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Trace Elemental Contents in Tissues of Talang Queenfish, *Scomberoides commersonnianus*, from Karachi Coast, Pakistan

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Abstract
Concentration of heavy metals (Cu, Zn, Fe, Pb, Cd, Cr, Ni) determined in the muscle, liver, kidney and gills of talang queenfish, *Scomberoides commersonnianus*. Sixty three fish samples collected seasonally from Karachi coast in Jan 2010-Dec 2010 . Samples were analyzed by AAS-700. Results shown highest mean concentration of Fe (495.73), Cu (47.64) Cd (1.59), Cr (1.63), Ni (1.55) and Pb (1.65) were determined in liver, Zn (48.98) in kidney in µg/g. Lowest mean concentrations of Fe (16.55), Zn (5.31), Cu (4.57) were estimated in muscles, Cd (1.59) in liver, Cr (0.38), Ni (0.50), Pb (0.48) in gills in µg/g. Fe, Zn, Cu were higher in liver, kidney and gills and Cd, Cr, Ni, Pb were lowest in muscles, kidney and gills during all seasons. ANOVA analysis clearly revealed that there was a significant different in organs and seasons in fish.
Keywords: Trace elemental contents, *Scomberoides commersonnianus,* Karachi Coast, Pakistan

INTRODUCTION

Essential heavy metals are absolutely required by an organism to grow and complete its life cycle, become toxic when its concentration levels exceed those required for correct nutritional response by factors varying between 40 and 200 folds (Venugopal *et al.*, 1975). Marine pollution indeed is a critical environmental issue of concern across the globe when growing human population increase the intensities of anthropogenic threats exert on the environment a result municipalities and agriculture activities (Raja *et al.,* 2009). Specifically aquatic systems are more sensitive to heavy metal pollutants and the gradual increase in the levels of such metals in aquatic environment, mainly due to anthropogenic sources, became a problem of primary concern (Meybeck *et al*., 1989; Allen *et al*.,1993). Fishes are major part of the human diet and it is therefore not surprising that numerous studies have been carried out on metal pollution in different species of edible fish (Prudente *et al*., 1997; Türkmen et al., 2005; Tepe *et al*., 2008; Türkmen et al., 2008; 2009). Fish can response to environmental changes that can be used for pollution indicator study. Fish is a good bio-indicator because it is easy to be obtained in large quantity, potential to accumulate metals, long lifespan, optimum size for analysis and easy to be sampled (Batvari *et al*., 2007). In general, studies on heavy metals by fish analysis can be important in two main aspects. First, from the public health point of view, where the attention has been drawn to the necessity of measuring the accumulation of heavy metals; particularly these metals which pose serious health hazards to humans (e.g. As, Pb, Hg). Second, from the aquatic environment view point, the main problem has been to prevent biological deterioration and to identify the sources which threaten ecological equilibrium. In this regard, the more abundant metals such as copper, zinc and manganese may sometimes represent greater hazard than lead, mercury and cadmium (Kinne, 1984). So, the present study has been conducted to determine the concentrations of Cu, Zn, Fe, Pb, Cd, Cr, Ni in the gill, muscles, kidney and liver of *Scomberoides commersonnianus* from coastal area of Karachi.

MATERIAL and METHODS

Sixty three (63) fishes (*Scomberoides commersonnianus*) were seasonally collected from Karachi coast (Figure 1). Twenty one fishes were taken in each season (pre-monsoon, monsoon, post-monsoon) from January 2010 to December 2010. Fish sample immediately transport to the laboratory, wash with distilled water to remove foreign particles, then taken length (cm) and weight (g) (Table 1) and then stored in a freezer (18 ^{0}C) until analysis. Approximately 5 g of samples muscle (edible parts), two gill arches from each sample, entire liver, and entire kidney were dissected, with the help of scalpels and scissors wash with de-ionized water, and take fresh weighted. Samples were ground and calcinated at 525 ^{o}C for 2 hrs until made up white or grey ash. The ashes were dissolved in 15 ml of 20 % (v/v) nitric acid, solutions was cooled and filtered and brought to final volume (50 ml) with distilled water. Sample blanks were prepared in the laboratory in a similar manner to the field samples. Calibration standards were prepared from multi element standard. All samples were analyzed for iron, zinc, copper, cadmium, lead, chromium and nickel by AAnalyst 700 Atomic Absorption spectrophotometer. All metal results were expressed as ug/g dry weight.

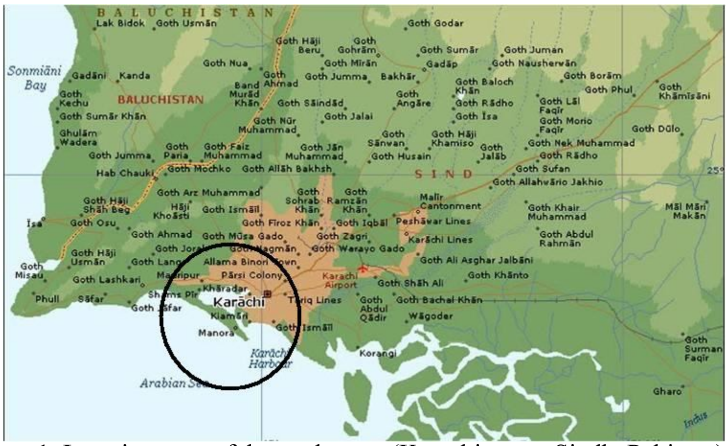

Figure 1. Location map of the study area (Karachi coast, Sindh, Pakistan)

Table 1. Mean length and weight of the species examined in the study (Mean±SD)

Season	Number of sample	Length (cm)	Weight (g)
Pre-monsoon	21	36.8 ± 1.31	304 ± 32.2
Mon-soon	21	36.3 ± 1.33	292 ± 31.2
Post-monsoon	21	36.0± 1.29	286 ± 30.0

Obtained data was analyzed using two-way analysis of variance ANOVA at (95%) significant to investigate the interaction of season and organs and variation of the metal concentration in fishes. Other calculation was performed by Microsoft Excel 2010.

RESULTS and DISCUSSION

Concentration level of heavy metals showed in Table 2. Iron showed the highest concentrations in all tissues of examined species. Second highest metal was zinc after iron. Similar situations were reported many researchers (Kalay et al., 1999; Çoğun et al., 2005; Tepe et al., 2008; Türkmen et al., 2010; 2011). The highest Fe level (496 µg/g) was determined in liver in post-monsoon season. Fe was detected highest in liver and kidney then muscles and gills. Lowest concentrations of Fe were found in muscles (16.6 µg/g) in pre-monsoon season. Zinc also was estimated highest in liver and kidney then muscles and gills. The highest Zn (48.9 µg/g) was determined in kidney in post-monsoon season. Liver also showed the highest concentration (47.9 µg/g) in monsoon season. The lowest Zn level (5.31 µg/g) was determined in muscles in Pre-monsoon season. Copper was found the highest in liver, kidney and gills. The lowest Cu level was estimated (4.57 µg/g) in muscles in Pre-monsoon season. Cadmium showed maximum level in liver then muscles, kidney and gills. While the highest Cd level was estimated (1.59 µg/g) in liver in monsoon season, the lowest level were found in gills (0.28 µg/g) in post-monsoon season. Although the highest Cr was determined in liver (1.63 µg/g) in pre-monsoon season, the lowest was estimated in gills (0.38 µg/g) in post-monsoon season. Nickel and lead were estimated highest in liver and kidney, then muscles and gills. The highest Ni (1.55 µg/g) was found in liver and the lowest (0.50 µg/g) was recorded in gills. The highest Pb (1.65 µg/g) was estimated in liver in pre-monsoon season and the lowest (0.48 µg/g) level was recorded in gills in post-monsoon season. Cadmium and Pb have higher tendencies to bioaccumulate in the fish kidney and liver tissues due to the similar functions of kidney and liver as the organs that involve in the detoxification process. The presence of free protein-thiol group content and metallothioneins binding proteins in kidneys and livers forms strong fixation with the heavy metals (Iwegbue, 2008). Gills are the first organs to be exposed to resuspended sediment particles, so they can be significant sites of interaction with metal ions. On the other hand, the liver was a key role in basic metabolism (Moon *et al.,* 1985) and is the major site of accumulation, biotransformation of contaminants in fish (Triebskorn et *al.,* 1994; 1997).

Result of ANOVA indicated that the differences between the mean heavy metal levels of seasons and organs were statistically significant ($p<0.05$) (Table 3). The data obtained clearly demonstrated that there was significant varation (Cl =95 %) between the heavy metal concentrations in organs. Studies have also indicated that fish are able to accumulate and retain heavy metals from their environment and that accumulation of metals in tissues of fish is dependent upon exposure concentration and duration as well as other factors such as salinity, temperature hardness and metabolism of the animals (Cusimano *et al.,* 1986; Heath, 1987; Allen, 1995; Karthikeyan *et al.,* 2007).

The results of the present study supply valuable information about metal contents in muscle and liver of *Scomberoides commersonnianus* from the cost of Karachi and indirectly indicate the environmental contamination of the environment. Moreover, these results can also be used to understand the chemical quality of fish and to evaluate the possible risk associated with their consumption. Statistically significant differences were observed in the mean metal values from different seasons and tissues ($p<0.05$). According to Nauen (1983) the maximum permissible copper, zinc, cadmium, lead and chromium levels are 10-100, 30-100, 0.05-5.5, 0.5-6.0 and 1.0 mg kg^{-1} for fish respectively. Becaus the levels of copper, zinc, cadmium, lead and chromium in all tissues of the examined fishes in this study were lower than maximum permissible levels (except levels in pre and post-monsoon for liver, and pre-monsoon for gill), it may be concluded that consumption of this species from the cost of Karachi is not a problem on human health.

Table 2. Concentrations (µg/g) of heavy metals in fish from the coast of Karachi

Seasons*	Organs	Fe	Zn	Cu	Cd	Cr	Ni	Pb
Pre-M		16.6±10.2	5.31±2.14	4.57±1.94	0.56±0.18	0.49±0.20	0.63±0.18	0.86±0.13
Mon-S	Muscle	38.0±15.5	6.71±2.90	14.2±3.46	0.43±0.17	0.46±0.18	0.56±0.19	0.81±0.17
Post-M		39.9±12.9	6.99±3.08	14.6±5.18	0.52±0.15	0.52±0.24	0.56±0.28	0.87±0.28
Pre-M		357±118	15.6±7.20	38.4±21.2	1.52±0.61	1.63±0.81	1.42±0.48	1.65±0.48
Mon-S	Liver	444±156	47.9±13.8	47.6±19.9	1.59±0.66	0.56±0.19	1.55±0.35	1.56±0.38
Post-M		496±189	41.4±13.2	41.2±16.1	1.41±0.46	1.26±0.86	1.53±0.18	1.58±0.19
Pre-M		48.8±18.5	27.1±13.7	16.2±7.76	0.54±0.46	0.42±0.14	1.03±0.16	0.76±0.31
Mon-S	Kidney	84.9±36.3	39.3±14.3	24.6±10.5	0.38±0.22	0.53±0.38	0.68±0.47	1.25±0.42
Post-M		31.5±12.2	48.9±12.5	24.1±12.9	0.50±0.19	0.43±0.15	0.69±0.43	1.31±0.31
Pre-M		20.0±8.35	16.3±7.45	24.3±6.78	0.59±0.47	1.22±0.47	0.60±0.10	0.63±0.27
Mon-S	Gills	18.4±11.1	26.3±12.6	19.7±5.14	0.54±0.30	0.41±0.18	0.50±0.19	0.61±0.19
Post-M		16.8±1267	26.5±11.7	21.5±8.03	0.28±0.24	0.38±0.18	0.54±0.48	0.48±0.43

*Pre-M: pre-monsoon, Mon-S: monsoon, Post-M: post-monsoon.

Table 3. Two-way Analysis of variance (ANOVA) for the effects of inter-season and inter organ and variability of heavy metal concentration in *Scomberoides commersonnianus*

Metal	Effect	Sum of square	df	Mean square	F	*p*
	Season	95884.414	2	47942.207	12.086	0.000
Fe	Organ	7461782.631	3	2487260.877	627.003	0.000
	Season*Organs	209460.760	6	34910.127	8.800	0.000
	Error	991725.785	250	3966.903		
	Total	1.3657	262			
	Corrected Total	8761849.181	261			
Zn	Season	11285.432	2	5642.716	48.602	0.000
	Organ	40134.615	3	13378.205	115.229	0.000
	Season*Organs	3623.018	6	603.836	5.201	0.000
	Error	29257.495	252	116.101		
	Total	262904.885	264			
	Corrected Total	84300.561	263			
Cu	Season	20.359	2	10.180	0.011	0.989
	Organ	54454.941	3	18151.647	19.475	0.000
	Season*Organs	5704.263	6	950.710	1.020	0.413
	Error	234876.723	252	932.050		
	Total	491599.964	264			
	Corrected Total	295056.286	263			
Cd	Season	86.247	2	43.124	2.154	0.118
	Organ	119.400	3	39.800	1.988	0.116
	Season*Organs	67.624	6	11.271	0.563	0.760
	Error	5025.088	251	20.020		
	Total	5764.888	263			
	Corrected Total	5298.648	262			
Cr	Season	84.646	2	42.323	2.228	0.121
	Organ	139.406	3	46.469	2.336	0.074
	Season*Organs	92.696	6	15.449	0.777	0.589
	Error	5012.516	252	19.891		
	Total	5756.468	264			
	Corrected Total	5329.264	263			
Ni	Season	0.788	2	0.394	3.653	0.027
	Organ	43.754	3	14.585	135.213	0.000
	Season*Organs	1.361	6	0.227	2.103	0.053
	Error	27.182	252	0.108		
	Total	304.176	264			
	Corrected Total	73.119	263			
Pb	Season	0.301	2	0.150	1.425	0.242
	Organ	56.461	3	18.820	178.220	0.000
	Season*Organs	0.684	6	0.114	1.079	0.375
	Error	26.612	252	0.106		
	Total	364.753	264			
	Corrected Total	84.057	263			

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