long time as the accumulated toxins that affect human health. Four kinds of toxic heavy metals contaminating water is often of lead, cadmium, copper, and zinc.

Fish produced in the Madura Strait is classified from pelagic and demersal of fish. Among other pelagic fish include *Formio niger*, while demersal fish include *Cynoglossus lingua*. Two of the many types of fish consumed by the public so get economic value is important because fish meat has nutritional content consisting of 82% protein, 1.7% fat, 8.9% moisture content, and 25% carbohydrate (DKP, 2004).

MATERIALS AND METHOD

Biological material used in this study are 2 types of fish that distinguished between pelagic and demersal fish. Among other pelagic fish *Formio niger*, while demersal fish belonging to the *Cynoglossus lingua*. Chemicals used for fish meat is chemically destruction include Nitric Acid (HNO_3) acid (City of Darmstadt, Germany, brand: KGaA, production year 2012, Lot No.: 1004562500), concentrated H_2SO_4 (City of Darmstadt, Germany, brands: KGaA , production year 2012, Lot No.: 1007311000), H_2O_2 (City of Darmstadt, Germany, brand: KGaA, production year 2012, Lot No.: 1187890001) and distilled water.

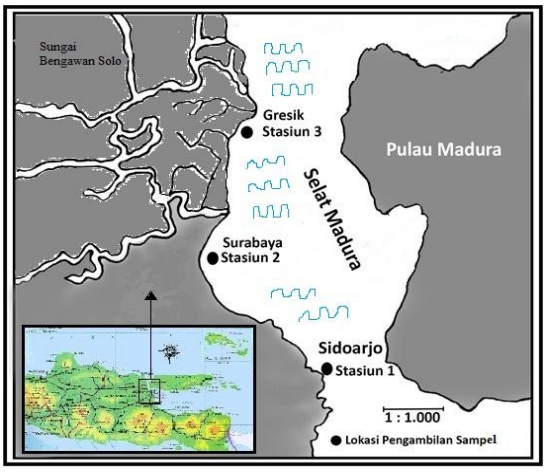

Figure 1. Location of sampling stations

Samples of fish was taken from the western part of the Madura Strait consisting of 3 stations namely Gresik (Ujung pangkah), Surabaya (Kenjeran), and Sidoarjo

(Sedati) each type of fish taken 10 samples shown in Figure 1. After that, stored in the ice box containing ice so as not to foul then examined the concentration of heavy metals in the laboratory and then measured body weight using scales. Samples were cleaned to remove mud and dirt, washed with clean water and cleaned her scales. Then take the meat as much as 3 grams and added 25 mL of distilled water, then put in a blender to physically destruction. Fish meat already physically then chemically destruction, so that the fish meat absolutely.

Destruction fish meat that has been physically incorporated into the digestion flask, then add 5 mL concentrated HNO_3 and H_2SO_4. The solution is heated at a temperature of fish ± 60°C for 30 minutes, then cooled for 5 minutes. After that, add 10 mL of concentrated HNO_3 and heated to boiling. The solution was left to stand for 5 minutes, then add 1 mL of H_2O_2 to clear color. The solution was transferred into a 100 mL volumetric flask and added with distilled water to 100 mL. Solution prepared metal levels measured by Atomic Absorption Spectrophotometer. After that, prepare the test sample and the preparation of acetylene gas burners 0.9 kg/cm3 then the tool is turned on by pressing the switch on the appliance ASS and personal computers.

To compare the content of heavy metals in the body weight of each fish, then analyzed using descriptive statistical Pearson correlation test to determine the relationship between body weight.

RESULTS

Content of heavy metals in fish meat in the western part Madura Straid showed in Table1.1.

Correlation between body mass fish and content Pb, Cd, Cu, and Zn in the western part Madura straid showed in Table 1.2.

Safe fish consumption limits fish in everyday and everyweek in the Western Part Madura strait accordance with the PTWI showed in Table 1.3.

Table 1. Average Value Body Weight and Content of Heavy Metals in Fish Meat in the Western Part Madura Strait

Name of Fish	Location	Body Weight (gram±SD)	Average Value Content of Heavy Metals (ppm±SD)			
		Range	Pb (Range)	Cd (Range)	Cu (Range)	Zn (Range)
Formi niger	Ujung pangkah	61.24±7.40 (47.50-83.54)	2.59±0.03 (2.43-3.04)	0.20±0.004 (0.14-0.27)	1.24±0.08 (0.76-2.36)	1.59±0.03 (1.05-2.04)
	Kenjeran	50.47±8.11 (34.42-79.05)	2.57±0.02 (2.41-2.81)	0.28±0.004 (0.24-0.33)	1.28±0.004 (1.19-1.35)	1.79±0.08 (1.05-2.92)
	Sedati	41.88±8.27 (31.22-66.82)	3.50±0.008 (3.28-3.62)	0.43±0.006 (0.38-0.51)	1.57±0.02 (1.38-1.82)	2.29±0.03 (1.98-2.58)
Cynoglossus lingua	Ujung pangkah	44.87±6.44 (24.53-64.29)	3.23±0.04 (2.71-3.81)	0.36±0.003 (0.31-0.41)	1.28±0.01 (1.05-1.46)	2.22±0.02 (1.90-2.51)
	Kenjeran	44,23±7,39 (16.39-67.32)	4.33±0.06 (3.88-5.11)	0.37±0.003 (0.31-0.41)	1.28±0.007 (1.20-1.38)	2.66±0.03 (2.15-3.02)
	Sedati	43,07±7,57 (20,54-65,89)	5.63±0.05 (4.82-6.32)	0.52±0.007 (0.42-0.62)	1.74±0.02 (1.56-2.01)	2.60±0.04 (2.36-3.11)

Table 2. Correlation Body Mass Fish and Content of Pb, Cd, Cu, and Zn in the western part Madura Strait

Name of Fish	Location	Pb		Cd		Cu		Zn	
		Correlation value	Sig.	Correlation value	Sig.	Correlation value	Sig.	Correlation value	Sig.
Formio niger	Ujung Pangkah	0.190	0.599	0.158	0.663	-0.103	0.778	-0.168	0.011
	Kenjeran	-0.764	0.010	-0.554	0.096	-0.318	0.371	-0.164	0.651
	Sedati	0,322	0.364	0.354	0.315	-0.103	0.778	-0.145	0.688
Cynoglossus lingua	Ujung Pangkah	-0.181	0.617	0.118	0.746	-0.762	0.010	-0.434	0.210
	Kenjeran	0.373	0.289	-0.017	0.964	0.124	0.733	0.134	0.712
	Sedati	0.494	0.146	-0.316	0.374	-0.301	0.398	0.105	0.773

DISCUSSION

The content of Pb in this study is quite high compared to other metal contents, namely Cd, Cu, and Zn. Pb contents were allowed to fish in European countries for consumption at 1.6 ppm (Soegianto, 2008). The highest Pb content of 5.63 ppm was identified in *Cynoglossus lingua* fish Sidoarjo (Sedati) showed that the content of Cd is higher than of that has required so that the metal content exceeds safe limits (Table 1.1). *Cynoglossus lingua* fish including demersal fish habitats are in the bottom waters so as to accumulate a very large Pb, where the presence of abundant Pb bottom waters.

The results of this study are supported by research Ebrahimi and Mahnaz (2009) showed that the content of Pb in *Cyprinus carpio* fish and *Capoeta* sp. from Iran Kor river locations at 6.73 ppm which exceeded safety limits that have been set by some countries.

The content of cadmium that has been required by the State of Europe at 0.4 ppm (Soegianto, 2008) while the lowest content of Cd were identified in fish *Formio niger* in Gresik (Ujung pangkah) of 0.20 ppm showed that the content of Cd is lower than of which has required so as not to exceed the safe limit metal content. Although cadmium in fish *Formio niger* in small amounts, cadmium is also harmful to living organisms if it

consumes too much. *Formio niger* including pelagic fish habitat amid waters so as to accumulate Cd very little but also harmful to living organisms.

This is supported by research Raimundo *et al* (2011) showed that the content of Cd has the lowest concentration of 0.03 ppm in *Merluccius merluccius* fish in some locations Tagos estuary area. This interpret that in addition to the location, type of fish also affect the differences of heavy metals.

The content Cu of which has been required in the State of Hong Kong amounted to 4 ppm (Soegianto, 2008). The highest Cu content of the tentacle heights identified in *Cynoglossus lingua* of Kenjeran of 1.28 ppm. Therefore, the content of Cu content does not exceed the safe limit that has required so that the fish tentacle heights if taken no harm.

These fish usually eat small animals such as small fish, small shrimps, insects, and moluska. Habitat on the seabed so that pollutants are absorbed by fish more (Directorate General of Fisheries, 1979). The high concentration of Cu in fish stored in fish tissue is higher than recorded in the head, this is because the copper contained in hemolimfe (Kumar et al, 2012).

Table 3. Safe Fish Consumption Limits Fish in Everyday and Everyweek In The Western Part Madura Strait Accordance With The PTWI

Name of Fish	Heavy Metal	Pb			Cd			Cu			Zn		
	Location	Content * (ppm	Save limits/ week ** (g)	Save limits/day*** (g)	Content * (ppm)	Save limit/ week ** (g)	Save limits /day *** (g)	Content * (ppm)	Save limits/ week*** (g)	Save limits/day*** (g)	Content * (ppm)	Save limit/ week ** (g)	Save limits/ day*** (g)
Formio niger	Ujung pangkah	2.59	591.11	84.44	0.20	2143.40	306.20	1.24	810.67	215.80	1.59	104301.70	14900.24
	Kenjeran	2.57	552.82	78.97	0.28	1421.00	203.00	1.28	155421.90	22203.13	1.79	96807.79	13829.68
	Sedati	3.50	347.43	49.63	0.43	810.67	115.81	1.57	76340.81	30905.83	2.29	77381.82	11054.55
Cynogl-ossus lingua	Ujung pangkah	3.23	348.37	49.77	0.36	872.47	124.64	1.28	122691.40	17527.34	2.22	141482.00	20211.71
	Kenjeran	4.33	255.37	36.48	0.37	836.78	119.54	1.28	120941.4	17277.34	2.66	116394.70	16627.82
	Sedati	5.63	191.25	27.32	0.52	579.79	82.82	1.74	86635.06	12376.44	2.60	783874.00	111982.00

Calculations based on PTWI (NSWHD, 2001)

The content of Zn in *Formio niger* exceed safe limits for metal content in the United States that have been required by 400 ppm, while in Indonesia (Soegianto, 2008). Zn content of *Formio niger* which has the highest Zn content of 2.29 ppm found in Sedati.

The content Zn of *Formio niger* which has Kahal can be supported by research Kumar, et al (2012) showed that the content of Cu and Zn in fish *Trichiurus Trichiurus, Pampus argentius, Harpadon nehereus*, *Arius* sp., *Daysciaena albida*, *Formio niger*, *Hilsa ilisha* and *Rastrelliger kanagurta* in East Indian waters is very high, the Cu content of 28.2 ppm and 99 ppm Zn contents that need to be considered to determine the safe limits of consumption. The papers described above, then use the regular monitoring to biomonitor species is needed to detect the water pollution in the environment and can bring health benefits to people who have been consumed by.

The content of Pb, Cd, Cu, and Zn Cu weight of the fish had no effect on heavy metal content in two species of fish in the western part of the Madura Strait due to the accumulation of heavy metals in fish body containing compounds in fish tissue depends on several factors, namely endogenous fat content , physiological conditions, and habitats (Table 1.2).

This research was supported by Nakayama *et al* (2010) showed that none of the heavy metals (Pb, Cd, Cu, and Zn) in the flesh of fish *Oreochromis niloticus*, *Serranochromis thumbergi*, *Cherax quadricarinatus* were statistically significant correlated to the length and weight.

Safe limit consumption of fish species two in the Western part of the Madura Strait (Gresik-Ujung pangkah, Kenjeran-Surabaya, Sidoarjo-Sedati) that most of these are in the fish's *Cynoglossus lingua* including demersal fish caught in Sedati contained in Zn for 783,874.00 grams / week or 27.32 grams / day and the lowest is also the *Cynoglossus lingua* including demersal fish caught in Sedati contained in Pb of 191.25 grams / week or 27.32 grams / day of the delimitation safe consumption of fish taken to avoid a low content of heavy metals that exceed the consumption limit (Table 1.3).

Based on data from the Department of Communication and Information, East Java (2009) that the rate of consumption of fish per capita per year in East Java is still very low at 17 kg per capita per year, compared to the national per capita fish consumption rate of 26.2 kg per year so far, while the standard world food organization that is standard *Agricutural food organization* (FAO) of 26-30 kg per capita per year.

Based on the results of research conducted, it can be concluded that the highest content of heavy metals is Pb in *Cynoglossus lingua* fish comes from the Sedati of 5.63ppm ± 0.05 while the lowest is Cd in *Formio niger* fish comes from Ujung pangkah of 0.20ppm ± 0.004, the measurement and analysis of the content of Pb, Cd, Cu, Zn in two fish species explained that the fish body weight did not correlate with the content of Pb, Cd, Cu, Zn, and limit consumption of fish safe this *Formio niger* based PTWI by WHO for 347.43 grams / week or 49.63 grams / day, the safe limit fish consumption *Cynoglossus lingua* by WHO PTWI of 191.25 grams / week or 27.32 grams / day.

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