



## Investigation and Measurement of Heavy Metals, Lead and Cadmium, in Muscle of *Periophthalmus Walltoni* in Persian Gulf (Khamir port, Dargahan Island and Golshahr)

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### ABSTRACT

This study was conducted to determine lead (Pb) and cadmium (Cd) concentrations in the muscle of *Periophthalmus waltoni* in Khamir Port, Dargahan and Golshahr in the Persian Gulf. Moreover, the influences of season (winter and summer), sex (male and female) and body size (total length and body weight) on the Pb and Cd concentrations in *Periophthalmus waltoni* were investigated. Then, the metals (Cd, Pb) concentration in muscle was compared with standards. Sampling was done in three station (Khamir Port, Dargahan and Golshahr) and two seasons, winter and summer, (n=30 for each season in each station). After biometry of *Periophthalmus waltoni*, the concentrations of heavy metals (Pb and Cd) were determined using Atomic Absorption Spectrometry (AAS). The results obtained for the concentration of metals (Pb and Cd) in muscle of *P.waltoni* showed that, there were significant differences between stations (Khamir Port, Dargahan and Golshahr), and also between winter and summer seasons ( $p < 0.05$  in both cases) and no significant differences were observed between concentrations of metals (Pb and Cd) in muscle of males and females ( $p > 0.05$ ). There were positive correlation between cadmium and lead with *Periophthalmus waltoni* body size (total length and body weight) in muscle of *P.waltoni*. The present study showed that concentration of heavy metals (Pb and Cd) in *p.waltoni* were below of the standard values and stations of Khamir Port, Dargahan and Golshahr are safety area for fisheries activities.

**Keywords** Persian Gulf, Khamir Port, Dargahan, Golshahr, *Periophthalmus waltoni*, Lead and Cadmium.

### INTRODUCTION

Extensive utilization of the large reserves of oil in the continental shelf and massive transportation of oil products by tankers are the causes of the pollution in the Persian Gulf that is more than the global average pollution per square kilometer (Abaspour, 2008). According to the statistics, approximately half of the world petroleum and oil products are exported from this region by means of vessels. Besides, the pollution resulting from transportation of oil and its products is estimated to be nearly 86% of the total pollution in this gulf, which compared to the world statistics, is almost 2 times the pollution of marine transportations worldwide (Abaspour, 2008). On the other hand, intensification of economic and social activities in the southern districts of Iran, like Bandar Abbas; centralization of such activities, including loading and unloading of different types of materials, commercial goods, and bulk mineral and chemical materials (such as lead, zinc, chromite, iron ore, coke, cement, sulfur, petroleum, bitumen, etc.) through Shahid Baahonar, Shahid Rajai, Foolad Bandar Abbas, and Oil Refinery piers and multiple sites of accumulating and unloading minerals in an area of approximately 35 km in length near the western coasts of Bandar Abbas; activity of large industrial and mining units and services such as the Eight oil refinery, and Tavanir Power Plant; construction and repair of heavy vessels, multiple desalination

units; establishment of factories such as the cement paste factory, and zinc and aluminum production plants, have all imposed serious dangers and severe pollutions on the marine environment and the vulnerable ecosystem of this region.

Among pollutants, the non-biodegradable ones (stable pollutants) like heavy metals that accumulate and concentrate in sediments, mud, sludge, and bodies of the aquatic, which are consumed by human beings, and can severely poison mankind and induce nervous system disorders, kidney disorders, and genetic mutations, are of great importance. Lead is an important environmental pollutant, which is found in any ecosystem including water, air, food and plants (Clark, 2006).

The concentrations of cadmium in mudskipper fish (*periopthalmus waltoni*) in three regions of Persian Gulf (Bandar abbas, Khamir port and Dargahan island) during winter and summer seasons were determined using atomic absorption spectrometry (AAS), and the correlation of cadmium concentration with size (length and weight). Heavy metals are dangerous pollution in sea ecosystem. (Al-Yousef, 2000) They have bad effects on fish. (Agbozu, 2007). In this research the study of body size effect (total length and total weight) on the degree of the aggregation of the concentration of cadmium in Mudskipper *Periopthalmus waltoni* in the regions of Khamir Port, Dargahan and Golshahr (Persian Gulf) was performed. 180 samples of Mudskipper waltoni (in every station and in each season separately  $n= 30$ ) in each region was sampled during the seasons of summer and winter randomly, which after the biometry in laboratory, the muscle tissue was separated and the cadmium metal was extracted by chemical digestion method, and its concentration was determined by Atomic Absorption Spectrometry (M00pam1999).

## MATERIALS AND METHODS

Sampling (180 samples of mudskipper waltoni) was done in three station Khamir Port, Dargahan and golshahr (Persian Gulf), and two seasons (winter and summer), ( $n= 30$  for each season in each station). After collection of samples and transfer them to lab, Biometry, separated the study tissue muscle and draying (by freeze dryer, model: Vacos) powdering and chemical digestion (microwave, Model: ETHOS1), Pb and Cd were analyzed with atomic absorption system (Model: Thermo). All chemicals used from Merck Company. We used the SPSS (version 16) for data (for significant analysis).

## RESULTS AND DISCUSSION

The results obtained for the concentration of metals (Cd) and (Pb) in muscle of *p.waltoni* showed that, there were significant differences between stations (Khamir Port, Dargahan and Golshahr), and also between winter and summer seasons ( $P<0.05$  in both cases). In the winter and summer, cadmium (Cd) and Lead (Pb) concentrations in Khamir port was significantly higher than Dargahan and Golshahr. No significant difference was observed between concentrations of metals (Cd) and (Pb) in muscle of males and females ( $P>0.05$ ). The present study showed that concentration of heavy metals (Cd) and (Pb) in *p.waltoni* were below of the standard values and stations of Khamir Port, Dargahan and Golshahr are safety area for fisheries activity.

The results of the present study showed that, stations (Khamir Port, Dargahan and Golshahr) and seasons (winter and summer), can influence the concentrations of (Cd) and (Pb), whereas, sex do not affect the metals concentrations in muscle of *p.waltoni*.

### Effect of seasons (winter &summer)

Fig. 1and 2 show influence the concentration of cadmium and lead in *p.walton* for summer is more than winter for Golshahr area ( $t = 3.58, P<0.01$ ). The figures also show that the concentration of cadmium and lead in *p.walton* for summer is more than winter for Khamir port ( $t = 4.08, P<0.01$ ).and also show that the concentration of cadmium and lead in *p.walton* for summer is more than winter for Dargahan ( $t=4.96, P<0.01$ ).

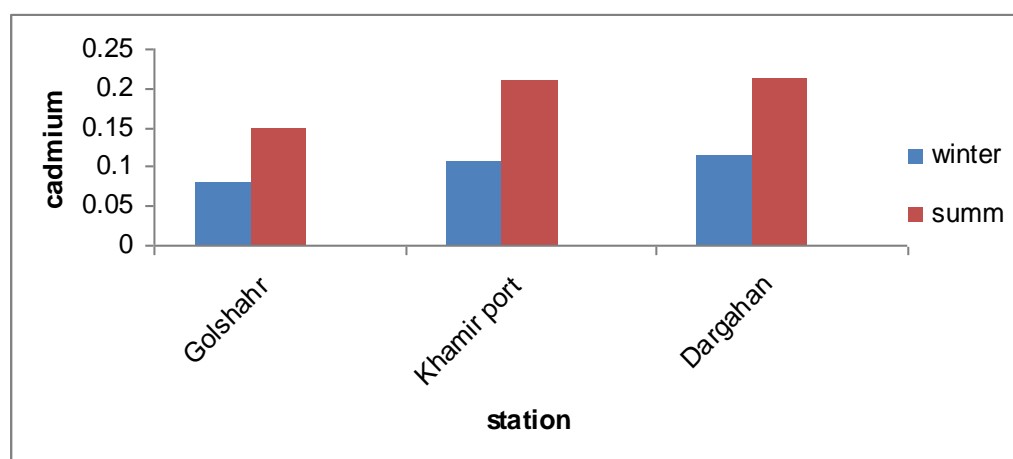
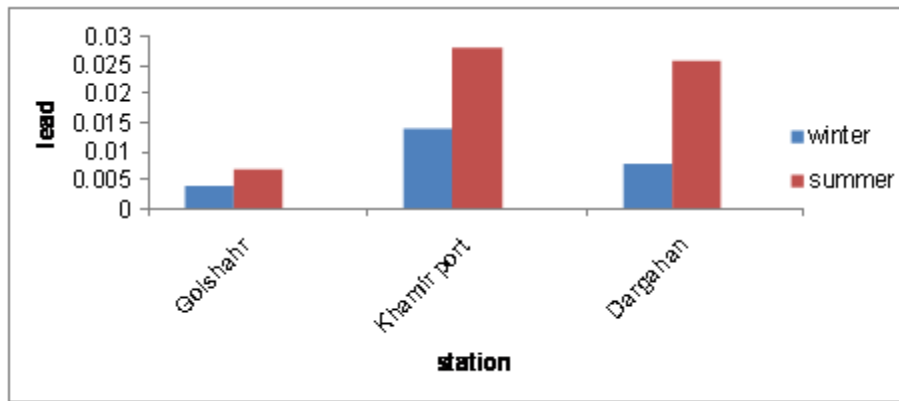


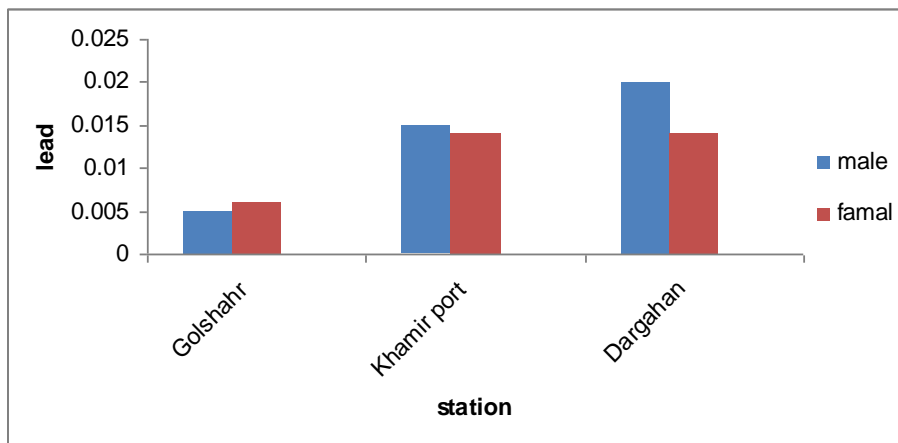
Figure 1. Comparison of the cadmium in fish muscle (Golshahr, khamir port and Dargahan) during summer and winter seasons



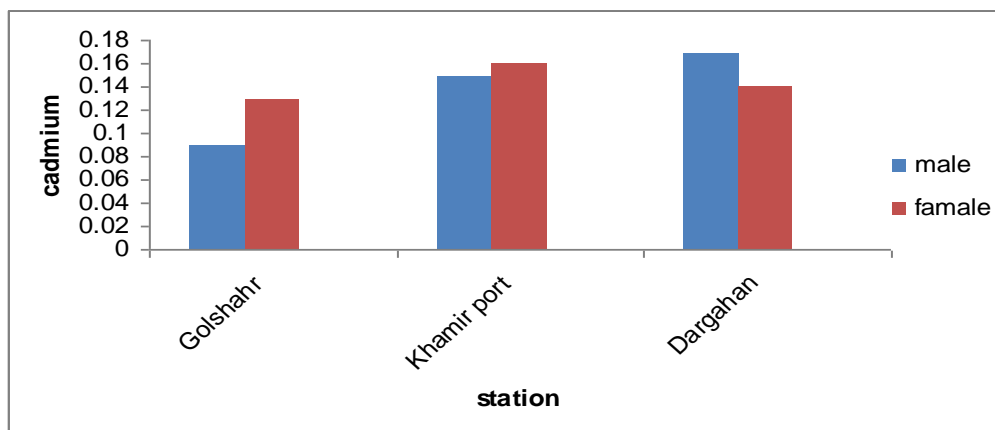
**Figure 2.** Comparison of the lead in fish muscle (Golshahr, khamir port and Dargahan) during summer and winter seasons

### Effect of sexuality

Results from this study (Figure.3) showed no significant difference between two sexes for the concentration of lead in fish muscle tissue Waltoni scored in three regional port of khamir, and Golshahr Dargahan ( $p > 0.05$ ). These results also showed (Fig. 4) no significant differences between two sexes for the concentration of cadmium in fish muscle tissue Waltoni scored in three regional port of khamir, and Golshahr Dargahan ( $p > 0.05$ ).



**Figure 3.** Comparison of lead in fish muscle (Golshahr, khamir port and Dargahan) between two sexes.



**Figure 4.** Comparison of cadmium in fish muscle (Golshahr, khamir port and Dargahan) two sexes.

### Effect of size

Results showed significant correlation between the degree of cadmium aggregation muscle tissue of p.waltoni and body size (length & weight) ( $P < 0.05$ ). It means that by increasing that total length and total weight, the aggregation of cadmium in fish body is increased (Figure 5 and 6).

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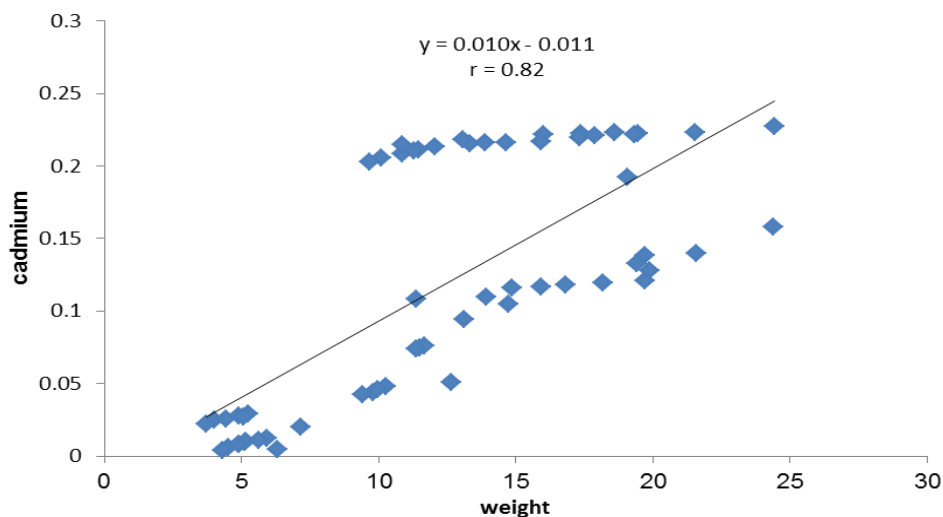


Figure 5. Relation between concentrations of cd with weight

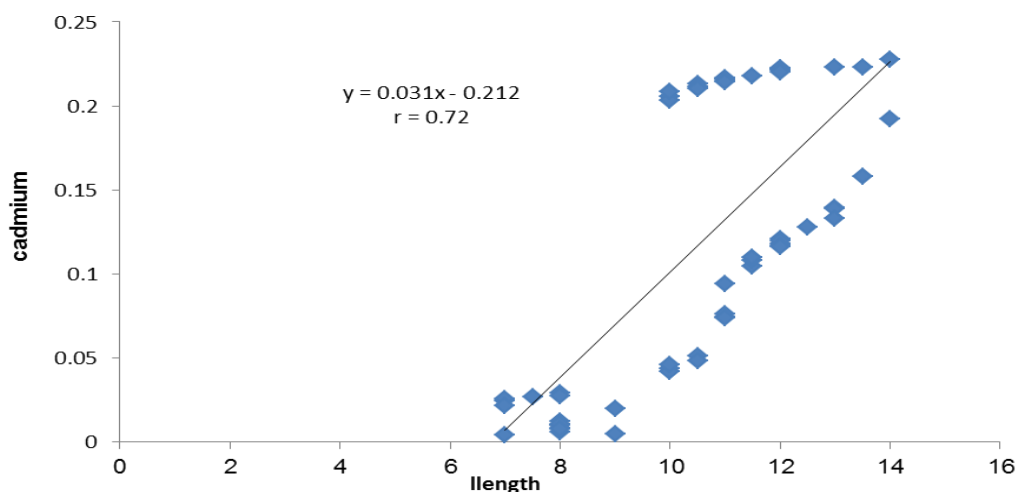


Figure 6. Relation between concentration of cd with length

### Influence of pollution:

In this study, for the concentration of lead and cadmium in the fish muscle *p.waltoni* scored the Persian Gulf port of three stations, Khamir port, Golshahr and Dargahan and compared with international standards (Table 1) showed that the amounts of these elements are in the muscle tissue of fish *p. waltoni* scored lower than the international standards.

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