

## $\gamma$ - SPECTRA OF MARINE ORGANISMS

by Michael BERNHARD

In the course of the investigations being carried out by our laboratory in the south eastern region of the Ligurian Sea, we have measured the gamma activity of certain marine organisms. The plankton sample dated 26 October was collected in the Gulf of La Spezia in the vicinity of the island of Palmaria; those dated 17 April and 5 May 1962 and 11 March 1964 were collected in the laboratory's «sampling zone» off the «Cinque Terre», west of La Spezia, in AREA I at 43°55' N, 9°42' E and at a depth of about 200 m, just at the edge of the continental shelf (fig. 1).

The plankton was collected with a 75  $\mu$  mesh, which means that only the larger forms of the phytoplankton were retained. The samples were separated from the remaining seawater by filtration and the residue dried at 105°C.

All fish samples with the exception of those from Malaga (1) come from the same zone. The fishes were caught with bottom trawler nets as used by local fishermen.

The fishes were measured and weighed according to species. The fish was «pressure-cooked» for a period of time just long enough to permit separation of the muscles from the bones. All the samples were dried at 150°C in a drying oven and ground in a mill or mortar.

The *Mytilus* samples were obtained from the culture beds belonging to M. FAGO which are situated on the west side of the Gulf of La Spezia near Panigaglia.

The flesh of the mussels was separated from the shells after a short period of heating in a pan. The flesh was either dried whole or after it had been divided into various parts at 105°C, and then ground.

The measurements were made directly on a 1 1/2 inch crystal with a «100-channel analyzer» supplied by the firm SELO, Milan; all measurements were extended over more than 12h and the majority over 24 h.

The figure show the net spectra, i.e., without background and in effective counting time. With the exception of the plankton samples, equal volumes under the same geometry were analysed, so that the spectra are comparable.

The dry weight of these samples varied between 40 and 50 g. The plankton samples contained only 2 to 3 g dry weight.

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(1) We should like to thank Dr. J.P. GOSSE of the Institut Royal des Sciences Naturelles de Belgique, Brussels, for supplying us with the samples.

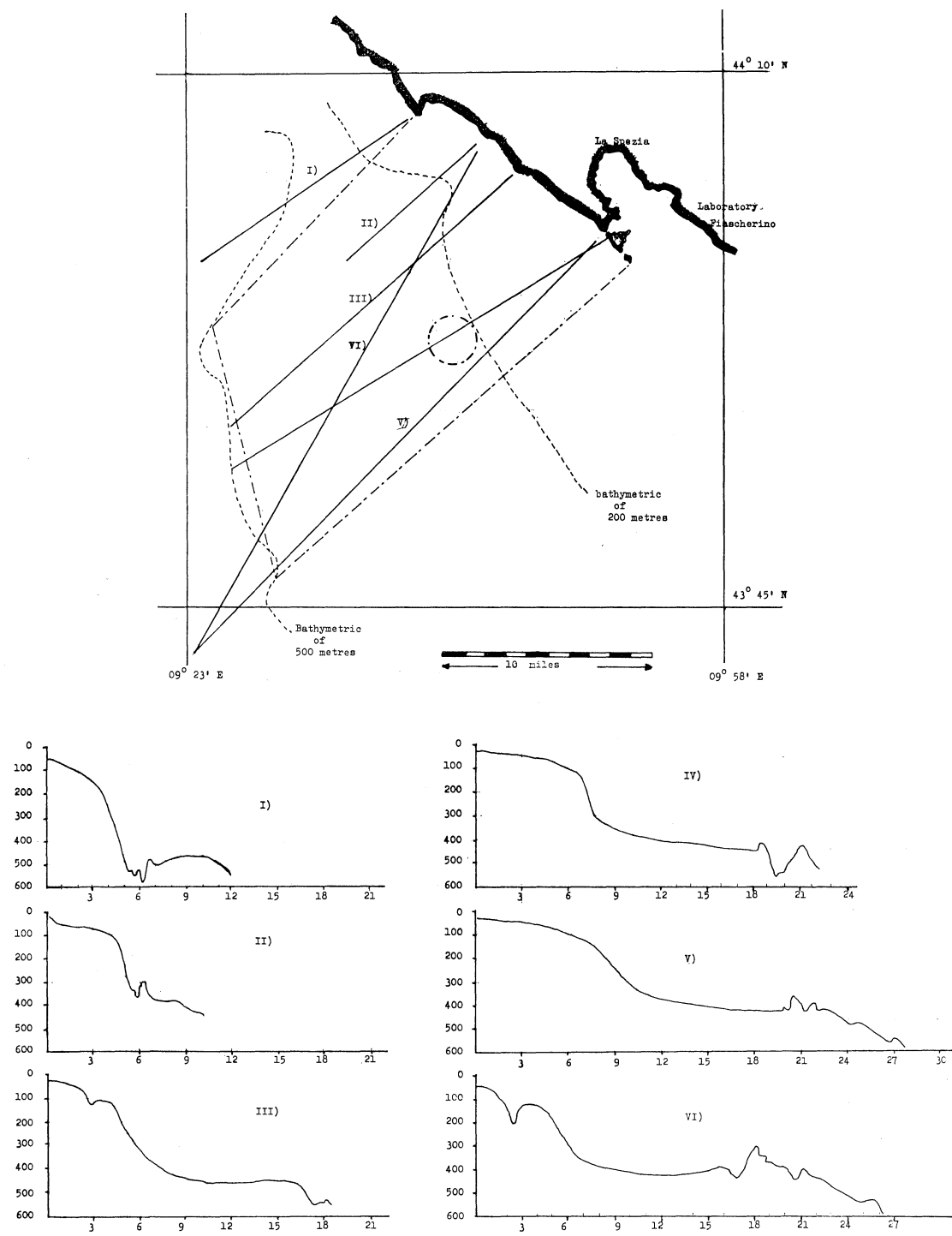


FIG. 1. — *Sampling area; the profile of depth, abscissa : miles off coast, ordinates : depth in metres.*

*Results.*

Figure 2 shows the spectra of the plankton collected in October 1961, April and May 1962 and March 1964, with peaks of Ce-144, Ru-103, Ba-La 140 and a very large peak of Zr-Nb 95,

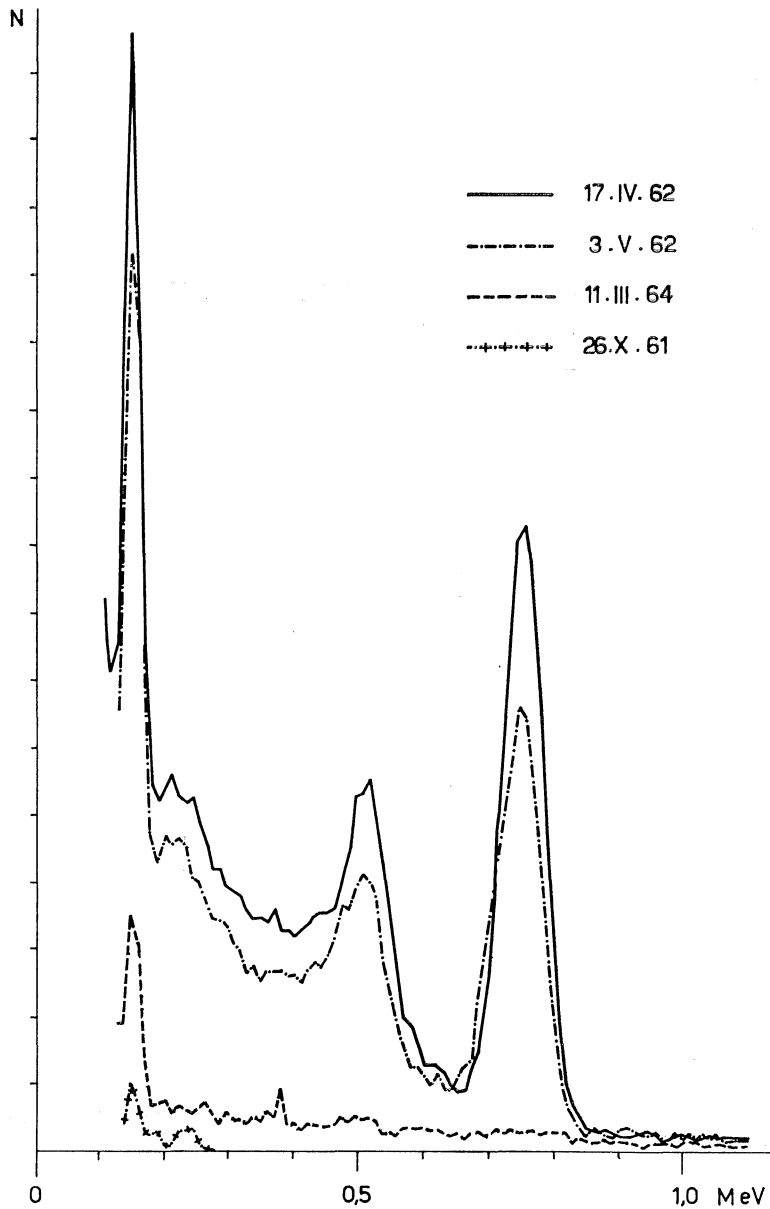


FIG. 2. —  $\gamma$ -spectra of net plankton collected in 1961, 1962 and 1964

La 140. Since there was a large atomic bomb test series in the autumn and winter 1961-62, it is understandable that the plankton samples taken in spring 1962 show a very marked increase in the amount of fallout nuclides accumulated over the samples taken in October 1961.

In *March* 1964, with the exception of Cerium, no fallout nuclides are present in the plankton.

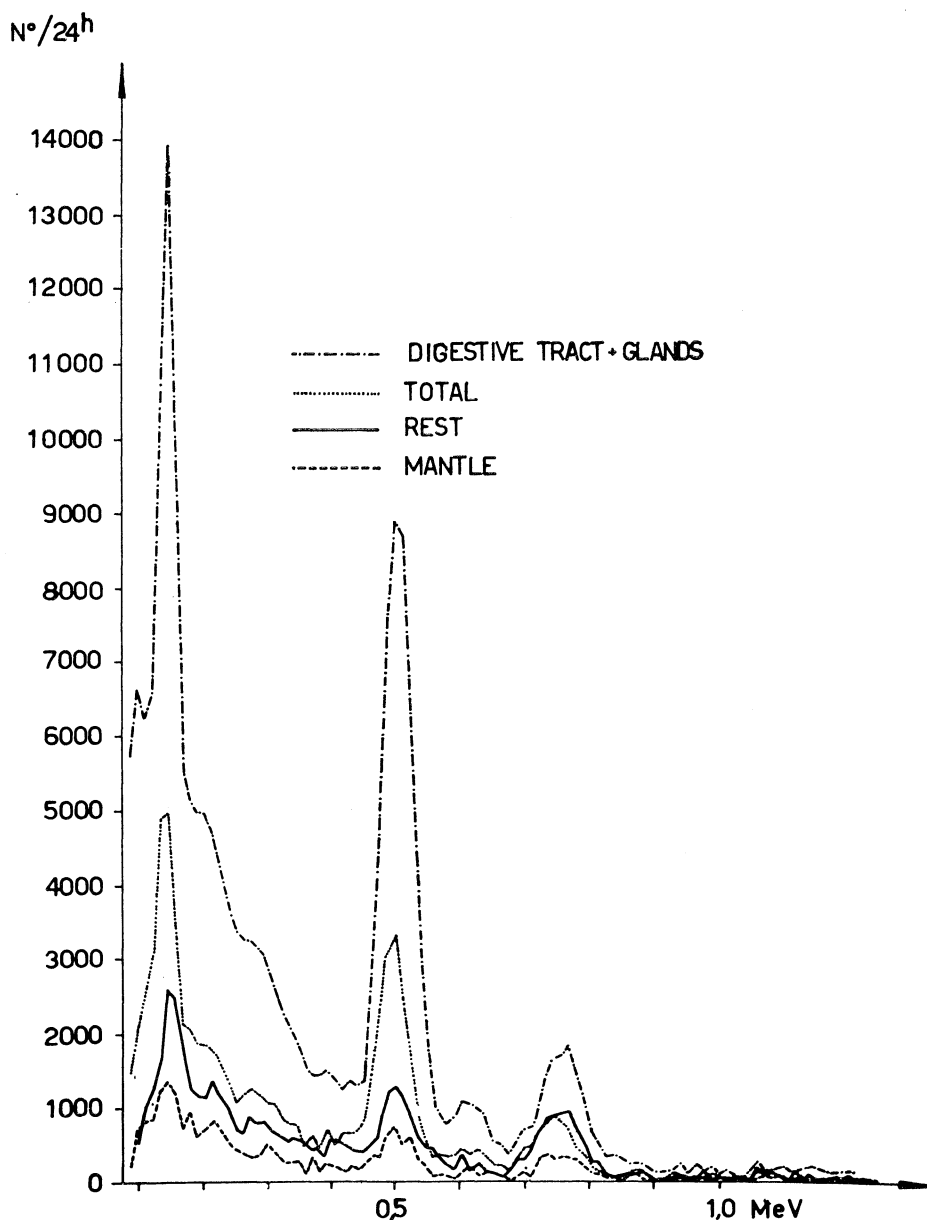


FIG. 3. —  $\gamma$ -spectra of various part of *Mytilus* collected on 18.X.62.

The  $\gamma$ -spectra of *Mytilus*, a filter feeder, were observed from February 1963 to May 1964. In order to determine the part of the mussel containing most of the activity, the soft material of the mussel was divided into the digestive tract with glands, mantle tissue etc. and then compared with the total soft tissues.

From figure 3 it can be concluded that the largest amount of activity is situated in the digestive tract with glands, which might indicate that the bulk of the nuclides merely pass through the organisms, but it should be noted that a considerable amount is also present in the mantle tissue.

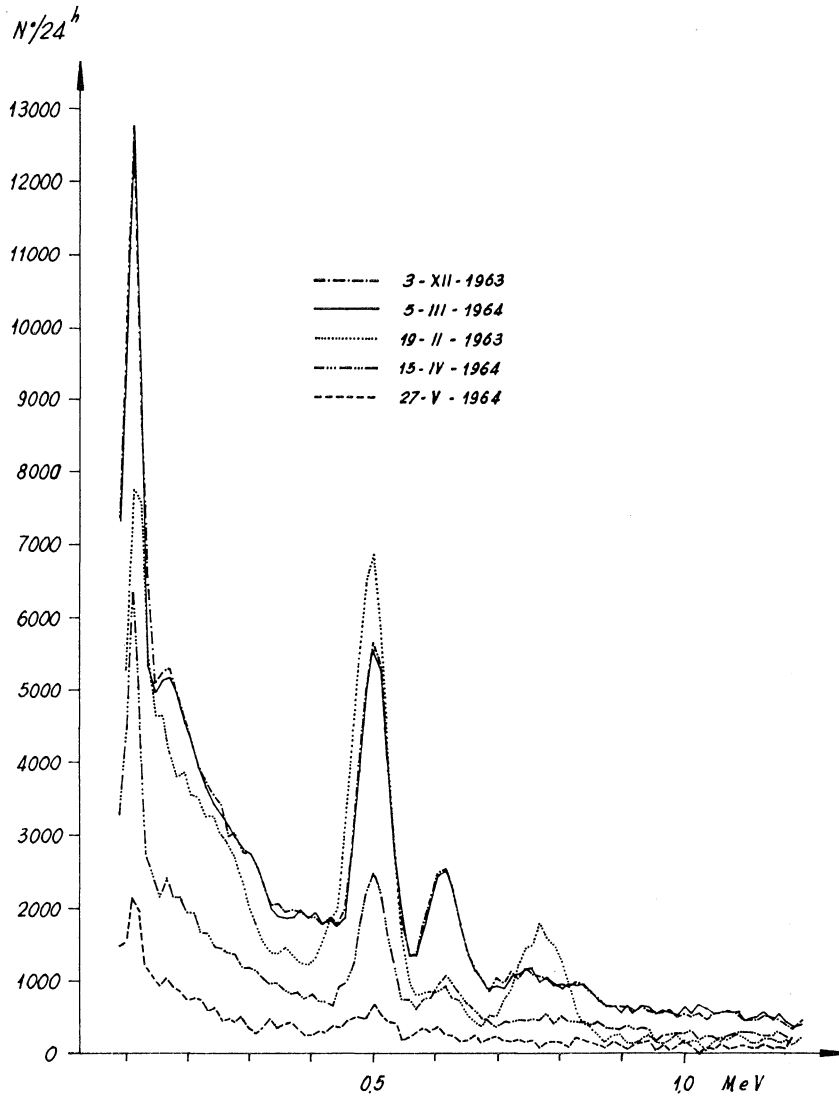


FIG. 4. —  $\gamma$ -spectra of *Mytilus* collected in 1963 and 1964.

Figure 4 compares several spectra taken over a period of one year. A general reduction from 1963 to 1964 can be observed, there is however a spring maximum in 1964, which reaches almost the values of 1963.

These spectra can be also compared with the spectra obtained from fish in 1962-1964 and from mud in 1962 (fig. 5 and 6). Great differences exist between the activity in plankton

and fish; even in the Sardine, a plankton-feeder, very little radioactivity can be found.

Fish measured during 1963 (fig. 6), when *Mytilus* was quite active (fig. 4) did not show any appreciable peak with the exception of Cerium.

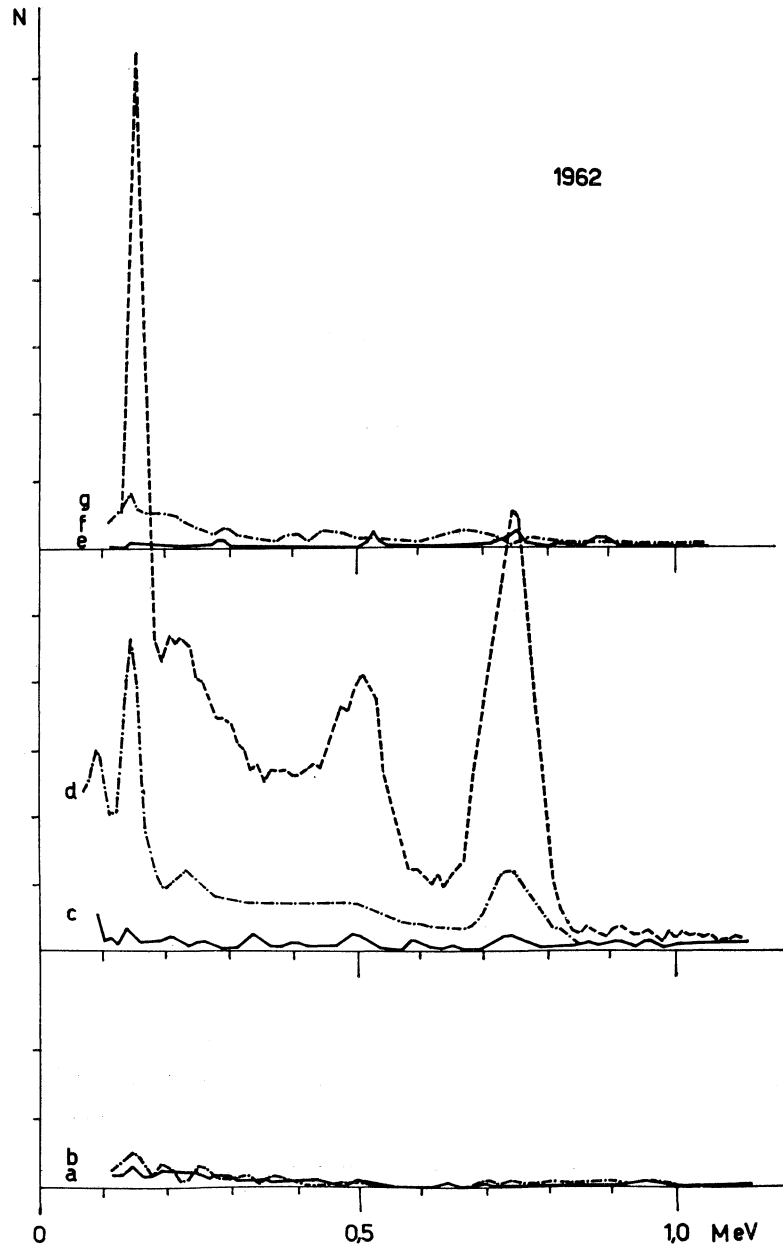


FIG. 5. —  $\gamma$ -spectra of net plankton, mud and various fishes collected in 1962. a. *Sardina sp.* from Malaga, muscle (20.VII); b. *Sardina sp.* from Malaga, gills (20.VII); c. *Solea solea* (13.V); d. Mud (15.VII); e. *Spicara vulgaris* (21.V); f. *Trachurus trachurus* (11.V); g. Net plankton (3.V).

From this it can be concluded that : no appreciable of Ce, Zr, Nb and Ru are transmitted

through the food chain into fish, a phenomenon which seems to indicate that the organisms of the higher level of the food chain can effectively discriminate against them.

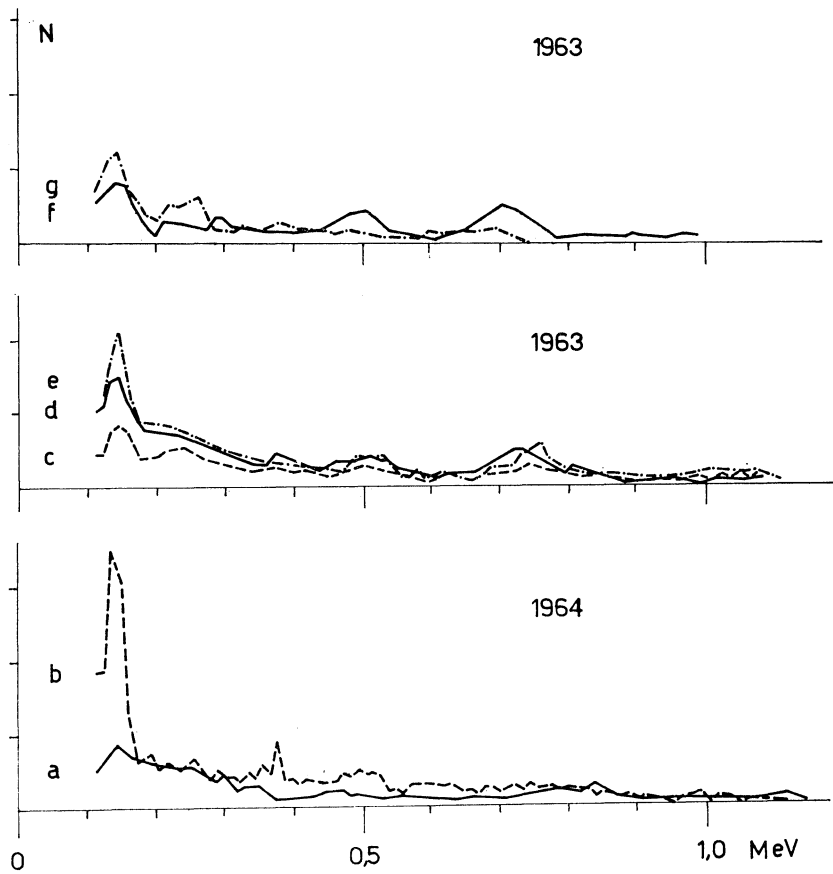


FIG. 6. —  $\gamma$ -spectra of net plankton and various fishes collected in 1963 and 1964. a. *Sardina pilchardus* (21.II); b. Net plankton (11.III); c. *Serranellus cabrilla* (3.V); d. *Spicara vulgaris* (3.V); e. *Solea solea* (3.V); f. *Merluccius merluccius*, muscle (20.III); g. *M. merluccius*, gills (20.III).

The filter-feeding *Mytilus*, on the other hand, accumulated the above-mentioned nuclides in the same way as the plankton, but since mussels are much easier to obtain in large quantities than plankton, it might be used as an indicator.

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