Indian Journal of Marine Sciences
Vol. 24, June 1995, pp. 113-115

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Seasonal variations of some metals in bivalve mollusc *Sunetta scripta* from the Cochin coastal waters

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Received 16 December 1993, revised 22 February 1995

Bivalve mollusc *Sunetta scripta* is abundant in the inshore waters of Cochin and is a suitable indicator species of metal pollution. The metal load in the bivalve showed an increase during the monsoon season indicating the apparent influence of river run off and reduction in salinity in the seasonality of metal uptake. In the case of copper, the smaller individuals recorded relatively higher load than that of larger ones.

Marine pollution monitoring programme known as mussel watch envisages analyses of trace metal and pesticide load of different species of bivalves from various localities[1]. Bivalve mollusc *Sunetta scripta* is abundant in the inshore waters of Cochin. A preliminary survey carried out in May 1983, reported[2] that population density of 420 clams/m^2 was found in the inshore waters of Cochin on the west coast of India, but the densities are likely to be higher during monsoon period. The objective of this study is to understand the seasonality and body size associated variations in metal load in the body tissue of the bivalve. Information on the seasonality of pollutants is important in designing monitoring programmes using bioaccumulator species to understand the variations in toxicant levels in the area.

Samples of *S. scripta* were collected from the landing centre at Vypeen (Cochin: lat. 09°58'N; long. 76°11'E) during 1989-90. Whole body tissues of 10 animals of similar size, ere analysed for Cu, Zn, Cd and Pb by wet digestion[3,4]. The digested samples were analysed on a Perkin Elmer AAS (Model 2380) in an air-acetylene flame. The precision and accuracy of the method followed and the instrument used was evaluated by recovery studies as well as inter-calibration exercises (with National Institute of Oceanography, Goa, India).

In general, the metal load in the bivalve increased during the monsoon season (Table 1). The metal levels in molluscs are usually linked to size, sex, reproductive condition, seasonal variation and also on the available chemical form in the ambient water. Three major inter-related factors which may contribute to fluctuation of pollutants in aquatic biota are: pollutant delivery to the aquatic environment, organism physiology, particularly sexual cycle and changes of ambient water quality parameters such as temperature or salinity[5]. It is known that river run off adds to the pollution input considerably. In the present study, the location of the sample collection is just outside the Cochin bar mouth. The changes in salinity and temperature are reported to be closely involved in the process of metal availability in water and intake by bivalves. The influence of salinity in the seasonality in this case is apparent since all the four metals studied showed significant increase in the metal load during monsoon season. (Cu: May-July; Zn: July-Nov.; Cd: July-Oct.; Pb: Nov.). In case of Cu, the smaller individuals recoreded relatively higher load than that of the larger ones (Table 2). However, the levels of all the four metals in *S. scripta* were much below the levels recommended for seafood for human consumption.

A review of copper in marine organisms indicated that, molluscs contained more copper in tissues and soft parts than any other group including plants,

Table 1—Metal levels in bivalve *Sunetta scripta*

Months	Metals (±SD) (μg/g wet weight)			
	Cu	Zn	Cd	Pb
Jan. 1989	5.15±0.70	19.86±0.94	0.18±0.10	0.26±0.11
Feb.	5.07±0.15	22.07±0.37	0.27±0.01	0.56±0.06
March	4.99±0.02	20.27±0.42	0.18±0.05	0.27±0.07
May	6.74±0.25	21.18±0.82	0.27±0.005	0.26±0.11
July	6.80±0.90	22.45±0.05	0.28±0.01	0.35±0.05
Aug.	4.28±0.06	21.57±0.10	0.22±0.005	0.25±0.05
Sept.	4.22±0.22	26.13±2.18	0.30±0.05	0.44±0.17
Oct.	6.15±0.02	30.07±0.90	0.31±0.09	0.33±0.26
Nov.	2.21±0.06	33.48±1.13	0.21±0.03	0.61±0.06
Jan. 1990	6.11±0.24	32.40±2.65	0.36±0.01	0.44±0.02

n = 10 nos. of similar size and analysed in duplicate.

Table 2—Metal levels of *Sunetta scripta* in relation with size variations (10 samples in each size and analysed in duplicate)

Month	Size	Metals (μg/g wet weight)			
		Cu	Zn	Cd	Pb
Feb. 1989	L S	3.73±0.41	46.71±0.26	1.35±0.04	0.75±0.05
	S S	5.07±0.15	22.07±0.37	0.27±0.01	0.56±0.06
March 1989	L S	3.89±0.60	43.24±0.38	1.50±0.16	0.75±0.22
	S S	4.99±0.02	20.27±0.42	1.18±0.05	0.27±0.07
May 1989	L S	4.13±0.23	51.83±1.48	1.14±0.06	0.41±0.16
	S S	6.74±0.25	21.18±0.82	0.27±0.005	0.26±0.11
July 1989	L S	5.41±0.59	37.25±0.45	1.70±0.01	0.31±0.11
	S S	6.80±0.90	22.45±0.05	0.28±0.01	0.70±0.20
Aug. 1989	L S	3.72±0.45	35.92±1.4	0.96±0.08	0.28±0.01
	S S	4.28±0.06	21.57±0.10	0.22±0.005	0.25±0.05

L S = Large aize (32.43 mm average); S S = Small size (8.31 mm average)

other invertebrate groups or vertebrates[6]. It is also reported that copper accumulations, or rates of accumulation varied with age of the organism, but even within the same species the pattern was not always predictable[7]. Decreasing copper content and increasing body weight were documented for clams *Pittar morrhauana*[7] and *Mercenaria mercenaria*[8]. But copper was positively correlated with increasing body weight for bivalve molluscs including *Mytilus edulis*, *Mercenaria mercenaria* and *Venusupis decassuta*[10]. It was proved that differences in rate of availability may not drastically influence the pattern of distribution of heavy metals over the various tissues, but it can significantly increase the quantity accumulated in each tissue[11].

Variations in zinc content of soft tissues from individual shellfish species have been correlated with seasonal, as distinct from thermal regimes[12,13]. In general, bivalve molluscs residing in comparatively saline waters contained reduced zinc concentrations in their tissue while those from lower salinity waters contained more zinc. But salinity of the medium was not an important factor governing uptake of zinc in mussels *Mytilus edulis*[14]. However, zinc content of marine molluscs tends to correlate positively with particulate matter produced as a result of dredging operations[16]. The location of the station from which samples are collected for the present study is exposed to dredge spoil deposited off Cochin regularly.

The salt content of the medium was inversely associated with Cd body burdens[7]. At low salinities, comparatively high Cd residues were measured in *M. edulis*[14] and *M. mercenaria*[9]. There appears to be considerable temperature salinity-Cd interactions in *M. edulis*[14]. It was also observed that the presence of other metals in solution such as Zn, Pb and Cu had no effect on the individual net uptake of Cd from the medium by mussels[14].

Temperature of the ambient seawater made little difference in Pb residues in mussel *M. edulis*[14]. However, the salinity of the medium significantly affected Pb residues, with high Pb concentrations reported in mussels from lower salinity waters[14]. The high Pb levels in mussels from low salinity waters are not correlated with higher levels of Pb in water, but attributed to the biological availability of Pb, which exists primarily in particulate form in seawater[15]. It is significant to note that higher levels of Pb load was observed in the bivalve may be due to the above said factor.

The apparent selectivity for Pb and other metals among various molluscan species largely depends upon its availability in the environment, its chemical and physical properties, the kind of number of ligands available for chelation, its transport, storage and the stability of the complex formed[7].

Bivalves are known for their capability of acting as efficient time integrated indicators of various metals over a wide range of environmental conditions[14]. From the present study it is apparent that *S. scripta* possesses the requisite features to be used as a bioaccumulator for metal pollution monitoring programme.

Authors thank Dr P S B R James, former Director for his encouragement in the investigations and to Dr M S Rajagopalan for his helpful suggestions.

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