

Study on the seasonal variations of trace elements in *Garra lamta* (Hamilton) from selected rivers of West Khasi Hills, Meghalaya

Abstract

***Precious Stone Iongwai
Department of Zoology
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***North Eastern Hill University
Shillong – 793 022, India***

In this study, we try to monitor the levels of trace elements (Fe, Zn, Mn, Cu, Ni and Co) in whole body of *Garra lamta* (Hamilton) keeping in view scarcity of data on this fishes. This study was designed to establish the distributions and seasonal variations of trace metals (Fe, Zn, Mn, Cu, Ni and Co), in commonly available fish species of the area and also to study the seasonal variation of trace elements and some of the important abiotic parameters like alkalinity, dissolve oxygen, pH and temperature. Correlation studies of trace elements between the two aquatic ecosystems are also studied. The objective of the baseline study of an ecological assessment is to provide adequate and accurate ecological baseline information. It is found out that all the selected elements falls well below the permissible value of World Health Organization, and the area can be regarded as pristine areas and it will not pose any threats to the biotic communities in the region.

Concentration of trace elements in the tissue of fish sample provide a time-integrated assessment of contaminant and a better understanding of the complexities of the distribution and effects of various trace elements. Trace elements can be ingested with stream bed sediment in the water column by benthic organisms and can accumulate and move through the food chain. Fishes are particularly good indicators of biologically available contaminant, because environmental contaminants can accumulates in their bodies at higher concentrations than in surrounding waters. Many trace elements concentrate in the viscera of fish such as liver and kidneys. The concentration of trace elements may vary depending on the number of factors such as the chemical properties of the elements and the fish species.

The uptake and accumulation of trace elements by organisms depends on many factors including physical and chemical form of the elements in the environment, the biological needs for specific elements or its homologue by the animal, seasons and other climatic factors such as temperature, the age of organisms, the specific tissues involved and the specific characteristic of the local ecosystem. Biological uptake is associated with metabolism which is dependent as well as function of body size, age, sex, physical conditions, metabolic rate and deposition of stable element where accumulation occurs. Hence to understand the bio accumulation and distribution of selected trace elements in this species the study was conducted under natural conditions.

In the present study it is found that over a period of two years Fe concentrations in whole body of *Garra lamta* from Kynshi River shows minimum concentrations of 29.40 $\mu\text{g/g}$ during the season of autumn in the year 2005, and maximum concentration of 95.50 $\mu\text{g/g}$ during summer season of the year 2005. Zn concentrations have minimum concentrations of 31.40 $\mu\text{g/g}$ during the season of autumn in the year 2004, and maximum concentration of 95.40 $\mu\text{g/g}$ during summer season of the year 2005. Mn concentrations have minimum concentrations of 2.37 $\mu\text{g/g}$ during the season of winter in the year 2004, and maximum concentration of 10.33 $\mu\text{g/g}$ during summer season of the year 2004. Ni concentrations have minimum concentrations of 0.20 $\mu\text{g/g}$ during the season of spring in the year 2004, and maximum concentration of 3.18 $\mu\text{g/g}$ during summer season of the year 2004. Co concentrations have minimum concentrations of 0.76 $\mu\text{g/g}$ during the season of winter in the year 2005, and maximum concentration of

1.54 $\mu\text{g/g}$ during summer season of the year 2004. Bio-accumulation factor of all the selected elements shows significant variation throughout the period of study.

In the study of trace elemental concentration in water samples of Kynshi River it is found that over a period of two years, Fe concentrations have minimum concentrations of 16.20 $\mu\text{g/l}$ during winter season in the year 2004, and maximum concentration of 75.34 $\mu\text{g/l}$ during summer season of the year 2004. Zn concentrations have minimum concentrations of 3.77 $\mu\text{g/l}$ during spring season in the year 2004, and maximum concentration of 17.86 $\mu\text{g/l}$ during summer season of the year. Mn concentrations have minimum concentrations of 12.57 $\mu\text{g/l}$ during spring season in the year 2004, and maximum concentration of 25.52 $\mu\text{g/l}$ during summer season of the year 2005. Cu concentrations have minimum concentrations of 0.39 $\mu\text{g/l}$ during winter season in the year 2005, and maximum concentration of 2.45 $\mu\text{g/l}$ during summer season of the year 2005. Ni concentrations have minimum concentrations of 2.73 $\mu\text{g/l}$ during winter season in the year 2005, and maximum concentration of 27.55 $\mu\text{g/l}$ during summer season of the year 2004. Co concentrations have minimum concentrations of 6.48 $\mu\text{g/l}$ during winter season in the year 2004, and maximum concentration of 13.58 $\mu\text{g/l}$ during summer season of the year 2004. It is found that the concentrations of all the selected elements were within the acceptable standards of WHO, and therefore at this concentration the elements will not pose any serious threat to the life of biota or man as a consumer.

Total alkalinity ranges from 16.50 to 24.00 mg/l in the sampled aquatic ecosystems. Alkalinity is, however, primarily attributed presently to methyl orange

alkalinity, which in turn is attributed to bicarbonate ions. The stated salient feature represented a characteristic attribute of acidic-circum neutral waters and also corresponded with identical results from several biotopes of N. E. India. Dissolved Oxygen of water bodies in the study areas and extent of pH variations confirmed with observations in various aquatic biotopes of the state of Meghalaya and elsewhere in Northeastern India. The variations in water temperature affirm “subtropical nature” of the sampled habitats and, in turn, also concur with the results of from subtropical environs of N. E. India.

Studies on the fecundity of *Garra lamta* from Kynshi and Rilang River in the year 2004 and 2005 it is found that at different length ranges, fish shows different fecundity, and significant highest mean fecundity was found during monsoon period. Fecundity plays a significant role to evaluate the commercial potentialities of fish stock and also be used to assess the abundance and reproductive potential of the spawning stock. At present the knowledge of fecundity has been applied for detecting the different populations of the same species of fish in different location. In this study, GSI clearly shows that *Garra lamta* has a wide spawning season (March-November) in fresh water environments of West Khasi Hills Districts of Meghalaya. This study was aimed to provide information regarding the natural background concentration of selected elements and their accumulation factor in selected fish species. Seasonal variation of all the elements and important abiotic parameters are also taken into consideration from both the study sites during the period of study. Correlation studies of trace elements between the two aquatic ecosystems also taken into consideration.

Contamination of fresh water environment by metals has risen in recent years due to the global population increase and industrial development. The distribution of heavy metals in the different components of fresh water ecosystem is regulated by physico-chemical processes, e.g. dilution, diffusion, precipitation and sorption, as well as other processes involving aquatic organisms, such as uptake and elimination. Biota is recognized as an important indicator of heavy-metal contamination of the marine environment. Fishes are used as indicators of marine pollution because they are relatively large and easily identified. Baseline surveys of the concentration of heavy metals in selected fish species have been conducted on several coasts around the world. The objective of the present study was to evaluate the background concentration and seasonal variation of selected elements in whole body of *Garra lamta* and also the seasonal variation of the selected elements from the water bodies of the two rivers. This species were selected because it has different habitats and feeding habits, and could be representative of different sources of heavy metals and also the most common fishes of the area which is consumed by the local populace.

Metals are natural constituents of the environment. At high concentrations, trace metals can become toxic for living organisms and behave as conservative pollutants. Metals enter the environment mainly by two means: (i) natural processes (for example, erosion of rocks, volcanic activity, forest fires) and (ii) processes due to human activities. Some anthropogenic activities may add considerable amounts of polluting compounds, which will influence the existing natural aquatic system. Metals are frequently released in large quantities during different processes derived from human activities and may lead to

major destruction of aquatic ecosystems. Moreover, human beings located at places contaminated by heavy metals could be especially sensitive to these contaminants due to bioaccumulation. At low concentrations, an element plays an important role in metabolic and fermentation processes, as an enzyme activator, stabilizer and functional component of proteins. It has been stated that for all trace elements that considered to be essential, including iron, there exists a fairly narrow "concentration window" between the essential and toxic levels. Iron is a moderately toxic element when compared with other transition metals. For the determination of trace metals in natural and mineral waters different Spectrochemical methods are used. However, flame atomic absorption spectrometry (FAAS) is one of the most extensively used techniques for determining various elements with significant precision and accuracy. This analytical technique is remarkable for its selectivity, speed and fairly low operational cost. However, in some cases there are many difficulties in determining traces of heavy metals in environmental samples due to insufficient sensitivity or matrix interferences. Thus, a pre concentration and/or separation step is necessary.

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