

# Radionuclides Australian marine organisms and baseline seafood dose

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Artificial and natural radionuclides are known to accumulate in marine organisms worldwide and can cause radiological dose to the biota as well as ingestion dose to seafood consumers. To better understand anthropogenic radionuclides in Australia's marine systems, we gathered samples in the vicinity of the three nuclear test sites in the Montebello Islands, each of which were conducted at separate locations and had slightly different plutonium (Pu) isotopic signatures. Today, many years after the tests, their distinct  $^{240/239}\text{Pu}$  atom ratios can be differentiated in biological samples, such as fish, sea turtles. The tissues of local fish tend to reflect a mixture of all three detonations due to the movement of the fish, and the transport of Pu by water currents, whereas the signatures in sea turtle hatchlings and eggs were distinct and matched their home beaches. On a larger scale, the  $^{240/239}\text{Pu}$  atom ratios in all samples from Montebello Islands (median ratio of 0.04) are distinct from worldwide fallout (0.17-0.18) and can be used as a tracer for migrating species and seawater/sediment movement. The Pu measurements, along with that of other radionuclides, were used to develop dose estimates for a range of marine organisms as well as human consumers of local fish [1,2].

While it has been known for many decades that ingestion of seafood contributes significantly to routine background dose (more than 70% of the total foods dose in some countries), there are substantial knowledge gaps on seafood dose rates in Australia and worldwide. ANSTO is leading a new assessment on the accumulation of radionuclides how these contribute to ingestion dose worldwide. We have worked in partnership with the marine environmental laboratories at the Monaco office of the International Atomic Energy Agency to expand a global database (Marine Radioactivity Information System -MARIS) as well as global diet data and updated parameters for dose calculation. The new assessment:

- Evaluates 16 natural and anthropogenic radionuclides.
- Draws from more than 21,200 global data for marine biota.
- Uses 344 seafood consumption data from Australia as well as national and sub-national diet studies representing approximately 35% of the world population.
- Implements a bespoke Monte Carlo tool for calculating seafood dose distributions.
- Compiles and evaluates >130 published seafood ingestion dose estimates from the past 30 years.

Our studies highlight the ongoing need for effective radionuclide measurement capabilities in Australia along with the development and sustenance of the human expertise needed to perform high quality analyses and interpret results.

[1] M. Johansen, D.P. Child, M.A.C Hotchkis, et al. *Mar. Poll. Bull.* **158**, 111390 (2020).

[2] M. Johansen, D.P. Child, M.A.C Hotchkis, et al. *STOTEN*, 691, 572-583 (2019)

