Mixture effects and endocrine disruptors

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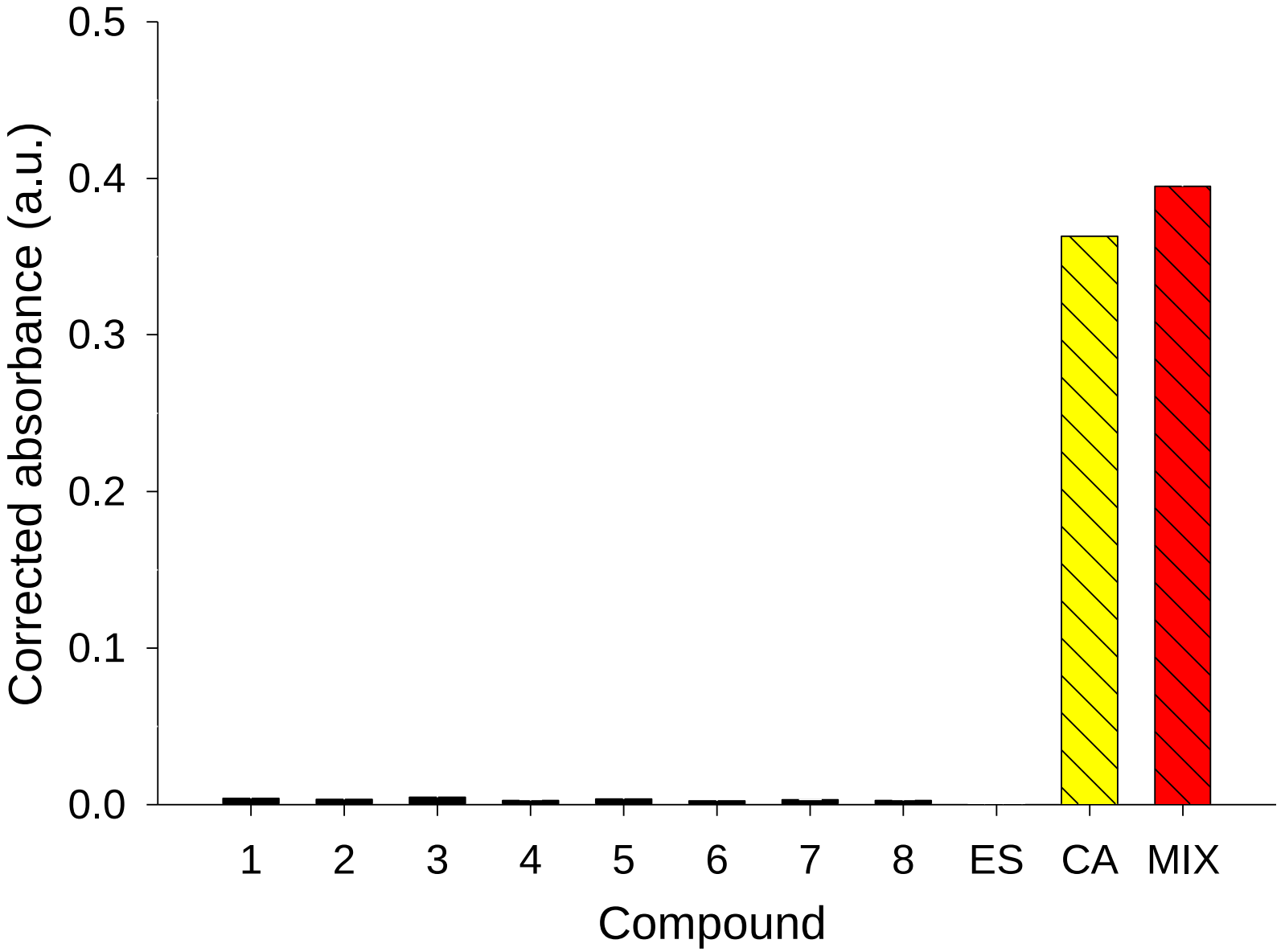
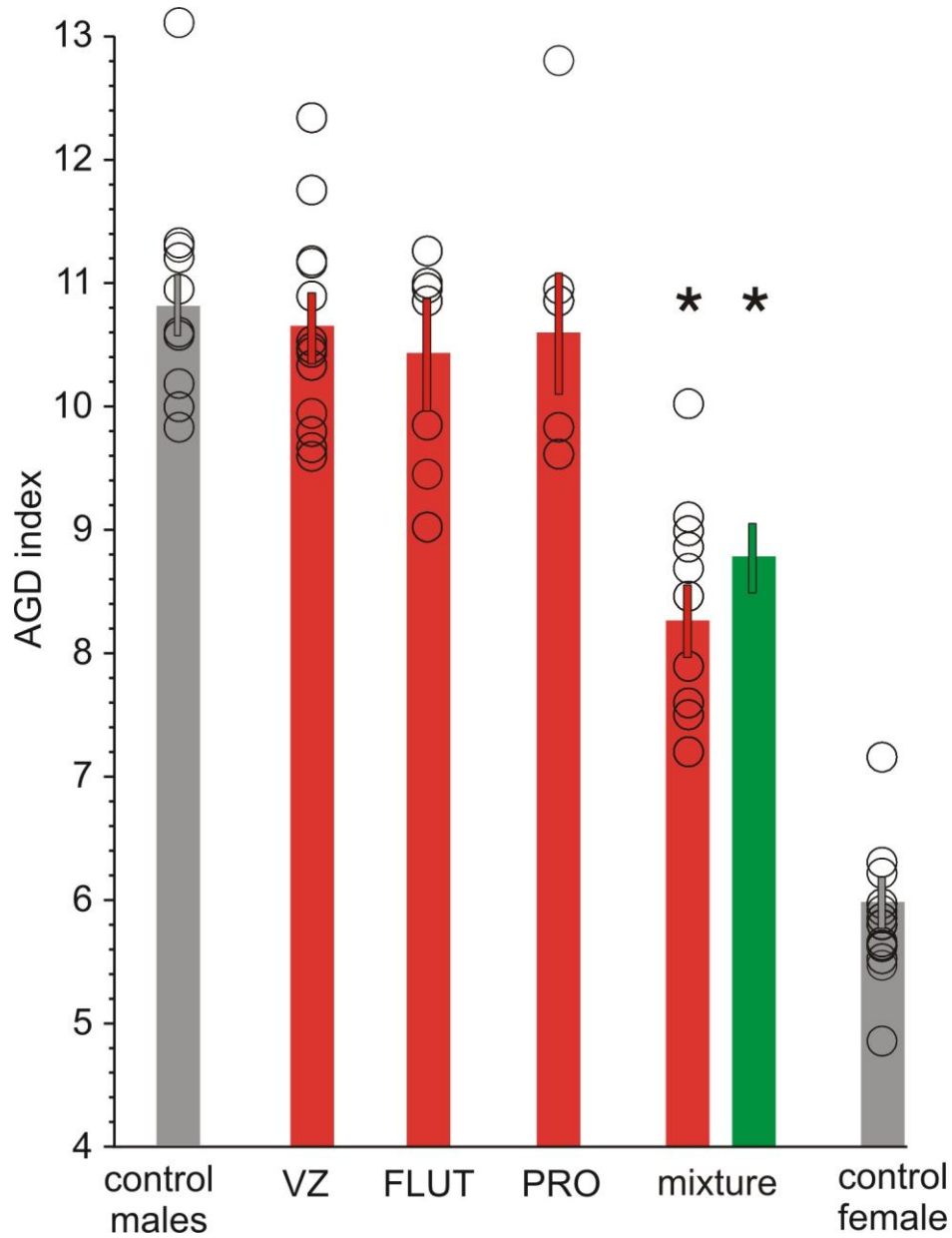
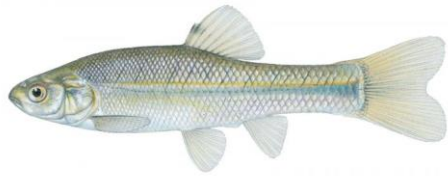
Risks from mixtures are **minimal** as long as chemical exposures stay **below regulatory limits**


0.5
0.4
0.3
0.2
0.1
0.0
Corrected absorbance (a.u.)
1
2
3
4
5
6
7
8
ES
CA
MIX
Compound


AGD index
13
12
11
10
9
8
7
6
5
4
*
*
control males
VZ
FLUT
PRO
mixture
control female

Water Framework Directive Environmental Quality Standards (EQS) for priority pollutants **do not protect** against mixture effects

Combinations of 14-19 pollutants at EQS produce toxicity in algae, daphnia and fish



Mixture of 15 chemicals at levels found in human amniotic fluids alter **thyroid hormones** and **brain development** in tadpoles

The single chemical regulatory regime cannot capture these phenomena

It systemically ignores mixture effects

No protection from coincidental mixtures

Progress

- **1987 European Inland Fisheries and Aquaculture Advisory Commission:** Setting of Quality Standards should focus on mixtures, not single chemicals

- **2005 European Regulation on Maximum Pesticide Residue Levels:** Consideration of cumulative and synergistic effects

- **Since 2005:** European Food Safety Authority works on the issue

Why so slow?


A.O.SMITH
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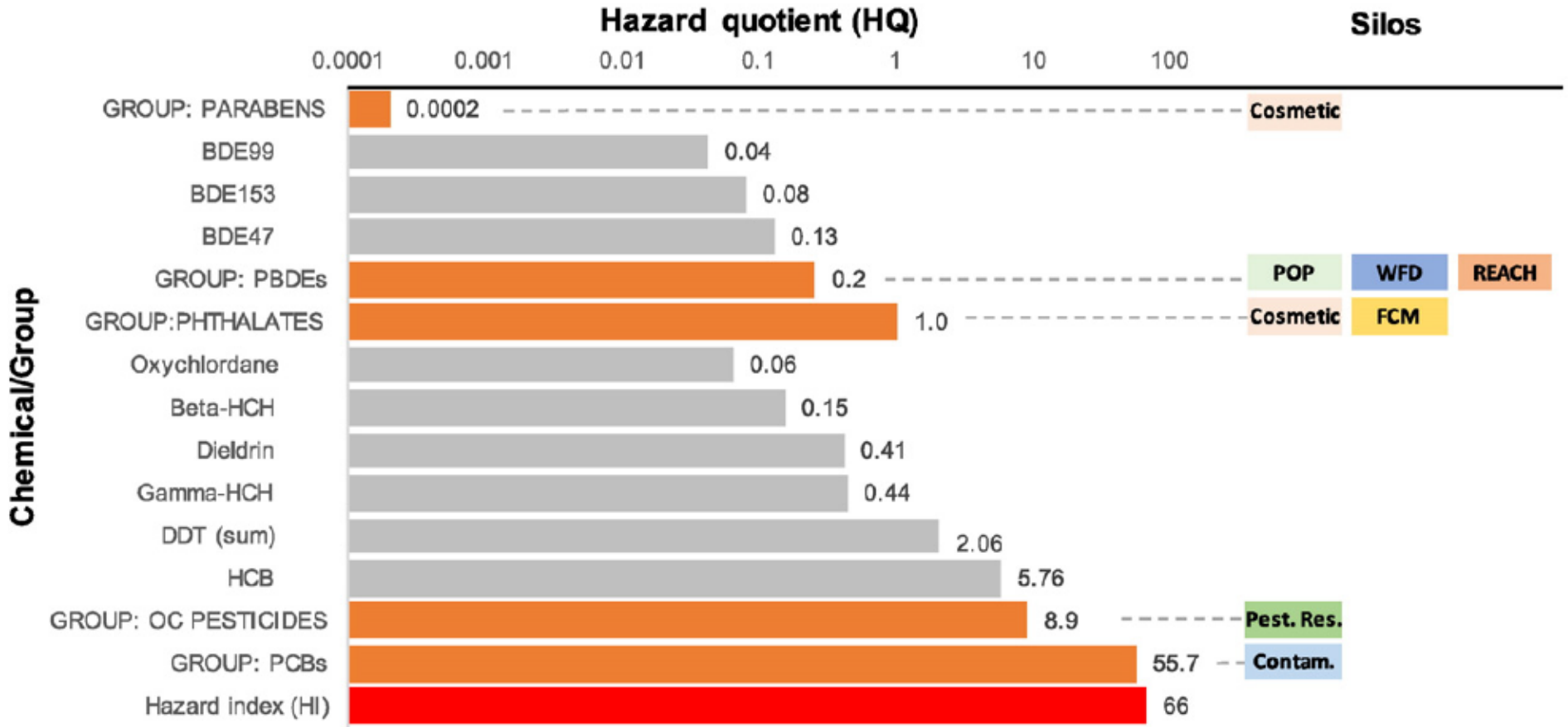
Exposed to chemicals from different silos

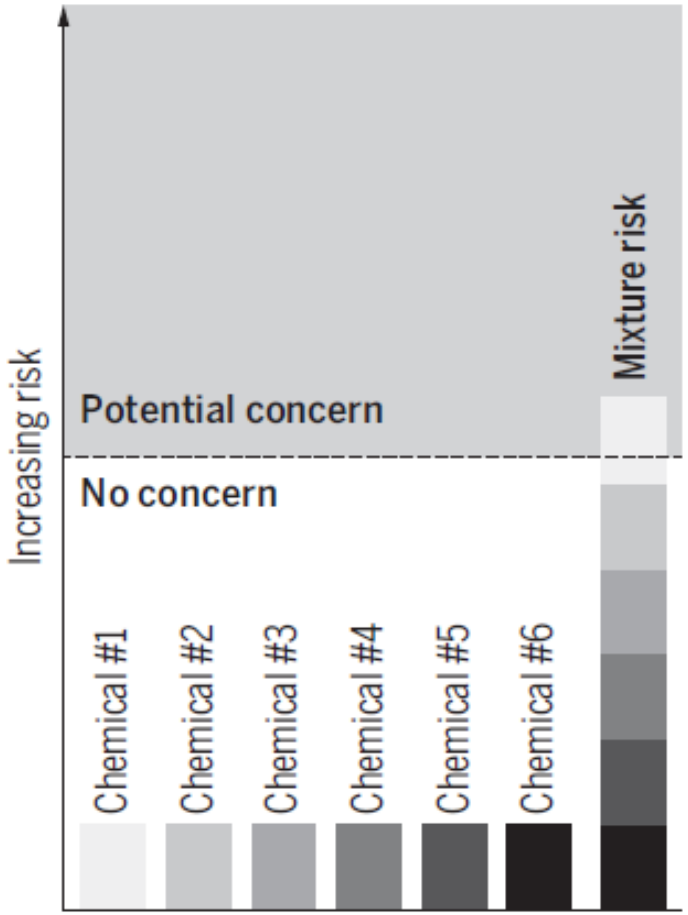


EU regulatory system

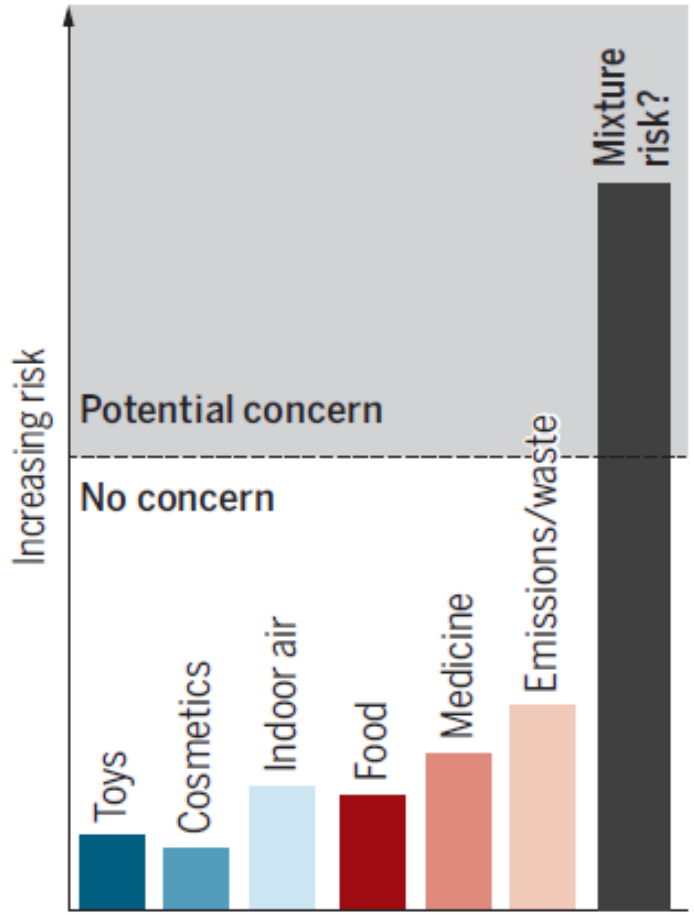
- **Some silos** have scope for dealing with mixtures (e.g. pesticides, food contaminants, WFD), **but not much implemented**

- Missing: mixture risk assessment **across silos** (e.g food contaminants and pesticides)

- **Multi-chemical, multi-route assessments lacking altogether**



Mixture effects
Experimental studies of up to 80 chemicals have shown that mixtures often have higher toxicity than the individual compounds.



Regulatory gaps
Humans and the environment are exposed to myriad chemicals from many different sources, but little is known about their combined risk.

Bottleneck:

Missing **legal mandates** in some relevant silos

Mandate for mixture risk assessment **across** silos