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Seasonal variation of Zinc and Sodium in different ea weeds at selected locations of Kollam Seacoast, Kerala State

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I. INTRODUCTION

stal and marine environments throughout the world suffer from high pollution caused by the humans. y metals are considered major anthropogenic contaminants in the coastal and marine environments ghout the world (Ruilian et al., 2008). They are a serious threat to living organisms and natural stems due to their toxicity (DeForest et al., 2007). Heavy metals can contribute to the degradation of e ecosystems by reducing the diversity of species and through the accumulation of metals in living sms and food chains (Hosono et al.,2011).Seaweeds contribute a key role in the nutrient dynamics of al systems as well as reflect alterations in water quality efficiently. Therefore, every change in the nature e dynamics will likely be reflected by them (Zbikowski et al., 2007).Seaweeds are excellent agents of g the metals like arsenic, zinc, iron, nickel and mercury from seawater. They remove the toxic als from the environment and accumulate in the body cell. The absorption of metals present in the ed depends on the surface reaction in which metals absorbed through electrostatic attraction to es sites. This is independent of factors influencing metabolism such as pH, temperature, light or age of ast, but it is inclined by the virtual abundance of elements in water (Sanchez-Rodriguez et al., 2001). owledge of trace metals levels in marine algae is a basic requirement for their use as biological rs of metal pollution.

ce, this study was conducted to assess the level of trace metals found in the different species of eds collected from the coastal areas of Kollam District of Kerala.

II. MATERIALS AND METHODS

ples were collected seasonally from coastal areas of Kollam district from January 2006 to December . Trace elements such as zinc in the algae collected from this area was determined by using the Atomic ption Spectrometer while, sodium was determined by flame photometry. For the determination of e elements, the algal samples were dried and powdered, and carefully digested with 10ml of a 5:1 of nitric acid and perchloric acid. The digested matter was extracted with water filtered and made up d. The filtrate was used for analysis. Sample solutions were directly aspirated in to the flame and the concentration in the digest was measured. Standards and blanks were also prepared and read wher necessary. All the analyses were performed in duplicate.

III. RESULTS AND DISCUSSION

There were 19 species of seaweeds which included 7 species (Chaetomorpha Chaetomorphaantemina EnteromorphaLinza, Enteromorphaintestinalis Ulvalactuca, Ulvafascia Calulerpataxifole.) from Chlorophyceaeae, 9 species (Ceramium, Gracilariacerticata, Gracilaria Hypneavalantea, Centroceros, Hypnea, Spongomorpha, Valanopsispanchenema and Spongomorpha from Rhodophyceae and 3 species (Chnoosporafastigata, Sargassamlilicifolium, Sargassum Phyeophyceae collected from 6 stations for analysis of Heavy metals concentration. The metal concentra in the collected seaweeds are tabulated below:

Table no 1: Monthly variation of Zinc content in seaweeds at different station at Kollam district du 2006.

Zn (mg/g)	Name of the Algae	Jan	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DE
SITEA	CHLOROPHYCEAE												
	CHAETOMORPHA MEDIA	6.58	8.76	7.38	8.02	9.23	9.02	–	8.93	9.57	[illegible]	[illegible]	[illegible]
	CHAETOMORPHA ANTEMINA	–				8.25	–	–	–	–			
	ULVA LACTUCA	7.92	8.71	8.02	9.52	9.44	–	–	–	5.44	[illegible]	[illegible]	[illegible]
	ULVA FASCIATA	5.41	5.63	6.28	–	–	–	4.28	7.21	9.65	[illegible]	[illegible]	[illegible]
	RHODOPHYCEAE												
	CERAMIUM	7.37	6.82	7.50	–	–	6.72	6.59	6.73	5.95	–	–	[illegible]
	GRACILARIA CERTICATA	8.02	7.82	8.03	8.08	–	–	8.02	7.68	8.14	[illegible]	[illegible]	[illegible]
	GRACILARIA	5.72	6.48	–	–	–	7.42	8.87	7.73	7.42	[illegible]	[illegible]	[illegible]
	HYPNEA VALANTEA			–	–	–	6.45	7.80	6.21	7.03	[illegible]	[illegible]	[illegible]
	CHNOOSPORA FASTIGATA	4.80	5.40	–	–	6.03	7.53	–	–	4.01	[illegible]	[illegible]	[illegible]
SITEB	CHLOROPHYCEAE												
	CHAETOMORPHA MEDIA	7.02	8.31	8.62	8.05	–	–	–	8.19	9.02	[illegible]	[illegible]	[illegible]
	CHEATOMORPHA	7.93	7.48	8.53	9.34	–	–	–	9.01	4.83	[illegible]	[illegible]	[illegible]
	ULVA LACTUCA	9.80	7.53	5.25	5.78	4.68	–	–	–	–	[illegible]	[illegible]	[illegible]
	ULVA FASCIATA	7.45	7.89	8.34	7.98	–	8.74	7.81	8.96	9.34			
	RHODOPHYCEAE												
	CENTROCEROS	6.32	6.87	5.19	–	–	–	–	5.86	6.73	[illegible]	[illegible]	[illegible]
	CERAMIUM	5.78	6.93	5.20	5.40	–	–	7.09	8.03	7.67	[illegible]	[illegible]	[illegible]
	GRACELAREA CERTICATA	6.34	6.96	8.29	–	9.18	8.62	8.30	7.08	7.29	[illegible]	[illegible]	[illegible]
	HYPNEA VALANTEA	–	9.23	–	–	–	–	7.34	7.45	8.59	[illegible]	–	[illegible]
	HYPNEA	–	9.28	–	–	–	–	–	–	–	7.34	[illegible]	[illegible]
	SPONGOMORPH	–	–	–	9.85	–	7.25	8.65	8.14	7.89	–	–	[illegible]
	VALANOPSIS PANCHENEMA	–	–	–	–	–	–	–	–	8.60	6.35	[illegible]	[illegible]
	PHEOPHYCEAE												
	CHNOOSPORA FASTIGATA	–	–	–	9.24	–	11.25	–	–	7.89	[illegible]	[illegible]	[illegible]
	SARGASSAM LILICIFOLIUM	7.08	–	–	–	–	–	–	6.34	7.52	[illegible]	[illegible]	[illegible]
SITEC	CHLOROPHYCEAE												
	CAULERPA TAXIFOLEA	4.78	4.09	5.98	9.30	–	–	–	–	–	–	[illegible]	[illegible]

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CHEATOMORPHA MEDIA	7.13	8.29	8.32	7.67	–	–	5.83	7.82	9.58	9.32	–	–
ENTEROMORPHA INTESTINALIS	8.57	9.22	9.47	7.83	–	–	11.49	10.00	–	–	–	–
ULVA LACTUCA	8.43	–	–	9.56	–	9.37	–	10.20	10.54	10.24	11.12	10.82
ULVA FASCIATA	7.45	8.54	–	–	9.03	–	10.99	11.67	–	10.22	9.23	10.45
RHODOPHYCEAE												
CERAMIUM	–	–	–	–	5.68	6.17	7.47	8.82	–	–	–	–
GRACILAREA CORTICATA	7.85	5.98	–	–	–	4.32	11.25	10.56	7.32	4.74	6.33	4.02
HYPNEA VALANTEA	9.78	10.42	12.30	10.50	–	–	–	–	–	8.43	6.38	8.95
VALANOPSIS PANCHENEMA	–	–	–	–	8.41	7.49	9.34	8.53	7.85	–	–	–
PHEOPHYCEAE												
CHNOOSPORA FASTIGATA	–	–	–	–	–	–	–	–	8.93	10.21	9.42	8.87
CHLOROPHYCEAE												
CAULERPA TAXIFOLEA	4.76	5.45	–	8.71	–	–	–	–	–	5.87	6.43	8.56
CHEATOMORPHA MEDIA	5.23	6.49	6.32	7.34	–	–	–	8.91	11.02	10.87	9.54	10.69
ENTEROMORPHA INTESTINALIS	4.79	5.29	5.38	6.87	7.14	–	7.77	6.18	8.93	7.39	8.98	9.32
ULVA LACTUCA	7.35	8.87	–	–	–	3.80	–	8.69	9.04	9.63	8.64	10.47
ULVA FASCIATA	4.67	5.78	4.87	4.25	5.78	–	–	–	7.54	7.04	8.63	9.65
RHODOPHYCEAE												
CERAMIUM	–	–	6.38	4.85	4.62	5.96	–	–	–	–	–	–
GRACELAREA CERTICATA	8.87	7.44	9.51	–	–	–	8.93	7.67	8.58	10.65	11.60	10.68
SPONGOMORPHA INDICA	–	8.65	–	–	9.52	–	8.82	8.90	9.34	7.68	8.03	7.54
SPONGOMORPH	–	6.81	5.48	6.89	–	–	9.58	8.32	9.31	–	–	–
VALANOPSIS PANCHINEMA	8.42	7.44	8.34	9.33	–	–	–	–	6.28	7.89	7.03	8.49
PHEOPHYCEAE												
SARGASSUM	9.32	8.97	9.34	–	–	–	–	8.51	7.39	9.56	9.36	10.32
CHLOROPHYCEAE												
CHEATOMORPHA MEDIA	9.36	9.87	10.26	9.33	–	–	–	4.71	5.62	4.89	7.23	6.58
ENTEROMORPHA INTESTINALIS	4.23	4.75	4.08	5.98	3.20	7.42	–	–	–	9.61	8.12	9.82
ULVA LACTUCA	11.12	–	–	–	9.34	8.34	11.85	10.48	10.04	11.36	8.71	9.03
ULVA FASCIATA	4.76	5.87	5.98	–	–	–	–	11.20	9.83	6.13	4.88	4.31
RHODOPHYCEAE												
CERAMIUM	4.05	5.21	5.10	6.70	–	–	–	–	–	2.35	4.27	3.64
GRACELAREA CERTICATA	3.98	5.72	5.22	–	–	7.42	6.84	–	–	8.27	7.58	8.03
HYPNEA VALANTEA	7.35	8.95	9.38	10.17	–	–	10.08	–	–	9.54	8.55	7.17
VALANOPSIS PANCHINEMA	8.94	9.32	9.07	10.40	–	–	–	–	–	7.39	7.04	8.72
PHEOPHYCEAE												
CHNOOSPORA FASTIGATA	11.05	10.34	11.52	7.11	–	–	–	–	–	7.54	8.63	11.80
CHLOROPHYCEAE												
ENTEROMORPHA LINZA	9.24	8.13	8.09	–	–	–	–	9.83	10.93	10.62	11.67	11.58
ENTEROMORPHA INTESTINALIS	4.73	5.22	10.00	7.35	–	6.51	7.96	9.32	5.81	3.78	4.34	5.01

Table no 2: Monthly variation of sodium content in seaweeds at different stations at district during 2006.

Sodium	Name of the Algea	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	[illegible]
SITE A	**CHLOROPHYCEAE**												
	CHEATOMORPHA MEDIA	0.66	0.86	0.81	–	1.48	1.73	1.22	0.68	0.91	0.76	[illegible]	[illegible]
	CHACTOMORPHA ANTEMINA	0.83	0.15	0.73	0.82	1.34	1.22	–	–	1.13	[illegible]	[illegible]	[illegible]
	ULVA LACTUCA	1	1.23	0.51	0.57	1.73	–	–	–	1.46	[illegible]	[illegible]	[illegible]
	ULVA FASCIATA	0.88	0.91	1.01	1.43	–	–	1.3	1.44	2.32	[illegible]	[illegible]	[illegible]
	RHODOPHYCEAE											[illegible]	[illegible]
	CERAMIUM	1.2	1.03	0.46	0.73	0.81	1.18	1.24	–	–		[illegible]	[illegible]
	GRACILARIA CERTICATA	1.06	1.48	0.37	2.31	2.26	1.73	1.22	1.28	1.64	[illegible]	[illegible]	[illegible]
	GRACILARIA	0.81	0.73	–	–	–	1.49	2.37	2.08	1.99	[illegible]	[illegible]	[illegible]
	HYPNEA VALANTEA	–	0.48	0.79	–	–	0.67	0.73	0.84	1.09	[illegible]	[illegible]	[illegible]
	PHAEOPHYCEAE												
	CHNOOSPORA FASTIGATA	1.29	1.66	2.07	1.5	0.65	–	–	–	1.33	[illegible]	[illegible]	[illegible]
	SARGASSAM LILICIFOLUM	1.39	–	1.76	1.49	0.6	1.13	1.29	2.09	–	[illegible]	[illegible]	[illegible]
SITE B	**CHLOROPHYCEAE**												
	CHEATOMORPHA MEDIA	0.87	0.56	0.73	1.25	1.09	–	–	1.28				[illegible]
	CHEATOMORPHA	1.7	1.19	2.01	2.19	2.65	–	–	0.71	0.81	[illegible]	[illegible]	
	ENTERO MORPHA LINZA	1.49	1.66	1.82	0.69	0.73	0.72	2.31	2.66	1.01			
	ULVA LACTUCA	0.32	–	0.47	1.86	0.79	–	–	1.99	2.34	[illegible]		
	ULVA FASCIATA	1.69	1.43	1.05	0.82	–	0.8	0.73	0.49	–	[illegible]	[illegible]	
	RHODOPHYCEAE												
	CENTROCEROS	2.08	2.11	1.93	1.47	0.49	–	–	0.73	0.47	[illegible]	[illegible]	[illegible]
	CERAMIUM	1.15	1.05	1.28	0.45	–	1.21	0.64	0.68	0.65	[illegible]	[illegible]	[illegible]
	GRACELAREA CERTICATA	1.25	0.95	0.61	0.64	1.91	0.94	0.48	–	1.73	[illegible]	[illegible]	[illegible]
	HYPNEA VALANTEA	1.96	2.06	2.84	3.22	2.72	1.54	0.99	–	–	[illegible]	[illegible]	[illegible]
	HYPNEA	1.91	3.08	2.5	2.14	3	2.6	1.29	–	–	[illegible]	[illegible]	[illegible]
	SPONGOMORPH	1.6	1.64	0.76	0.71	0.85	0.92	1.27	1.36	1.49	[illegible]	–	
	VALANOPSIS PANCHENEMA	1.95	1.46	1.665	1.8	0.94	0.64	0.73	0.46	1.01		–	[illegible]
	PHAEOPHYCEAE												
	CHINOOSPORA FASTIGATA	–	–	1.2	1.09	–	1.82	0.94	1.94	2.22	[illegible]	[illegible]	–
	SARGASSAM LILICIFOLUM	1.5	1.33	0.59	0.86	0.73	0.49	1	–	–		[illegible]	[illegible]
SITE C	**CHLOROPHYCEAE**												
	CAULERPA TAXIFOLEA	1.9	1.69	2.05	–	2.33	2.51	1.26	1.67	1.35		–	[illegible]
	CHEATOMORPHA MEDIA	2.06	–	1.64	1.49	2.3	2.11	1.83	–	1.06	[illegible]	[illegible]	[illegible]
	ENTEROMORPHA INTESTINALIS	–	0.99	–	–	1.27	1.64	1.38	1.43	0.68	[illegible]	–	[illegible]
	ULVA LACTUCA	0.72	0.95	0.48	0.77	–	1.77	–	1.38	1.103	[illegible]	[illegible]	[illegible]
	ULVA FASCIATA	2.5	1.94	1.28	1.49	0.47	0.656	1.84	1	–	[illegible]		–
	RHODOPHYCEAE												
	CERAMIUM	2.6	1.26	–	1.015	0.62	1.15	2.05	0.39	0.98	[illegible]	[illegible]	
	GRACELAREA CERTICATA	0.82	1.2	–	–	0.65	2.04	1.9	2.58	–	[illegible]	[illegible]	[illegible]

YPNEA VALANTEA	1.25	1.54	0.45	1.12	1.56	1.88	2.08	-	-	2.485	2.9	2.65
VALANOPSIS PANCHINEMA	1.64	1.69	0.5	0.94	0.96	0.73	0.97	1.36	1.95	-	-	1.2
PHAEOPHYCEAE												
NOOSPORA FASTIGATA	1.88	0.95	0.94	0.732	-	-	0.15	1.2	2.06	2.39	2.13	1.3
CHLOROPHYCEAE												
CAULERPA TAXIFOLEA	1.25	1.64	1.93	0.46	0.64	-	-	1.71	1.69	1.52	1.24	0.68
CHEATOMORPHA MEDIA	0.56	0.87	0.99	-	0.34	0.72	1	-	1.6	-	1.2	1.6
ENTEROMORPHA INTESTINALIS	0.64	0.88	0.91	-	0.74	-	1.93	-	-	1.28	1.64	-
ULVA LACTUCA	0.65	0.541	0.52	-	-	1.53	0.48	0.41	0.37	0.77	-	-
ULVA FASCIATA	0.29	0.61	1.3	-	0.6	-	-	-	1.91	1.02	1.42	
RHODOPHYCEAE												
CERAMIUM	0.169	0.25	0.45	0.19	0.11	0.258	-	-	0.71	0.17	0.21	-
GRACELARE/ CERTICATA	0.184	0.251	0.56	0.34	-	-	0.43	0.73	0.81	0.17	1.42	-
SPONGOMORPHA INDICA	-	0.64	0.28	0.37	2.79	0.5	0.72	1.23	1.3	-	-	1.63
SPONGOMORPH	-	0.71	0.73	1.08	-	-	0.82	1.24	1.39	1.43	1.61	-
VALANOPSIS PANCHINEMA	0.94	0.86	0.72	0.35	1.16	-	-	1.34	-	-	1.48	1.5
PHAEOPHYCEAE												
SARGASSUM	2.64	2.4	2.7	2.64	2.06	-	-	1.84	1.3	-	-	2.47
CHLOROPHYCEAE												
CHEATOMORPHA MEDIA	1.52	1.24	0.74	-	0.7	1.29	2.1	-	1.27	1.02	2.24	-
ENTEROMORPHA INTESTINALIS	0.68	-	-	0.67	1.29	1.61	0.94	-	-	1.37	1.28	-
ULVA LACTUCA	1.03	1.48	1.37	0.84	0.73	0.8	0.95	0.38	-	0.65	0.73	-
ULVA FASCIATA	-	1.08	1.23	-	1.64	1.44	0.87	1.96	1.18	0.94	1.66	-
RHODOPHYCEAE												
CERAMIUM	1.3	0.5	-	-	0.67	0.94	0.92	0.33	0.48	-	-	0.58
GRACELARE/ CERTICATA	1.49	1.96	2.05	1.6	0.8	0.67	-	-	1.28	2.32	2.22	-
HYPNEA VALANTEA	2.09	2.11	1.96	0.77	-	-	1.16	1.07	0.55	-	0.9	0.83
VALANOPSIS PANCHINEMA	1.03	0.87	0.81	0.66	0.73	0.86	-	-	-	-	1.29	1.44
PHAEOPHYCEAE												
CHNOOSPORA FASTIGATA	1.76	1.29	1.34	0.64	0.94	-	0.62	0.35	0.38	1	2.54	2.78
CHLOROPHYCEAE												
ENTEROMORPHA LINZA	-	1.37	1.94	-	-	2.04	2.4	2.88	1.25	1.65	1.56	-
ENTEROMORPHA INTESTINALIS	1.01	0.97	0.25	1.35	-	0.63	1.32	1.2	-	-	2.09	2.3

e observations thus throw light on the efficient metal uptake by various seaweeds. This also explain onal variation of the mineral concentration in aquatic biota may be due to seasonal fluctuation in ts and changes in physical chemical characteristics of the surrounding water. The algae may be vantages due to metabolic uptake and continuous growth. Marine macroalgal accumulate trace om solution and for this reason, they have been used extensively as biomonitors of metal ation of sea water (Topcuoglu., 2003). Besides the available metal concentration in the ambient ther factors such as water conditions, the stages of development and variation in growth and al composition of the algae may influence the pattern of accumulation. The accumulation of metals in algae occurs by different mechanism depending on the algae specie, metal, ambient solution conditio the like (Greene and Bedell, 1990). These include intracellular accumulation of metals by active biologi transport, intracellular chelation by biological polymers, accretion or precipitation of the metals on the wall surface and adsorptive surface binding to various cell wall chemical function group including am phosphate, thiol, sulphate, carboxylate, imidazole or other groups associated with various biopolymers fo in the cell wall. Thus the present study was effective in find out the use of seaweeds as a good bio-sor for heavy metals.

IV. CONCLUSION

Heavy metal contamination in water bodies is harmful to plants and animals. It has now become cruc find an effective biosorbent that can uptake harmful trace metals from water bodies. The present s revealed that the various seaweeds collected from Kollam coastal areas could take up metal such as zinc sodium. Thus these seaweeds can be considered as efficient tools for the removal of heavy metals f contaminated aquatic bodies due to its large abundance and easy accessibility.

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