

Heavy metals concentrations in *Otolithes ruber* and *Pampus argenteus* location from the Gulf

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ABSTRACT

For determination of the Concentration of six heavy metals (Cu, Fe, Mn, Zn, Cd, Pb) in the muscle of *Otolithes ruber* and *Pampus argenteus*. Eighty samples were collected from north Qeshm Island in the Persian gulf. For digestion of samples mixture of HNO₃ and H₂O₂ was used. Flame atomic absorption spectroscopy (FAAS) were used for analysis of samples. Result showed that concentrations of all metals was lower than permissible amounts. One way analysis of variance were applied to test significant differences between samples. Significant regression between body weight and standard length (S.L.) was observed. Key words. Heavy metals, Fish *Pampus argenteus*, *Otolithes ruber*, Persian Gulf

Introduction :

During the last two decades, Industrial development and wastewater discharge into marine ecosystems have become major problems that seriously threaten our environment. Heavy metal toxicity to marine organisms is well documented (1). Hormozgan province in the southern coast of I.R.Iran has undergone rapid industrial development in the last decade, such as the establishment of oil refinery in Bandar Abbas, thermal power plant, and plants in the industrial free zone in Qeshm Island Furthermore, in recent years oil spills has been a serious problem in the region.

Information on heavy metal contents in fishes and other marine organisms from Iranian coastal waters is limited. Pourang (2) reported the levels of four heavy metals in various tissues of two freshwater fish. Concentrations of 8 heavy metals in

cultured fishes of Isfahan showed that the concentrations were lower than the permissible amounts (3). *Otolithes ruber* and *Pampus argenteus* together constitute. Very low contribution so why they were chosen ? only 4 percent of annual fish landing of Hormozgan Province. However these are the most important fishes in the local market (4).

The main objective of this study is to estimate the levels of Mn, Zn, Cu, Pb, Cd and Fe in muscle of fishes and to determine the relationship between metal concentration, body length and weight. the heavy metals studied were Mn, Zn, Cu, Pb, Cd and Fe.

Materials and methods

Sample of *P. argenteus* and *O. ruber* were collected from the coastal waters of Qeshm Island in the Persian Gulf between

May 1996 to March 1997. After collection samples were kept in polyethylene bags and stored at 4°C (5) and transferred to the laboratory.

In the laboratory, body length (S.L.), weight and sex were recorded for specimens. In total 80 specimens were examined. Dorsolateral muscle samples for metal determination were taken from males and females separately and stored at -20°C prior to analysis. All glassware and plastic containers were thoroughly acid washed (6).

About one gram of dried at what temperature? and homogenized. How? What about the % of water content? sample was digested with concentrated nitric acid and hydrogen peroxide (7). Digested samples were diluted with deionised water to 25 ml in a volumetric flask. Metals were measured using a double beam flame not recommended for Cd. PI? Any matrix modifier added? spectrophotometre (ZEISS Germany, AAD 4). Standard solution for instrument calibration was prepared from titrisol ampoules.

Statistical computations were carried out using Statgraphics software (Version 6). One way analysis of variance was used to test the significant differences between samples (8). Simple regression was applied to test relationship between weight, length and bioaccumulation of various metals.

Results and discussion

Table 1 summarizes the analytical results of the present study. The levels of cadmium and lead in all samples were lower than detection limit? Where is this? (D.L.) of atomic absorption spectroscopy

Copper

According to figure 1? the level of Cu in *P. argenteus* was greater than *O. ruber* but one way analysis of variance (NOVA) showed no significant difference ($P > 0.01$). In *P. argenteus* the levels of copper in males were less than that of females (Figure 1-a) but no significant difference was noted ($P > 0.01$). Mean concentrations of copper in *P. argenteus* and *O. ruber* were lower than the permissible amounts. Concentrations of copper in 28 fish species caught from Kuwait coastal waters were reported with in the range of 4.2-96.2 µg/g (9). The result of present study is in accordance with the range of some of the species in the above mentioned report.

Many researchers have shown a relation between heavy metal bioaccumulation and body weight or body length in marine organisms (10,11,12). Regression analyses (Table 2) revealed significant relationship between copper concentration in *P. argenteus* and body weight ($r=0.55$, $P < 0.01$; $\log y = 3.99 + 0.59x$) and a similar relationship was observed between Cu content and standard length $r^2=0.58$, $P < 0.01$; $\log y = 2.29 + 0.2x$)

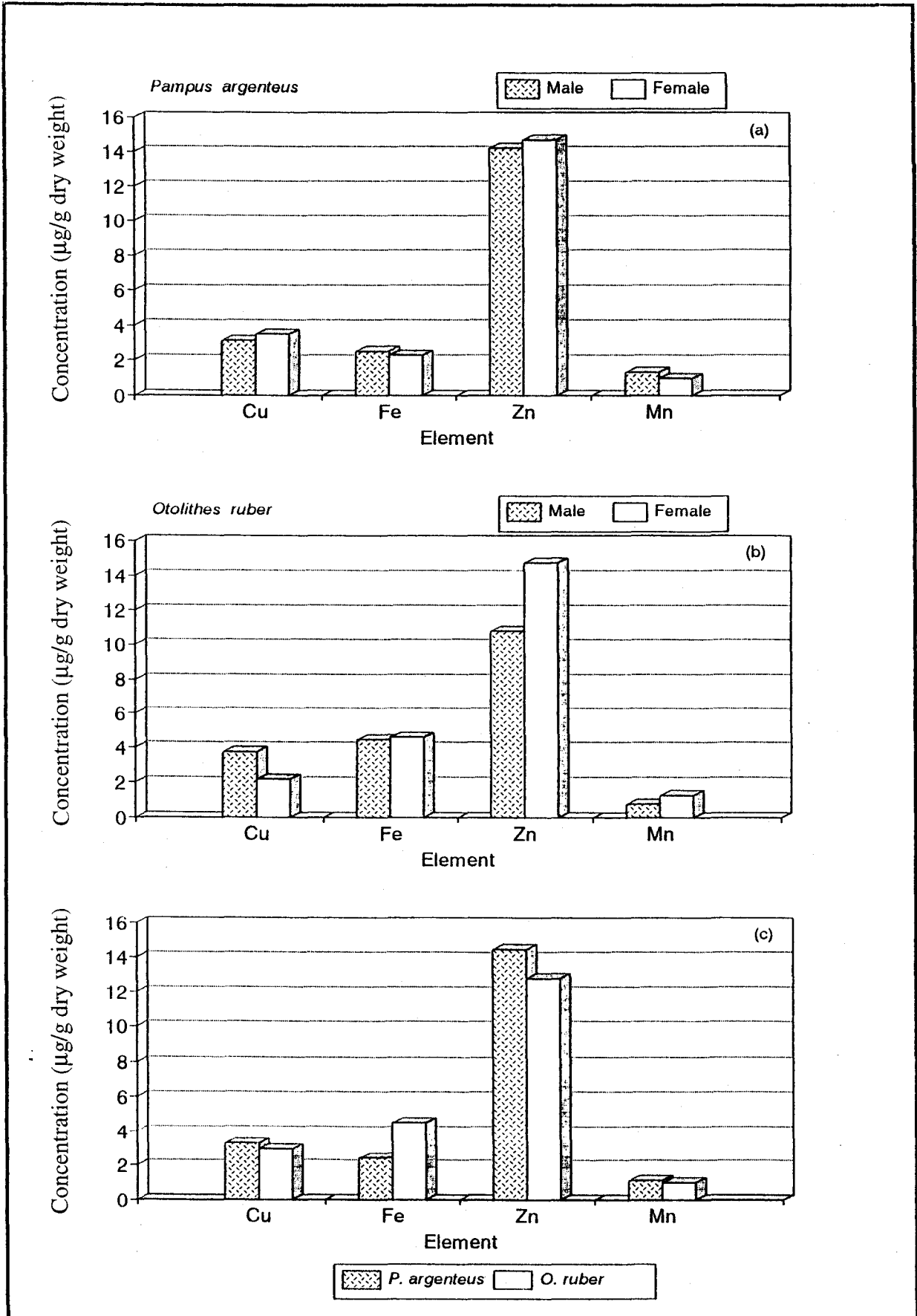


Fig. (1): Comparison of mean concentration of four heavy metals

Iron

The mean iron content in the muscle of *P. argenteus* and *O. ruber* was clearly lower than the previous reports on various species listed in Table 2 Differences in the metal concentration between the sexes of *O. ruber* are not particularly noticeable (Figure 1-b).

Significant differences between mean concentration of iron in two species was

observed. This may be due to their different feeding habits (10) *P. argenteus* is a zooplanktivore and *O. ruber* is a carnivore fish (13). Iron bioaccumulation in the muscle of *P. argenteus* was proportional to the weight and no statistical significance between the sexes were observed ($P>0.01$).

Regression analysis also supported the fact that the level of Fe in *P. argenteus* was related to weight or length (Table 2)

Table 1 : Mean and range of heavy metals concentrations in fish muscle ($\mu\text{g/g}$ dry weight)

Metal	<i>P. argenteus</i>		<i>O. ruber</i>	
	Male	Female	Male	Female
Cu	3.1 ^a (1.6-10.5 ^b)	3.5 (0.8-7.42)	3.7 (2-8.8)	2.2 (0.4-2.4)
Fe	2.5 (1.5-4.2)	2.25 (0.5-10)	4.5 (3.2-6.8)	4.6 (1-10)
Zn	14.2 (5.9-21)	14.7 (11.3-30.5)	10.7 (8.5-16.35)	14.8 (6.8-28)
Mn	1.30 (0.48-2.4)	0.95 (0.15-1.5)	1.25 (0.15-2.23)	1.25 (0.25-2.5)
Pb	ND	ND	ND	ND
Cd	ND	ND	ND	ND

ND : not detected - a : mean - b : range

Table 2 : Regression analysis between heavy metal concentration (y) body weight or length (x) for *P. argenteus*

Metal	Model	loga	S. E. *	b	S. E.	r
Cu (1)	$y = ax^b$	3.99	0.86	0.59	0.16	0.55
Cu (2)	$y = ax^b$	2.29	0.06	0.2	0.05	0.58
Fe (1)	$y = ax^b$	4.79	0.15	-0.39	0.15	-0.58
Fe (2)	$y = ax^b$	2.54	0.05	-0.2	0.06	-0.74

* : Standard error - (1) x : weight - (2) x : Standard length

Table 3 : The concentration of heavy metals in the fish muscle $\mu\text{g/g}$ dry weight from various geographical regions

Metal	Fe	Cu	Mn	Zn	Cd	Pb	Reference
<i>Scomberomorus gullalum</i>	75.61	1.64	1.46	48.5	0.04	1.55	15
<i>Hemirhamphus for</i>	32	16.1	--	81.3	--	0.7	9
<i>Lujtanus argentimaculatus</i>	21.3	12.3	--	52.5	--	0.5	9
<i>Sparus sarba</i>	--	0.361	--	4.07	0.028	0.163	16
<i>Psuedosciaena coantis</i>	79.71	1.55	ND	19.7	--	--	14
<i>Johnliies sp.</i>	112.3	1.5	ND	18.06	--	--	14
<i>Mini maulata</i>	250	4.63	6.83	38.58	--	--	14
<i>Lates calcrifer</i>	117.56	0.76	4.76	33	0.09	0.68	15
<i>A thalassinus</i>	--	1.05	--	10.45	--	0.29	15
<i>Pampus argenteus</i>	2.4	3.3	1.13	14.43	ND	ND	Present study
<i>Otolithes ruber</i>	4.5	2.96	1	12.77	ND	ND	Present study

Zinc

As shown in Table 4, zinc was the most abundant element in both species. Zinc levels in the muscle of *P. argenteus* and *O. ruber* were 5.9-30.5 $\mu\text{g/g}$ and 6.8 - 28y $\mu\text{g/g}$, respectively. The maximum concentration of zinc (30.5 $\mu\text{g/g}$) was measured in *P. argenteus*. Sex based differences in zinc concentrations in both species were statistically not significant ($P>0.01$). Zinc concentration found in the muscle of male *O. ruber* was similar to that reported by Maheswari Nair (14). Regression analysis showed no significant correlation between zinc bioaccumulation and weight or length ($P>0.01$).

Table 4 : Concentration series for two species of fish

Species	Order of bioaccumulation
<i>P. argenteus</i>	Zn>Cu>Fe>Mn
<i>O. ruber</i>	Zn>Fe>Cu>Mn

Manganese :

Manganese concentrations fobsewed in this study ranged between 0.48-2.4 $\mu\text{g/g}$ in *P. argenteus* and 015-2.5 $\mu\text{g/g}$ in *O. ruber* (Table 1). Sexual differences in the Mn concentration of two species were not particularly great (Figures 1-b and 1-c).

There was no significant correlation between Mn concentration and body weight or length in two species.

Conclusion :

Result from this study revealed that the level of heavy metals in *P. argenteus* and *O. ruber* were lower than the permissible amounts . In some cases bioaccumulation was related to weight or length of fish. The muscles of both species accumulate higher concentrations of Zn compared to the other heavy metals studied.

Acknowledgments

The author wish to thank the Oman Sea Fisheries Research Center for the financial support of this project.

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