BIOACCUMULATION AND RETENTION OF RADIONUCLIDES IN MARINE BIVALVES

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A series of laboratory radiotracer experiments has been conducted in which the accumulation and retention of radioisotopes are quantified for marine mussels (*Mytilus edulis*), marine clams (*Macoma balthica, Mercenaria mercenaria*) and oysters (*Crassostrea virginica*).^{110}AG, ^{241}AM, ^{109}Cd, ^{14}C, ^{57}Co, ^{51}Cr, ^{210}Pb, ^{75}Se and ^{65}Zn were examined. For each animal species and radioisotope, the relative contributions of dissolved and particulate sources are quantified. To determine the importance of the particulate (i.e., food) source term, the assimilation efficiencies of ingested radioisotopes were determined for up seven different food types (the diatoms *Thalassiosira pseudonana* and *Phaeodactylum tricornutum*, the chlorophytes *Chlorella autotrophica* and *Nannochloris atomus*, the dinoflagellates *Prorocentrum minimum* and *Alexandrium tamarense*, the prasinophyte *Tetraselmis levis*, and the prymnesiophyte *Isochrysis galbana*). The effects of food quantity and temperature on assimilation efficiencies were also determined. Studies investigating the bioaccumulation of radioisotopes from the dissolved phase measured the effects of salinity and dissolved organic carbon on the bioavailability of the radioisotopes to the animals.

Overall conclusions includes the following : (1) assimilation efficiencies in bivalves for ingested radionuclides ranged from nearly zzero for ^{241}AM to over 90% for ^{75}Se; (2) metal assimilation was related to ingestion rate which is dependent on food quantity, with assimilation efficiencies decreasing inversely with algla food densities; (3) metal assimilation varied between food sources and was related to the distribution of the metals in the algal cells, with the cytosol fraction being most assimilable; this is similar to earlier findings with marine copepods and bivalve larvae (REINFELDER and FISHER, 1991, 1994); (4) assimilation of essential elements (e.g., Se, Zn) was related to carbon assimilation; (5) for most radioisotopes, increasing salinity had a small dampening effect on metal accumulation rates from the dissolved phase; (6) oysters retained certain metals (especially ^{110}AG and ^{65}Zn) much longer than did clams and mussels, perhaps explaining the very high concentrations of these metals in oysters in nature (NOAA, 1989); (7) the distribution of radionuclides in the bivalves was strongly dependent on the dominant source term, with most dissolved radioisotope localizing in shell and most ingested radioisotope in soft parts (particularly viscera),as noted in earlier studies (e.g., BJERREGAARD *et al.*, 1985; FISHER and TEYSSIE, 1986); (8) those elements which display low assimilation efficiencies in the bivalves are probably accumulated in these animals predominantly from the dissolved phase, whereas elements with high assimilation efficiencies are probably obtained primarily through trophic transfer, consistent with earlier conclusions of earlier work (LUOMA *et al.*,1992). The results are being used to develop both equilibrium and kinetic models of radioisotope accumulation in marine bivalves, which are being tested in bivalve field transplant experiments.

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