

Status of Copper and Zinc in Biotic and Abiotic Components of Karwar Waters Central West Coast of India

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Abstract

The present study was undertaken to study the concentration of Copper and Zinc in the water, sediment and important edible bivalves for a period of 6 months from January 2011 to June 2011. The concentration of copper in water sample at Majali was within the permissible limit (0.05 ppm as per BIS standards), it was (0.23 ppm) in the month of March and May at Devbagh, it was beyond the permissible limit (0.05 ppm) at Majali. In the case of Zinc, the highest concentration observed during May was (0.09 ppm) at Majali and (0.07 ppm) at Devbagh which is far below the permissible limits (5.0 ppm). In case of sediment samples the concentration of Cu was within the permissible limit (which is between 2.0-4.0 mg/L as per FEPA) the highest concentration was (0.39 ppm) in the month of January at Majali and (0.238 ppm) in the month of March at Devbagh, the limit of Zn was also within the permissible limit which is (50 mg/L according to FEPA) 0.09 ppm at Majali and 0.09 ppm at Devbagh. In *Paphia malabarica* and *Mactra violaceae*, concentration of Zn and Cu was within the permissible limit ((According to Standard Oyster tissue 156a which is 66.30 ± 4.30 mg/g for Cu and 830 ± 57 mg/g for Zn) highest concentration of Cu in *Paphia malabarica* was observed (0.4367 ppm) in the month of January at Majali followed by (0.267 ppm) of Zn in the month of June. In *Mactra violaceae*, the highest concentration of Cu was recorded in the month of January (0.476 ppm) followed by (0.297 ppm) of Zn in the month of June at Majali.

Keywords: *Mactra violaceae*; *Paphia malabarica*; Copper; Zinc; Karwar ppm

Introduction

Metals are generally the components found in the earth's environment in a certain amount. These elements in trace amounts are very beneficial but can cause harm when present in excess. Due to the human interference the bioaccumulation of such elements in the biotic components has increased many folds. In today's world, many constituents are used for easy sustainability which contain these harmful elements and enter the ecosystem in bulk and are responsible for many ill effects on the biota. Sediments are one of the important abiotic components in the aquatic ecosystem. It has the important quality to withhold certain element like trace metals on which certain organisms are dependent primarily or secondarily. Sediment because of it this quality can be an important indicator of certain pollution [1-4]. Thus the sediment plays a very important role in determining the state of the ecosystem. Vertical profiles of pollutant species in sediment cores have been commonly used as "pollution records" over the last decades [5]. These bivalves feeds on benthic assemblage, there is possibility of accumulation of undesirable elements in these organisms [6,7].

Study area

The present study was carried out at two places Majali and Devbagh. Majali is located 14 kilometers away from the Karwar city; this is one of the important fishing places and located at border of Goa and Karnataka. Fishing is the main occupation for most of the people of this area. The beach of this area is about 4 kilometers, the position of this area i.e., Latitude is 14°53' 46.50"N and Longitude 74°5' 51.65"E. Another study site selected for study is Devbag area, which is hardly one kilometer away from Devbag beach resort operated by Jungle Lodges and Resorts of forest Department of Karnataka (Figures 1-5). There is creek which forms very good natural habitat for many mangrove plants and aquatic organisms of ecological importance. This area is 7 kilometers away from first station towards southern side.

Materials and Methods

The present study was carried out for a period of 6 months, for which water, sediment and Clams (*Mactra violaceae*, *Paphia malabarica*) were collected every month. Water sample was collected in a 250 ml bottle, 2 ml HNO₃ was added to it and kept at 2°C until analysis. About 1 gm of the sediment sample was collected and 5 ml Chloroform was added and stored until analysis [8,9]. The clams were collected manually and stored. These samples were then digested and treated with HNO₃ and Perchloric acid to get the suitable concentrate for analysis of trace metals. The samples were analyzed by using Perkin Elmer atomic absorption spectrophotometer at Solaris Chemtech Industry, Binaga. The atomic absorption spectrometry quantifies the absorption of ground state atoms in the gaseous state. The atoms absorb ultraviolet or visible light and make transitions to higher electronic energy levels. The analyte concentration is determined from the amount of absorption. The results were expressed in parts per million (ppm).

Result and Discussion

Copper

"During present observation concentration of Copper in the month of January in the water sample was (0.052) at Majali, it was low

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Figure 1: Showing the map of Uttara kannada district of Karnataka.



Figure 2: Showing the location of Majali study site.



Figure 3: Showing the location of Devbagh study site.

in the month of February (0.039 ppm) (Figures 6 and 7). Then there was a slight increase in the month of March (0.047 ppm) and remained same in the month of April and May. Then it decreased in the month of June (0.18 ppm)."

In the sediment sample at Majali, the concentration of copper in sediment was high compared to water sample (0.393 ppm) in the month of January, then it decreased in the month of February (0.034 ppm), then in the month of March there was a slight rise (0.238 ppm)

(Figure 8), then absent in the month of April, then again it appeared in the month of May with a slight increase (0.238 ppm) and later a decrease in the month of June (0.036 ppm).

At Devbagh, the concentration of Copper in the water sample in the month of January was (0.046 ppm), it was (0.045 ppm) in the month of February and (0.047 ppm) in the month of March and April (Figure 9). It was (0.023 ppm) in the month of May and (0.013 ppm) in



Figure 4: Showing the image of *Paphia malabarica*.



Figure 5: Showing the image of *Mactra violaceae*.

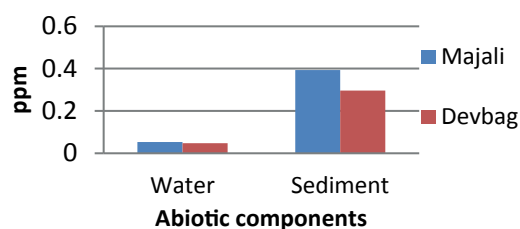


Figure 6: Variation in concentration of Cu (ppm) in the month of Jan 2011.

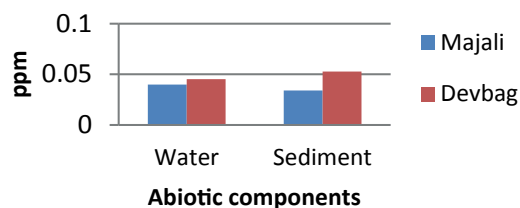
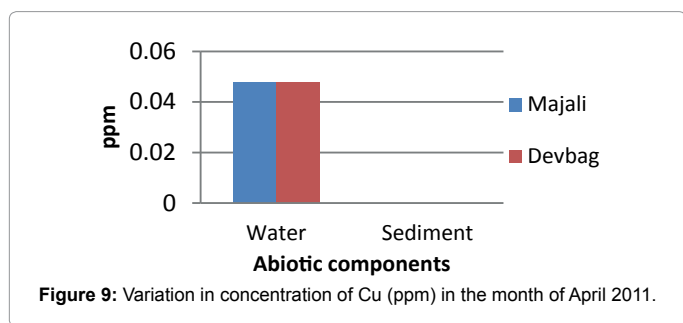
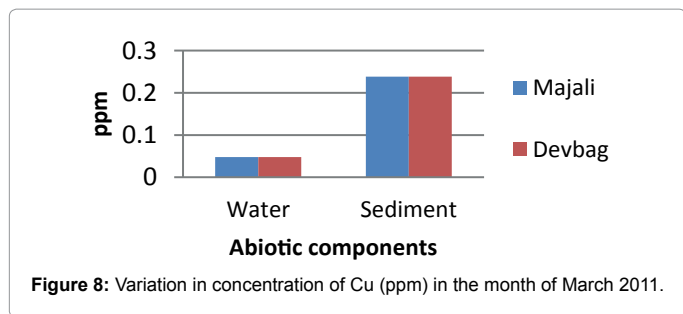


Figure 7: Variation in concentration of Cu (ppm) in the month of Feb 2011.



the month of June. In the sediment samples, the concentration in the month of January was (0.29 ppm), then it decreased to (0.05 ppm) in the month of February then increased in the month of March (0.238 ppm) and was 0 in the month April (Figures 10 and 11), it was (0.023 ppm) (Figures 12 and 13) in the month of May and (0.125 ppm) in the month of June.

Zinc

The concentration of Zinc in the water sample at Majali in the month of January was (0.076 ppm), then it increased in the month of February (0.0966 ppm) then there was a slight decrease (0.085 ppm) in the month of March (Figures 14 and 15). Then in the month of April it was (0.031 ppm). Then a slight increase in the month of May (0.085 ppm) and decreased in the month of June (0.015 ppm). The concentration of Zinc in the sediment sample was (0.875 ppm) in the month of January, then (0.321 ppm) in the month of February, then it was (0.775 ppm) in the month of March, April and May, then it was (0.05 ppm) in the month of June (Figures 16 and 17).

At Devbagh, the concentration of zinc in water sample was (0.065 ppm) in the month of January and (0.051 ppm) in the month of February and a slight increase (0.0775 ppm) in the month of March, (0.007 ppm) in the month of April and (0.0775 ppm) in the month of May and (0.012 ppm) in June (Figures 18a, 18b and 19).

In the sediment sample, the concentration of Zinc in the month of January was (0.567 ppm) and (0.3381 ppm) in the month of February. In the month of March it was (0.852 ppm), it was (1.007 ppm) in April which was the highest in all the months. It was (0.8527 ppm) in the month of May and (0.04 ppm) in June (Figure 20).

Copper

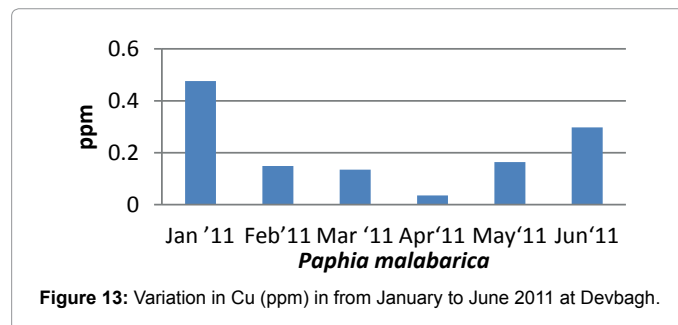
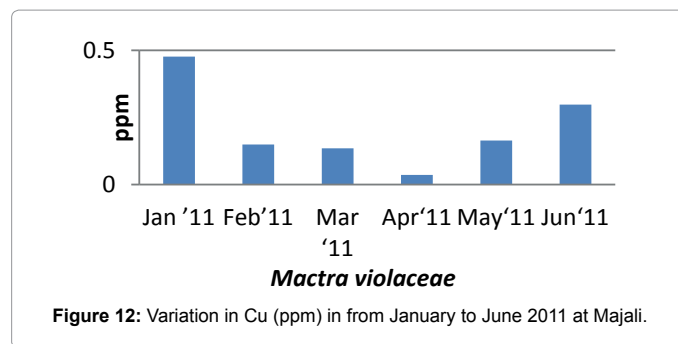
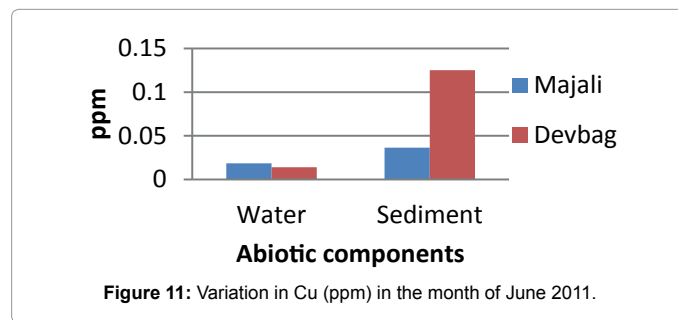
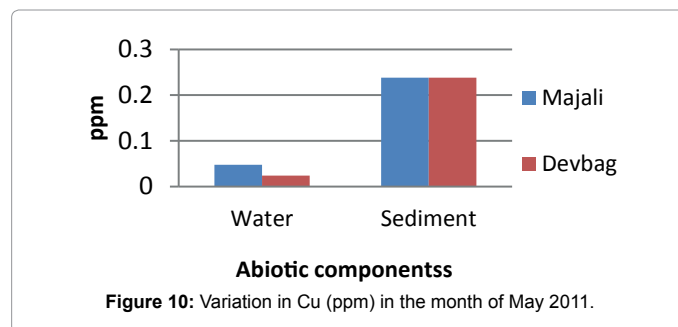
In the case of, *Paphia malabarica* of Majali area the concentration of these metals were very high compared to water and sediment samples.

In the case of Copper, It was (0.04 ppm) in the month of January, (0.14 ppm) in the month of February, it was (0.13 ppm) in the month of March, it was (0.13 ppm), in April it was (0.03 ppm) it was (0.16 ppm) in the month of May and it was (0.29 ppm) in the month of June.

Zinc

In the case of Zinc, the concentration was highest in the month of January (2.48 ppm) which decreased in the month of February (1.3 ppm) than it was (1.8 ppm) in the month of March and increased further in the April (2.24 ppm) it was second highest concentration recorded then it again decreased in the month of May (1.8 ppm) and was lowest in the month of June (0.4 ppm).

In *Macra violaceae*, found at Devbagh, the concentration in the month of January was (0.43 ppm) followed by (0.12 ppm) in the month of February and March then a decrease of (0.02 ppm) in the month of April and (0.1 ppm) in May and (0.2 ppm) in the month of June.



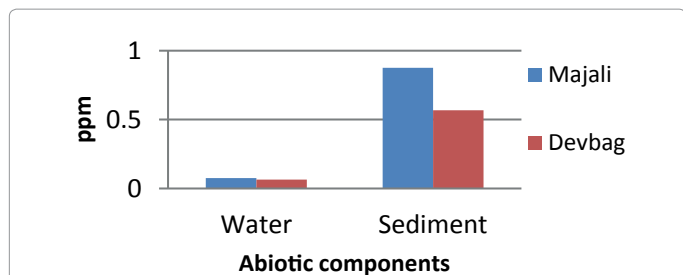


Figure 14: Variation in Zn (ppm) in the month of January 2011 at Mazali and Devbagh.

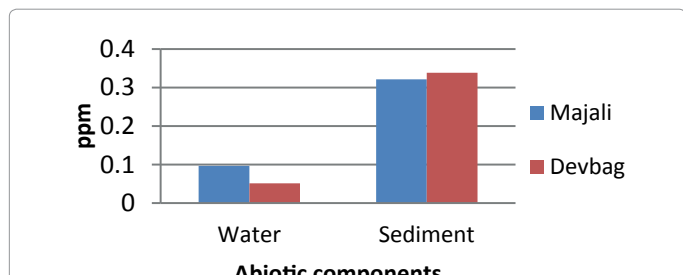


Figure 15: Variation in Zn (ppm) in the month of February 2011 at Mazali and Devbagh.

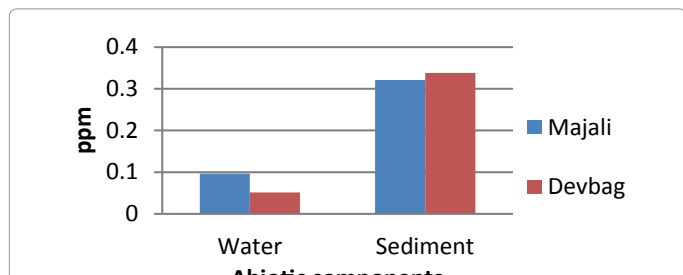


Figure 16: Variation in Zn (ppm) in the month of March 2011 at Mazali and Devbagh.

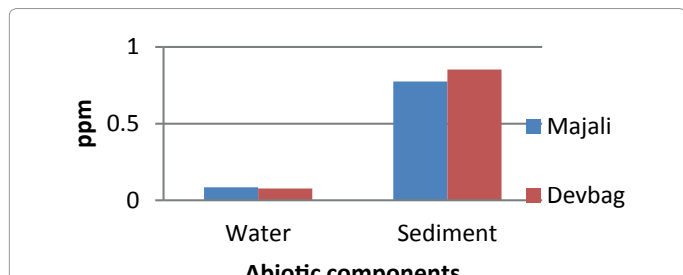


Figure 17: Variation in Zn (ppm) in the month of April 2011 at Mazali and Devbagh.

In the case of Zinc, the highest concentration was observed in the month of January (2.5 ppm) followed by a decrease in February (1.2 ppm) and (1.5 ppm) in the month of March and (1.8 ppm) in the month of April then an increase was noticed in the month of May (2.3 ppm) and then a decline in the month of June. Zinc can enter the water bodies from a number of sources including industrial effluents, sewage effluents and runoff (Boxall et al. 2000).

Statistical analysis

In the present study Anova was conducted in order to know the significance. At station 1, Majali, there was no significant difference for both Copper and Zinc in both water and sediment. In the case of *Paphia malabarica* a significant difference was observed in the case of copper concentration which was $0.03 < p < 0.05$ and also in the case of Zinc

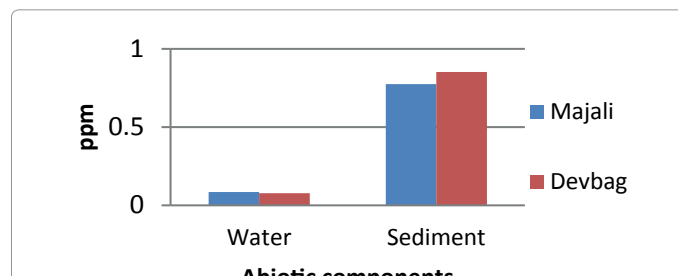


Figure 18a: Variation in Concentration of Zn (ppm) in the month of May 2011 at Mazali and Devbagh.

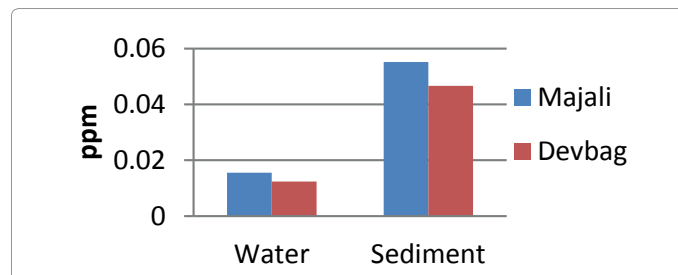


Figure 18b: Variation in Zn (ppm) in the month of June 2011 at Mazali and Devbagh.

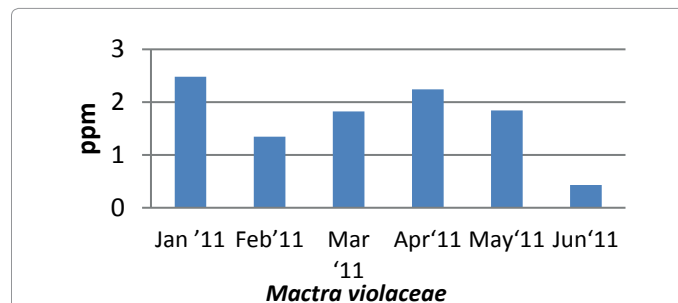


Figure 19: Variation in Zn (ppm) from January to June 2011 at Mazali.

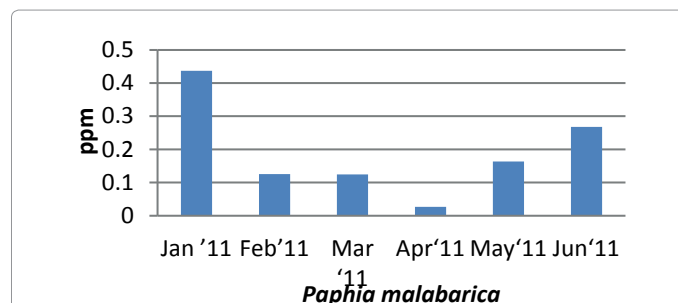


Figure 20: Variation in Zn (ppm) from January to June 2011 at Devbagh.

which was $0.001 < p, p = 0.05$. At Devbagh, no significant difference was observed in copper and zinc concentration in both water and sediment. In the case of *Macra violaceae* at Devbagh, a significant difference was observed in Copper content which was $0.043494 < p, p = 0.05$ and Zinc also showed a significant difference of $0.003469 < p, p = 0.05$.

Conclusion

The results show that there was very low concentration of said metals than permissible for Cu, Zn) concentration of Copper and Zinc in the water and sediment components, this may be because of non-availability of industries in that area. The presence of these metals may be mainly due to the anti-corrosive and anti-fouling paints used to protect the hull portion of the boat and natural activities like weathering of rocks and erosion of soils. In the case of bivalves *Paphia malabarica* and *Macra violaceae*, the concentration of Zinc is more because these organisms mainly feeds on sediments, the Zinc content is mainly present in the paints used for the protection of the hull and other domestic and electrical appliance which are discarded in to the sea after use without any prior treatments these organisms have tendency to bio accumulate.

There was observed an metal-metal interaction in some bivalves (Flower et al.).

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