

Spatial and interspecific variation of accumulated trace metals between remote and urbane dwelling birds of Pakistan



Naeem Akhtar Abbasi^a, Muhammad Usman Khan^a, Veerle Leontina Bernard Jaspers^b, Muhammad Jamshed Iqbal Chaudhry^{a,c}, Riffat Naseem Malik^{a,*}

^a Environmental biology and Ecotoxicology laboratory, Department of Environmental Sciences, Faculty of Biological sciences, Quaid-i-Azam University, Islamabad, Pakistan

^b Department of Biology, Norwegian University of Science and Technology (NTNU), Trondheim, Norway

^c WWF-Pakistan, Ferozpur Road, PO Box 5180, Lahore 54600, Pakistan

ARTICLE INFO

Article history:

Received 25 June 2014

Received in revised form

30 October 2014

Accepted 25 November 2014

Available online 17 December 2014

Keywords:

Feathers

Metals profile

Pakistan

Regional differences

Birds

PCA

ABSTRACT

The current study was designed to evaluate the hypothesis that birds of urbanized and/or industrialized origin depict higher metal accumulation as compared to remote dwellers. We selected seven representative species from three families (Anatidae, Motacillidae and Sturnidae) at two different locations; Baroghil valley (remote location) and Soan valley (urbanized location) of Pakistan and analyzed the concentrations of 8 metals Pb, Cd, Cr, Ni, Cu, Mn, Fe and Zn in feathers of these species. Feathers from Soan valley which is under higher anthropogenic influence exhibited significantly ($P < 0.001$) higher metal concentrations when compared with the feathers of the same species at Baroghil valley which has negligible anthropogenic input. Terrestrial birds of the Baroghil valley revealed greater metal loads than aquatic birds while at Soan valley it was vice versa. In general, elevated concentrations of metals were recorded in insectivorous species as compared to omnivorous species. Within each location, species belonging to Anatidae and Motacillidae revealed similar metal contamination patterns. Principal component Analysis (PCA) based on correlation matrices depicted a clear tendency of metals towards the species originating from areas with greater pollution load (Soan valley) than relatively undisturbed sites (Baroghil valley) and hence corroborated our hypothesis. The pattern of metal accumulation in feathers of both the locations suggested that there may be a flux of migration between the two regions and/or trans-boundary movement of pollutants/metals, which either singly or synergistically influence the overall metal profile in the studied bird species.

© 2014 Elsevier Inc. All rights reserved.

1. Introduction

Industrial and urban expansion introduced a sudden increase of pollutants in the environment (Abbasi et al., 2014). Among these pollutants metals are getting great global concerns due to their potential harmful effects on humans, biota and the environment (Burger, 2013). Pollution through metals is notorious for its toxic, ubiquitous, non-degradable and accumulative nature (Deng et al., 2007). It is a long running proven notion that elevated concentrations of metals are affecting the exposed avifauna and hence considered as one of the important culprits behind the declining population of birds species (Dauwe et al., 2004b, 2005; Nam and Lee, 2006). Birds are susceptible to environmental pollution either from contaminated air inhalation and/or through water and

dietary intake that further bioaccumulate metal residues in different bird tissues (Seco Pon et al., 2011). Besides internal assimilation through diet during feather growth when the feather is connected to the bloodstream and metals are integrated in the keratin structure (Tsipoura et al., 2008), metals may be externally deposited on the feathers of exposed birds from the environment and/or through preening (Dauwe et al., 2003; Cardiel et al., 2011; Jaspers et al., 2004). Monitoring of pollutant concentrations using bird feathers as a matrix, has proven to be a useful tool for assessing environmental quality of aquatic and terrestrial habitats (Eulaers et al., 2011; Garcia-Fernandez et al., 2013).

In Europe and the United States metal concentrations in birds have been extensively studied for environmental quality assessments and to test the usefulness of birds as a bio indicator species (Burger, 2013; Frantz et al., 2012; Tsipoura et al., 2008). Although an elevated level of metal contamination has been reported in South Asian regions (Kim and Koo, 2007; Malik and Zeb, 2009;

* Corresponding author.

E-mail address: r_n_malik2000@yahoo.co.uk (R.N. Malik).

Deng et al., 2007; Khan et al., 2013), surprisingly little literature about metal accumulation in birds has been documented so far in south Asia, particularly in Pakistan. The studies which are reported up to date mostly focused on the use of single or similar species for metal quantifications in the local environment (Movalli, 2000; Ullah et al., 2014; Shahbaz et al., 2013). In fact, like most of the developing world, avian toxicity through metals is still of important concern to measure ecological damage and associated hazards (Khan et al., 2013).

Global literature about metal contamination in birds mostly highlighted metals assessment in different bird tissues and their toxicological impacts (Burger and Gochfeld, 2000, 2009; Movalli, 2000; Kim and Koo, 2007; Naccari et al., 2009; Lambertucci et al., 2011; Lucia et al., 2010). Nevertheless, it has been emphasized that metal accumulation in birds correlate with different features such as behavior and physiology of the species, composition of diet,

gender, breeding period, traits of life history and intensity/rate of exposure (Burger and Gochfeld, 2000; Ochoa-Acuna et al., 2002; Dauwe et al., 2005; Zolfaghari et al., 2009). However, only few studies discussed the comparative exposure pattern and behavior of a single representative species under different metal exposure conditions. A recent study on feathers of urban pigeons (Frantz et al., 2012), suggested that metal concentrations implicitly depend upon the pollution load of the bird's habitat and movements of the bird's species. It largely reflects that birds inhabiting areas with higher anthropogenic influence and pollutant exposure may accumulate higher levels of pollutants in their tissues when compared to birds residing in a less polluted environment. Individuals of the same species belonging to a similar age group and inhabiting different locations may provide a good snapshot for the correlation of metal accumulation in bird's tissues with the environmental levels. Certain bird species move a larger distance or

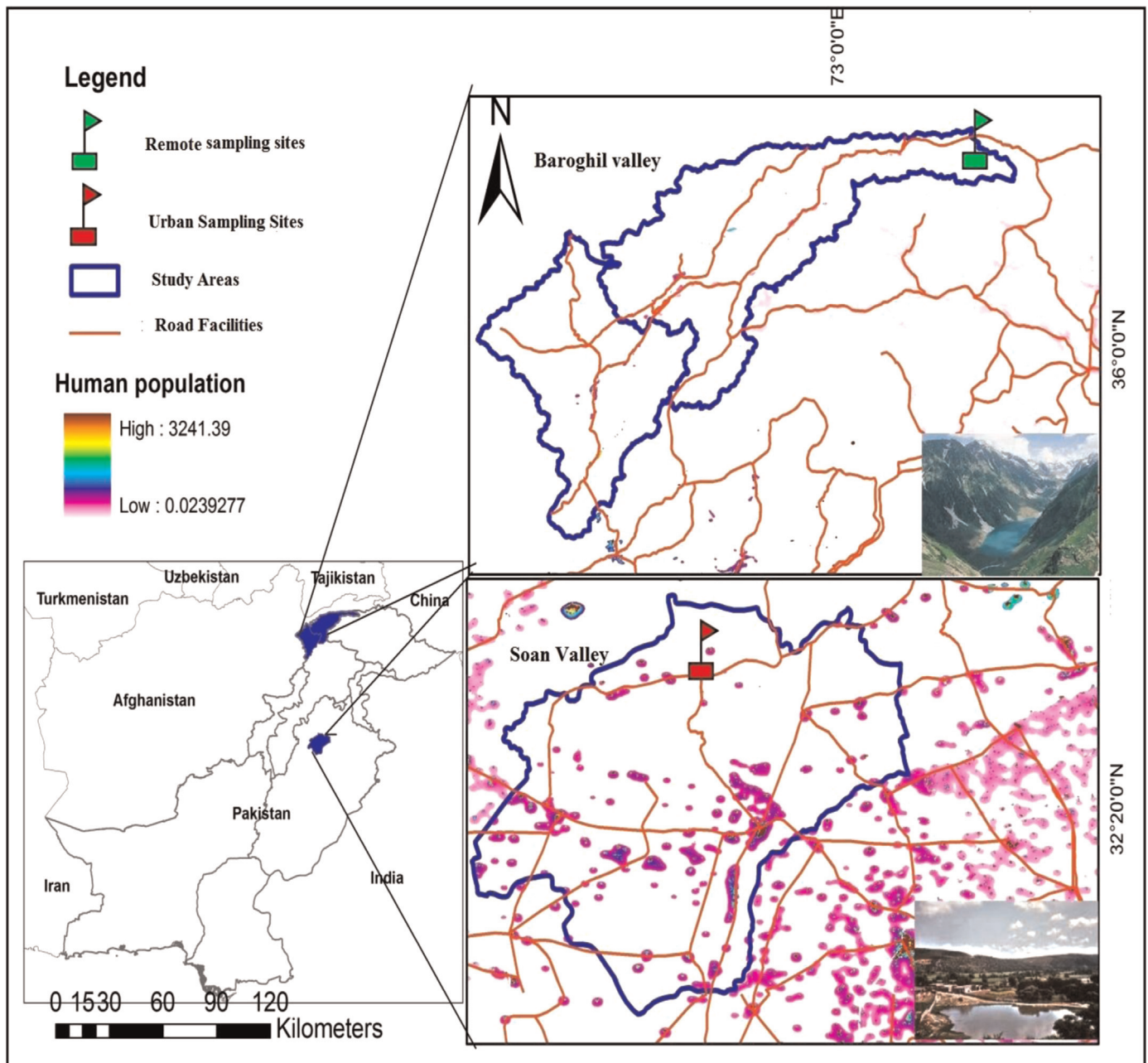


Fig. 1. Showing sampling locations and human population/settlement level. Inset pictures show Karamber Lake and tributaries (Baroghil) and Khabeki lake and its surroundings (Soan valley).

Download English Version:

<https://daneshyari.com/en/article/4419684>

Download Persian Version:

<https://daneshyari.com/article/4419684>

[Daneshyari.com](https://daneshyari.com)