

**Concentration factors of certain stable elements
of radioecological significance in Boops boops**

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ABSTRACT. Concentration factors of the stable elements Ag, Se, Co, Cs, Zn, Rb, Cr, Fe and Sc, were determined in flesh, liver, heart and spleen of the edible pelagic fish Boops boops. Instrumental neutron activation analysis and gamma spectrometry were applied for the determination of the above elements in the tissues of the fish and sea water, sampled from Aegean Sea. Comparison of the stable element concentration factors found in the parts of the fish was made.

INTRODUCTION. It is well known that artificial radionuclides introduced into the sea by various sources can be concentrated by marine biota and enter the food chain. The characterisation of the marine species as indicators of certain stable elements or radionuclides, is of great importance for the pollution research. Moreover the study of the distribution pattern of the elements in various organs of the animal, can provide information on the incorporation sites of the stable element or radionuclide in the organism itself and this is also important for the protection of the marine population (1). In order to get information on the radiation effect to the organisms it is important to know the capacity of the organisms to concentrate stable elements possessing radioisotopes of radioecological significance. Stable element chemistry of the organism is a valuable factor for the determination of the food chain reconcentration of certain radionuclides by marine species (2). In the present work, concentration factors, K, of Se, Cr, Cs, Sc, Rb, Fe, Zn, Co and Ag were obtained in Boops boops in an attempt to provide data on the concentration, under natural conditions, of certain stable elements of radioecological interest in a common pelagic fish species of the Aegean Sea.

EXPERIMENTAL. Ten Boops boops specimens were collected from North Aegean Sea, Sporades Island, in September 1987. Sea water samples were also taken from the same area. From each fish, a portion of muscle, the heart, liver and spleen were taken and freeze dried prior to analysis. The size and weight of the fish were also recorded. Sea water samples were also lyophilized. Instrumental neutron activation analysis and gamma spectrometry were used to determine the trace elements Se, Cr, Ag, Cs, Sc, Rb, Fe, Zn and Co. Samples and standards were sealed in quartz tubes, irradiated for 30 h at a thermal neutron flux $2.7 \times 10^{13} \text{ n/cm}^2 \cdot \text{sec}$. After a 20 day-cooling (40 d for sea water), samples were counted on a 37 cc Ge(Li) detector connected to a 4000 channels pulse height analyser.

RESULTS AND DISCUSSION The concentration factors K of stable elements in tissues of Boops boops are given in Table 1. They express the ratio of the mean value derived from ten single specimen analysis, divided by the corresponding mean value of six water sample analysis.

Concentration factors expressed in relation to wet weight reflect the ability of the organism to concentrate chemical elements from the aqueous medium. However it should be noticed that the differences in the physicochemical form between the radionuclides and their stable elements may influence the biogeochemical behaviour of both isotope and stable element. From the results presented in Table 1, it can be concluded that the essential elements Fe, Se, Zn and Co, are those highly concentrated in the organs of the fish, compared with the other determined elements. Significant differences for iron accumulation, three orders of magnitude, were found between muscle and spleen, while the K value for liver and heart was similar and hundred times higher than the lowest value found in muscle. The distribution pattern trend of the elements Se and Zn is similar to iron accumulation, but K values are much higher for Se than for Zn, while Co follows the same pattern, roughly, in a lesser extent possessing the lowest K values.

TABLE 1. Stable element concentration factors (K), in Boops boops (on wet weight basis).

Element	T I S S U E			
	Muscle	Liver	Heart	Spleen
Se	1200	21100	21500	28100
Cr	3	38	43	100
Cs	43	21	19	29
Sc	14	24	64	13
Rb	10	7	7	3
Fe	19	2780	2080	15000
Zn	180	1210	765	2970
Co	23	528	208	124
Ag	67	80	97	70

The remaining elements present medium and low K values. No difference in K values was observed between the organs of the fish for Ag, Rb and Sc, but Cr showed a slightly higher K value in spleen compared with the muscle K value. It has been pointed out that neutron activation products of biologically essential stable elements, like Fe-55, Co-60, Zn-65 and Ag-110m were found in the flesh and liver of certain pelagic fish species from the Pacific Ocean long ago (2). This findings enhance the need for a systematic study on the stable element concentration factors, also in other fish species from the Aegean Sea, in order to be able to characterise the most suitable pollution indicator organism.

REFERENCES

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