checking contamination of the sea

In July, 133 scientists from 15 countries attended an IAEA symposium on the Interaction of Radioactive Contaminants with the Constituents of the Matine Environment. It was held at the University of Washington, with the USAEC acting as host.

Representatives from five international organisations, the CEC, OECD-NEA, WFUNA, WHO and the IAEA attended.

The symposium was primarily aimed at elucidating the influence of radioactivity on the marine ecosystem and providing some background material for estimation of the capacity of the sea to accept radioactive waste without any significant harmful effects on man and the ecosystem.

At the U. N. Conference on Human Environment held in Stockholm inJune this year, a special concern was expressed regarding the international waters, such as the seas and oceans, and the need to conserve the resources of the sea. For the past 14 years the Agency has conducted an intensive programme on the discharge of radioactive waste into the sea, and the behaviour of radionuclides in the sea.

A number of papers dealt with chemical reactions after the introduction of fission products and other radionuclides into the sea, and those which take place with radioactive wastes and trace metals in rivers during their transport to the sea. These reactions may depend on the change of dissolved chemical species, the dissolution from and sorption by suspended matter, the reactions with dissolved and particulate organic matter as well as the change of the salinity or chlorinity and pH of the water.

However, only a few papers dealt with the problem of the sea bottom as a reservoir and sink for radionuclides and trace metals and the transport of these isotopes in conjunction with sediment transport.

Dr. R. Fukai from Monaco Laboratory reported on the intercalibration excercise for analysis of radionuclides in normal samples organized by the Monaco Laboratory in 1970-71. Two kinds of homogenous seawater samples contaminated with various radionuclides under natural conditions at monitoring levels were distributed to laboratories of world-wide distribution. Forty six laboratories reported the results of measurements on fission products in these samples.

The scatter of the results is less pronounced for SR-90 and Cs-137 than for Zr-Nb-95, Ru-106, Cs-134 and Ce-144. Especially for Ru-106 in the higher level sample, the results are scattered over nearly two orders of magnitude. This seems to be related to the incapability of some methods to measure different chemical forms of this radionuclide occurring in seawater.

Dr. J. Ancellin from CEA, Laboratoire de Radioécologie Marine, Centre de La Hague, Cherbourg, France, presented a review paper "Biological and physico-chemical aspects of radioactive contamination of marine species and sediments" by himself and colleagues. He reported various conditions of radioactive contamination of the constituents of marine environment based on the experiment conducted with Cs-137, Ce-144, Co-60.

Prof. Y. Nishiwaki reported on the result of a survey on the distribution of the concentrations of thorium and rare earth elements in an estuary at Osaka Bay, Japan, conducted in 1966. He also reported some of the results of the experimental studies on absorption of various radionuclides on some bottom sediments in the water with different salinities and pH. The dilution and dispersion of radioactive substances disposed into sea water were mostly inferred from the experimental studies on the dispersion and distribution of easily traceable dyes, such as rhodamin-B. The dispersion of the elements in the estuarine water could not be interpreted by simple dilution and diffusion of the element in water mass. The presence of the mud flats, as well as the marine meteorological conditions, seem to affect markedly the distribution of the element in the estuarine water. The adsorption of the element on the bottom sediment was influenced not only by the coarseness of the sediment, but also by the salinity and pH of the water.

A second symposium topic was "The Interaction of Radionuclides with Marine Biota". In these sessions, the biological interaction of radionuclides as a function of their physico-chemical state in sea water and the flux of radionuclides through marine biota as a function of different environmental parameters were discussed. Some papers dealt with the transfer of radionuclides along marine food claims and the effects of ionizing radiation on marine biota.

Dr. Allyn H. Seymour, director of the Laboratory of Radiation Ecology reported that the radioactive material from Hanford, which once could be traced all the way up the coast, through the Strait of Juan de Fuca and into Puget Sound, has declined rapidly since the last of the old plutonium-producing reactors at Hanford was closed early in 1971. Even at its highest level before the reactor closures began in 1965, the amount of waste in the rivers and coastal waters was well within safety limits set by the USAEC. Radioactive zinc was the most abundant component of Hanford waste which appeared in marine organisms off the Washington coast. However, the level of radioactive zinc by last May had declined to the point where it was less than naturally occurring radioactivity in the ocean.

Researchers V.F. Hodge and T.R. Folsom from Scrips Institution of Oceanography, La Jolla, California, and D.R. Young from Southern California Coastal Water Research Project, Los Angeles, reported on the repeated measurements of Co-60, Zn-65, Mu-54, Cs-137, Ag-110m, Ag-108m and Pu-239 in several organs of albacore tuna taken in the commercial fishery of San Diego. The results of the analyses suggest that the upper layers of the North Pacific Ocean can retain large fractions of several species of trace elements for periods of a decade or more.

The fish were selected because of their spectacular migration travels. They arrive off Southern Califnornia in July, travel north along the West Coast and later migrate back to the Central Pacific and even to waters off Japan. Travelling as much as 17 nautical miles a day (500 miles a month), the albacores make excellent sampling mechanisms for upper layers of water.

Health and safety problems, especially the effects of radionuclide contaminants in ocean water, biota and sediment with respect to the evaluation of the hazards to man were also discussed. At the beginning of this session, Mr. A. Preston from the Ministry of Agriculture,

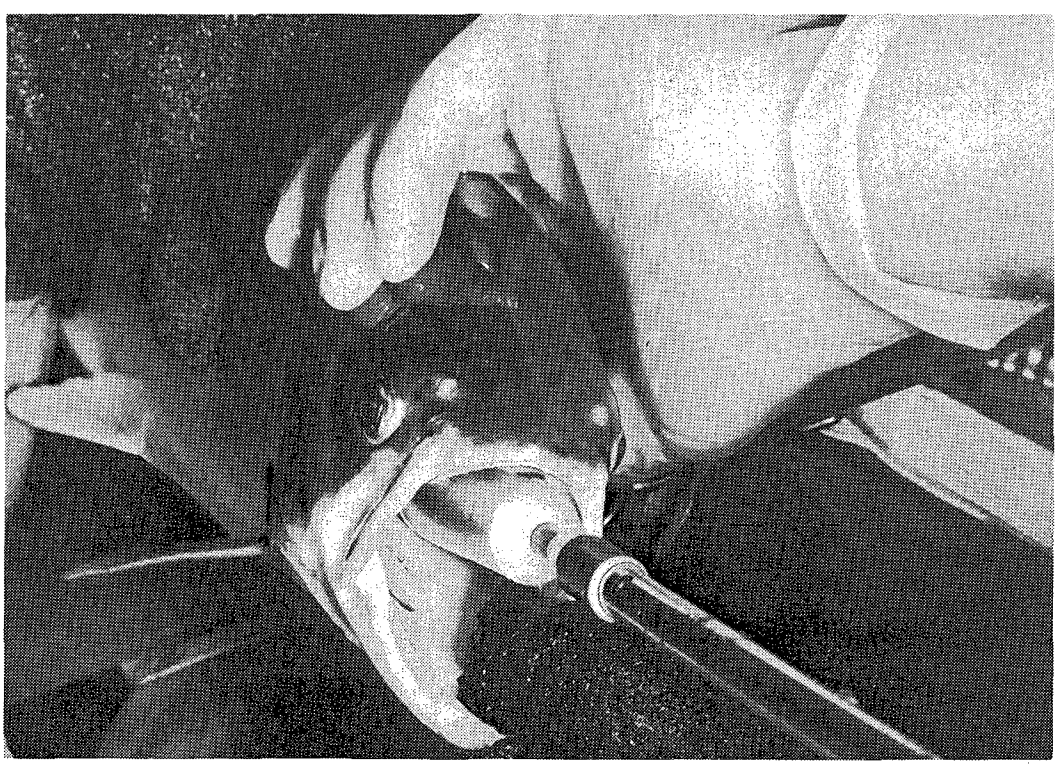
Fisheries and Food, Fisheries Radiobiological Laboratory, Hamilton Dock, Lowestoft, Suffolk, England, presented a review paper, "The evaluation of public radiation exposure from the controlled marine disposal of radioactive waste" by himself and N.T. Mitchell. In this paper, he discussed the application of critical path techniques to the evaluation of public radiation exposure from the controlled marine disposal of radioactive waste.

The discussion related exclusively to the situation in the U.K., since critical path techniques had been more extensively applied there and because there is a dearth of published information on which to base reliable estimates of radiation dose commitment for other situations. The principal sources of radioactive waste at this time are nuclear power programmes, and especially at the stage at which fuel is reprocessed.

In the U.K., low level liquid radioactive wastes from these programmes are dispersed in surface waters and the inshore marine environment. The origin and nature of such of these disposals as are made to estuaries and the sea were summarized and the method of control was briefly introduced.

In line with this subject, the IAEA has plans for two panel meetings in 1973. One would discuss the Effects of Radioactivity on Marine Organisms, and the second Disposal of Radioactive Waste in the Sea. This constitutes part of the Agency's broadening activities in the field of environmental behavious or radionuclides in the nuclear industry.

Sonic "beepers" are inserted into the stomachs of fish to track their course. These tags emit a signal which can be detected by electronic receiving gear. Photo: Battelle-Northwest



This was the only paper in this symposium which dealt directly with the applied health physics side of the controlled marine disposal of radioactive waste in the U.K.

The final session discussed the application of radiologically labelled environments, especially the studies of biogeochemical processes. Dr. R. W. Buddemeier from Hawaii Institute of Geophysics and Department of Chemistry, University of Hawaii, Honolulu, Hawaii, read the paper "Distribution of radionuclides in reef corals" by D. W. Knutson and himself. He reported that the autoradiography of sectioned massive corals from Eniwetok had revealed the presence of discrete bands of radioactivity identifiable with specific nuclear test series. X-ray radiographs of these and other corals show structural density variations, which comparison with the autoradiography demonstrate to be seasonal in nature. The coral structure contains a reasonably reliable internal calendar. Residual Sr-90 activities have been determined for the Eniwetok corals, and a Fanning Island coral has been used to reconstruct the uptake of excess C-14 at that location.

In addition to permitting reconstruction of past radionuclide concentrations as sampled by the corals, the method permits retrospective study of the organism's structural response to incorporation of the radioactivity.

The results of their study indicate that the macroscopic growth rates and patterns of these corals are relatively unaffected by uptake of the observed amounts of radioactivity, and that reef corals can provide a valuable record of past variations in the marine concentrations and distributions of various radionuclides.

Scientists track the fish which have "swallowed" their sonic "beepers".
Photo: Battelle-Northwest