NEUROSOME

Exploring The Neurological Exposome

Mercury Concentrations In Edible Fish From The Western Mediterranean Sea (Balearic Islands, Marseille And Alicante)

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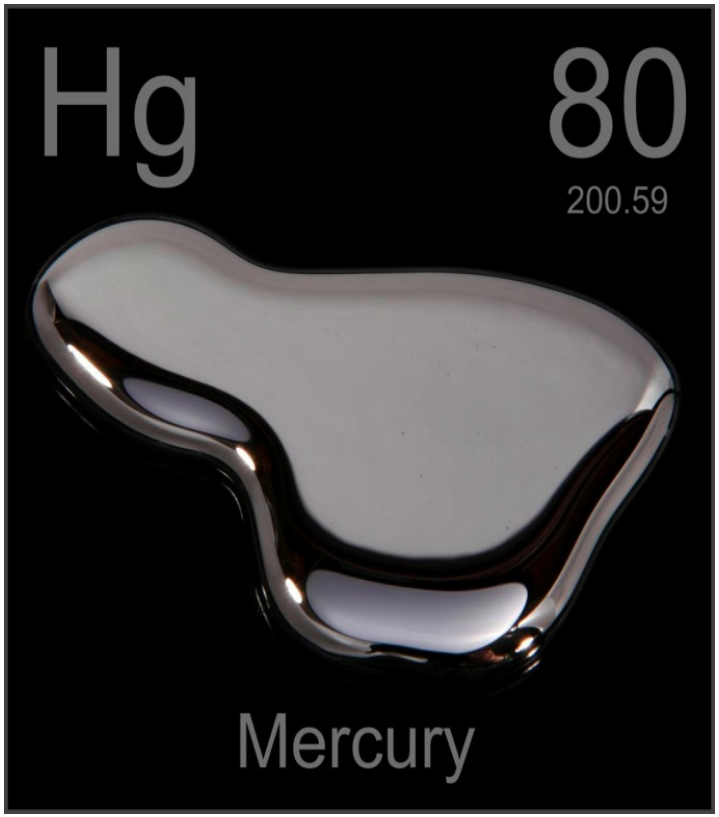
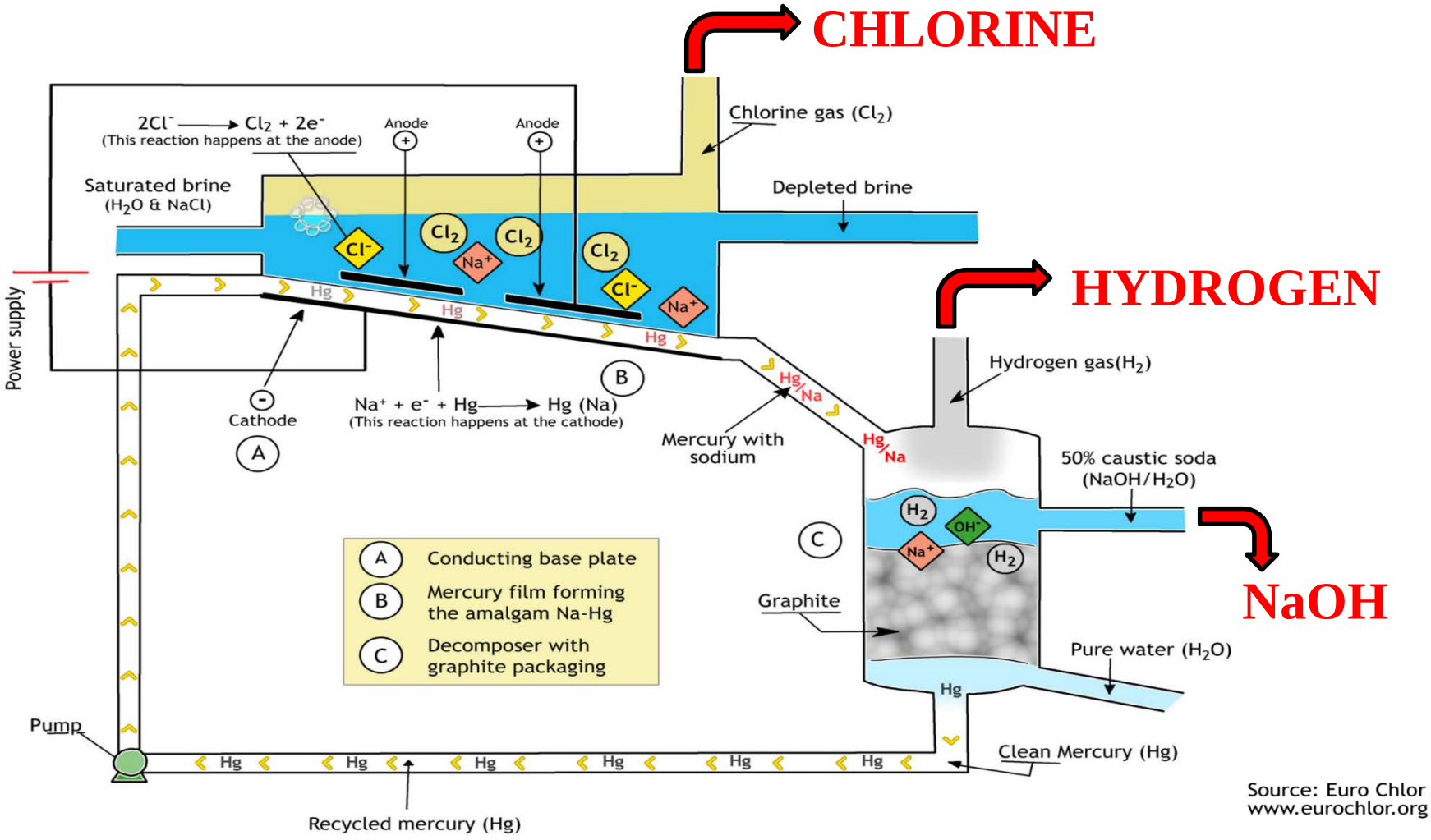
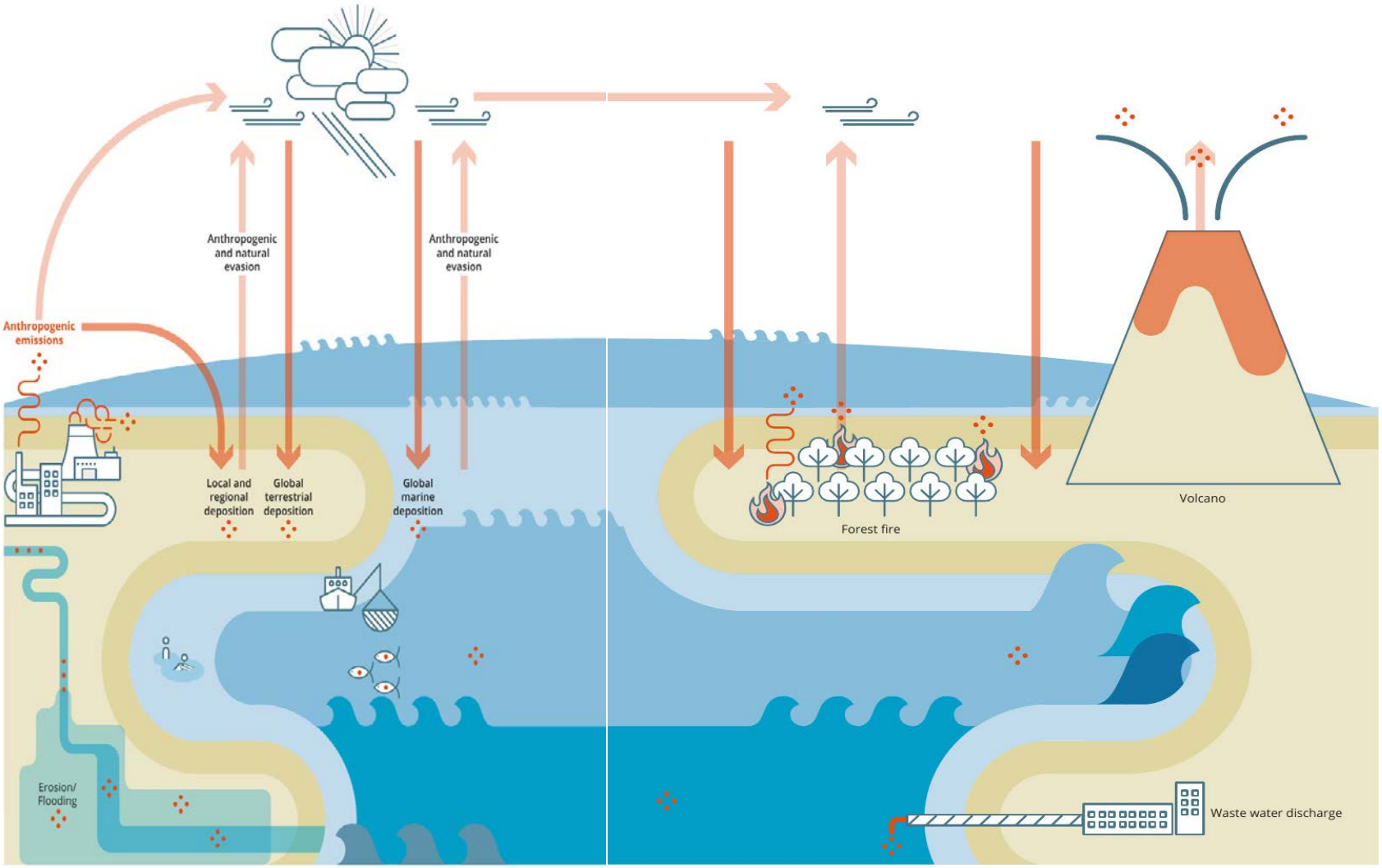


(Streets et al., 2017).


CHLORINE
HYDROGEN
NaOH
$2Cl^- \rightarrow Cl_2 + 2e^-$
(This reaction happens at the anode)
Anode
Anode
Chlorine gas (Cl_2)
Saturated brine
(H_2O & NaCl)
Depleted brine
Power supply
Hydrogen gas(H_2)
Cathode
A
$Na^+ + e^- + Hg \rightarrow Hg\ (Na)$
(This reaction happens at the cathode)
B
Mercury with sodium
50% caustic soda
($NaOH/H_2O$)
C
Graphite
Pure water (H_2O)
Pump
Recycled mercury (Hg)
Clean Mercury (Hg)
A Conducting base plate
B Mercury film forming the amalgam Na-Hg
C Decomposer with graphite packaging
Source: Euro Chlor
www.eurochlor.org

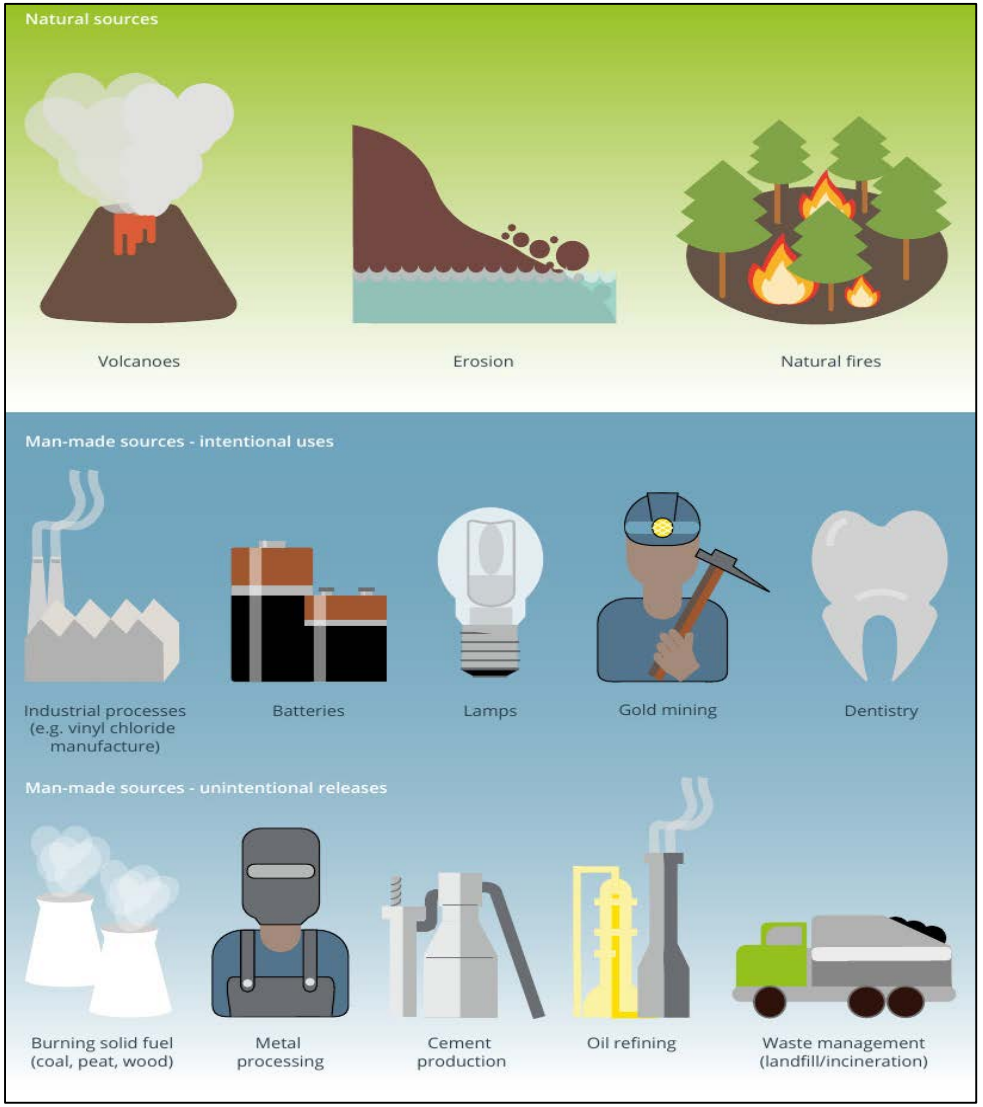
The global mercury cycle



(Selin, 2009)

Annual mercury emission to atmosphere

- about 10% = natural sources (eruptions, erosions, natural fires)
- about 30% = anthropogenic activities (coal combustion and industrial activities).
- about 60% = re-emissions of mercury that was previously released into the environment.



(UNEP, 2013)

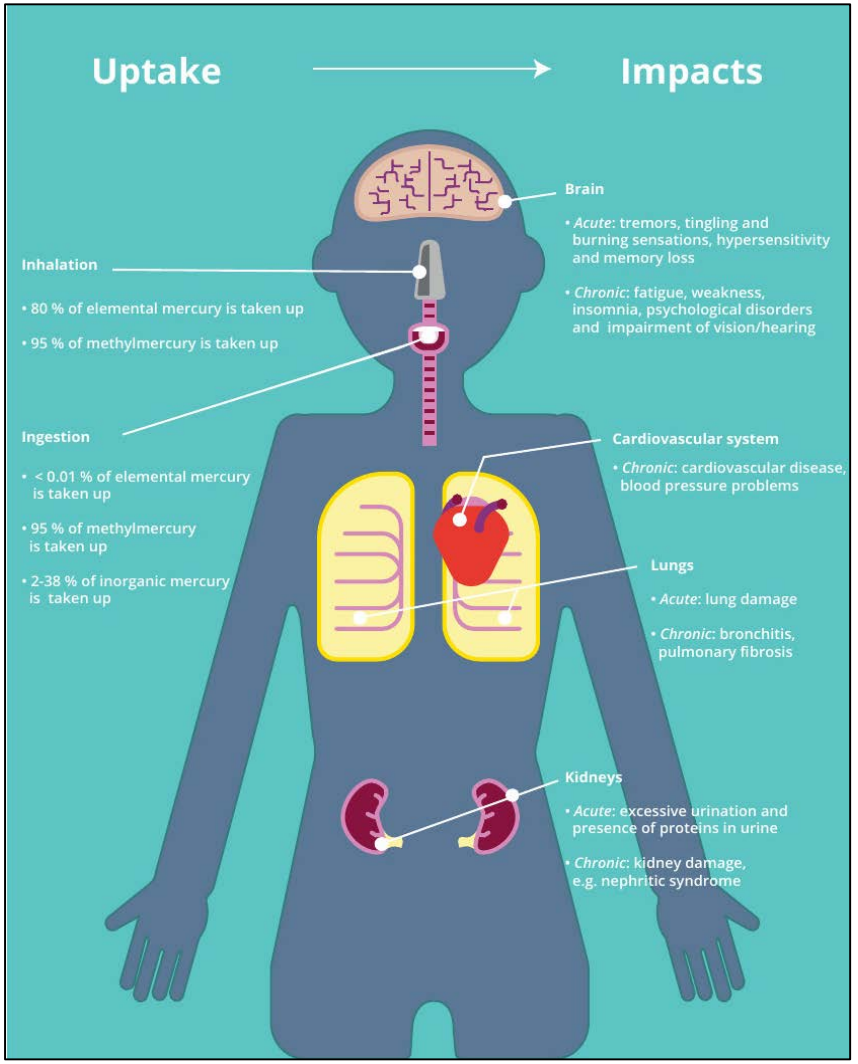
Hg uptake: potential and relevant impacts

Mercury affects mainly:

1. nervous system
2. kidneys
3. lungs (when inhalated)
4. cardiovascular system

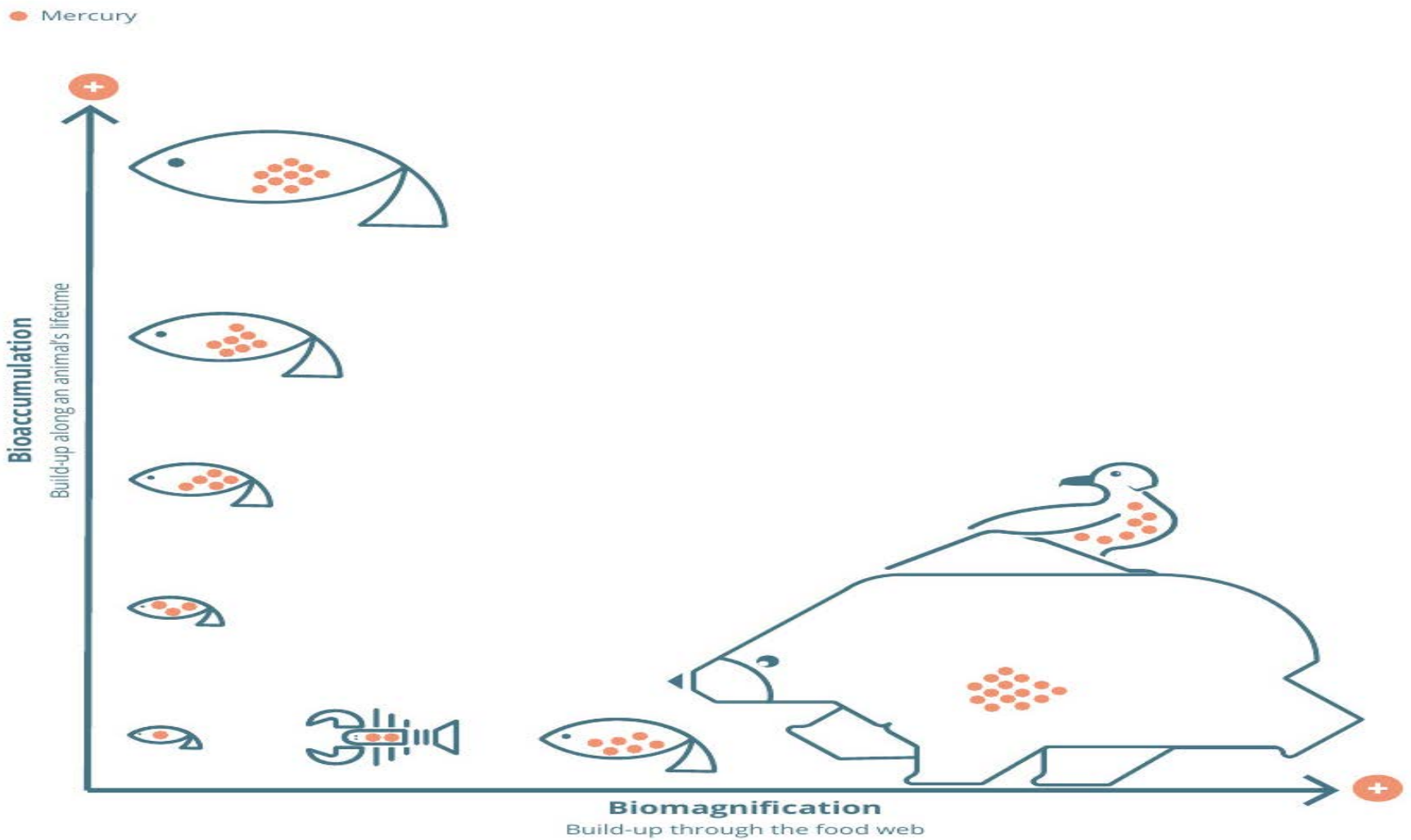
Hg exposure during pregnancy or in infancy affects the <u>development of the brain and nervous system</u>.

- vision and hearing problems
- impaired motor skills
- delays in language
- development & memory/ attention deficits.



(Bose-O'Reilly et al., 2010; Grandjean & Herz, 2011; Bernhoft, 2012; Karagas et al., 2012; Park & Zheng, 2012; Genchi et al., 2017).

Bioaccumulation of mercury within species and biomagnification through the food web



(Khaniki et al., 2005; Perrot et al., 2010)

The Mediterranean Sea supplies fish to over 480 million people.

(Višnjevec et al., 2014; European Environment Agency, 2015)

Limitations and threshold value imposed by EU legislation

H2020-MSCA-ITN-2017 GA - 766251

- The maximum safe mercury content specified is 0.5 milligrams per kilogram – wet weight (ww) - for most fish species, and 1 milligram per kilogram, ww, for some predatory species.

- In addition, European and national food safety authorities provide advice on fish consumption with a view to minimising mercury intake.

(EFSA, 2006)

Objectives

The aim of this study was to to report mercury concentrations in edible fish species from the Westerns Mediterranean Sea, with a special focus on the Balearic Islands, Marseille and Alicante, in order to assess the potential toxicity risk of Hg in the population that usually consume fish in their daily/weekly diet.


500 km
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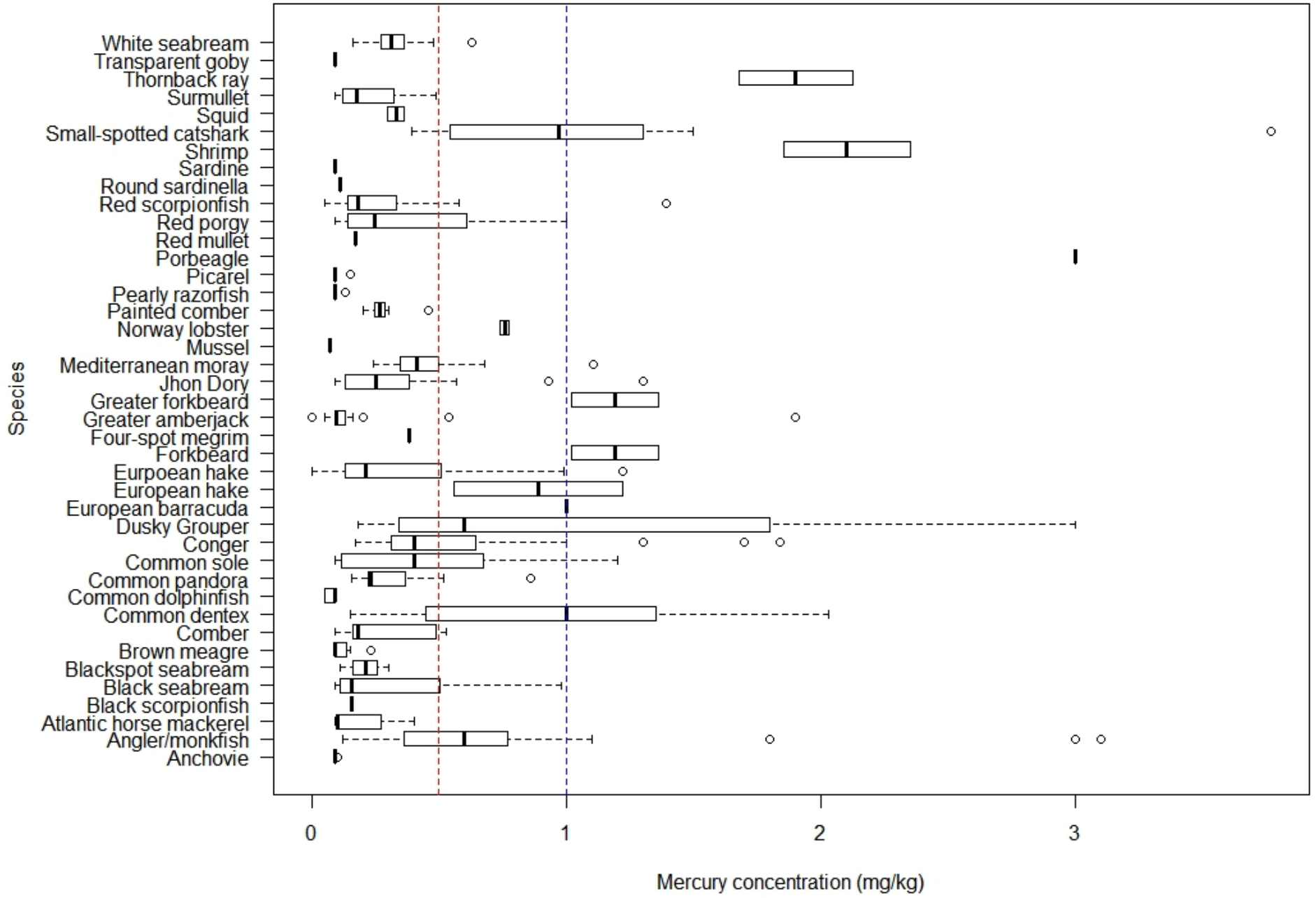
Tunis
Valletta
1927
MERCADO DE PESCADOS


White seabream
Transparent goby
Thornback ray
Surmullet
Squid
Small-spotted catshark
Shrimp
Sardine
Round sardinella
Red scorpionfish
Red porgy
Red mullet
Porbeagle
Picarel
Pearly razorfish
Painted comber
Norway lobster
Mussel
Mediterranean moray
Jhon Dory
Greater forkbeard
Greater amberjack
Four-spot megrim
Forkbeard
Eurpoean hake
European hake
European barracuda
Dusky Grouper
Conger
Common sole
Common pandora
Common dolphinfish
Common dentex
Comber
Brown meagre
Blackspot seabream
Black seabream
Black scorpionfish
Atlantic horse mackerel
Angler/monkfish
Anchovie
Species
0
1
2
3
Mercury concentration (mg/kg)

Results

The mercury concentration ranges were from 0.09 to 3.76 mg/kg wet weight - ww - (mean 0.45 mg/kg, ww) in the Balearic Islands.

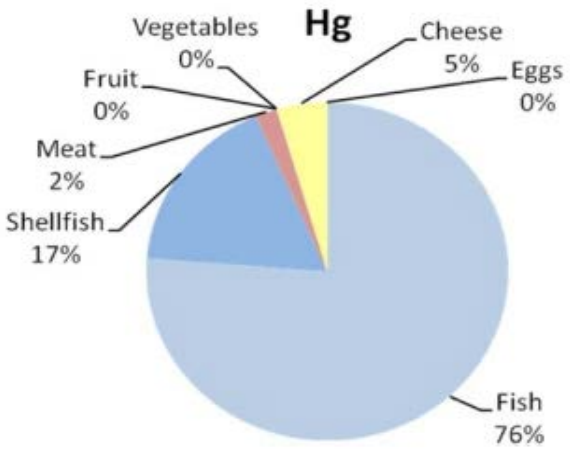
- 66% of the analyzed fish species exceeded the human consumption safety limits.

- 12% duplicates the threshold values.

- Taking into consideration the individual species in this area, 82% of the Dusky groupers (*Epinephelus marginatus*) specimens analyzed have Hg concentration above the limit.

- Food Frequency Questionnaire (FFQs) -> Fish frequency intake per day and per week.

- Hair samples in children (4 years) -> Hg concentration



Population study

The Hg week intake was 11 mg/kg – body weight (bw) per week – for 4-years children (average bw = 18,5 kg).

The Provisional Tolerable Weekly Intake (PTWI) for total Hg recommended by FAO/WHO was 4 mg/kg bw.

Since about 90% of total Hg in fish is present in the form of MeHg (the most toxic form for humans and animals), the weekly intake of MeHg for children is 7.52 mg/kg bw per week. The PTWI for MeHg are set to 1.3 mg/kg bw (EFSA, 2012).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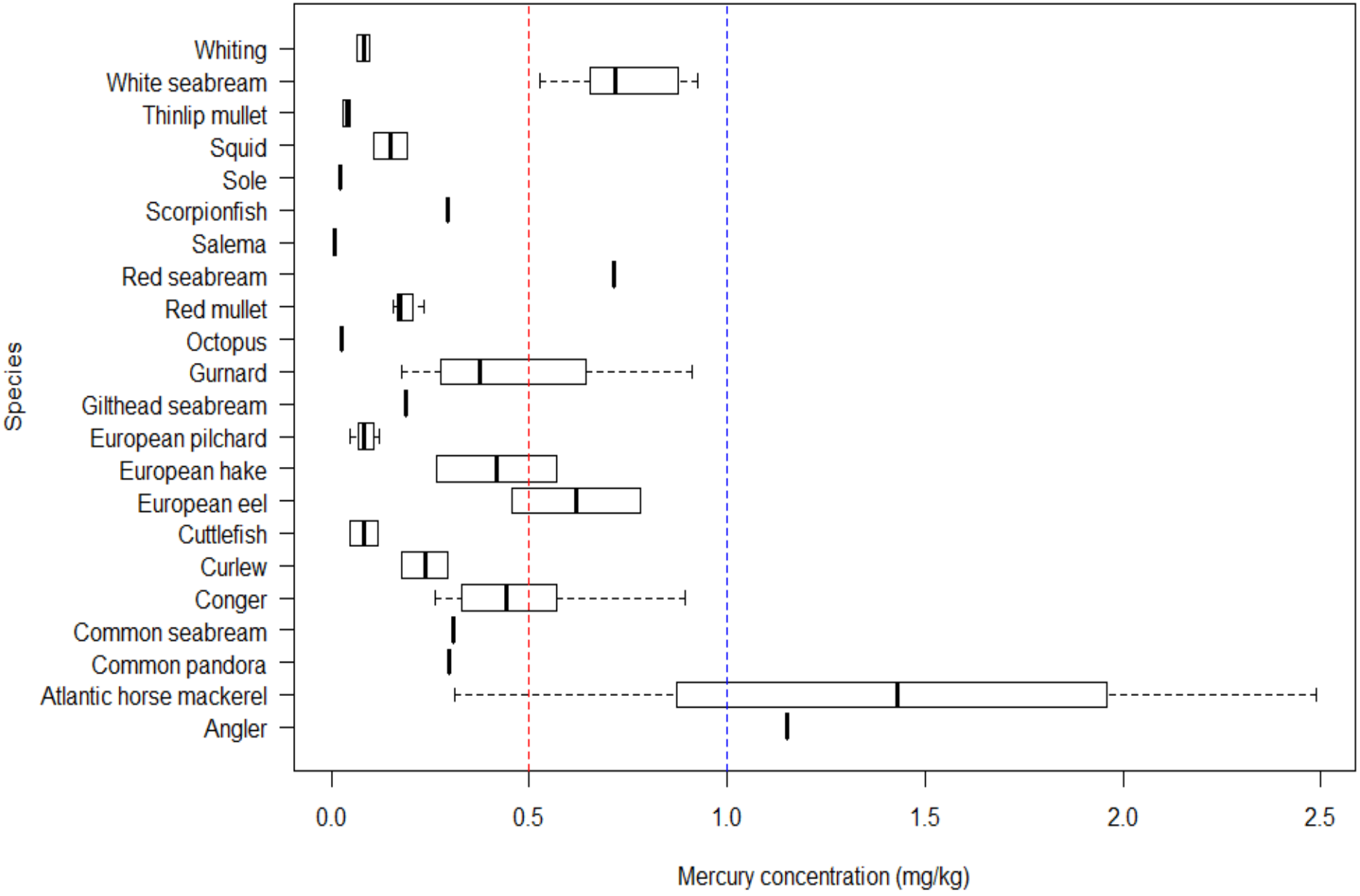
Whiting
White seabream
Thinlip mullet
Squid
Sole
Scorpionfish
Salema
Red seabream
Red mullet
Octopus
Gurnard
Gilthead seabream
European pilchard
European hake
European eel
Cuttlefish
Curlew
Conger
Common seabream
Common pandora
Atlantic horse mackerel
Angler
Species
0.0
0.5
1.0
1.5
2.0
2.5
Mercury concentration (mg/kg)

Results

The mercury concentration ranges were from 0.02 to 2.48 mg/kg, ww (mean 0.35 mg/kg, ww) in Marseille.

- 24% of the analyzed fish species exceeded the human consumption safety limits.

- 6% duplicates the threshold values.

- Taking into consideration the individual species in this area, 100% of the White seabream (*Diplodus sargus*) specimens analyzed have Hg concentration above the limit.

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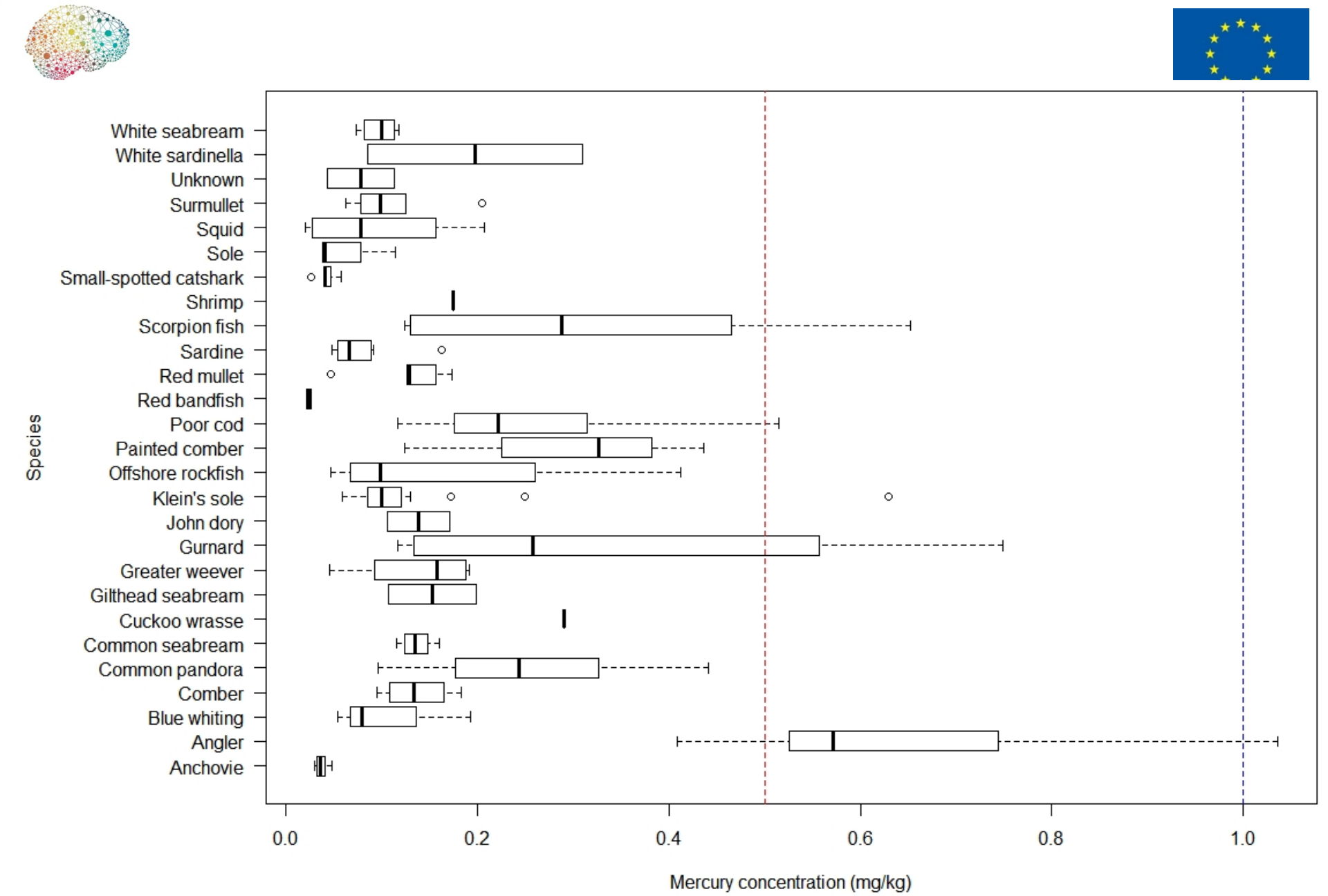
White seabream
White sardinella
Unknown
Surmullet
Squid
Sole
Small-spotted catshark
Shrimp
Scorpion fish
Sardine
Red mullet
Red bandfish
Poor cod
Painted comber
Offshore rockfish
Klein's sole
John dory
Gurnard
Greater weever
Gilthead seabream
Cuckoo wrasse
Common seabream
Common pandora
Comber
Blue whiting
Angler
Anchovie
Species
0.0
0.2
0.4
0.6
0.8
1.0
Mercury concentration (mg/kg)

The mercury concentration ranges were from 0.02 to 1.03 mg/kg, ww (mean 0.18 mg/kg, ww) in Alicante.

- 4% of the analyzed fish species exceeded the human consumption safety limits.

- 0% duplicates the threshold values.

- Taking into account the individual species in this area, 13% of the Poor cod (*Trisopterus minutus*) specimens analyzed present Hg concentration above the limit.

Conclusion

In total 699 specimens were analyzed: 183 specimens (26% of the total) were beyond the limits, 66 of which (9% of the total) duplicates the threshold value.

Most of the samples that were above the European threshold values come from Balearic Islands and Marseille (99%). Only 1% belongs to Alicante samples.

All the fish samples that overcome the threshold value by at least twice hail from Marseille and Balearic Island.

Next steps

- Reinforce the relevant data from Marseille, completing another fish sampling campaign.

- Going sampling in other strategic sites in Italy to have a complete pictures of the mercury risk in the whole Western Mediterrnean Sea.

- Evaluation of the effects of mercury exposure on the population that consume a great amount of fish in their daily/weekly diet.

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idaea INSTITUT DE DIAGNOSI AMBIENTAL I ESTUDIS DE L'AIGUA

CSIC CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

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GOVERN ILLES BALEARS

THANK YOU FOR YOUR ATTENTION!

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Adverse effects on animals

Toxic effects include:

- reduced fertility
- reduced breeding frequency
- impaired development of embryos
- changes in behaviour
- negative effects on blood chemistry
- brain damage

In fish:

- different hatching times
- decrease survival rates of offspring.

(Rutkiewicz et al., 2011; Tartu et al., 2013; Bridges et al., 2016).

AMA-254 Advanced Mercury Analyzer


1927
MERCADO DE PESCADOS