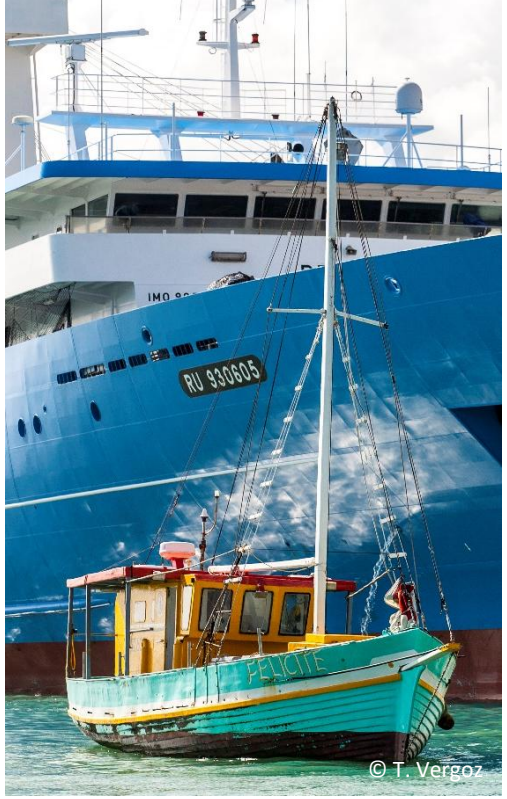

Methylmercury and other pollutants studies in tunas (WCPFC-SC22-2026-RP-P35b03)

Anaïs Médieu, Valérie Allain, David Point, Mélanie Lemire, Pierre Ayotte, Tony Gardon, Fany Sardenne,
Ika Paul-Pont, Zahirah Dhurmeea, Catherine Munschy, Yann Aminot, Anne Lorrain

Pacific Community
Communauté du Pacifique

SC22 - Apia, Samoa - August 2026

IRD
Deploying research
Sharing science
Transforming the future

Background: a global environmental contamination

Environmental contaminants = **chemical** (e.g. heavy metals), **physical** (e.g. microplastics), **biological** (pathogenic bacteria) or **radioactive elements** released naturally or anthropogenically in the environment

- **Mobile** and **globally distributed**
- **Persistent** and **bioaccumulative**
- **Toxic** to humans and wildlife
- Some **under regulation by international treaties**

MINAMATA CONVENTION ON MERCURY

Stockholm Convention on persistent organic pollutants (POPs)

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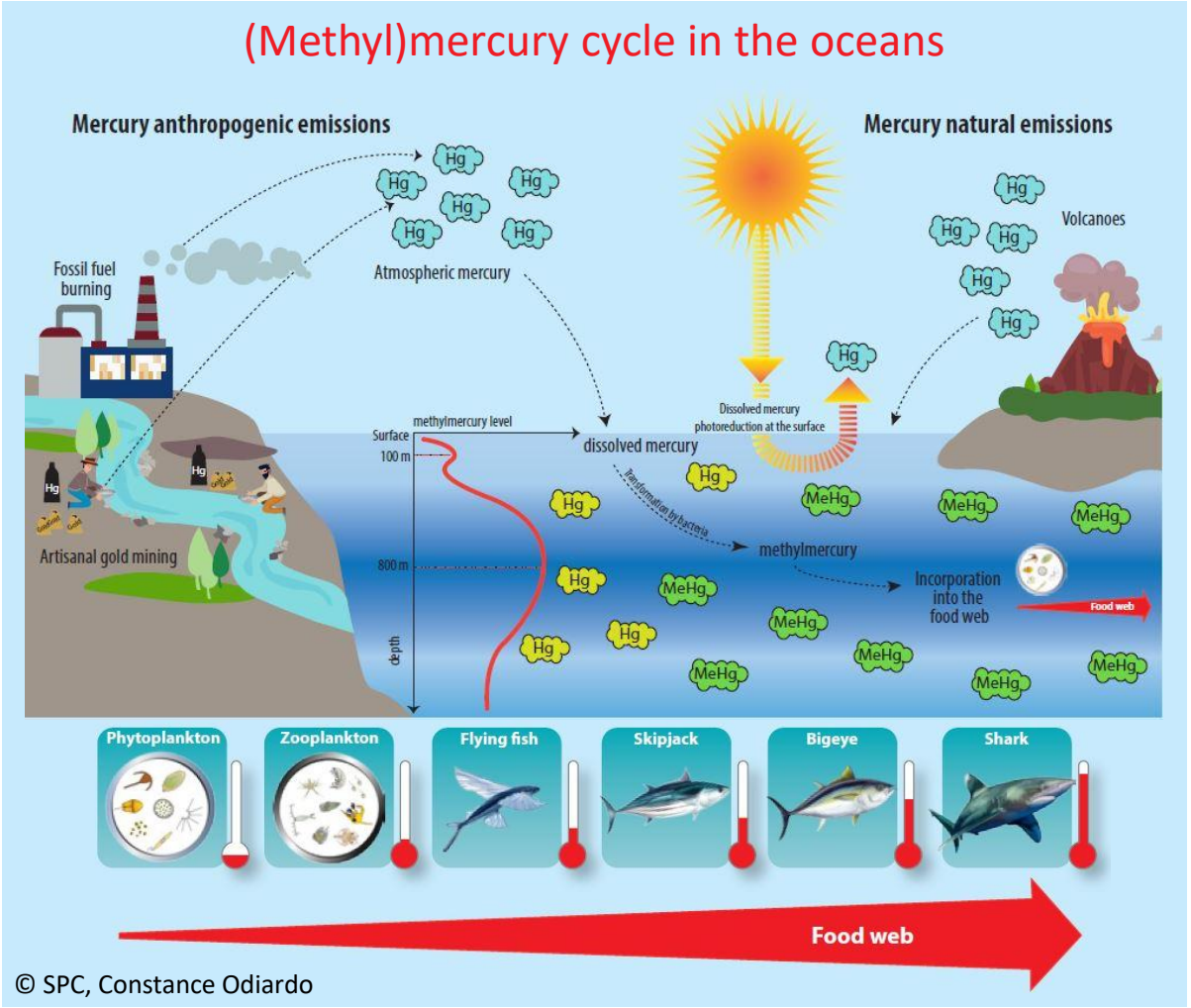

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MINAMATA CONVENTION ON MERCURY

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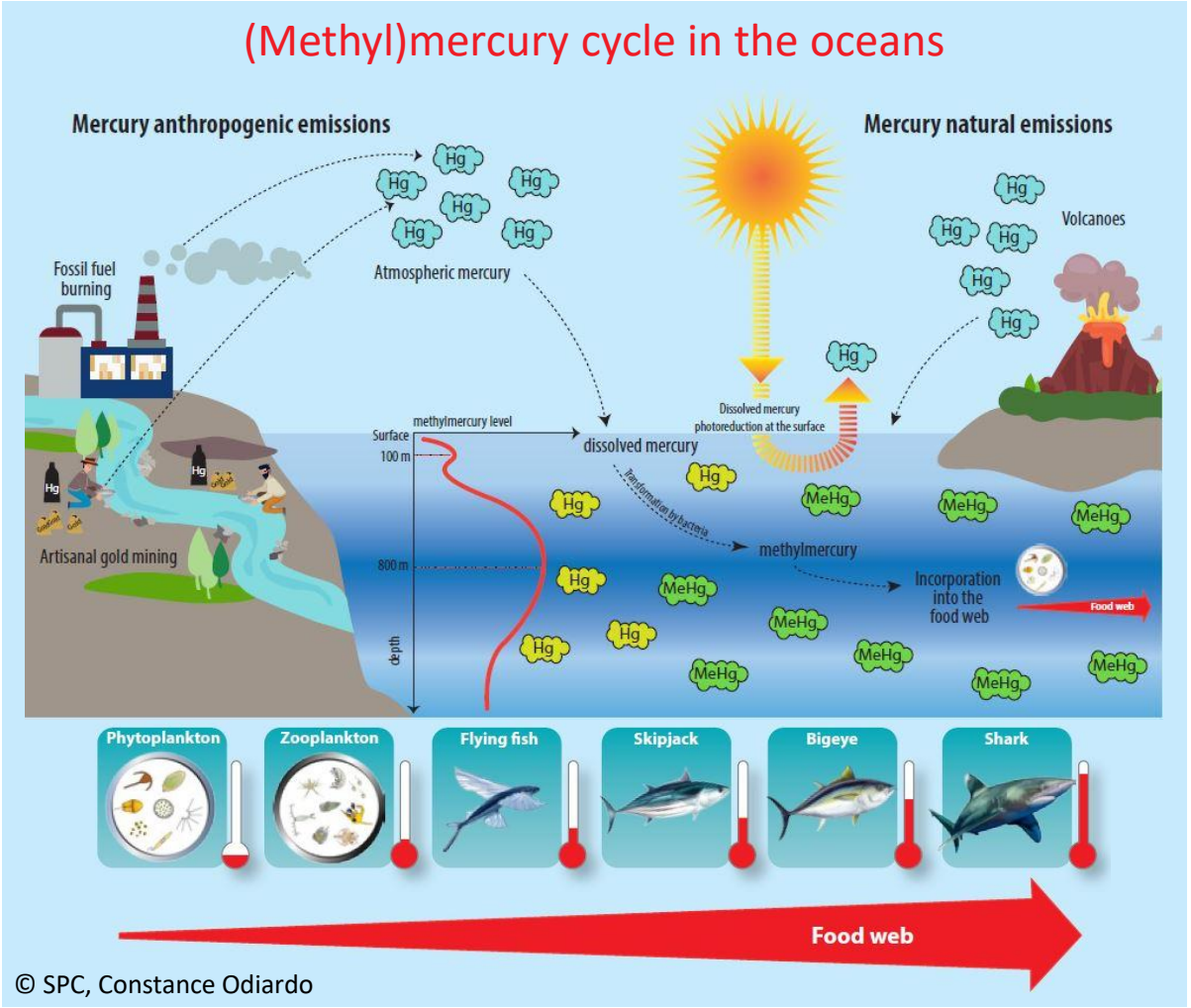
Global biomonitoring studies needed to understand pollutants accumulation in marine top predators



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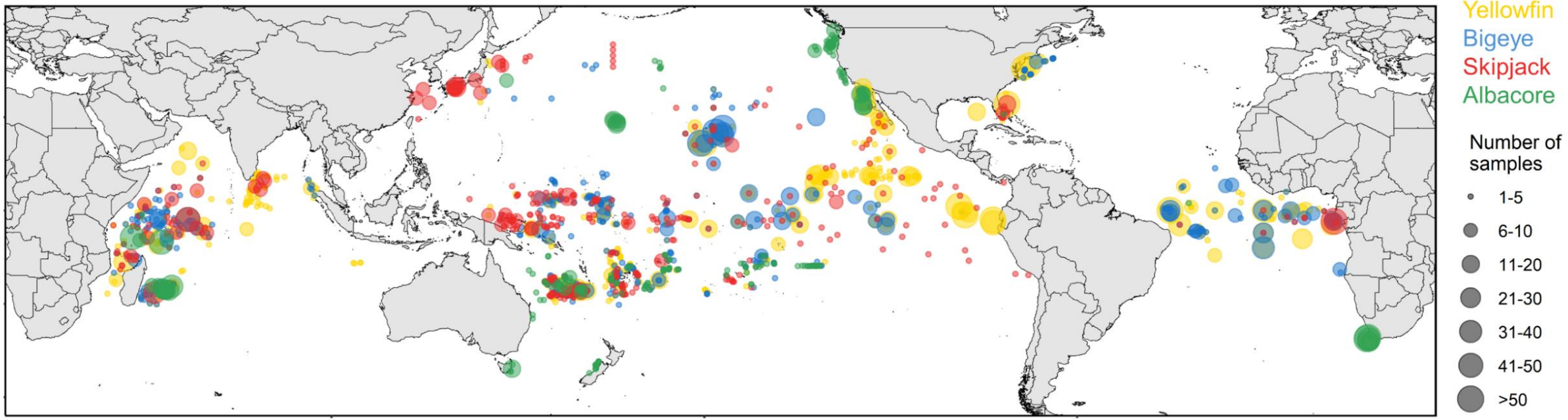
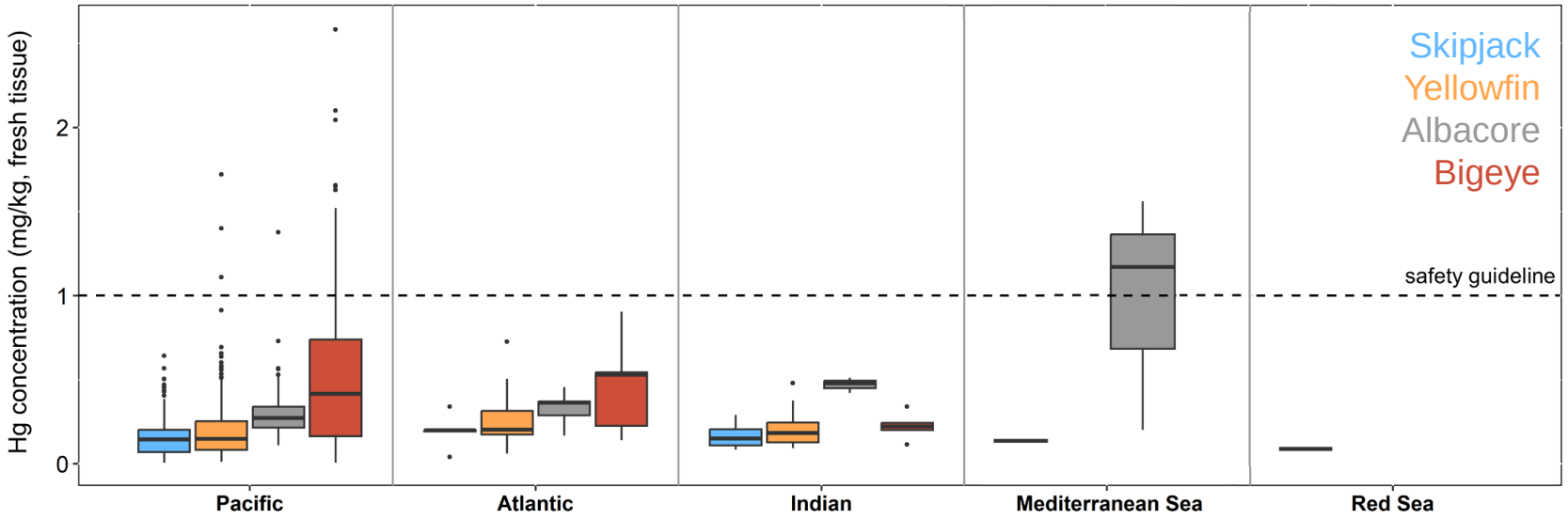
The largest global mercury (Hg) database in tunas



***n* > 5,700 samples, 27 % from the WCPFC Pacific Marine Specimen Bank**

Inter-species variability of mercury (Hg) levels



- **Tuna Hg levels highly variable** among **species** and **ocean regions**

- **General global pattern**:

skipjack < yellowfin < albacore < bigeye

Médieu et al., 2023; Houssard 2019

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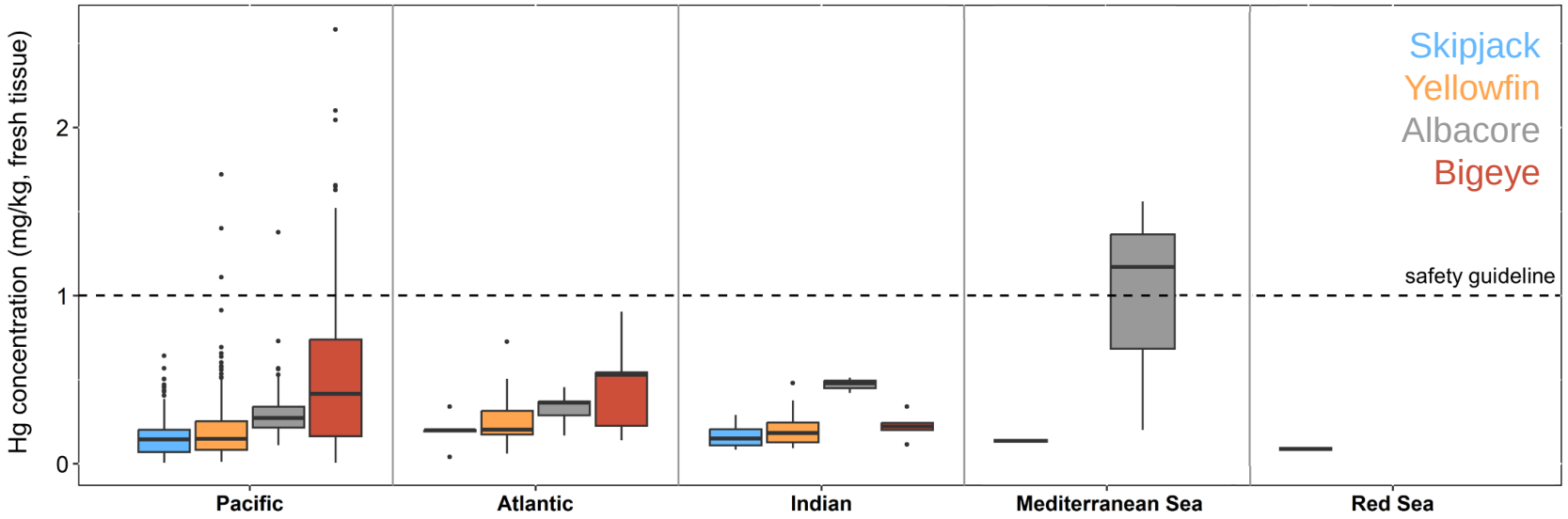

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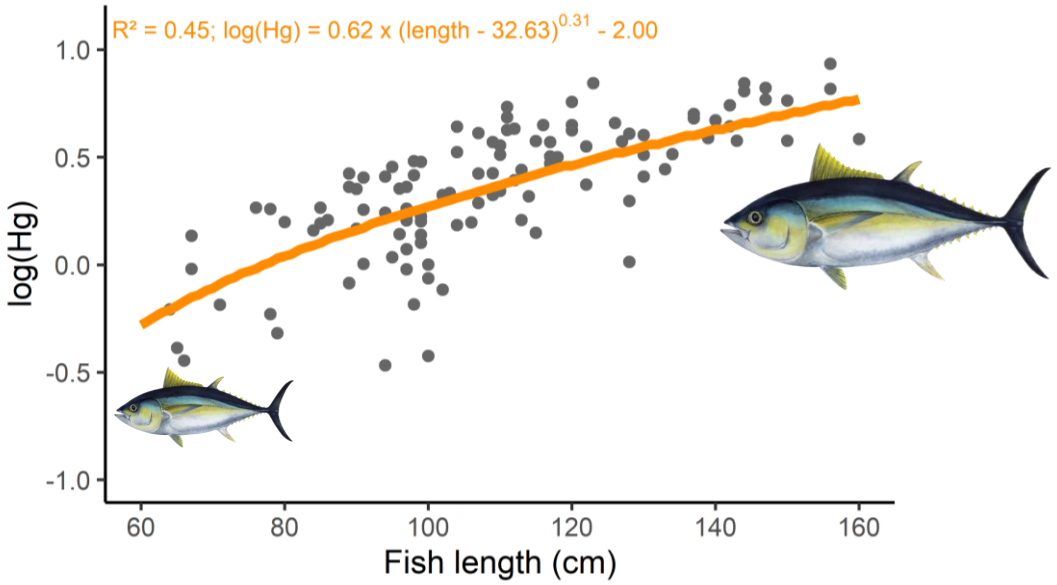
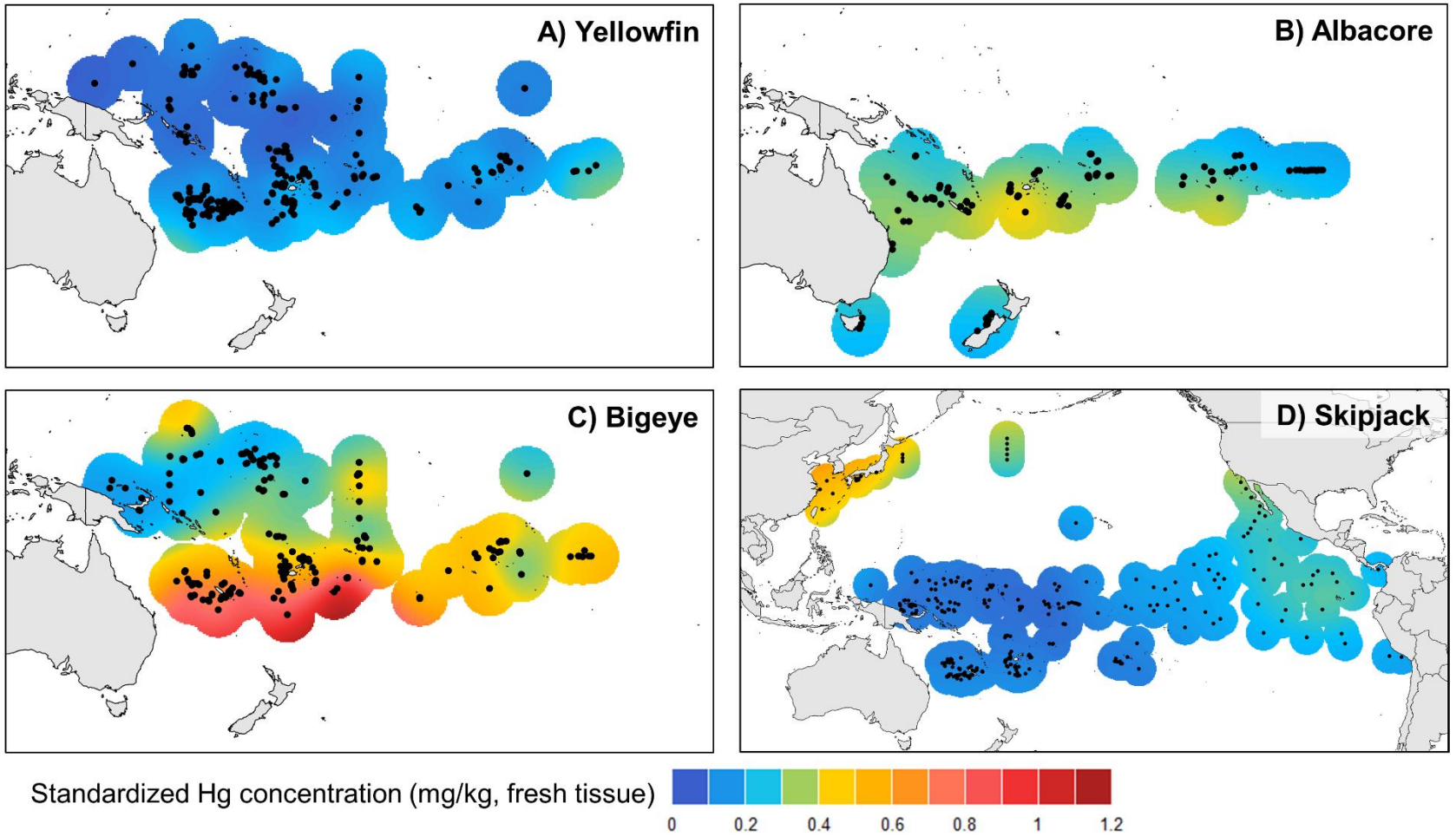


- **Fish size** is a key parameter: bigger and older individuals generally display higher Hg levels (**natural Hg bioaccumulation**)

Médieu et al., 2023; Houssard 2019

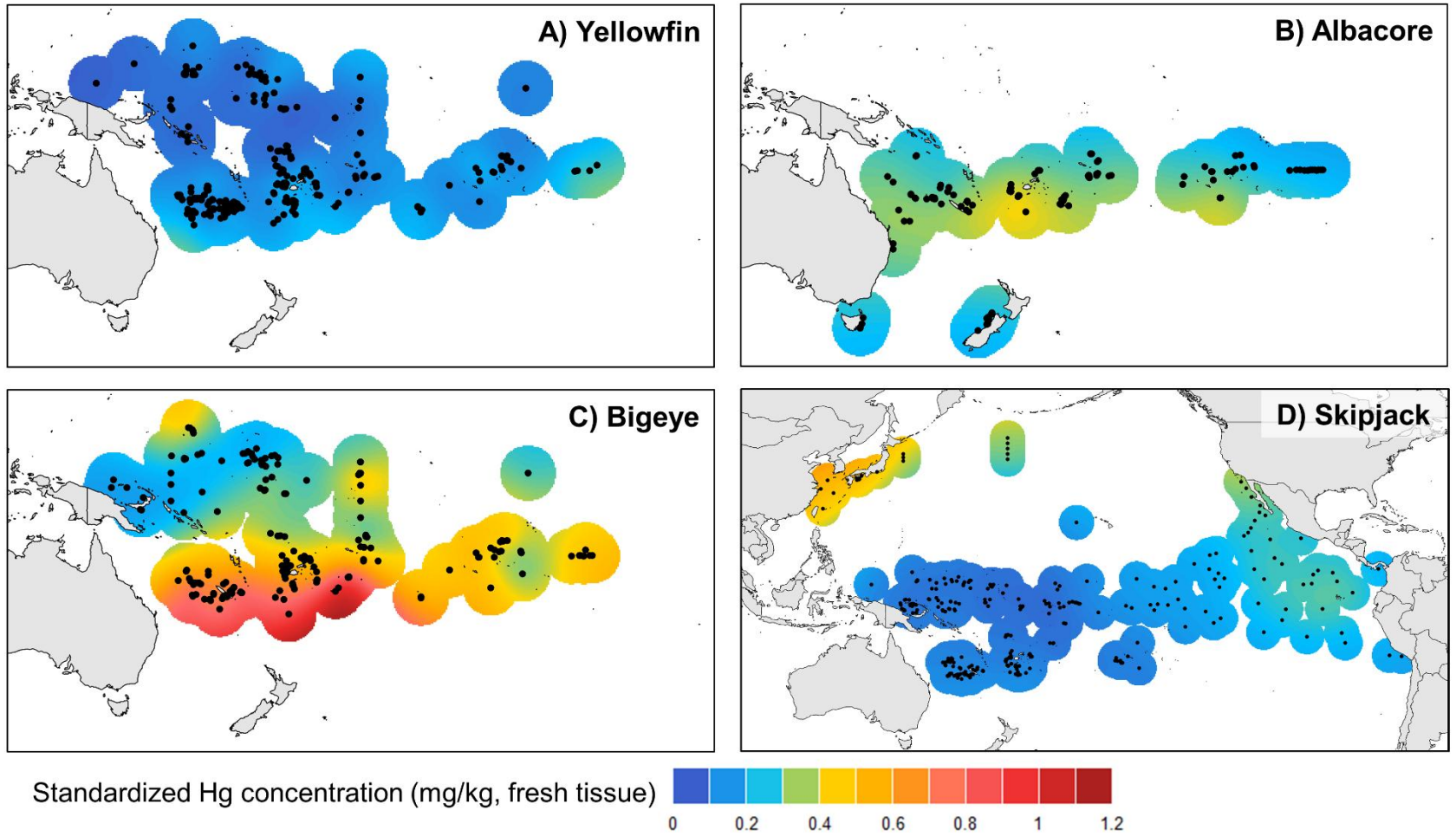
Spatial variability of tuna mercury (Hg) levels



- Strong spatial variability of tuna Hg not explained by fish size differences

Houssard et al., 2019; Médieu et al., 2022

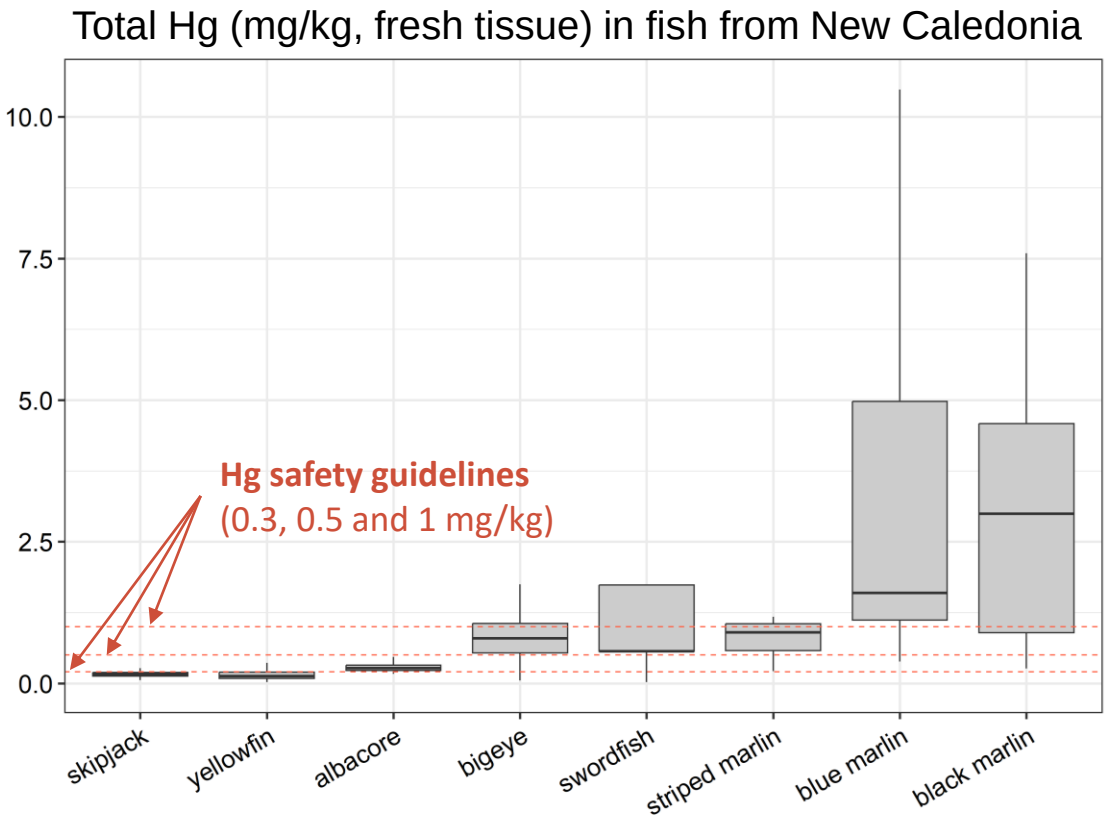
Spatial variability of tuna mercury (Hg) levels



- Strong spatial variability of tuna Hg not explained by fish size differences
- **Spatial Hg patterns** were primarily driven by **tuna foraging depth** and **regional marine biogeochemistry controlling MeHg bioavailability**
- **Local anthropogenic footprint along the Asian coats**

Houssard et al., 2019; Médieu et al., 2022

Implications for human exposure to (methyl)mercury



- **Most skipjack and yellowfin** tested (> 92 %) were **below the strictest Hg safety guideline** (0.3 mg/kg)

- **Bigeye** displayed the **highest Hg concentration among the tuna group**: **33 %** of them (**biggest individuals**) were **above the food safety guideline used for predatory fishes** (1 mg/kg)

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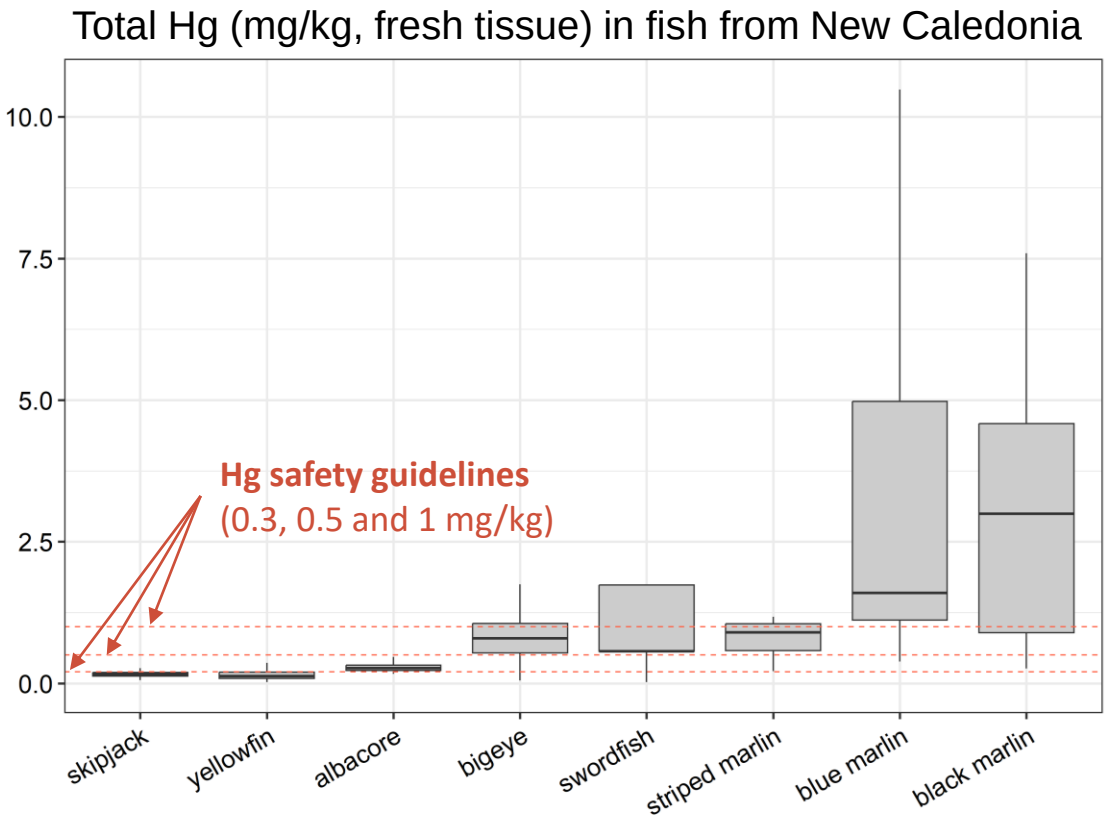

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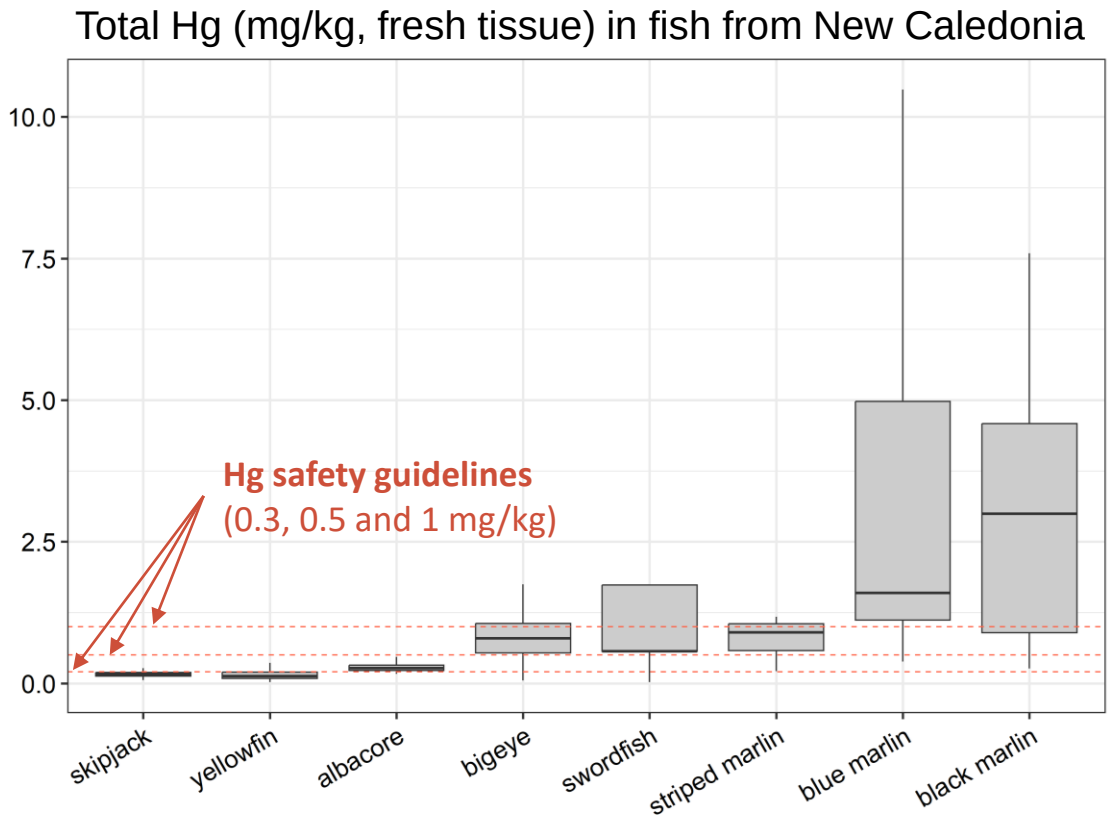

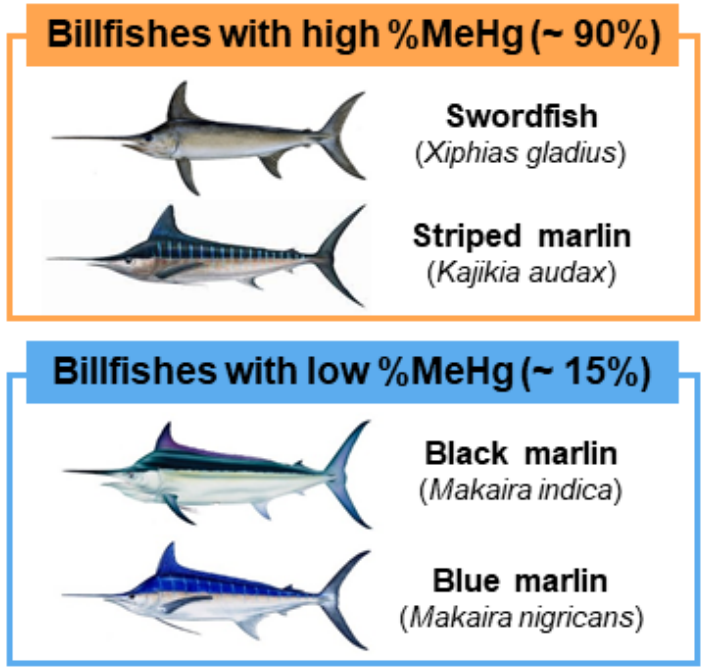

Médieu et al., 2024

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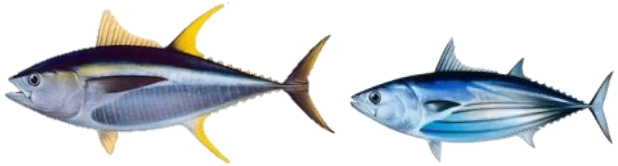
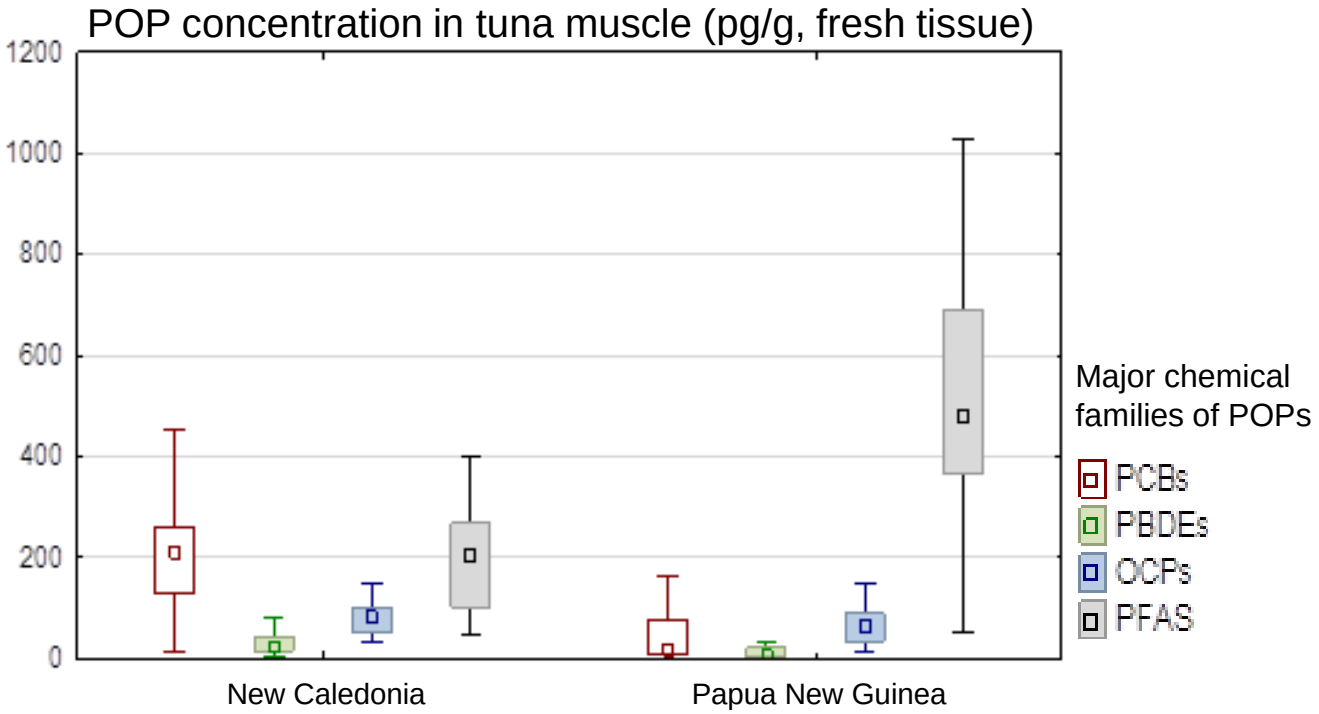
- Swordfish and marlins >> tunas
- But ***in vivo* methylmercury detoxification** capabilities in **billfishes** likely involving **selenium (Se)-dependant biological mecanisms**
  → ***Current frontier research***

Persistent organic pollutants (POPs) and plastics in tunas





- **Low POP contamination in skipjack and yellowfin** in comparison to other oceans (Munschy et al. 2020).
- **Consumption** of **these fish** currently **poses no known health risk in relation to these substances**.

Munschy et al., in prep; Gardon et al., in prep

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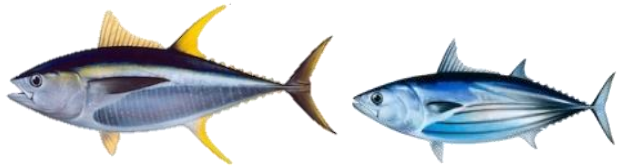

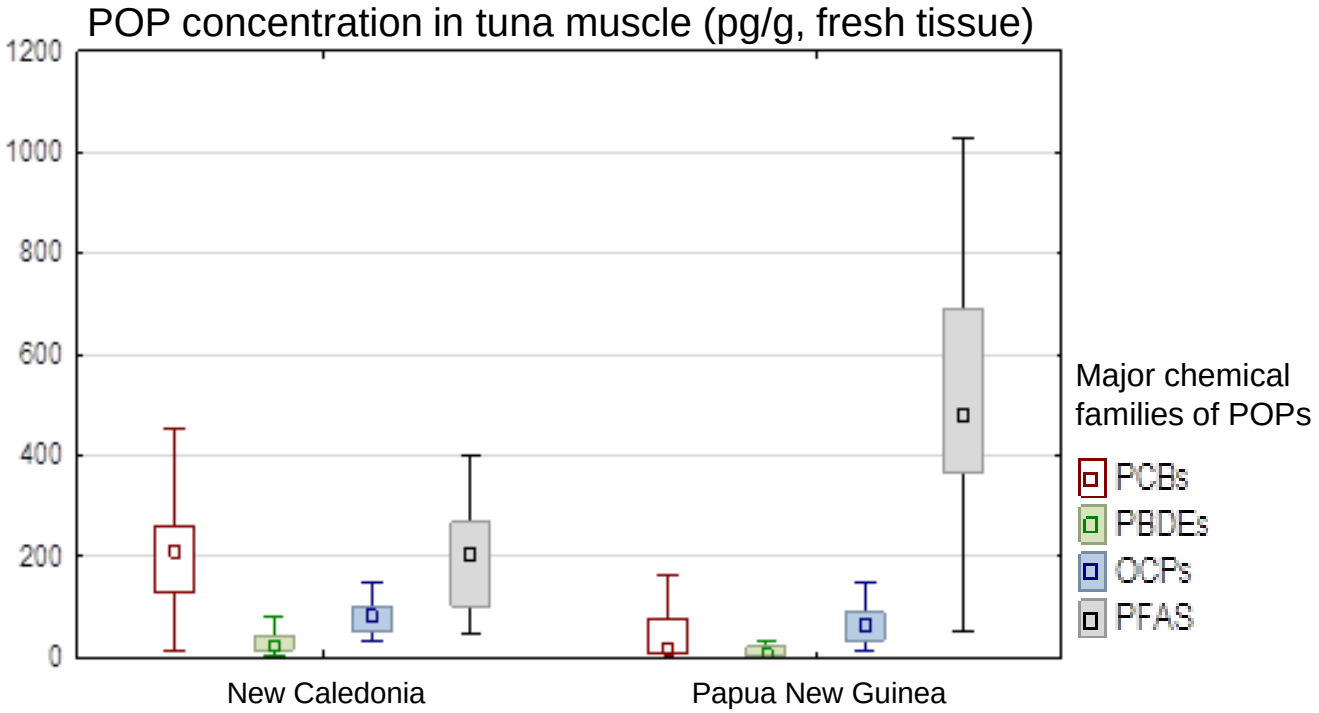

- **Low POP contamination in skipjack and yellowfin** in comparison to other oceans (Munschy et al. 2020).
- **Consumption** of **these fish** currently **poses no known health risk in relation to these substances**.
- The stomachs of 6 out of 20 tuna (30 %) contained **plastic fragments or fibres >2 mm**, and these synthetic materials were mainly polypropylene and polyester.
- Two **plastic additives** have been **detected in tuna**, at levels comparable to those found in Spain (Sambolino et al., 2023). There are no health standards for these substances.

Munschy et al., in prep; Gardon et al., in prep

Conclusion, perspectives and recommendation

The scientific committee is invited to:

- Note the **interest of conducting monitoring of pollutants in tuna and bycatch** species that could potentially impact human health.

- Note the **variations observed in pollutant concentrations according** to **fish species**, **size** and **catch location**.

- Note the **uncertainties existing on mercury contamination understanding** and the **capabilities for some species to detoxify**, likely **in relation to selenium**

- Note that **tuna and bycatch species provide fatty acids** and **essential elements beneficial to human health**.

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- Note that **tuna and bycatch species provide fatty acids** and **essential elements beneficial to human health**.

- **Support** the ongoing activities of the **Pacific Marine Specimen Bank** to maintain an accessible repository of biological samples **for long-term monitoring of known and emerging pollutants**, thereby **enhancing scientific understanding** and **informing evidence-based policies** on the **health risks and benefits of consuming tuna and bycatch** species.

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Deploying research
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Transforming the future

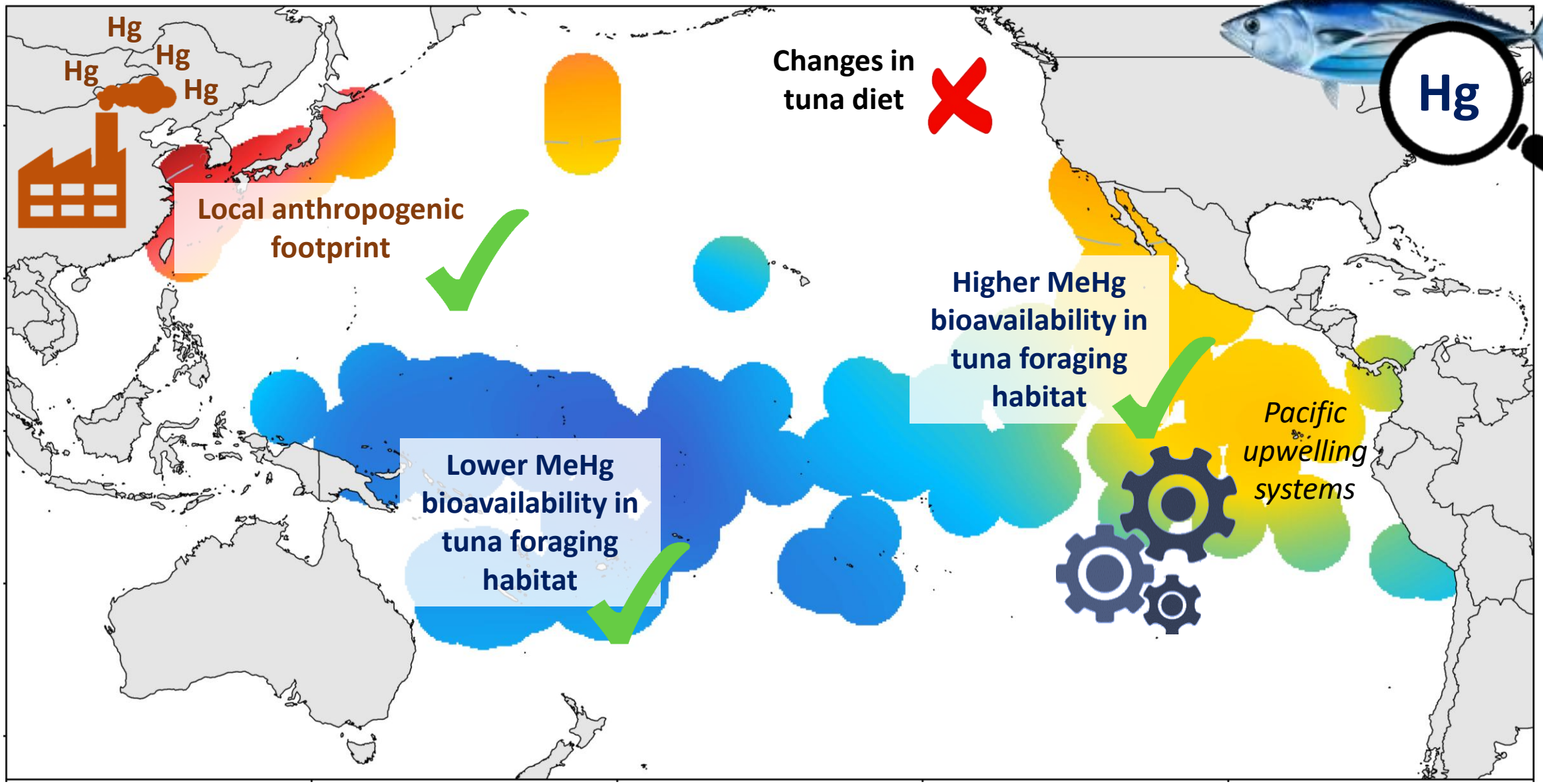
Many thanks to our collaborators:

- the **WCPFC Pacific Marine Specimen Bank** and the **Pacific Community Fisheries, Aquaculture and Marine Ecosystems (FAME) division**
- all the **fishermen**, **observers**, **port samplers**, and **technical staff** who participated in the collection and preparation of tuna samples
- the **research communities** working on **tuna ecology**, **mercury cycle**, **emerging pollutants**, **biogeochemical modelling**, and **ecotoxicology** who contributed to this research

This work has been conducted in the framework and with the financial support of the MERTOX project from Agence Nationale de la Recherche, the Pacific Fund VACOPA and TIPTOP projects, Région Bretagne, Université de Bretagne Occidentale, and IRD.

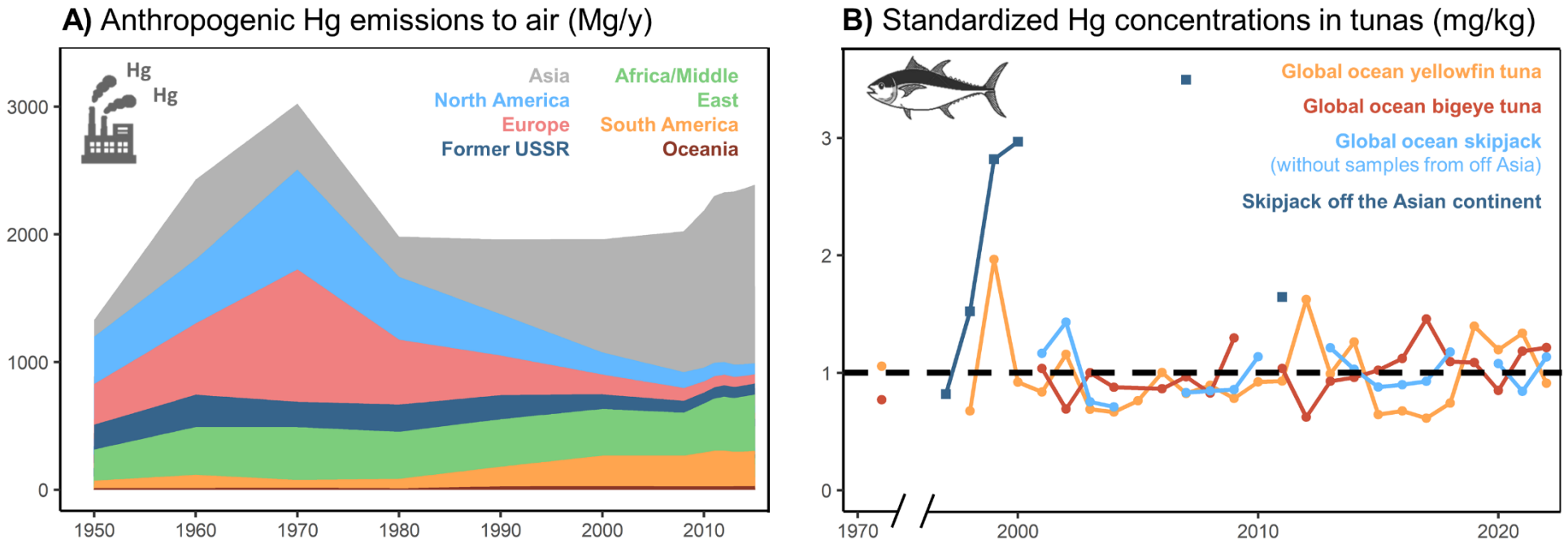
It was assisted by collaborations under the international framework of the IMBeR regional program Climate Impacts On Oceanic Top Predators (CLIOTOP).

Spatial variability of tuna mercury (Hg) levels



Médieu et al., 2022, PNAS

Contrasted temporal trends of tuna mercury (Hg) levels



Médieu et al., 2021; 2024

- **Increasing tuna Hg levels** in the **northwestern Pacific** during the **late 1990s**, coinciding with rising **Asian anthropogenic Hg emissions**
- **Stable tuna Hg concentrations since 1970** despite global efforts to reduce anthropogenic Hg emissions in the environment
- Reflect **ocean inertia** and the **persistence of legacy Hg** emitted centuries ago

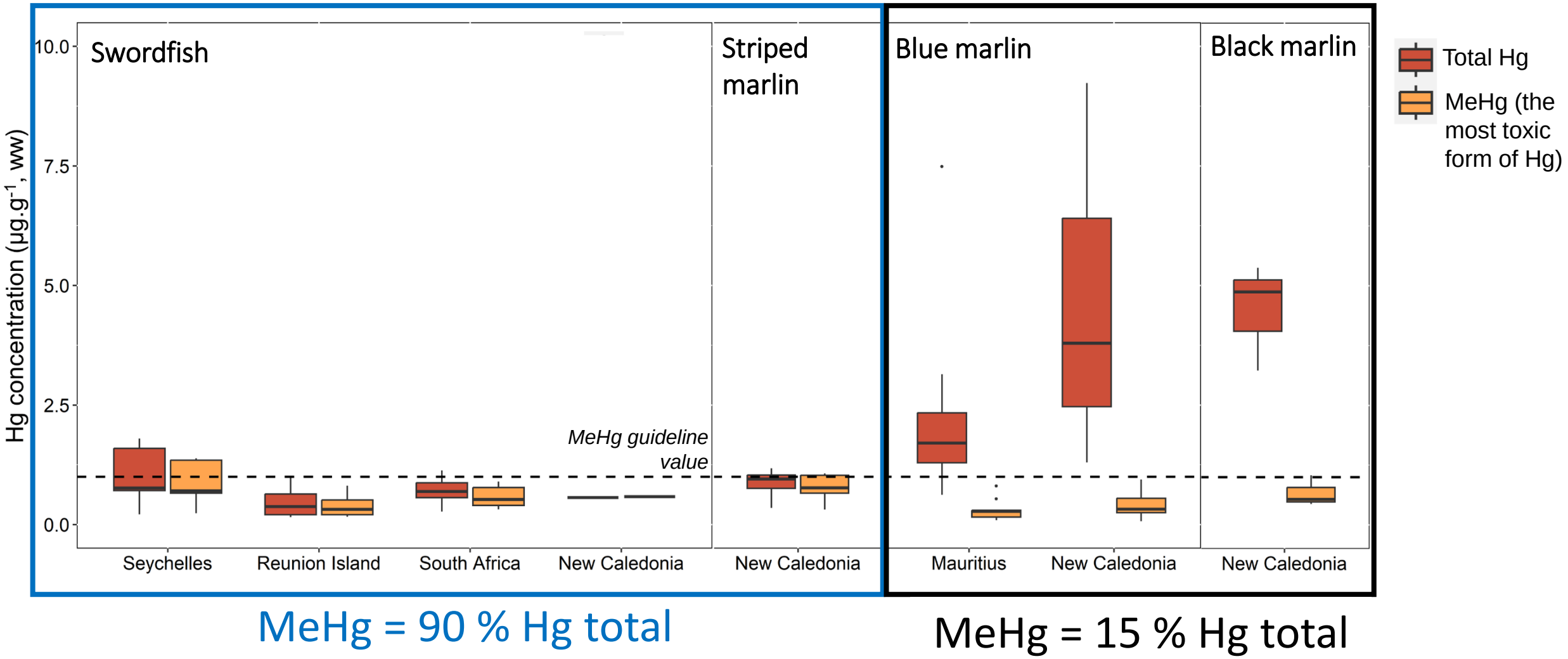
→ **Need for strong emissions reductions** under the **UNEP Minamata Convention**

- **Elevate tropical tunas** as relevant **biomonitoring tools** to **document changes of the marine Hg cycle**

→ **Need for large-scale monitoring programs** to evaluate the **effectiveness of environmental policies**

MINAMATA CONVENTION ON MERCURY

In vivo detoxification of MeHg in billfishes



MeHg = 90 % Hg total

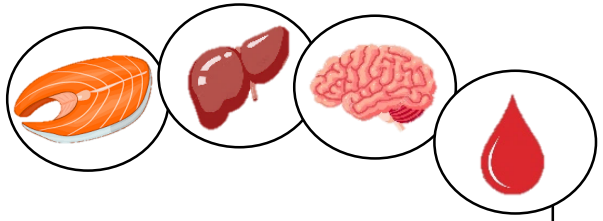
MeHg = 15 % Hg total

***In vivo* methylmercury detoxification** capabilities in billfishes likely involving **selenium (Se)-dependant biological mecanisms**

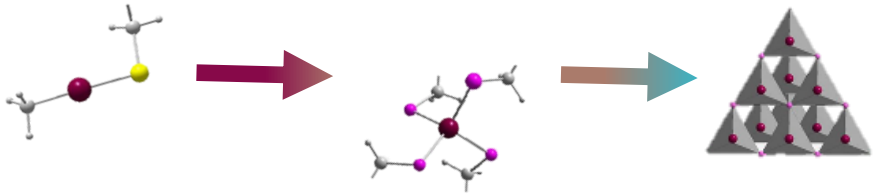
Médieu et al., 2024

In vivo detoxification of MeHg and role of selenium

Hg-Se interactions in different fish tissues

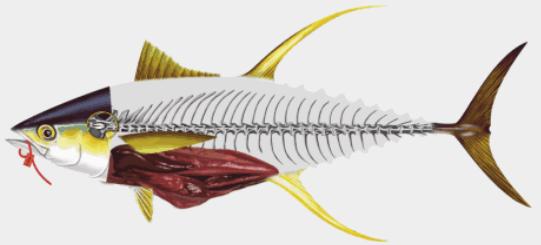


MeHg → $Hg(Sec)_4$ → HgSe



PACIFIC MARINE SPECIMEN BANK

Samples to understand the biology and ecology of specimens in the Pacific region



Internal dynamics and distribution of Hg and Se

Brain

Gonads

Blood

Muscle

Spleen

Kidney

Liver