Using stable isotopes in organisms to trace sewage-derived material in the Adriatic Sea

[a]Rožič P Ž, [a]Dolenec T, [b]Lojen S, [c]Kniewald G, [a]Dolenec M

Stable isotopes have been used effectively to trace impacts of different components and conseqently potential polutants on ecosystems. Numerous investigations of nitrogen isotope have shown significant differences between organisms exposed to anthropogenic sewage particles and naturally occurring material. Organisms from anthropogenically-impacted areas have shown nitrogen isotopic signatures usually higher from those at unpolluted reference sites. Nitrogen isotope composition ($\delta^{15}N$) is therefore useful for tracing anthropogenically derived organic matter from untreated municipal and industrial wastes in coastal marine environments.

Measurements of stable nitrogen isotope composition in several benthic organisms from the Adriatic Sea were carried out in order to establish the extend of anthropogenic impact as well as to understand the relations within the food web. This work presents the study of nitrogen isotopic measurements in Patella sp. as potential indicator for tracing anthropogenically derived organic matter on the coastal marine environment.

The samples were collected at 14 locations along the coast of Istra Peninsula in Northern Adriatic Sea (from Savudrija town to Raša estuary) in the summer of 2008. Between 10 and 15 individuals were sampled at each location in approximately 1-2 m. Selected samples of each sampling site was divided in five groups regarding the diameter of organism shell (A<3.0, B=3-3.5, C=3.5-4, D=4-4.5, E>4.5) to establish possible differences between different sizes or ages of the same individuals. To test the variability of nitrogen isotope composition within the individual organisms, animals from two locations were sectioned and different parts of body were analyzed separately. The results were also compared with the $\delta^{15}N$ values in same organisms from other locations in the Adriatic Sea with different sources and amounts of organic matter.

Nitrogen isotope composition in muscle of Patella sp. between sampling sites show differences up to 5 ‰. The highest values (8.1 ‰) were measured in areas closest to bays that were usually even more affected due to untreated municipal wastes from towns.

Generally, $\delta^{15}N$ values in more exposed coastal parts vary from 3.5 and 6 ‰, in more restricted areas as bays from 4.5 and 7 ‰. The lowest $\delta^{15}N$ values (2.8 ‰) were also observed at the location near largest town and are explained to be the result of purification plants that remove undesirable materials from municipal cities sewages.

The results at two sampling locations show the variations of $\delta^{15}N$ within different parts of single organism on average below 1 ‰. Therefore, only the muscle part of Patella sp. was used for other analyses. Between the different size groups of Patella sp. generally light increase of nitrogen isotope composition were obsereved in larger individuals.

[a] *University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Geology, Aškerčeva 12, 1000 Ljubljana (petra.zvab@guest.arnes.si)*
[b] *Jožef Stefan Institute, Jamova 39, 1000 Ljubljana*
[c] *Ruđer Bošković Institute, Bijenička 54, 10 000 Zagreb*