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Accumulation of toxic heavy metal; the lead (pb) in tissues of the little tuna (*Euthynnus alletteratus*), (Rafinesque, 1810) from the Oran Coastline, Algeria

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ABSTRACT

The aim of the present study is to determine the levels of toxic heavy metal; the lead in the liver and muscle tissues of little tuna (*Euthynnus alletteratus*), from the Oran coastline. Metal levels in fish samples were analyzed by using atomic absorption with flams. 120 readings were carried out between October 2012 to February 2013. The average concentrations recorded, in this study, ranged, respectively, between 0,42 to 0,67 mg/l for liver, 0,23 to 0,39 mg/l for muscle and between 0,36 to 0,42 mg/l for gonads. The levels measured in liver tissue are higher than those reported for muscle tissue. The present study confirms that the little tuna from the Oran coastline can bioaccumulate a toxic heavy metal from a polluted environment. The average concentrations of Pb, recorded in our study, were above FAO limiting standards for food fish.

Keywords: *Euthynnus Alletteratus*; Pollution, Heavy Metals, Lead; Oran Coastline.

I. INTRODUCTION

Heavy metal pollution has become a serious environmental and public health issue (Venkatramreddy *et al.,* 2009). Marine organisms could bioaccumulate numerous inorganic pollutants, with mercury (Hg), lead (Pb) and cadmium (Cd) contaminants being the most commonly studied elements. These elements are characterized by bioaccumulation, biomagnification and bioamplification in the food chain environment (Morgano *et al.*, 2014). Their toxicity for humans is mainly caused by their persistence in the environment. Due to their bioaccumulative and non-biodegradable properties.

Lead, is a potentially toxic metal, that may be directly ingested by man or indirectly through aquatic animals like fish and shellfish .The effects of lead on man include mental retardation, learning dysfuntion, and loss of coordination (Goodman and Gilman, 1992).

The toxic biochemical effects of lead is problems in the synthesis of haemoglobin, effects on the kidneys, gastrointestinal tract, joints and reproductive system, and acute or chronic damage to the nervous system.

The objective of the present study, is to determine the level of the toxic heavy metal (lead) in organs of *Euthynnus alletteratus*, from gulf of Oran.

The little tuna, *Euthynnus alletteratus* (Scombridae), which was selected for this present study, is a medium size epipelagic and neritic tuna (small tuna), with anphiatlantic tropical and subtropical distribution, including the Mediterranean Sea (Collette & Nauen, 1983). It is the only species belonging to the genus *Euthynnus*, it's diet consists essentially at a small pelagic fish, such as sardine, round sardinella and constitute an important component of the total pelagic fishing activities in Algeria.

II. METHODS AND MATERIAL

Samples of little tuna were collected between October 2012 and February 2013. The study area is located on the Algerian west coast, between the industrial gulf of Arzew in the east, and the un Andalouses Coast in the west. More than 90 million m3 of untreated wastewaters are discharged annually by the Oran metropolis and many industrial units. Generally, these industries shall carry out the evacuation of their waste without any processing. Total waste-water discharge along the bay of Oran can be estimated for industrial plants (with water consumption of more than 1000 m3/year) and domestic discharge (SOGREAH Engineering, 1998).

Samples were placed in polyethylene bags and transported in a polystyrene ice-chest to the laboratory. The total lengths (cm) and weights (g) of the fish species were measured and after measurements, livers, gonads and muscles were removed, weighed and frozen until the time of their chemical analysis. Samples were prepared for trace metal analysis (UNEP, 1984a).Wet mineralization of samples was performed according to the method of Amiard et al. (1987) using a mineralizator type VELP. One ml of nitric acid is added to 1g wet weight of fish sample and then adjusted to 4 ml of bidistilled water after one hour at 95°C. The trace metals were determined The water distribution agency of the wilaya of Sidi Bel Abbes, by flame atomization (UNEP, 1984b) using a Perkin Elmer, Analyst 100 Atomic Absorption Spectrophotometer. To ascertain the accuracy of the results, blanks were included in every batch of nine samples analyzed. Analytical quality control measures adopted by the International Atomic Energy Agency (IAEA-350) – the intercomparison which uses tuna fish homogenate as a certified reference material was used. The statistical analyses were made by means of the software Statistica version 6.1 (Co Microsoft).

III. RESULTS AND DISCUSSION

In this study, the concentrations of lead were detected in all samples. The mean concentrations, in the studied tissus of *Euthynnus alletteratus*, varied from 0.23 ± 0.1 to 0.67 ± 0.19 mg/l.

In general, in the Bay of Oran, we see episodes of rising and falling concentrations of metallic elements. The highest mean Pb concentration levels, were observed in January and February, while during the month of October, the average concentrations are minimal (Figure 1).

Thus, the concentrations of heavy metal detected in the muscle, gonads and liver samples indicating different capacities for accumulating between the tissues,

In fact, the distribution patterns of Pb in the three tissues of little tuna were generally higher in liver compared to muscles and gonads, and these differences were statistically significant.

Finally, the mean concentrations of Pb, showed that the females accumulate more than the males. The difference are statistically significant (P<0.05; Figure 2).

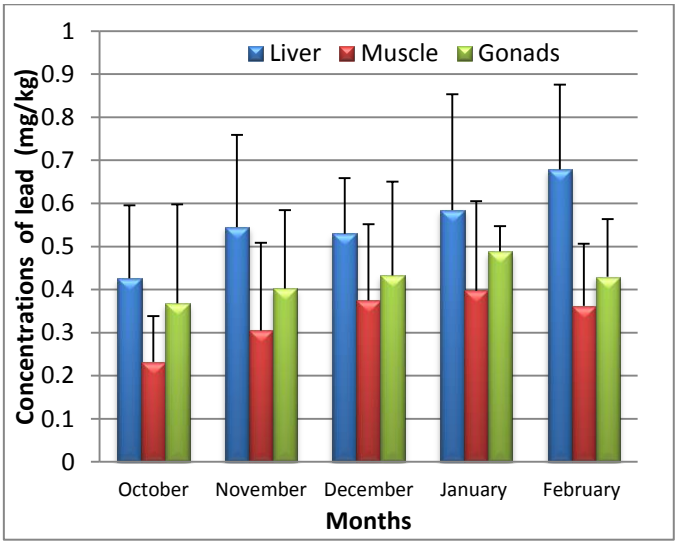

Figure 1. The monthly average concentration of lead in muscle, gonads and liver of *Euthynnus alletteratus*, (mean ± standard deviation).

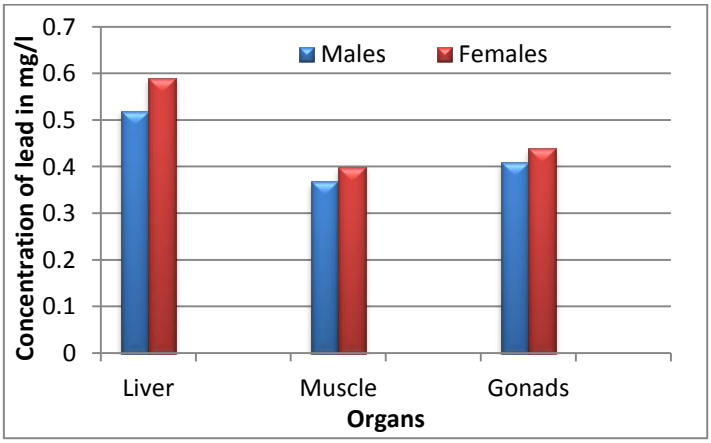

Figure 2. The average concentration of lead in tissues of male and female *Euthynnus alletteratus.*

The observed variability of heavy metal level in little tuna, depends on the level of exposure (water, food) and physiological factors (metabolic activity) as does in all fish (Kim *et al.* 2004).

The relationship between metal accumulation and sex, found in this study, may be due to the difference in the metabolic activities between the males and the females.

According to Hajjej *et al* (2009), the spawning period for *Euthynnus alletteratus,*during from May to October during this period, the female rejects a large proportion ofthe accumulated heavy metals; which explains the low levels during the month of October.

After this period, the fish will be tired and anorexic it is the sexual rest (Benamar, 2011), so it will start feeding abundantly to regain better health. The nutrient, carbohydrate materials, lipid and protein storage, is accompanied by an accumulation the metallic pollutants found in the biota; which explains the high contamination with heavy metals from the month of December.

Higher accumulation of heavy metals in liver compared to muscles and gonads, has also been reported fish studied in bay of Oran, like: *Sardina pilchardus, Sardinelle aurita, Trachurus trachurus, Diplodus sargus* (table 1).

Table 1 : The average concentration of lead (Pb) in muscle of different pelagic fishes from Oran coastline (mean ± standard deviation).

Studied fishs	Lead (mg/l)	Autors
Sardina pilchardus	0,21±0,45	Merbouh (1998)
Sardinelle aurita	0,29±0,08	Benamar (2006)
Trachurus trachurus	0,062±0,04	Bennadda (2009)
Diplodus sargus	0,23±0.185	Ayad (2009)
Euthynnus alletteratus	0,34±0,16	Present studie (2016).

The observed values in our study, were higher than values of other pelagic fishes of the bay of Oran (Table 1). In the other hand, *Euthynnus alletteratus, is predator of Sardinella aurita and Sardina pilchardus,* so we can involve a bioamplification of lead, across the food chain.

As for regulation and guideline levels, the Food and Agricultural Organization (FAO) has set permissible limits for heavy metals in the muscle of fish, because it is the part consumed by humans. The mean levels found in *Euthynnus alletteratus* samples were 0.34 mg/kg ; it is less than the FAO-permitted level, which is 0.5 mg/kg (Onianwa *et al.* 2001)(Table 2).According to the French Agency for Food Safety of France (AFSSA), daily doses tolerable intake (TDI) is and 3.5 g / kg / day for lead. we notice that our samples are the more contaminated by lead than little tuna from the west Africa waters and the Liberia's waters (table 2).

The lead is considered that one of the most neurotoxic metals, it's tend also to accumulate in the liver or kidneys (Merbouh 1998). In addition, the liver is the principal organ responsible for the detoxification, transportation and storage of toxic substances and an active site of pathological effects induced by contamination.

Table 2. Comparative concentrations of leadin muscles of *Euthynnus alletteratus* from different areas.

Area	Lead (mg/l)	Reference
Monrovia, Liberia waters	0,051	Ngumbu (2014).
West Africa waters	0,20±0,03	Asmah & Biney (2014)
Oran coastline (Algeria)	0,34±0,1	Present study (2016).
Permissible guide values	0,5	(CSHPF,1996) (conseil supérieur d'hygiène publique de France)

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V. CONCLUSION

These works demonstrate that the quality of Oran's water are contaminated by toxic heavy metal : lead. The study area had been influenced by discharges from the industrial and urban units of the sampling sites. The mean concentrations of lead, seems not presented a real danger to the consumer, but it should be have a cumulative effect long-term on public health.

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