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RESEARCH ARTICLE

COMPARATIVE SOME METAL IN FEMALE AND MALE OF MOSQUITOFISH POPULATIONS (*Gambusia affinis*)

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ABSTRACT

A total of 217 fish samples (83 male, 124 female) from *Gambusia affinis*, a common fish of the ponds, were analyzed for the concentrations of heavy metals. Fork length, weight, and sex were recorded for each fish. Weight from male and fame fish was found in the range of 68–6625mg and 73-6634mg respectively. Further, fork length from male and fame fish was found in the range of 15-92mm and 16-78 mm. Average concentration of chromium (Cr), nickel(Ni), cadmium(Cd) and lead(Pb) were found 0.885, 0.846, 0.1.301 and 0.1.671 µg per weight in case of male fish and in females it were 0.865, 0.859, 1.347 and 1.690 µg per weight, respectively. As resulted in the percent work concentrations of all the analyzed elements were found higher in female fish samples.

INTRODUCTION

The *Gambusia affinis* (Baird and Girard, 1853) can thrive a wide variety of water types, being very tolerant to high water temperatures, a wide range of salinities, pH and very low dissolved oxygen levels (Peterson and Peterson, 1990; Haynes and Cashner 1995; Meffe, 1986). Additionally this fish are considered the main predators of mosquitoes. In most habitats, fish can feed on a wide variety of preys ranging from floating larvae of mosquitoes, other aquatic insects, crustacean to zooplankton and algae (Bence, 1988; Rauchenberger 1989; Benoit *et al.,* 2000). The natural aquatic systems may extensively be contaminated with heavy metals released from domestic, industrial and other man-made activities (Eisler, 1981; Forstner and Wittmann, 1983; Conacher *et al.,* 1993; Velez and Montoro, 1998). Heavy metal contamination may have devastating effects on the ecological balance of the recipient environment and a diversity of aquatic organisms (Antonovics *et al.,* 1971; Ashraj, 2005; Vosyliene and Jankaite, 2006; Farombi *et al.,* 2007). Fish are widely used to evaluate the health of aquatic ecosystems because pollutants build up in the food chain and are responsible for adverse effects and death in the aquatic systems (Yousuf and El-Shahawi, 1999; Farkas *et al.,* 2002). In additionally fish which occupy top level in the aquatic food chain are notorious for its ability to bioconcentrate heavy metals in its flesh muscles and organs (Zhou *et al*., 2008; Olowo *et al*., 2010). Fish and other aquatic life forms are constantly exposed to chemicals in polluted and contaminated waters. Fish have been found to be good indicators of heavy metal contamination in aquatic systems because they occupy different trophic levels and are of different sizes and ages (Burger *et al.,* 2002). In addition, fish are located at the end of the aquatic food chain and may accumulate metals and pass them to human beings through food causing or acute diseases (Al-Yousuf *et al.,* 2000). The aim of this study is to determine heavy metal (Cd, Co, Cr and Pb) levels in female and male tissue of *G. affinis* from the Babol-Rood of Iran and to investigate the relationships between fish sex and size (length and weight) and metal concentrations in the tissues.

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MATERIALS AND METHODS

Study area

The present study 217 fish samples (83 male, 124 female) from *Gambusia affinis* was collected during February 2010 from Babol-Rood, North of Iran. It is Long River. This river is from the mountain of Savadkoh. This river passes through the town Babol and town Babolsar, and then it ends to Caspian Sea (latitudes 36°N and longitudes 53°E).

Sampling

The sites were located 36°N latitude and longitude53°E. Fish samples from the twelve aforesaid rivers were collected during July2010. Fish samples were collected by dip net with a 1 mm mesh-size. All samples were preserved in 4% formalin. Sex was determined from the morphology of the anal fin (Rosen

and Gordon 1953). Fork length (FL) and weight (W) were measured to the nearest 1.0 mm and 0.001g, respectively. Condition factor (CF) was calculated according to the following formula (Bagenal and Tesch, 1978; Bolger and Connolly, 1989):

$$CF = W/L^b \times 100$$

Where W=weight (g), L=fork length (in mm). The exponent is derived from the length–mass relationship at each site which is described by $W=a\ L^b$.

To analyses the trace elements content tissue of fish, 1g each of dried samples of fish pond in triplicate were digested in HNO_3:$HCLO_4$(3:1,V/V) mixture at 80°C. Also metals determined by atomic absorption spectrophotometer.

RESULTS AND DISCUSSION

As resulted in the percent work; total length of the male *G. affinis* was ranging from 15 to 92 mm whereas female were measured to be 16 to 78 mm. Total weight of the male and female was recorded to be from 68 to 6625 mg and 73 to 6634 mg, respectively. The relationship between length and weight of male and female populations of *G. affinis* are depicted in (Table 1). According to Langston and Spence 1995 (1995), weight-length relationships have several applications namely on fish biology, physiology, ecology and fisheries assessment. In biological studies, Weight- length relationships enable seasonal variations in fish growth to be followed and calculations of condition indexes. Additionally Mayrat, 1970; Ricker, 1975 reported, the weight is a function of length in fish. If the fish retains the same shape and its specific gravity remains unchanged during lifetime, it is considered to be growing isometric and the value of exponent "b" is exactly 3.0 (Sokal and Rohlf, 1987).

study it is clear that the weight of *G. affinis* increases as the cube of the length. The value of "b" in the sample collected in this study are close to 3 which is almost same to the slope for an ideal fish (b=3) and show that the fish is growing isometric in relation to length. Pronounced sexual dimorphism in length-weight relationship was observed for of *G. affinis* with significant differences in the slopes of length-weight relationships between males and females. Similar studies were observed by Morato *et al.,* 2001. They reported sexual dimorphism did not affect the length-weight relationships.

The average concentrations of the metals detected in fish summarized in Table 2. It was found that, the concentrations of the metals in female are higher than in the male. Similar reported by Al-Yousuf *et al.,* 2000; Authman, 2008. They found that the average metal concentrations in tissues of female fish were higher than those in male fish, indicating the differences in metabolic activities of the two sexes. As resulted in the percent work, in both sexes, the mean concentration of the tested elements followed the sequence Pb>Cd>Cr>Ni. Sex of fish can be considered as main factors of affecting the concentration of trace elements in fish where higher concentrations were found in muscle of females than those in males (Shakweer and Abbas, 2005). Also some studies have shown a relationship between the metal accumulation and sex (Al-Yousuf *et al.,* 2000). The nature of hormones and the available number of active sites in the proteins and cytochromeP-450 in the females may be determinant factors to this relation (Jargensen and Petersen, 1994), indicating the differences in the metabolic activities between the sexes. As reported by (Authman, 2008; Al-Yousuf *et al.,* 2000); the metal concentrations in muscle of female were higher than male fish. The concentrations of heavy metals in fish vary significantly not only as function of fish sizes and age, but is influenced in a remarkable degree by the fish condition and sex. On the other hand Bryan and

Table1. Ranges and the relationships between weight and total length of the fish's gilthead *G. affinis* caught from the Babol-Rood

Sex	n[b]	Weight	Length	Equation[a]	R^2
F	124	73-6634	16-78	$Y=0.0201X^{2.9780}$	0.9633
M	83	68-6625	15-92	$Y=0.0075X^{3.1211}$	0.09657

[a] Y is total fish length (mm) and X is total fish weight (mg); [b] numbers of fishes sampled.

Table 2. Mean of some metal concentrations of *G. affinis* (µg/g of dry weight) of the studied sites. Ranges of values are given in the parentheses

Sex	Cr	Ni	Cd	Pb
F	0.865	0.859	1.347	1.690
	(0.790-1.083)	(0.633-1.043)	(0.646-1.883)	(1.400-2.000)
M	0.885	0.846	1.301	1.671
	(0.760-1.011)	(0.637-0.996)	(0.652-1.877)	(1.375-1.986)

Table 3. Multiple Metal Correlation Coefficient Matrix for Various Metals in Canned *G. affinis* Samples

	Pb	Cd	Ni	Cr
Pb	1.0	0.393	0.341	0.089
Cd		1.0	0.248	0.551
Ni			1.0	0.447
Cr				1.0

The value of exponent "b" in regression equation may vary with feeding, state of maturity, sex and furthermore between different populations of a species indicating taxonomic differences in small populations. From the equations in this

Langston, 1992; Canli and Furness, 1993; Kalay and Canli, 2000 reported, ecological needs, sex, size and molt of marine animals were also found to affect metal accumulation in their tissues. Metal to metal correlation studies (Table 3) showed

that only one element is strongly correlated in *G. affinis* fish. The significant correlation coefficient (r>0.500) was found between Cd and Cr.

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