

## Accumulation of Mercury and Lead in European Hake (*Merluccius Merluccius*) From the Albanian Coast

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**Abstract** – Heavy metal contamination of marine ecosystems remains a global environmental concern due to the persistence, toxicity, and bioaccumulative nature of the elements. Mercury (Hg) and lead (Pb) are among the most hazardous metals, capable of accumulating in fish tissues and posing risks to human health through their consumption. European hake (*Merluccius merluccius*) is a benthic fish species widely distributed both in the Mediterranean and Adriatic Seas. The objective of the study was to evaluate mercury and lead concentration levels in edible tissue of European hake collected from the Albanian Adriatic coast, with particular attention to size-related accumulation patterns. A total of 64 muscle sample tissue of European hake were divided into small and large size groups. The results of the study indicated low concentration levels of both metals, with no statistically significant differences between sized groups of fish samples. These findings contribute valuable baseline data for the Albanian coastal region and support further monitoring efforts.

**Keywords** – mercury, lead, heavy metals, contamination, Albania

### I. INTRODUCTION

Marine environments serves as an important source of contaminants released through natural and anthropogenic activity. Heavy metals, are not biodegradable and can persist in marine waters and sediments for a long period of time. Coastal regions are especially vulnerable due to riverine inputs, urbanization, industrial activities, shipping, and tourism [8]. Mercury is considered one of the most dangerous environmental contaminants because of its ability to be transformed into methylmercury by the processes of methylation in aquatic environment. Methylmercury readily bioaccumulates in aquatic organisms and biomagnifies through food chains, reaching highest concentrations in predatory fish [3] as European hake. Lead, is a toxic metal with no known biological function and can cause neurological, hematological, and neurological effects in humans and wildlife [2]. The Mediterranean Sea is a semi-enclosed basin with limited water exchange, making it particularly sensitive to heavy metals accumulation. Several studies have reported measurable concentrations of Hg and Pb in Mediterranean

fish species, including European hake (*Merluccius merluccius*), often with spatial and temporal variability related to local pollution sources and ecological factors, [9], [6], [1], [4]. The Albanian Adriatic coast has experienced increasing anthropogenic pressure over recent decades, yet data on heavy metal contamination in commercially important fish species remain scarce. The present study aims to evaluate Hg and Pb levels in European hake muscle tissue from Albanian waters, and compare the result with the EC limits for human consumption.

## II. MATERIALS AND METHOD

A total of 64 of European hake samples were collected from the Albanian Adriatic coast during 2018. The specimens were divided in two groups according to fish size: small ( $n = 32$ ) and large ( $n = 32$ ) fish size. After collection fish samples were dissected, homogenized and then stored at  $-20\text{ }^{\circ}\text{C}$ . Tissue samples were dissected from the dorsal part of each individual. The European hake samples were analysed for mercury and lead concentration using an Atomic Absorption Spectrophotometer (AAS).

*Statistical evaluation:* Metal concentrations are expressed as mean  $\pm$  standard deviation (SD). Differences between size groups were evaluated using Student's  $t$ -test, with statistical significance set at  $p < 0.05$ .

## III. RESULTS

The concentration levels of Mercury (Hg) and Lead (Pb) in European hake muscle tissue expressed in mg/kg ww are presented in the below Table 1.

Table1. Average mean concentration levels and SD of heavy metals in European hake expressed mg/kg ww

Metal	Groups	nr	Mean value	SD	t	df	p-value
Hg	Small	32	0.0086	0.0197	-0.251	62	0.803
	Large	32	0.0103	0.0316			
Pb	Small	32	0.0039	0.0058	-1.427	62	0.164
	Large	32	0.0197	0.0623			

Mercury concentrations resulted low in both size groups, and no statistically significant difference was observed between small and large samples of fish ( $p = 0.803$ ). These values are markedly lower than those reported for European hake from other Adriatic regions, where mean Hg concentrations up to 0.3–0.4 mg/kg ww have been recorded [9].

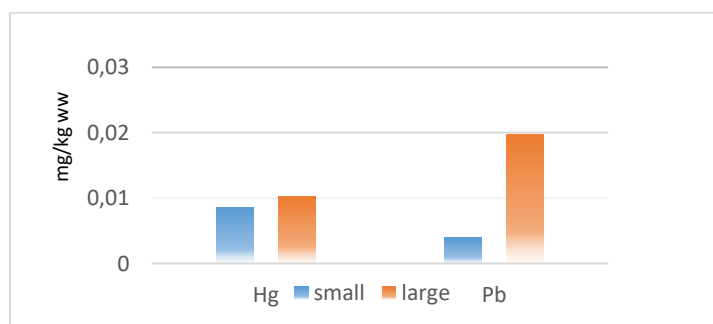


Fig. 1. Average mean concentration levels of mercury and lead between different fish size

Lead concentrations resulted lower and did not differ significantly between size groups samples ( $p = 0.164$ ). Although mean Pb values were higher in larger fish, variability was high, and the difference was not statistically significant. Similar findings have been reported in Mediterranean demersal fish species, where Pb accumulation in muscle tissue is often weak or inconsistent [2].

#### IV. DISCUSSION

Size and age are commonly used proxies for bioaccumulation potential in fish. Many studies report positive correlations between fish size and Hg concentration due to long-term dietary exposure and biomagnification [3], [6]. However, the absence of significant size-related differences in this study suggests that local environmental exposure may be relatively uniform or that growth dilution may reduce apparent accumulation in larger individuals [8]. Compared to published local data, the Hg and Pb concentrations measured in this study are relatively low [6–7]. Northern Adriatic studies have often reported higher Hg levels in European hake, attributed to sediment characteristics and historical pollution [9]. The lower concentrations observed along the Albanian coast may reflect lower background contamination or differences in trophic structure. From a food safety perspective, the measured Hg and Pb concentrations are well below maximum levels for human consumption set by European regulation [5]. These results suggest that consumption of European hake from the Albanian Adriatic coast poses a low risk with respect to Hg and Pb exposure. Nevertheless, long-term monitoring remains essential given increasing coastal development and environmental change.

#### V. CONCLUSION

This study provides extended baseline data on mercury and lead concentrations in *Merluccius merluccius* from the Albanian coast. Both metals resulted at low concentrations levels, and no significant size-dependent accumulation was detected. The findings align with regional and local studies reporting variable but generally low heavy metal levels in hake muscle tissue. Future research should incorporate seasonal sampling, additional contaminants, and sediment and water analyses to better understand sources, pathways, and long-term trends of heavy metal contamination in Albanian marine ecosystems.

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