Gamma-spectometric analyses of some North Adriatic organisms

by

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In the last two decades investigations in various fields of sciences and technology have been directed by an increasing use of atomic energy. One of the major problem thus arising is the ecological aspect of the disposal of the unavoidable wastes [CHIPMAN, 1960; TEMPLETON, 1965], because of their effect on biota and the whole biocenoses.

The great bioaccumulative potential of marine biota is a well known fact [VINOGRADOV, 1953] and up to now in practically all marine forms some accumulation of radioactive by-products has been found [POLIKARPOV, 1964], originating either from nuclear explosions or from nuclear power plants' discharge.

The present work was undertaken to contribute some additional, knowledge on the concentration of radionuclides in marine organisms, and especially on the radioecological characteristics of the North Adriatic.

Materials and methods

Samples of biota were collected during 1965 and 1966 from various places in the North Adriatic off the west Istrian coast. The collected samples were cleaned by careful washing, and in some cases certain organs were treated separately. All samples were dried at 110° C to a constant weight and then ashed in a muffle furnace at 600° C. The ashed material was homogenised and powdered to a grain size of 100 μ.

For the determination of the gamma ray spectrum a 256-channel pulse-height analyser connected to a 3'' × 3'' NaI (Tl) Harshaw scintillation crystal was used. The instrumental spectra were corrected for the background. The calibration and the photopeak efficiency were made by standard methods [GUNNINK & STONER, 1961]. For the calculation of the absolute activity the equation given by LIEBSCHER [LIEBSCHER *et al.*, 1961] was used.

Results and discussion

In plankton samples, collected by horizontal tows of plankton nets (mesh size 63 and 250 μ) activities due to Mn^{54}, Co^{60}, Zn^{65}, Zr^{95} and Ru^{106} were identified (Figure 1).

These results confirmed the conclusion based on the results of laboratory experiments reviewed by RICE [1963] and analyses of plankton samples collected in the Mediterranean Sea [CERRAI *et al.*, 1963; SCHREIBER *et al.*, 1964; CERRAI *et al.*, 1964; BERNHARD, 1966; SCHREIBER, 1967] that the activity taken up by plankton, which is ultimately almost the only source of organic matter for the higher trophic levels, might be a very important process from radioecological standpoint.

Comparing the radioactivity found in seaweed collected in the same area it was interesting to note, that the content of radionuclides varied from species to species. Thus in *Cystoseira* the contamination due to Mn^{54}, Zn^{65}, Zr^{95} and Ru^{106} was found, while Fucus showed only the Mn^{54} activity regularly (Zn^{65} and Ru^{106} were found in one Fucus sample only).

Rapp. Comm. int. Mer Médit., **19**, 5, pp. 953-955, 3 fig. (1969).

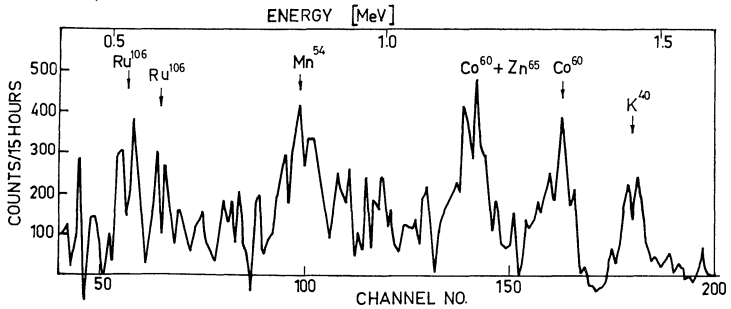

FIG. 1. — Gamma spectrum (background subtracted) of a plankton sample collected in April 1966.

A relatively high concentration of Ru^{106} and Zr^{95} were found in mussels. In some other molluscs (Loligo) Mn^{54} was found as well as Ru^{106} (Figure 2).

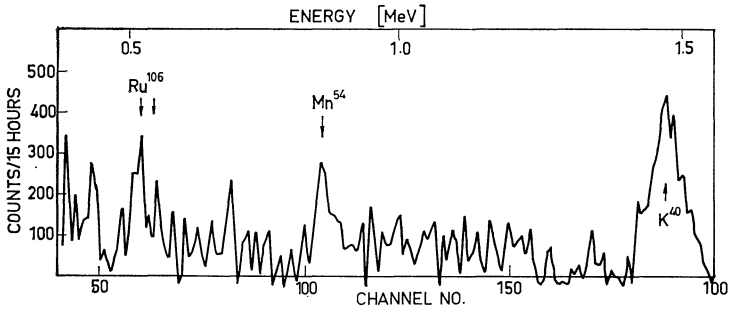

FIG. 2. — Gamma spectrum (background subtracted) of a Loligo vulgaris collected in March 1966.

A great number of radionuclides were identified by analysing the gamma ray spectra of the ash from various fish. Especially high activity was found in a Diplodus (Figure 3). This sample, collected in August 1964, contained as much as about 340 $\mu\mu$Ci of Ru^{106} per gram of ashed material. The presence of other radionuclides in the same sample, such as those of manganese, cerium and zinc, indicate that the fish had probably passed through a high activity « spot » where it picked up the activity.

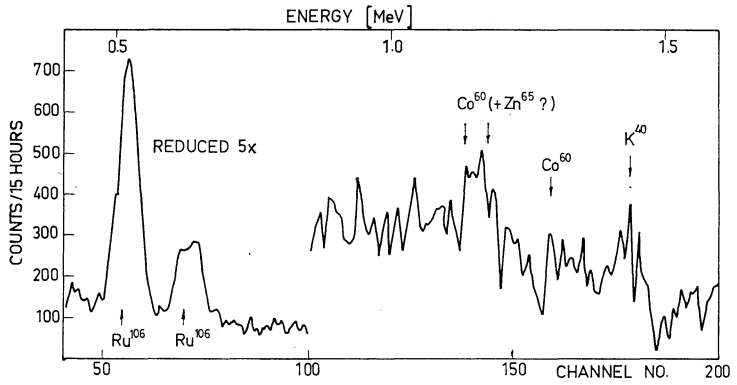

FIG. 3. — Gamma spectrum (background subtracted) of a Diplodus annularis collected in August 1964.

In conclusion one can say that the biota in North Adriatic contain measurable quantities of various nuclear waste products, mainly Ru^{106}, Mn^{54}, Zn^{65}, Co^{60}, Zr^{95} and Ce^{141}. It seems that in plankton and

seaweeds we have a strong accumulation of these radionuclides, probably due to passive surface adsorption. Special attention should be paid to the fact that in some nectonic animals, among them in two economically important migratory fish, relatively high radioactivity was found.

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