HEAVY METAL CONCENTRATIONS IN THE DEEP–WATER SHRIMP *ARISTEUS ANTENNATUS* (RISSO, 1816) FROM WEST MEDITERRANEAN (SE SPAIN)

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Mercury, Cadmium, Lead, Copper and Zinc concentrations have been determined in the deep–water shrimp *A. antennatus* (Risso, 1816). Males and females of different size classes were analyzed separately and were sampled from Cabo de Palos and Aguilas, two areas of the coast of Murcia (SE Spain). A high correlation has been found between Hg concentrations and length for females. We have tried to relate the results with biological factors of the species. Specimens were collected in 1991 by commercial bottom–trawl gear seasonallly from April to November from the two sites. Individual shrimps were measured (cefalotorax length), weigthed and dissected. Sex of the specimens was also recorded in the basis of external morphological characteristics. The total number of samples analyzed was 26 corresponding to 193 individuals : 79 males and 114 females. Analyses were performed separately for males and females. All procedures employed in sample preparation and chemical analyses were the usual at the laboratory and have been described before by GUERRERO *et al.* (1988). The concentrations of heavy metal determined for the different areas, year, sex and length of the shrimps are summarized in table I. No significant differences for all metals were found between sites for a given sex and length. Significant differences ($p < 0.05$) in the concentration of mercury between one year old females (Lc = 25 mm) and four year old (Lc > 54mm) were found. The linear correlation coefficient between Hg concentration in muscle of the shrimps and their length was 0.88 and the determination coefficient shows that the model explains the 78% of the variation found. This pattern of correlation in the case of mercury has been observed in many fish species, mollusca, crustaceans and marine mammals.

It is well known that a number of biotic and abiotic factors can influence the accumulation of trace metals in marine organisms. It is considered unlikely that in this case the levels are affected by environmental factors as discharges from coast, or salinity and temperature of the surrounding waters as they can be considered constant at the depth were the samples were taken. The highest concentrations for cadmium, copper, zinc and mercury were found in November, immediately after spawing when the lipidic and proteic body burden and gonadal composition are lowest (MARTÍNEZ–BAÑOS and ROSIQUE, 1994). This is in accordance also to MANCE (1987), who have reported the occurrence of highest heavy metal concentrations in tissue immediately after spawing. In males the seasonal variations follows the same pattern than in females but no correlation can be established as there is no seasonality in the spawing, and adult males can be found during the whole year (MARTÍNEZ–BAÑOS *et al.* 1992). The high concentrations found in females can be due to their longer life cycle and bioaccummulation period. Generally females can live one year more than males (DEMESTRE, 1990). There are no previous studies taking sex and size of the animal and season of the year into account in relation to metal accummulation for *A. antennatus*. The average values (arithmetic mean for both males and females in each region) lie within the range reported by other authors (HERNÁNDEZ *et al.*, 1986 and GUERRERO *et al.*, 1988) for the Spanish mediterranean area. According to these authors no seasonal variations were found, but in our study high correlation was found between concentration and size.

Table I: Heavy metal concentrations in Aristeus antennatus.

Date	Area	Sex	Nº indiv	Lc (mm)	Weight (g)	µg/g fresh weight				
						Hg	Cd	Pb	Cu	Zn
April	Aguilas	M	6	20±0	3.9±0.3	0.36	0.013	0.079	3.55	9.70
		M	7	25±0	7.1±0.3	0.25	0.009	0.070	4.34	10.53
		F	10	25±0	6.8±0.4	0.35	0.015	0.088	4.63	11.49
		F	11	35±0.5	19±1.2	0.33	0.010	0.079	3.21	10.75
		F	4	54±4.1	54±6.2	0.51	0.010	0.056	3.69	12.72
	C.Palos	M	13	19±0.5	3.8±0.4	0.31	0.008	0,093	3.50	9.91
		M	4	25±0.8	7.0±0.7	0.29	0.012	–	–	–
		F	10	25±0.4	7.7±0.6	0.21	0.010	0.085	2.90	10.16
		F	9	35±0.5	18±0.9	0.47	0.012	0.086	3.16	11.07
July	Aguilas	M	8	22±1.6	5.6±1.1	0.30	0.011	0.058	2.51	10.61
		F	8	25±0.3	7.4±0.5	0.25	0.011	0.054	2.65	12.72
		F	8	35±0.8	17.6±1.6	0.35	0.011	0.052	2.56	13.52
		F	3	59±4.9	61.6±9.2	0.81	0.013	0.045	2.80	11.40
	C.Palos	M	7	19±1.0	3.8±0.5	0.16	0.011	0.092	4.18	10.77
		M	2	28±2.0	9±2.5	0.41	0.020	0.090	2.74	10.29
		F	10	24±0.4	6.7±0.4	0.22	0.010	0.070	2.93	10.83
		F	8	35±0.4	18.2±1.4	0.34	0.007	0.055	2.35	11.71
Nov.	Aguilas	M	8	21±1.2	4.8±0.8	0.23	0.011	0.062	3.20	10.05
		M	6	32±1.1	12.2±1.2	0.53	0.014	0.104	3,21	9.90
		F	6	26±1.1	7.1±1.4	0.27	0.012	0.078	2.18	11.20
		F	10	36±0.4	17.9±0.9	0.38	0.016	0.088	4.21	13.23
		F	3	56±1.6	50.1±3.2	0.87	0.019	0.082	3.45	13.17
	C.Palos	M	8	20±0.4	3.5±0.3	0.59	0.015	0.047	3.08	10.38
		M	10	27±2.3	7.2±1.8	0.70	0.016	0.050	3.12	14.99
		F	10	25±0.7	6.7±0.5	0.38	0.012	0.047	3.98	11.64
		F	4	36±0.8	16.7±0.5	0.55	0.016	0.090	4.94	12.13

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