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Seasonal variations in levels of Heavy metals in muscles of crab *Sesarma boulengeri* collected from Al-Garaf canal at Thi Qar province, Iraq

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Summary

The present work is aiming at investigating seasonal variations in levels of some heavy metals (Ni, Cd, and Cu & Zn) in muscles of the crab *Sesarma boulengeri*. Samples were collected from Al-Garaf canal at Thi Qar governorate. The study extended from March 2004 to February 2005. Specimens were collected from a location supply cities of Basrah, Thi Qar, Shatra and Garaf water's purification boards with crude freshwater for domestic uses. The surrounding areas are affected with sewage and agricultural disposals. It also represent mixing zone of water masses of various compositions. Elements found to vary seasonally in their levels and analyses of muscles indicate that Ni occupied the first position and revealed the highest levels, in general. The minimal recorded accumulative values (200.11 µg/g dry wt) was in Spring and the highest (243.20 µg/g dry wt) in summer. Zinc occupied second accumulation levels and showed the minimal (55.13 µg/g dry wt) in spring, whereas Cd, by no means, exhibited the minimal concentrations and the lowest value (4.82 µg/g dry wt) was in winter. Causes and effects of trace elements were discussed.

Introduction

It is well known that trace elements are dangerous environmental materials. They may accumulate within various organs of living creatures (Flessas and Pinel-Alloul, 1993) and find their way to human (Al-Saadi *et al.*, 1999). Trace elements present in nature at different forms as dissolved (Hart, 1982) or particulate (Chester and Voutsinou, 1981). Levels of accumulation are related to several causes (Itawi, *et al*., 2000; Van den Broke, *et al.*, 2002) and known to be low in aquatic ecosystems (Evans, 1995), but population expansion (Little and Smith, 1994; Hawkins and Roberts 1994) and man various activities (Kakula and Osibanjo, 1992; Biney, 1991) magnify impacts . Absence of some trace elements may cause abnormalities or growth retardation in living organisms, but excess amounts are definitely fatal (Venugopal and Lucky, 1975). In many cases distortion occurs even at low concentrations by metals like mercury, copper and cadmium (Malik *et al*., 1998). High Sensitivity assigns many organisms, including crustaceans, as bio-indicators (Widianarko *et al., 2000;* Burger, *et al.,* 2002) (Allinson *et al.,* 2000). Abiotic environment may influence level of stress (Piekering and Henderson, 1966; Howarth and Sprague; 1998; Abdul Karem, 1998; Abdul Hassan, *et al*. 1989; Abdulla and Abdul-Hassan, 1994; Al-Khafaji, 1996)). Several workers (Khalifa, 1986; Abdul Hassan, *et al*., 1989) deduced that effect of any single item may be duplicated with presence of others. Garaf canal is of essential importance for domestic and agricultural uses and its water masses are essential to satisfy requirements of Basrah and Thi Qar provinces. However, no published work was found to take in consideration levels of trace elements in aquatic organisms in Thi Qar province or the Garaf canal.

Description of study area

Tigris is one of the two main rivers feeding Iraq with essential quantities of freshwater. It splits, after passing Kut Dam into two major branches, the former moves towards Mysan province and the other branch (Garaf canal) is penetrating Thi Qar governorate and directed towards Shatra town. The latter is situated at south eastern region of the pluvial region. The canal is distinguished, at this location, with low gradient and sluggishly moving current creating considerable loads of sediments. To execute the work specimens were captured from a location supply Basrah, Thi Qar, Shatra and Garaf water's purification boards with raw water. The adjusted lands influenced by domestic sewage, wastes from land cultivation and some private factories. The location of specimen's collection is situated at distance 167 km from Kut Dam, northern Shatra town and affected by disposals of Garaf district and also affected by drainage water from the surrounding cultivated land (Figure 1). Canal width at sampling position is 52 m and depth 8 m. Quite few aquatic vegetations were detected in the region including *Phragmites australis*, *Typha sp.*, *Potamogeton sp.*, *Ceratophyllum demersum*, and *Vallisineria spiralis*. Some Crustaceans and mollusks were also found such as Sesarma *boulengeri*, *Unio tigridis* , *Melnoides tuberculata and Melanopsis nodosa*. About 8 fish species were recovered from sampling location, as well. However, a detailed and comprehensive description to the study area is available in Hussein and Fahad (2008 under publication)

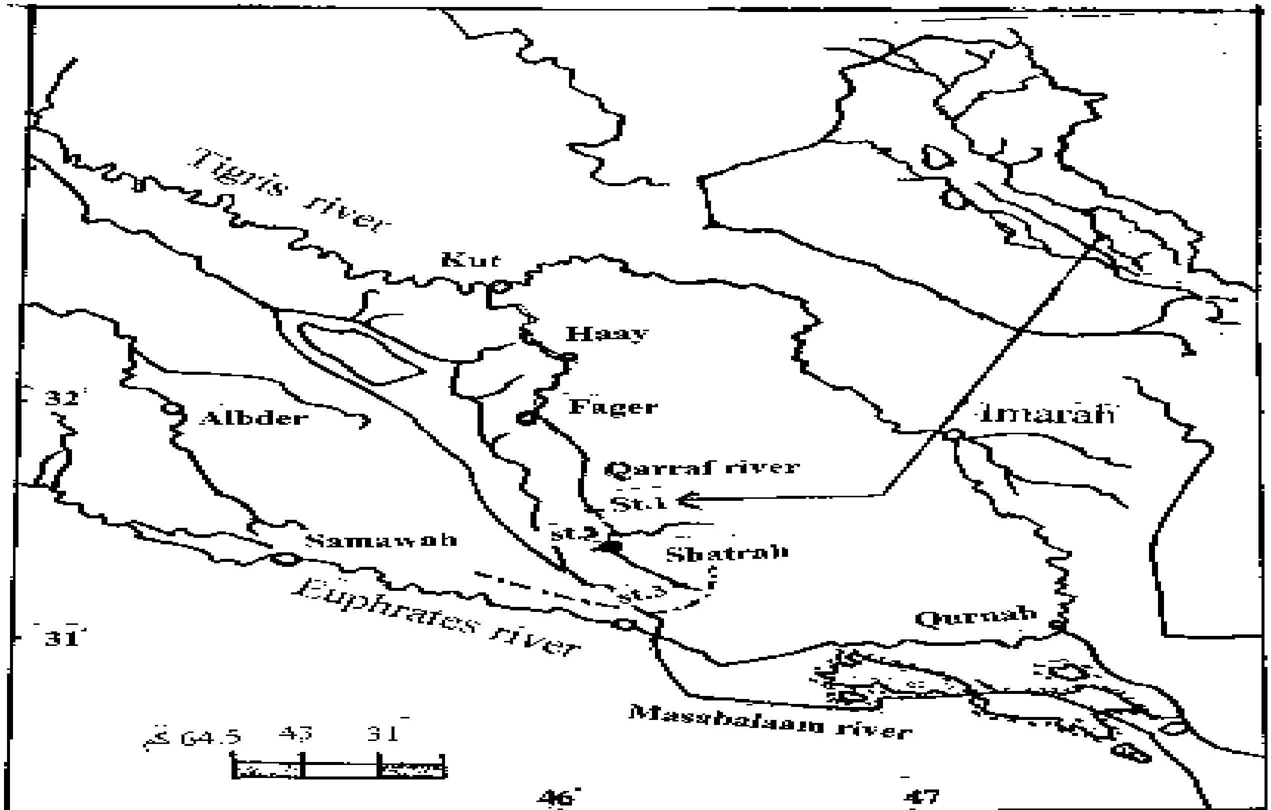

Figure (1) showing map of sampling locations in the study area

Figure (1) showing the sampling location in Garaf canal

Materials and Methods

Crap (*Sesarma boulengeri*) specimens were collected on seasonal basis manually or by using hand net, but samples recovered at each sampling period were pooled and a random representative sub-sample was taken for analysis. Tissues were isolated from ribs and placed, to dry, in an electrical oven less than 105° C for 24h, then grinded in an Agate Mortar and Postal grinder to get powdered.

Concentrations of accumulative heavy metals were measured, after performing the steps of preparation, by flame-Atomic absorption spectrophotometer. A specific hollow cathode lamb were used for each element. Stock solutions were prepared by dissolving the specific weight of each item salt in diluted nitric acid. The following equation was adopted to calculate concentrations of trace elements:

$E_{con} = (A\ V\ df)/D$ where,

E_{con} : Conc. of element in the sample as µg/g dry wt.

A: Conc. of the element calculated from calibration curve (µg/g)

V: The final sample volume (by ml)

df: Dilution factor, when used it is as follows:

df= volume of diluted solution (ml)/ vol. water used for dilution(ml)

D: Dry wt of the sample (g).

Results

Heavy metals found to vary seasonally in their levels of accumulation in crab (*Sesarma boulengeri*) muscles (Table 1). The analyses indicate that Ni revealed the highest levels in tissues, in general, and the highest (243.20 µg/g dry wt) was encountered in summer and the minimal values (200.11 µg/g dry wt) was in April, whereas Cu, by no means, exhibited the minimal concentrations and the lowest (28.35 µg/g dry wt) was in winter. Zinc came next in accumulation levels followed Ni and showed the minimum (55.13 µg/g dry wt) in spring. Cadmium exhibited the lowest levels, all the year round, altogether.

The study also revealed that annual mean of Ni (213.94 µg/g dry wt) was the highest, but that of cadmium (5.45 µg/g dry wt) was the lowest. Seasonal variations in levels of Cu were fluctuating, but the highest (40.12 µg/g dry wt) was in spring and the yearly means was 11.37 µg/g dry wt. It is evident that the maximum seasonal concentration of Zn (168.83 µg/g dry wt) was in autumn and the yearly mean was 111.92 µg/g dry wt.

Figure (1) indicates seasonal variations in concentrations of heavy metals in tissues of crab *Sesarma boulengeri*. Values were found to vary among elements and within the same element at different seasons. The maximum 243.2, 168.83, 40.12 and 5.80 µg/g dry wt for Ni, Zn, Cu and Cd respectively encountered in summer, autumn, summer and spring in the same order and the minimum were 200.11, 55.13, 12.69 and 4.82 µg/g dry wt for the above items in the same order. However, elements recovered from crab muscles can be arranged as follows: Ni>Zn>Cu>Cd.

Table (1). Indicates seasonal ranges, means±S.D of concentrations of the recovered heavy metals in muscles of crab (*Sesarma boulengeri*) collected from Garaf canal during the study period.

Trace element	Mean ± S.D	Maximum value	Minimum value	Replicates
Ni (µg/g)	213.9±19.09	242.2	200.1	4
Cd (µg/g)	5.45±0.44	5.8	4.82	4
Cu (µg/g)	28.35±12.10	40.12	12.69	4
Zn (µg/g)	111.92±49.3	168.8	55.13	4

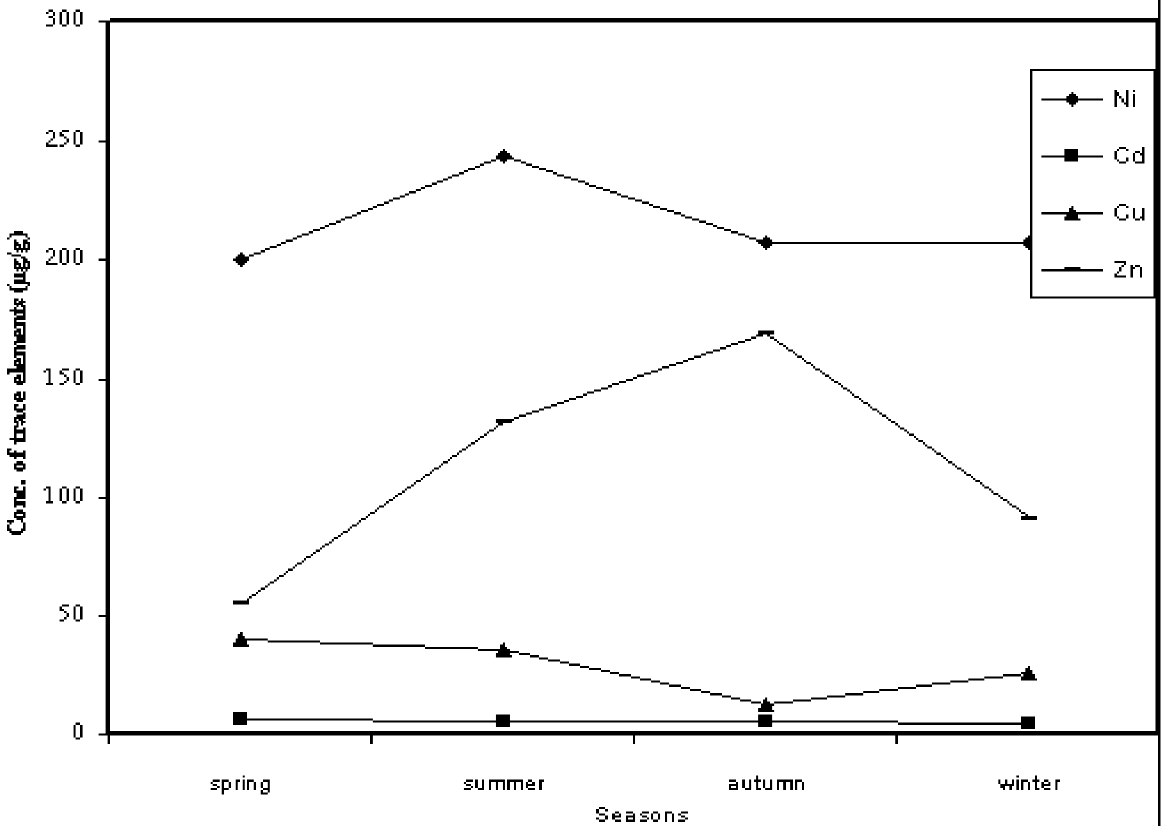

Figure (2) illustrates seasonal changes in concentrations of the four selected trace elements in crab muscles of Sesarma boulengeri from Garaf canal.

Figure (1) Seasonal changes in levels of the four selected heavy metals in muscles of crab *Sesarma boulengeri* from Garaf canal

Discussion

Several causes are responsible on levels of trace elements in aquatic ecosystems (Itawi *et al*., 2000). Including mortalities of aquatic organisms (Al-Aliawee and Ali, 2001) in the region, industrial effluents (Kakula and Osibanjo, 1992), sewage and river loads (Abed Ali *et al.*, 2000). Trace elements may cause distortions or be fatal at abnormal levels (Venugopal and Lucky, 1975).Several items like Hg, Pb, Cd and Ag are dangerous even at low concentrations (Malik *et al*., 1998) affecting productivity (Benoit, 1995). High concentrations of copper cause growth retardation (Lett, *et al*., 1976) and result in making organisms more vulnerable to be invaded by diseases. Presence of various elements is intolerable may magnify stress (Muhesin, 1983; Khalifa, 1986). It has been pointed out that permissible levels of Pb and Cu in drinking waters should not exceed 0.06 mg/L (WHO, 1991).

On the other hand, various abiotic environmental conditions (mainly temperature, salinity and hardness) in addition to season, location and reproductive stage affect accumulation of trace elements in biota (Brown, 1980; Win and Nicholas, 1997). Similarly, Zayed *et al*., (1994) deduced that levels of heavy metals are more pronounced during hot seasons than other periods of the year. This may attributed to rise in respiration and increasing activities for searching for food and food consumption (Brown, 1980; Abdulla and Abdul-Hassan, 1994). Whereas, Olson and Horrel (1973) is of the opinion that high salinity reduce strength of trace elements, but without providing any explanation. The study revealed that annual mean levels of heavy metals in crab muscles were 213.94±19.09, 5.45±0.44, 28.35 ±12.1 and 111.94±49.3 µg/g dry wt for Ni, Cd, Cu and Zn respectively. Although it is evident that cadmium concentrations were the lowest recovered from tissues, but it is more poisonous to biota than others (Al-Samer, 1989). However, it has been pointed out that levels of corruption do not just depend on the type and concentrations of elements, but also on the recipient organism itself. Bjerregaard and Vislie (1986) observed that littoral crab tolerate low levels of Cu (0.25-0.5 mg/L) and remain survive for more than a month, whereas concentration ≥ 1 mg/L is fatal to 50% of the population within eleven days.

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الاختلافات الفصلية في مستويات العناصر النزرة في عضلات السرطان النهري" أبو الجنيب" *Sesarma boulengeri* المستجمع من قناة الغراف، في محافظة ذي قار، العراق

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الخلاصة

درست التغيرات الفصلية في تراكيز العناصر الثقيلة (النيكل والكادميوم والنحاس والخارصين) في أنسجة السرطان النهري "أبو الجنيب" (*Sesarma boulengeri*) في مدينة الناصرية ضمن مقطع حيوي من قناة الغراف، للمدة من آذار ٢٠٠٤ إلى شباط ٢٠٠٥. وجمعت النماذج من هذا الحيوان القشري من موقعا يزود المياه العذبة غير المصفاة لمشاريع ماء البصرة والناصرية والشطرة والغراف وتتأثر المناطق المتاخمة له بمياه المجاري المنزلية وفضلات المزارع، ويمثل منطقة خلط لكتل مائية قادمة من أعالي نهر دجلة. وتباينت القيم في تراكيزها فصليا. واظهر تحليل العضلات اختلافا في التراكيز على مدى المواسم. إذ احتل النيكل المرتبة الأولى واظهر ، عموما، أعلى المستويات، وكان أدنى تركيز (٢٠٠،١١ مايكروغرام/غم) وزن جاف في الربيع وأعلاه (٢٤٣،٢٠ مايكروغرام/غم وزن جاف) في الصيف. وجاء الخارصين بالمرتبة الثانية في التركيز وكانت أوطأ القيم (٥٥،١٣ مايكروغرام/غم وزن جاف) في الربيع. بينما اظهر الكادميوم اقل التراكيز على الإطلاق وسجلت أدنى القيم (٤،٨٢ مايكروغرام/غم وزن جاف) في الشتاء. ونوقشت مسببات وتأثيرات العناصر النزرة.