Assessing bird feathers as a biomonitoring tool for heavy metal pollution in selected ecosystems of Sri Lanka

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R L Jayaratne
Faculty of Science
University of Colombo
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ABSTRACT

Monitoring bioaccumulation of heavy metals require extraction of a tissue sample from the indicator species. Bird feathers tend to accumulate heavy metals since feathers are shed from time to time and therefore can be used as a means of removing heavy metals from the body. Therefore, use of bird feathers as a biomonitoring tool has been the focus of ecotoxicologists during the past 3-4 decades. Further, using feathers is a nondestructive method as feathers can be taken from live birds without damaging them.

Since almost all the pollutants such as agricultural and industrial effluents end up in water bodies, this study was mainly concentrated on aquatic ecosystems and study sites were selected based on climatic variations and land use patterns of each site. Since egrets are the commonest bird species encountered in variety of aquatic ecosystems it was decided to use Cattle egret (*Bubulcus ibis*), Great Egret (*Ardea alba*), Intermediate Egret (*Ardea intermedia*) and Little Egret (*Egretta gazetta*) as the model species and field observations were carried out to gather information on foraging grounds, roosts and heronries both breeding and non breeding seasons. During the preliminary investigation, a breeding migration of Cattle Egrets and nesting density variations of Great and Intermediate egret were observed. Based on this analysis, Little Egret fledgling-feathers were selected as the most suitable biomonitoring tool for Sri Lankan conditions through a thorough investigation.

In order to determine the complex relationships in movement of heavy metals through organisms and tissues, feathers, regurgitated pray items, blood and eggshells were sampled. The collected Samples were tested for Cadmium (Cd), Lead (Pb) and Arsenic (As) using Palladium Nitrate as a binding agent and a Spectra AA 220 Zeeman Atomic Absorption Spectrophotometer with a graphite tube atomizer (Varian AA 240 FS). Further, samples were tested for Mercury (Hg) using a Cold Vapor Atomic Absorption Spectrophotometer (Varian VGA-77).

Hg was the most abundant heavy metal found in the fledgling feathers of Little Egret followed by As and Cd. Although Pb was not detected in feathers except samples which were collected from CTB depot heronry Anuradhapura, it was detected in the egg shells and blood of egrets. Although Hg and As detected in low concentrations in water, they showed a clear bioaccumulation trend in most food chains and accumulated in high concentrations in fledgling feathers of Little Egrets. It is noteworthy that fledgling feathers should not be used as a biomonitoring tool to detect Pb in the environment.

A national database of heavy metal pollutants in Sri Lanka was developed in order to make available findings of this research to other researchers in this area as well as the general public and policy makers. This is available through https://fos.cmb.ac.lk/opendata/.