

A review of mercury concentrations in Western and Central Pacific Ocean (WCPO) tuna and it's relevance to the Minamata Convention

Mercury (Hg) is a naturally occurring, non-essential, toxic, volatile, persistent and bioaccumulative element in the environment. Natural (volcanoes, forest fires, weathering) as well as anthropogenic (coal combustion, biomass burning, artisanal and small scale gold mining, energy generation processes) sources of Hg are emitted mainly as gaseous elemental Hg into the atmosphere.

Gaseous elemental Hg emissions to the atmosphere from natural and anthropogenic sources.

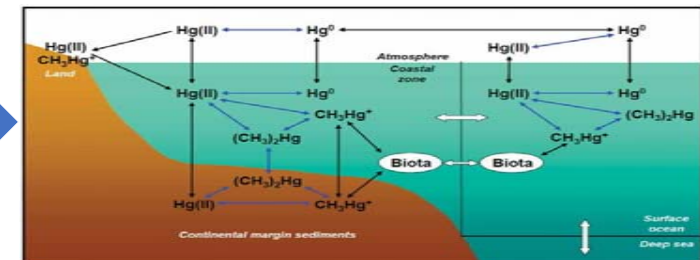
Long range transportation and oxidation of atmospheric Hg. Elemental Hg can be transformed to gaseous oxidized Hg, as well as reactive Hg; and together are classified as total atmospheric Hg.

Deposition of total atmospheric Hg to the geosphere and the hydrosphere. Hg cycles between the atmosphere, geosphere and the hydrosphere through a complex web of physical and chemical processes. Hg gets transformed and can bioaccumulate in aquatic food webs leading to food contamination and exposure risk.

Methyl mercury formation in aquatic environment



Tuna species (scientific name)	Geographical location	Form of mercury analysed	Portion analysed and Hg concentration	Study
Yellowfin tuna (n=326) (<i>Thunnus albacares</i>), Skipjack tuna (n=148) (<i>Katsuwonus pelamis</i>) and Bigeye tuna (n=135) (<i>Thunnus obesus</i>)	South western Pacific Ocean (New Caledonia-Fiji subregion) between 2003-2018. Samples taken from the Pacific marine Specimen Bank	Total mercury	White muscle area from the anal area and freeze dried and homogenized for analysis. Bigeye tuna: $2.7 \pm 1.7 \text{ ug/g}$ Yellowfin tuna: $0.7 \pm 0.5 \text{ ug/g}$ Skipjack tuna: $0.7 \pm 0.3 \text{ ug/g}$	Midiu et al. 2021
Skipjack tuna (n=661) (<i>Katsuwonus pelamis</i>)	Pacific ocean including WCPO	Total mercury	Homogenized freeze-dried tissue muscle Skipjack tuna: $0.01 \text{ to } 3.35 \text{ ug/g}$	Midiu et al. 2022
Bigeye tuna (n = 88) (<i>Thunnus obesus</i>) Yellowfin tuna (n= 60) (<i>Thunnus albacares</i>)	WCPO	Total mercury	Tuna blood (from near the pectoral fin) Tuna muscle: freeze-dried and homogenized Blood sample Bigeye tuna: $1.77 \pm 2.30 \text{ ug/g}$ Yellowfin tuna: $0.36 \pm 0.24 \text{ ug/g}$ Tuna muscle Bigeye tuna: $1.30 \pm 1.32 \text{ ug/g}$ Yellowfin tuna: $0.54 \pm 0.45 \text{ ug/g}$	Barbosa et al. 2022
Bigeye tuna (n=364) (<i>Thunnus obesus</i>) Yellowfin tuna (n=477) (<i>Thunnus albacares</i>) Albacore tuna (n=160)	WCPO	Total mercury	White muscle samples freeze-dried Bigeye tuna: $1.4 \pm 1.5 \text{ mg/kg}$ Albacore tuna: $1.0 \pm 0.5 \text{ mg/kg}$ Yellowfin tuna: $0.6 \pm 0.5 \text{ mg/kg}$	Houssard et al. 2019



THE MINAMATA CONVENTION

- UNDP targets to achieve sustainable, inclusive and resilient human development through its Sustainable Development Goals (SDGs).
- SDG14 "highlights on the conservation and sustainable use of the oceans, seas and marine resources for sustainable development".
- The UNDP assists countries to decrease the use and release of mercury (Hg) from various land-based activities, prevents Hg entering water sources, and reduce the build-up of Hg in the food chain whilst UNEP targets to protect human health and the global environment from the release of Hg and its compounds by minimizing global anthropogenic Hg releases to air, water and land.
- Mercury is the only metal in the periodic table to have its own convention, referred to as the Minamata Convention; to which 131 countries are signatories to.
- The Convention targets to protect human health and the environment from anthropogenic emissions and releases of Hg and Hg compounds.
- Hence, it becomes essential to monitor Hg to assess the Minamata Convention effectiveness.
- The WCPO tuna is amongst the most highly consumed seafood products; and hence human exposure results.
- The tuna muscle is generally considered as a storage compartment of methyl mercury, accumulating over its lifetime.
- Methyl mercury is a neurotoxin; which bioaccumulates across the aquatic food web.
- Hence, through the determination of total mercury in tunas is a way forward to study methyl mercury distribution in the ocean; and the potential consequences to human exposure and human health.

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Sofia B Shah
PhD student
University of the South Pacific
Suva,
Fiji Islands