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Seafood-Borne Diseases between Engineered Nanoparticles and Algal Blooms

S.R. Dolci[1], and S.L. Vesely[2]
[1]VESPA-UNIMI, Milan
[2]ITB-CNR, Milan

Edible fish is claimed to be healthier than meat due to its beneficial fatty acid profile, rich in omega-3. It is being caught, farmed worldwide, and genetically modified on a trial basis. In return, more and more often concern is voiced over the danger of restricting biodiversity and the ongoing contamination of the environment, that increasingly includes the aquatic one. Besides algal blooms, that can be harmful regardless of their origin, and especially when it comes to contamination, there has arisen a toxicological issue as to whether nanoparticles (NPs) have a different risk of hazard from bulk matter in the gas phase, say.


Multiple parasitic granulomas derivating from an *intra vitam* disease


Post-mortal alteration due to wrong preservation

The signs are not always evident. Targeted examinations are required to highlight microbial and viral contamination.

Whether farmed or fished, fish can suffer from zoonoses, their flesh is very perishable and may be contaminated, resulting in foodstuff that is harmful to human health.


An European hake infested with many live Anisakis larvae.

These things have long been known, and all fish are inspected before undergoing processing or sale.

The differences between farmed and fished fish emerge when monitoring the effects of industrial pollution and algal blooms. In fact, the water where farmed fish are raised and harvested is subjected to regular analysis, while caught fish can migrate and move between polluted and clean water. Maintaining the biodiversity of marine species is not totally under our control.

Toxins are liable to concentrate or accumulate toward higher level in the food-chain, a phenomenon known as biomagnification.

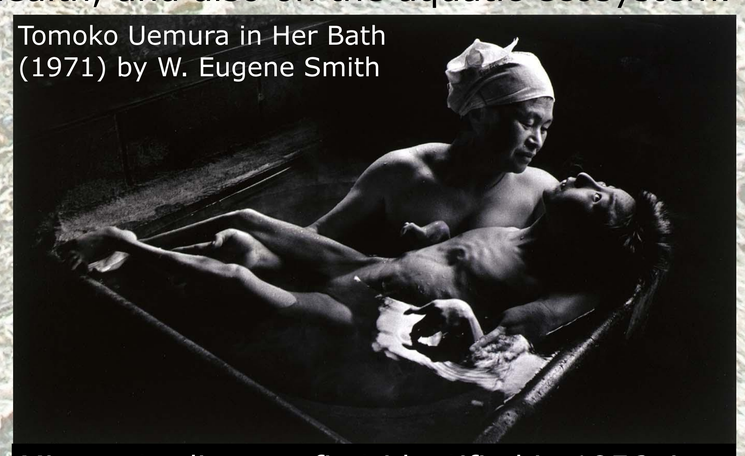
Pesticides, and insecticides can be more harmful to fish than to their intended targets. Togehter with polychlorinated biphenyls (PCB), they have been associated with cancer risk in human consumers of fish.

Higher concentrations of fertilizers in water, particularly phosphorus and nitrogen compounds, may cause algal blooms. Blooms tend to deplete the oxygen dissolved in water, and can become detrimental to aquatic organisms. Furthermore, some species of single-celled algae (phytoplankton) are toxigenic.

Metals are persistent pollutants crossing biological barriers, and also accumulating in the edible parts of fish. Target organ and accumulation rate depend on the metal and on the species. Failure to detect seafood contamination early enough has an impact on human health, and also on the aquatic ecosystem.


This bigfin reef squid (*Sepioteuthis lessoniana*), indigenous to tropical waters, was photographed in Greece.

Once in the marine environment, nanoparticles (NPs) tend either to agglomerate or to disperse and ionize, depending on their preparation. Particles possibly settle, thus 'only' affecting the benthic environment. As with nanoplastics, it is difficult to determine NPs concentration once they are released in the environment.


Tomoko Uemura in Her Bath (1971) by W. Eugene Smith

Minamata disease, first identified in 1956, is a methylmercury (MeHg) poisoning caused by consumption of heavily contaminated seafood taken in the Minamata Bay. Possible cases of intrauterine poisoning were reported.

Cyto and genotoxicity to engineered metal and metal oxide nanoparticles (NPs) are being evaluated in cultured cells, in multicellular organisms and in vertebrates.

Data-based standards for toxic environmental exposures estimate allowable exposure levels to an identified type of hazard, and heavily rely on probabilistic risk assessment. However, NPs differ from 'ordinary matter' in that they are aimed at enhancing just one feature, while equalizing everything else as much as possible. With the degree of refinement chemical, electrical, optical, and colligative properties are liable to change aside from the dose-response relationship.

Impurity-doping shows that concentration needs not be high to affect a homogeneous milieu. Perhaps, once highly refined NPs are released into the marine environment, they can enable the onset of collective rather than statistical features.

In our opinion, when dealing with NPs, the dose-response assessment of the chemicals should be adjusted to also reflect the specific toxicity of the additional relevant features.