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# SEASONAL VARATIONS OF TRACE ELEMENTS IN THE SHRIMP *Penaeus semisulcatus* FROM THE ARABIAN GULF.

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## SUMMARY

Seasonal variations of trace elements Cd, Cr, Fe, Mn, Ni, Pb, V and Zn have been determined in the shrimp *Penaeus semisulcatus* from the North Arabian Gulf. It was found some element relatively higher concentrations in the shrimp, especially Cr (7.95 µg/g) Ni (41.9 µg/g). V(16.8 µg/g) and pb (5.18 µg/g) dry weight. Stationary variations in element concentrations were found in the shrimp and sediment. These were attributed to pollution source in that region. No seasonal fluctuation were found in the element concentrations in the shrimp tissue. This was attributed to the biological behaviour of shrimp such as feeding habit.

## INTRODUCTION

The use of aquatic organisms to monitor trace elements bioavailability is well established, these element concentrations in tissuse of accumulator being by definition a function of amounts of elements in the environments integrated overtime (Abaychi and Mustafa, 1988). Prerequistie properties of biomonitors are discussed by phillips (1977) and Farington *et al* (1983), ideal biomonitors are recognizable, common, accessible, available at all times of years, relatively stationary long lived, of seasonable size and tolerant enough of salinities.

Several authors such as Voutsinou – Taliadouri (1980); Satsmadjis and Voutsinou – Taliadouri (1983), Al-Mohanna and Nott (1986), and Alliot and Frenet-Piron (1990), have discussed the shrimps as a rational monitoring for trace element contaminants, which introduced into the environment. However, Enomoto (1971) and Badawi (1975) have been reviewed the biology of the shrimp *Penaeus semisulcatus* (De Haan) Crustacea: decapoda at the Arabian Gulf region, therefore the shrimp was possess certain characteristics as a bio-indicator in that region of the world, as well as, it is known to accumulate trace elements (Al-Mohanna and Nott, 1986 ; Anderlini *et al*., 1986). So forth, it may be appears to be a promising bio-indicator.

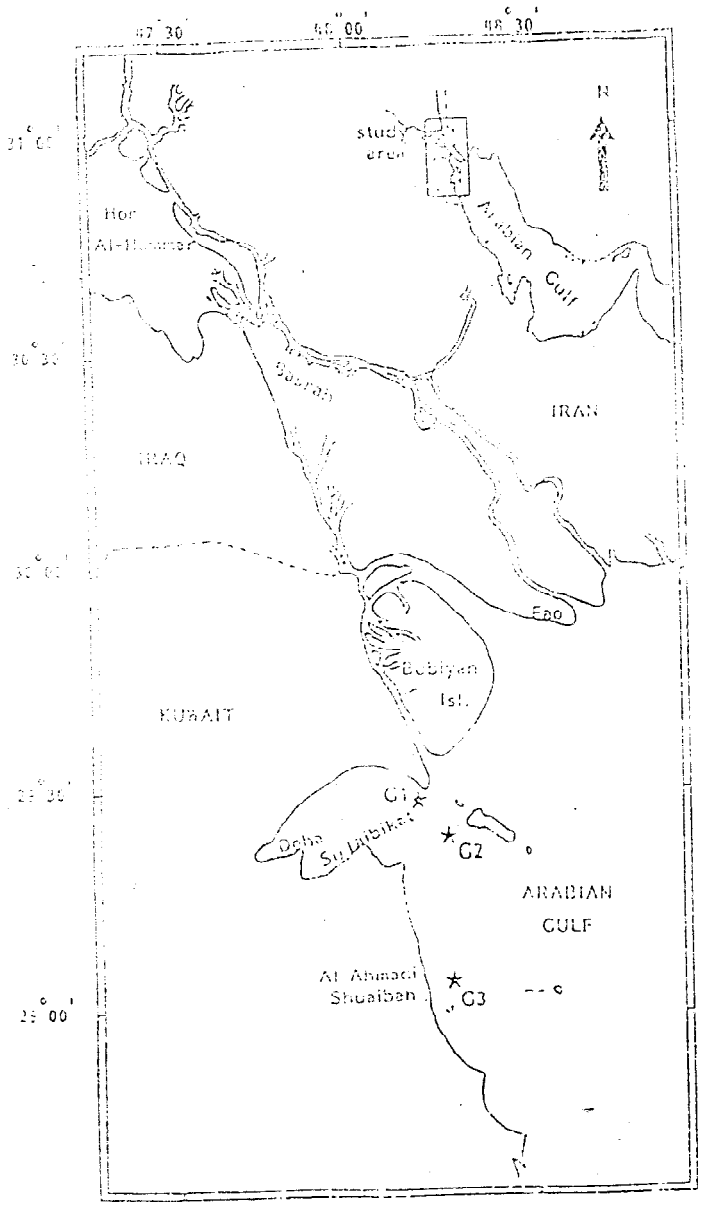


Fig.(1) .Sampling stations in the studied section of the Arabian Gulf area

Although, the shrimp is of great economic importance in the region, froms part of the food chain for the founa, which is directly exploitable by man. The present study endeavours to fill some major gaps in the knowledge of the shrimp *Penaeus semisulcatus* as bioindicator in that region relating to estimate seasonal variation of trace elements in the shrimp and correlated it with their concentrations in the sediment.

## MATERIALS AND METHODS

Three sampling stations were selected from studied section of the Arabian Gulf area (Fig. 1). Sampling was conducted in these stations most likely to contain point sources of trace element pollutants (Anderlini *et al.*, 1986). The shrimp and sediment samples were obtained from these stations seasonally between summer (1989) and spring (1990) soft tissues of the shrimps were removed from the shell and pooled together. Each pooled sample was freeze-dried, and ground with agate mortor and pestle, before the trace elements were extracted according to the procedure described by Goldberg *et al.* (1983), in which cold extraction by $HNO_3$ of triplicate samples proceeded for 16 h, followed by evaporation to near dryness. The extraction was completed by adding 2:1 mixture of $HNO_3$ and $HClO_4$ and evaporation to near dryness. The residue was dissolved with 0.5 N $HNO_4$. Sediment samples were obtained by means of Van Veen grab samplers. Trace element analyses were performed on the < 63 μm fraction of the sediment which had been separated by sieving after grinding. The extraction of trace elements from sediment were following the procedure of Anderlini *et al.* (1986) by leaching freeze-dried samples with 50 % $HNO_3$ for 2 h at 90-95 C°. After leaching the samples were centrifuged, rinsed with deionised water.

The trace elements Cd, Cr, Fe, Mn, Ni, Pb, V. and Zn were determined on a pye-unicam flamless ( AAS ) model, Sp 9, equipped with graphite furnace, video furnace programmer and data graphics system. The standard conditions recommended by the manufactures were found satisfactory after minor modifications.

## RESULTS AND DISSCUSION

Mean concentrations (triplicate estimation of each sample) of trace elements in shrimp *Penaeus semisulcatus*; from all collection sites are presented in Table (1). In general, these date showed stationary variation of element concentrations in the shrimp higher concentration of Cd, Cr, were found in shrimp from stations 1 this may be attributed to industrial and navigation developments at that part (Al-Mohanna and Nott, 1986, Mohammed,*et al.*1998) and lower concentration of Ni and V which may

local migratory nature of the shrimps, or may represent either the level of these elements in that shrimp or possible regulation of these elements by the animal (Anderlini *et al.*, 1986). Active regulation of some essential elements such as Zn is known for other marine invertebrates of special interest were observed in the Zn concentration between shrimp and sediment in this study. Anderlini *et al.* (1986) have been reported the uniformity of element concentrations in Arabian Gulf shrimps, and these values were similar to values reported for other decapoda crustaceans. As well as the local shrimp is not contaminated by trace element and that the concentrations of more toxic elements are well below potentially dangerous levels. But our data had showed relatively higher concentrations in the shrimp especially Cr (7.95 µg/g), Ni (41.9 µg/g), V (20.6 µg/g) and pb (5.18 µg/g) and lower in Cd (0.52 µg/g) comparing with world wid (Bryan, 1976; Pourang *et al.*2003 a and Anderlini *et al.* 1986) data.

**Table (1).** Concentrations of trace elements (µg/g dry weight) in *Penaeus semisulcatus* tissue.

| Station | Cd | Cr | Fe | Mn | Ni | Pb | V | Zn |
|---|---|---|---|---|---|---|---|---|
| **Summer** | | | | | | | | |
| **1** | 0.56 | 11.98 | 255 | 6.4 | 10 | 6.8 | 10 | 39.5 |
| **2** | 0.68 | 6.22 | 298 | 8.8 | 72 | 6 | 38 | 64 |
| **3** | 0.37 | 5.8 | 235 | 4.4 | 62 | 4.9 | 32 | 68.8 |
| **Mean** | 0.53 | 8 | 262.6 | 6.5 | 48 | 5.9 | 26.6 | 57.4 |
| **Autumn** | | | | | | | | |
| **1** | 0.6 | 12.34 | 256 | 5.5 | 15 | 4.5 | 4.8 | 95 |
| **2** | 0.55 | 6.17 | 290 | 7.4 | 42 | 7 | 23 | 70 |
| **3** | 0.3 | 6 | 235 | 6.9 | 62 | 5.5 | 24 | 64 |
| **Mean** | 0.48 | 8.2 | 260.3 | 6.6 | 39.6 | 5.6 | 17.2 | 76.3 |
| **Winter** | | | | | | | | |
| **1** | 0.73 | 11.43 | 223 | 7 | 17 | 2.3 | 11 | 102 |
| **2** | 0.53 | 5.5 | 250 | 8.4 | 70 | 7.3 | 30 | 80 |
| **3** | 0.45 | 5.5 | 225 | 7 | 70 | 5.6 | 29 | 40 |
| **Mean** | 0.57 | 7.47 | 232.6 | 7.46 | 52.3 | 5 | 23.3 | 74 |
| **Spring** | | | | | | | | |
| **1** | 0.62 | 12.3 | 223 | 5.5 | 15 | 3.8 | 6.8 | 78.3 |
| **2** | 0.33 | 6.1 | 250 | 7.5 | 40 | 3.6 | 23.8 | 100 |
| **3** | 0.55 | 6.1 | 223 | 6.3 | 28 | 5 | 15 | 80.1 |
| **Mean** | 0.5 | 8.16 | 232 | 6.4 | 27.6 | 4.1 | 15.2 | 86.1 |

Finally, no significant seasonal variation in element levels were observed in the shrimp. This may be attributed to the decapoda crustaceans ability for regnlation of trace elements (Alliot and Frenet-piron, 1990; Satsmadjis and

Voutsinou-Taliadouri, 1983; Voutsinon-Taliadouri 1980 and Pourang *et al.*2003 b).

Sediment samples data obtained from surveys are presented in Table(2) in which the mean concentrations of trace elements from the studied region. In general, trace element concentrations in these matrices show the elevated levels of Cr, Fe, Mn, Ni and V suggests a pollutant source for this element. This may be due to industrial development along this region, such as higher level of Ni and V concentrations observed during the study appear to be related to the extensive oil loading facilities and navigation at this part, since crude oil contains more Ni and V than any other trace element (Anderlini *et al.*, 1986; and Abduqader,1995).

**Table (2).** Concentrations of trace elements (µg/g dry weight) in sediment.

| Station | Cd | Cr | Fe | Mn | Ni | Pb | V | Zn |
|---|---|---|---|---|---|---|---|---|
| **Summer** | | | | | | | | |
| **1** | 0.54 | 66 | 14403 | 550 | 60 | 22.7 | 62 | 100 |
| **2** | 0.66 | 70.8 | 45666 | 896 | 148 | 23.6 | 120 | 98 |
| **3** | 0.7 | 93.5 | 37000 | 998 | 68 | 23.1 | 58 | 99 |
| **Mean** | 0.63 | 76.7 | 32356.3 | 814.6 | 92 | 23.1 | 80 | 99 |
| **Autumn** | | | | | | | | |
| **1** | 0.4 | 66.78 | 14430 | 506 | 58 | 24.4 | 50 | 100 |
| **2** | 0.63 | 73 | 45760 | 850 | 100 | 25 | 98.82 | 98 |
| | | | | | | | | |
| **3** | 0.66 | 93 | 37051 | 962 | 53 | 24 | 48 | 99 |
| **Mean** | 0.56 | 77.59 | 32413.6 | 772.6 | 70.3 | 24.5 | 65.6 | 99 |
| **Winter** | | | | | | | | |
| **1** | 0.56 | 69 | 15330 | 506 | 60 | 24 | 50 | 92 |
| **2** | 0.66 | 77.4 | 46003 | 890 | 145 | 25 | 108 | 95 |
| **3** | 0.73 | 95.62 | 37030 | 998 | 60 | 24 | 45.8 | 95 |
| **Mean** | 0.65 | 80.6 | 32787.6 | 798 | 88.3 | 24.3 | 67.9 | 94.1 |
| | **Spring** | | | | | | | |
| **1** | 0.41 | 69.51 | 14880 | 500 | 50 | 22 | 55.73 | 93 |
| **2** | 0.62 | 71.75 | 45500 | 850 | 129 | 24 | 116.99 | 96.1 |
| **3** | 0.66 | 98.3 | 37028 | 955 | 53 | 22.9 | 55 | 92.88 |
| **Mean** | 0.56 | 79.77 | 32469.3 | 768.3 | 77.3 | 22.9 | 75.9 | 93.99 |

Finally, to examine the possible correlation in the distribution of trace elements in shrimp tissue and sediment in each season data were subjected to regression analysis. Is shown in Table (3) that element concentrations in Shrimp was not correlation with their corresponding concentrations in sediment. This

may be attributed to the biological behaviour of the shrimp. They are usually feed on a variety of small organisms such as, mollusca, polychaet worms and crustacea as well as planktons (Enomoto, 1971). So forth, the trace element concentrations in the shrimp shoud be correlated with their concentrations in their food. (Abduqader,1999).

**Table (3)** Correlation coefficients between Trace element concentrations in the *Penaeus semisulcatus* tissue and their corresponding values in the sediment.

| Season | Cd | Cr | Fe | Mn | Ni | Pb | V | Zn |
|---|---|---|---|---|---|---|---|---|
| Summer | -0.363 | -0.68 | 0.461 | -0.165 | 0.686 | -0.36 | 0.563 | -0.779 |
| Autumn | -0.707 | -0.7 | 0.397 | 0.88 | -0.011 | -0.737 | 0.428 | 0.76 |
| Winter | -0.762 | -0.743 | 0.769 | 0.308 | 0.5 | -0.76 | 0.489 | -0.835 |
| Spring | -.057 | -0.559 | 0.714 | 0.652 | 0.871 | -0.188 | 0.871 | 0.227 |

## CONCLUSIONS

Stationary variations in element levels were observed in the shrimp and sediment. These were attributed to industrial and navigations development. No significant seasonal variations in element concentrations were observed in the shrimp tissue. This was attributed to the biological behaviour of shrimp such as feeding habit.

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# التغيرات الفصلية للعناصر النزرة للروبيان *Peneus semisulcatus* في الخليج العربي

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## الخلاصه

تم قياس التغيرات الفصلية للعناصر النزرة التالية: الكادميوم، الكروم، الحديد، المنغنيز، النيكل، الرصاص، الفانيديوم والنحاس للروبيان ***Penaeus semisulcatus*** في الخليج العربي.
وقد وجد زيادة نسبية لتراكيز بعض العناصر في الروبيان خاصة الكروم ( 7.95 مايكروغرام/ غم) النيكل (41.9 مايكروغرام/ غم )، الفانيديوم (16.8 مايكروغرام/غم) والرصاص (5.18 مايكروغرام/غم) في الوزن الجاف. كما وجد تغير في تراكيز العناصر حسب المواقع في الروبيان والرواسب وهذا ينسب الى مصدر التلوث في المنطقة. لايوجد تموج فصلي في تراكيز العناصر في انسجة الروبيان وهذا يعزى الى الطبيعة البايولوجية للروبيان وطبيعة التغذية.