

# Bioaccumulation of Trace Metals in *Meretrix lyrata* near the Saigon-Dong Nai River Estuary, Vietnam

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## INTRODUCTION

The high rate of urbanization and industrialization of provincial cities and Ho Chi Minh City (HCMC) has resulted in serious water issues in the Saigon-Dong Nai (SG-DN) River. The lyrate Asiatic hard clam *Meretrix lyrata* is one of the most important aquatic commercial products exploited in southern Viet Nam. In filter-feeding organisms like the hard clam, the metal content of tissue can be highly dependent on environmental conditions such as sediment and suspended particulate matter (SPM) and on the physiological status of individuals. This study aims to determine trace metal bioaccumulation (Mn, Fe, Co, Ni, Cu, Zn, As, Se, Cd, Hg, and Pb) in the hard clam, which feeds along the coastal areas near the Saigon-Dong Nai River estuary in southern Viet Nam. There is a need to monitor trace metal bioaccumulation in the environment and tissues of *M. lyrata*, given that it is one of the most popular seafood items in Viet Nam.



Figure 1. Study Area

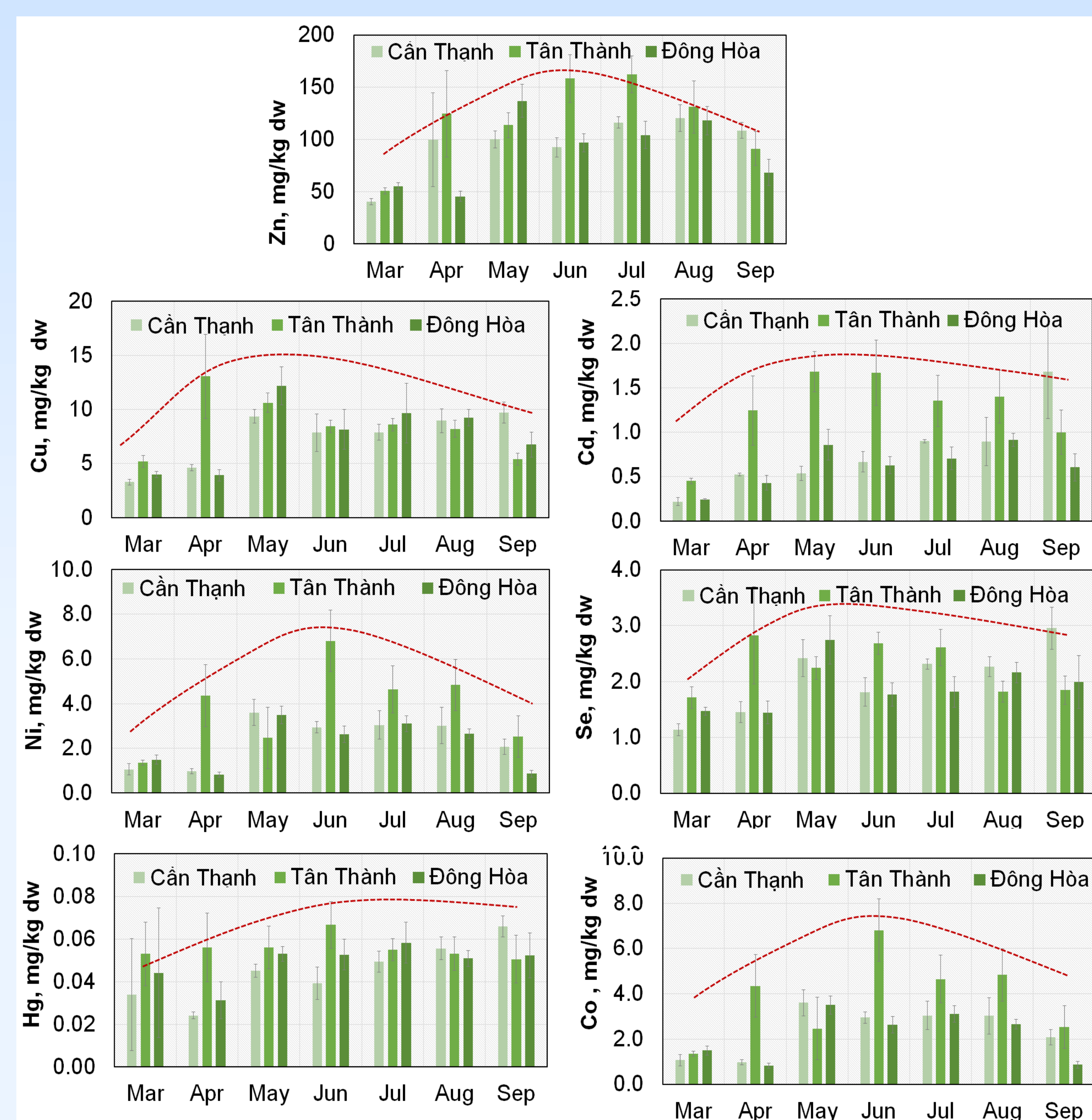
## MATERIALS AND METHODS

Suspended particulate matter (SPM), sediment and hard clam samples were collected monthly in dry (Mar.-Apr.), transition (May-Jul.), and wet (Aug.-Sep.) seasons in Southern Viet Nam from March to September 2016.

Metal concentrations (Mn, Fe, Co, Ni, Cu, Zn, As, Se, Cd, Hg, and Pb) in whole body, gills, digestive gland, and the remainder of hard clams, sediment, and SPM were analyzed by ICP-MS (Agilent 7700x Series).

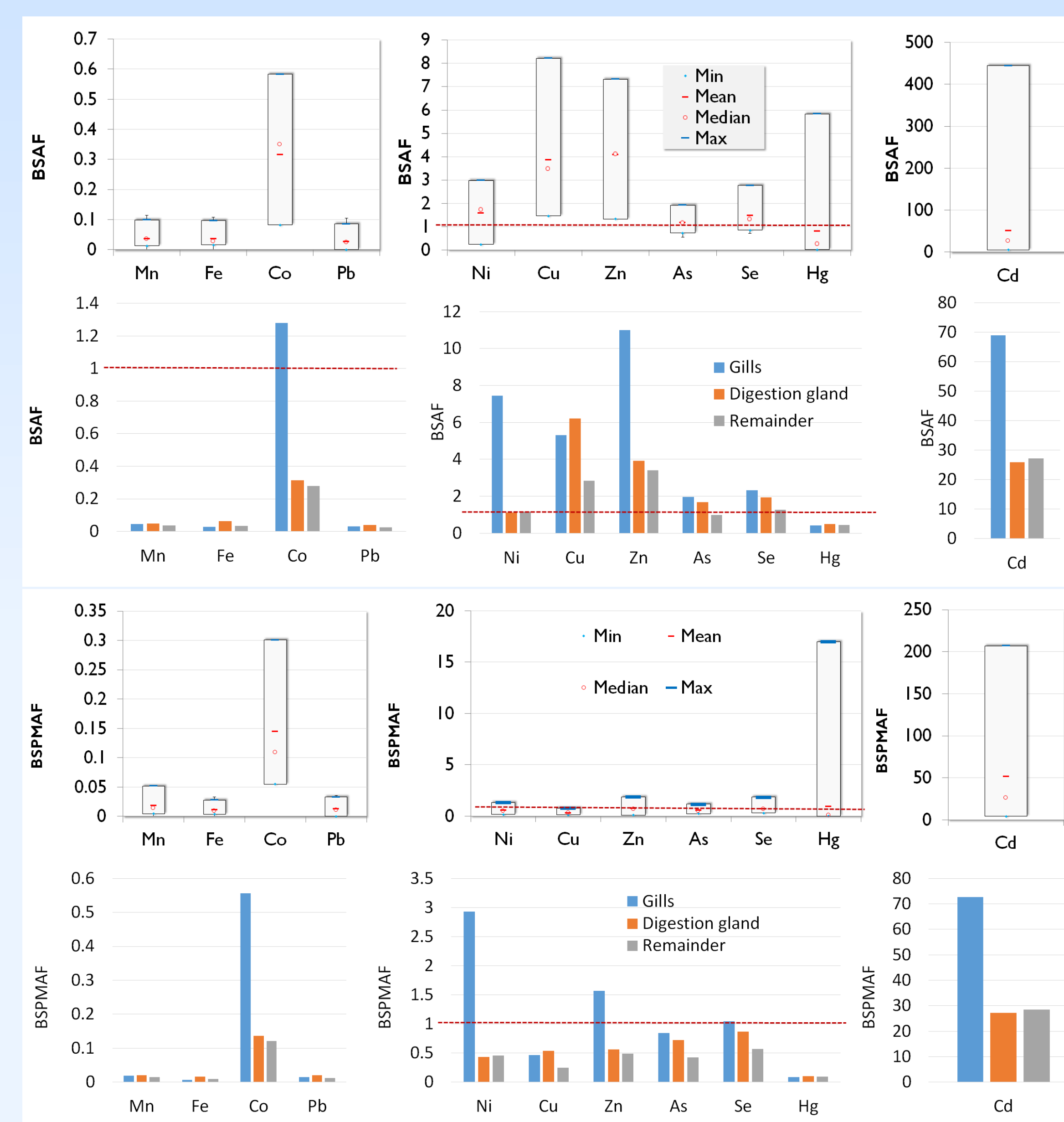
The analytical results were used to calculate: (1) bioaccumulation via the biota-suspended particulate matter accumulation factor (BSPMAF) and biota-sediment accumulation factor (BSAF); and (2) the health risk to local metal-contaminated hard clam consumers via calculation of a hazard quotient (HQ).

## METAL CONCENTRATIONS IN HARD CLAM



ANOVA results (n=94) showed that concentrations of the 7 studied metals were highest during the transition period. It is suggested that increased precipitation in May-July may mobilize metals from the terrestrial environment into the aquatic environment, and thereby increase exposure of clams to metals.

## BSAF & BSPMAF



\* The BSAF and BSPMAF for Mn, Fe, Co and Pb were below 1. This means that these metals in sediments and SPM did not accumulate in the hard clam. However, Co may accumulate in gill tissues.

\* Most of the BSAF and BSPMAF values in digestive tissues or gills were higher than in other tissues

\* The highest BSAF and BSPMAF were recorded for Cd in sediment and SPM habitats used by these clams.

\* A small number of BSAF and BSPMAF values for Hg were >1.

\* Except for Cd, all of other studied metals had BSAF values higher than BSPMAF.

## THE HAZARD QUOTIENT

The hazard quotient (HQ) was calculated as follows:  $HQ = \frac{EDI}{RfD} = \frac{C_{bivalve} \frac{dc_{bivalve}}{bw}}{RfD}$

where  $bw$  is body weight (kg);  $EDI$  is the estimated daily intake ( $\mu\text{g/kg bw/day}$ );  $C_{bivalve}$  is metal concentration in hard clam ( $\mu\text{g/g wet weight}$ );  $dc_{bivalve}$  is daily bivalve consumption = 4.97 g bivalve/capita/day (FAO estimation for Vietnamese person in 2013) (FAOSTAT, 2017);  $RfD$  is reference dose ( $\mu\text{g/kg body weight/day}$ ).  $RfD$  is equivalent to Tolerable Daily Intake and it can also be calculated from Provisional Tolerable Weekly Intake.

\*The result showed that HQ ranged in the safe limit ( $HQ < 1$ ) from 0.0002 to 0.0436

## THE MAXIMUM DAILY CONSUMPTION

Daily consumption of the lyrate Asiatic hard clam *M. lyrata* (including shell weight) by local people should not exceed:

\* Tan Thanh: 843 grams

\* Dong Hoa: 760 grams

\* Can Thanh: 777 grams

