HSC 2025

HELCOM Stakeholder Conference 2025
A 'one Baltic' approach towards a sea unaffected by hazardous substances
31 March 2025

COCKTAIL EFFECTS OF HAZARDOUS SUBSTANCES: THE NEED FOR A HOLISTIC REGIONAL VIEW

Gastón Alurralde
HELCOM Secretariat

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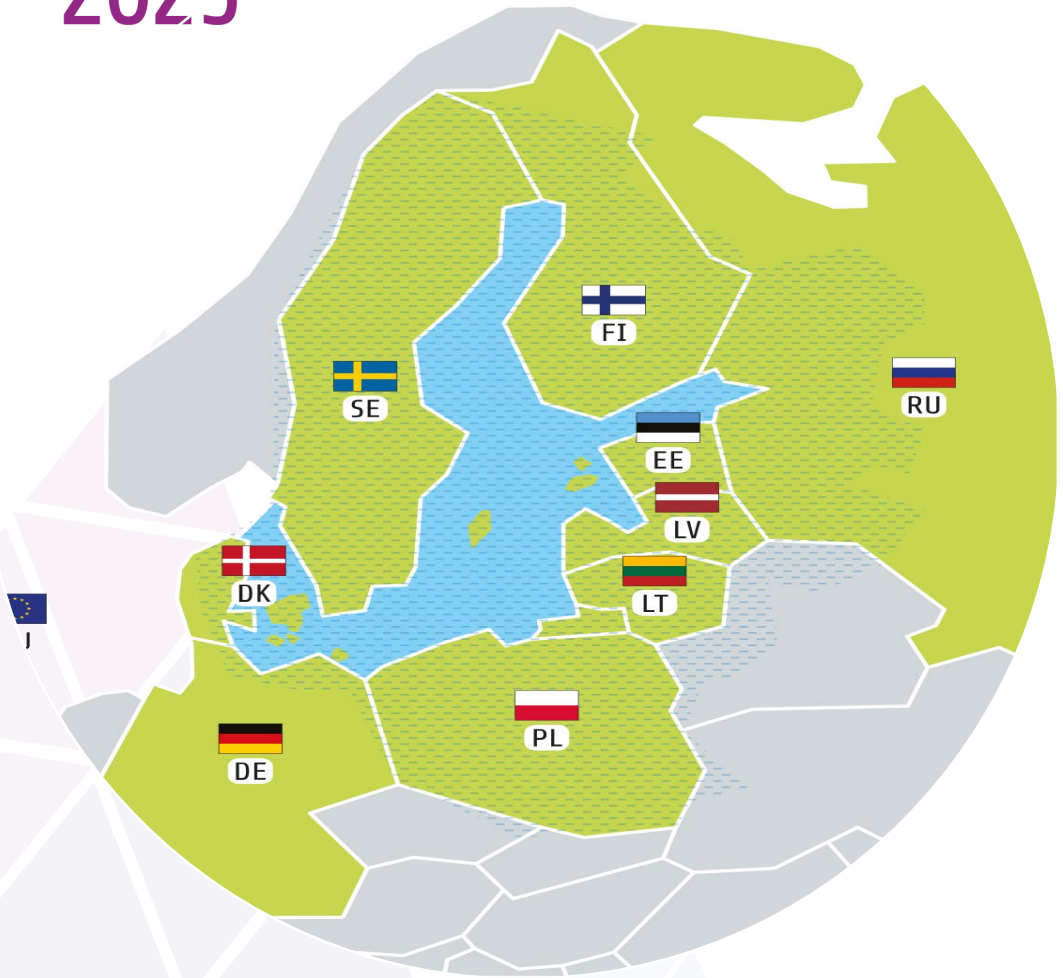

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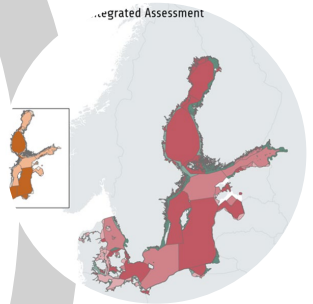

No GES

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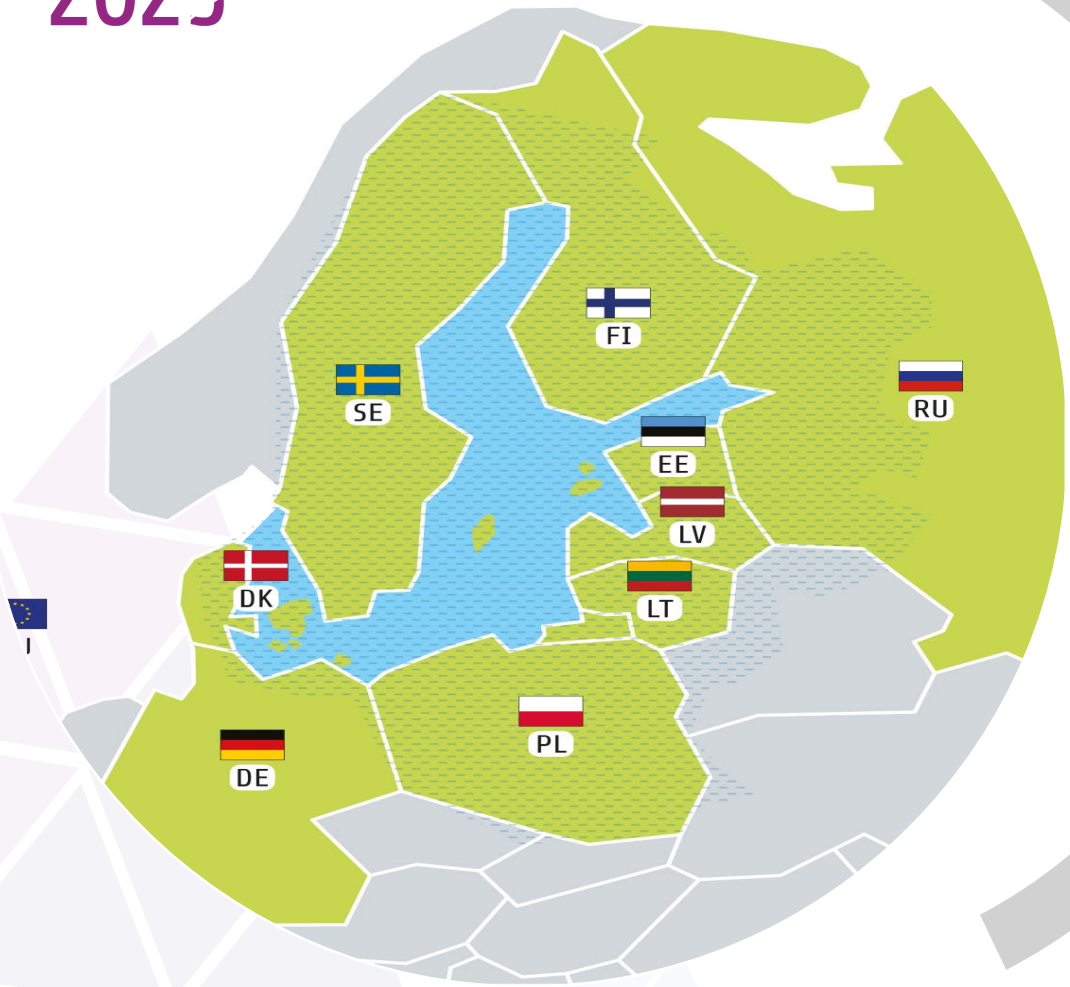

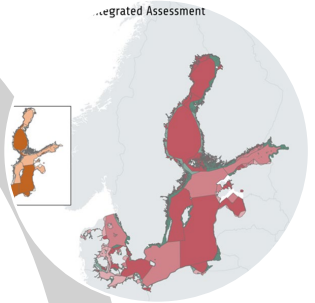

Non GES

Single substances

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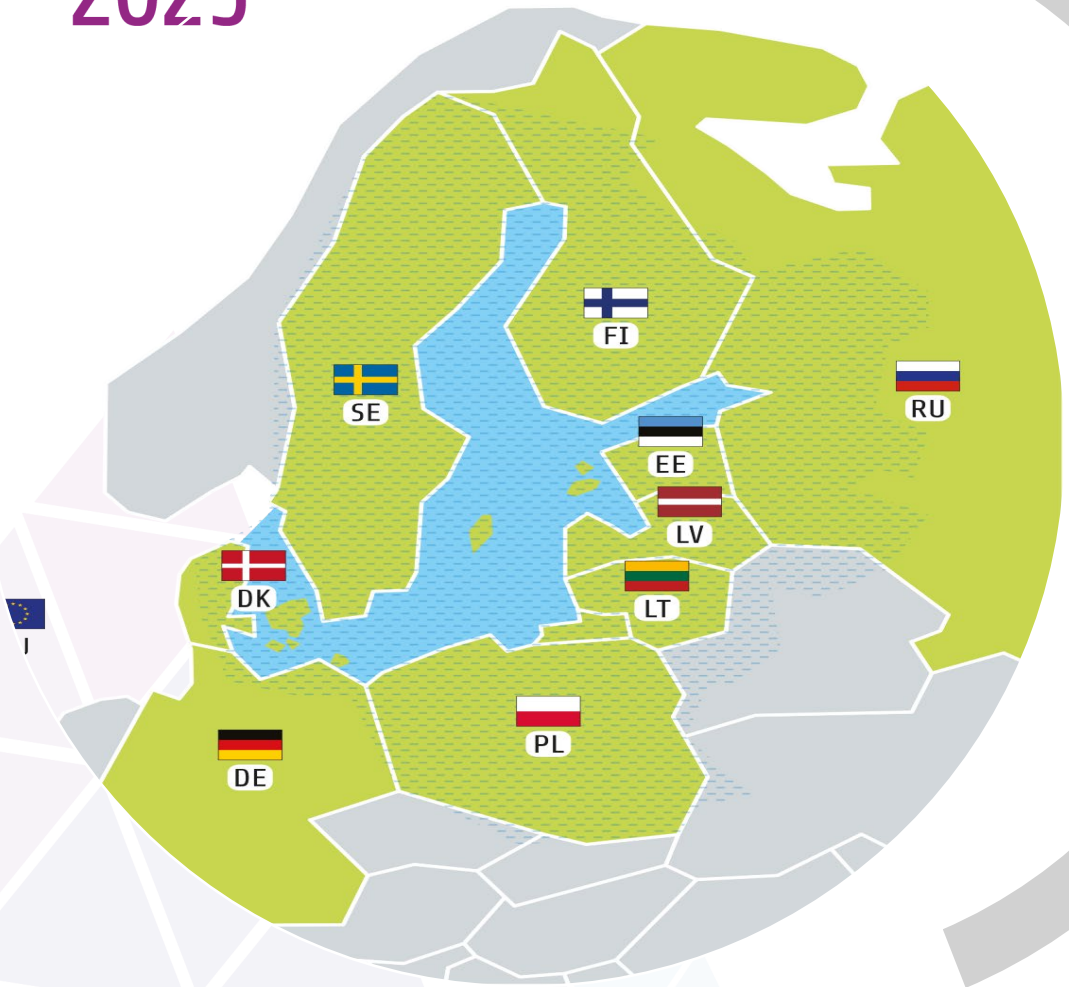

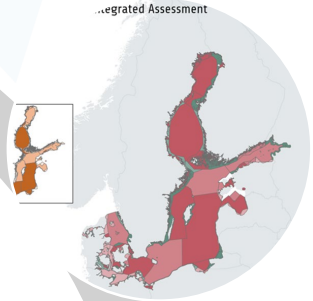

Non GES

Single substances

Exposure to complex mixtures

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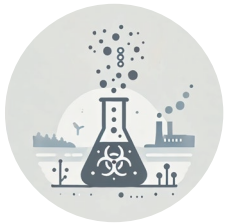

Known chemicals – detectable

Known chemicals – characterized hazards and exposure

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Known chemicals – detectable

Known chemicals – characterized hazards and exposure

Known chemicals – below detection limits

Unknown chemicals

Transformation products

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Known chemicals – detectable

Known chemicals – characterized hazards and exposure

Mixtures– “cocktail effect”

Known chemicals – below detection limits

Unknown chemicals

Transformation products

Mixtures– “cocktail effect”

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WHAT IS THE "COCKTAIL EFFECT"?

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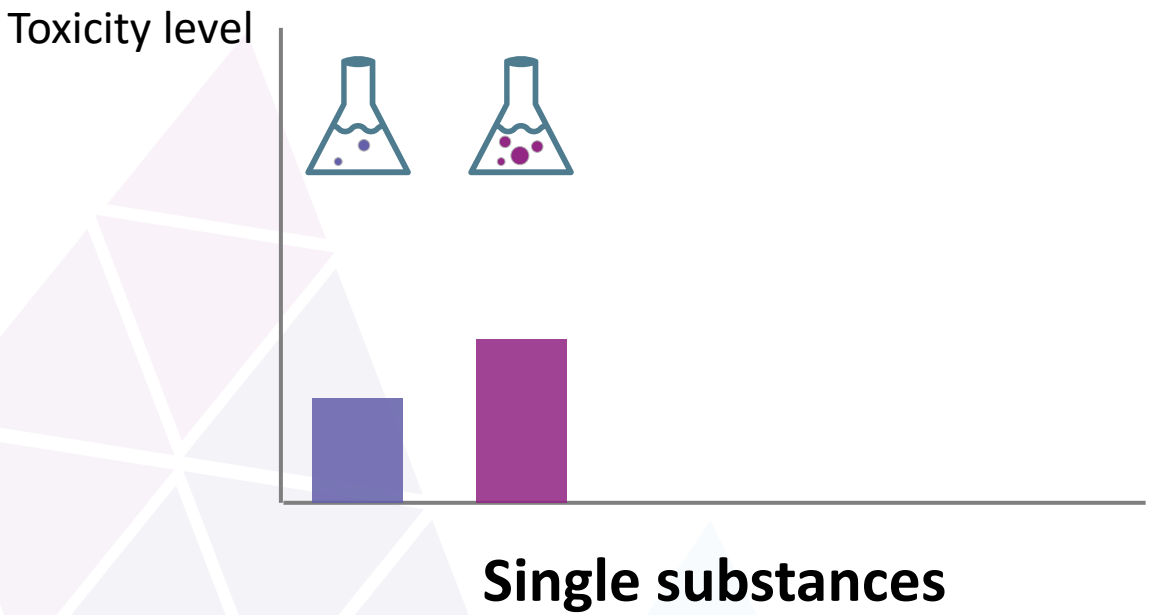

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WHAT IS THE "COCKTAIL EFFECT"?

Single substances

Concentrations below defined safe threshold

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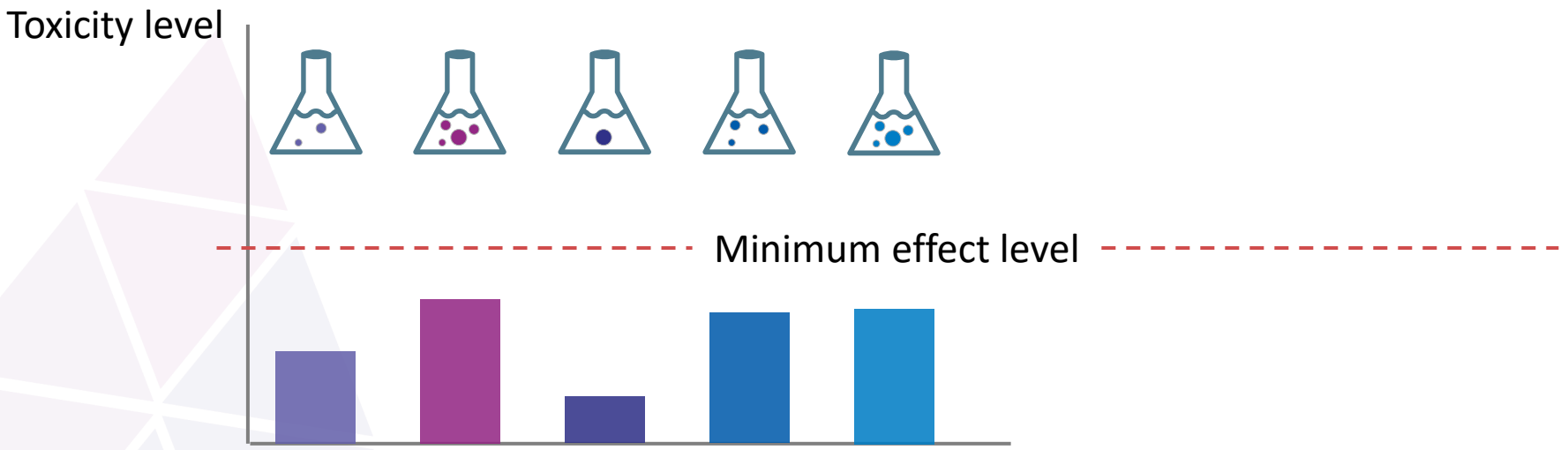
WHAT IS THE "COCKTAIL EFFECT"?



Single substances

Concentrations below defined safe threshold

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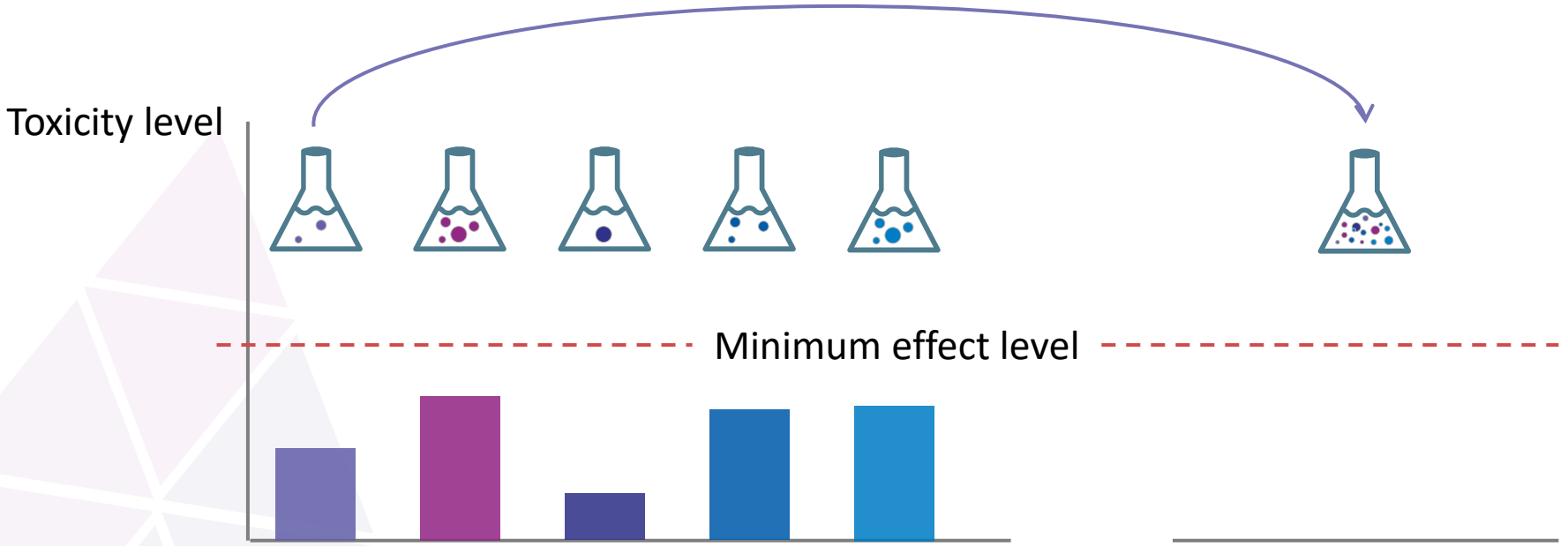

Single substances

Concentrations below defined safe threshold

Mixtures

Substances at concentrations below its individual accepted levels

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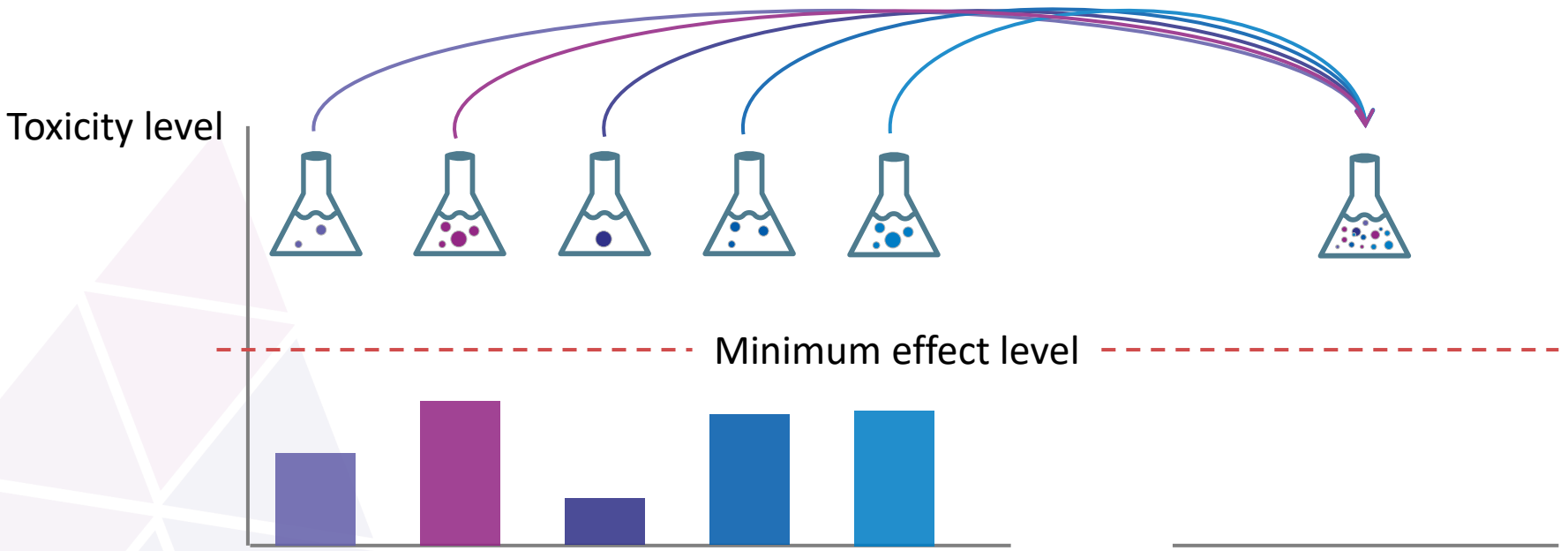
WHAT IS THE "COCKTAIL EFFECT"?



Single substances

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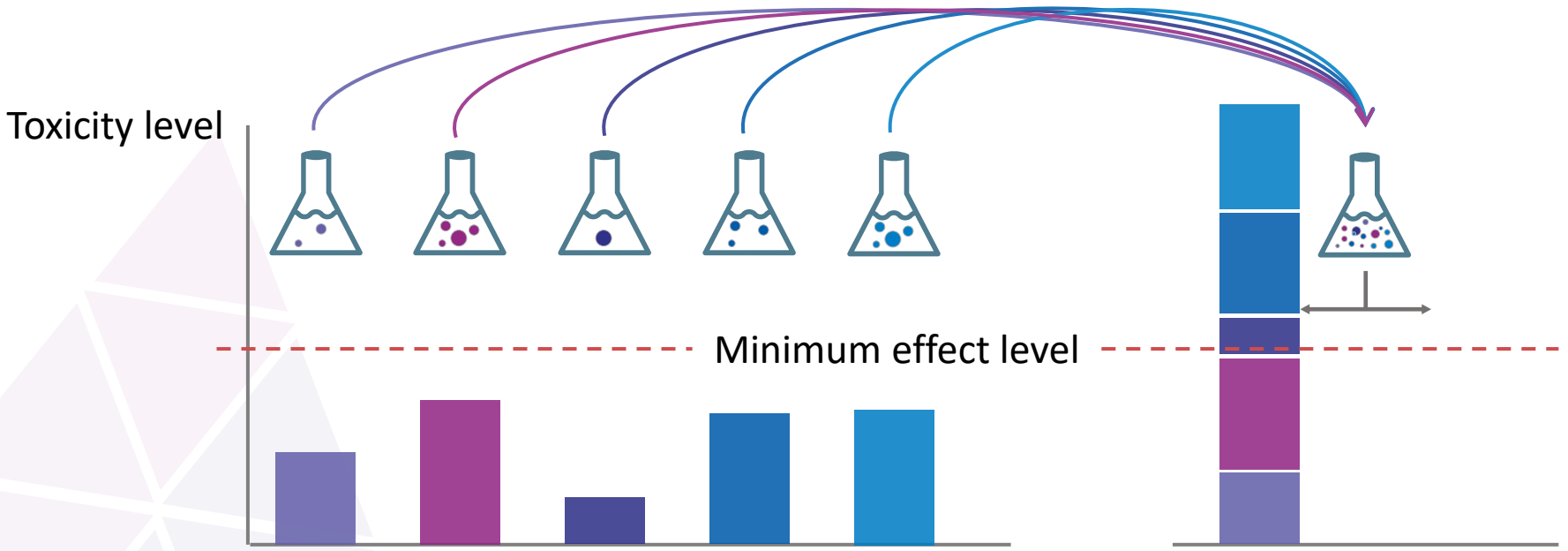

Single substances

Concentrations below defined safe threshold

Mixtures

Substances at concentrations below its individual accepted levels

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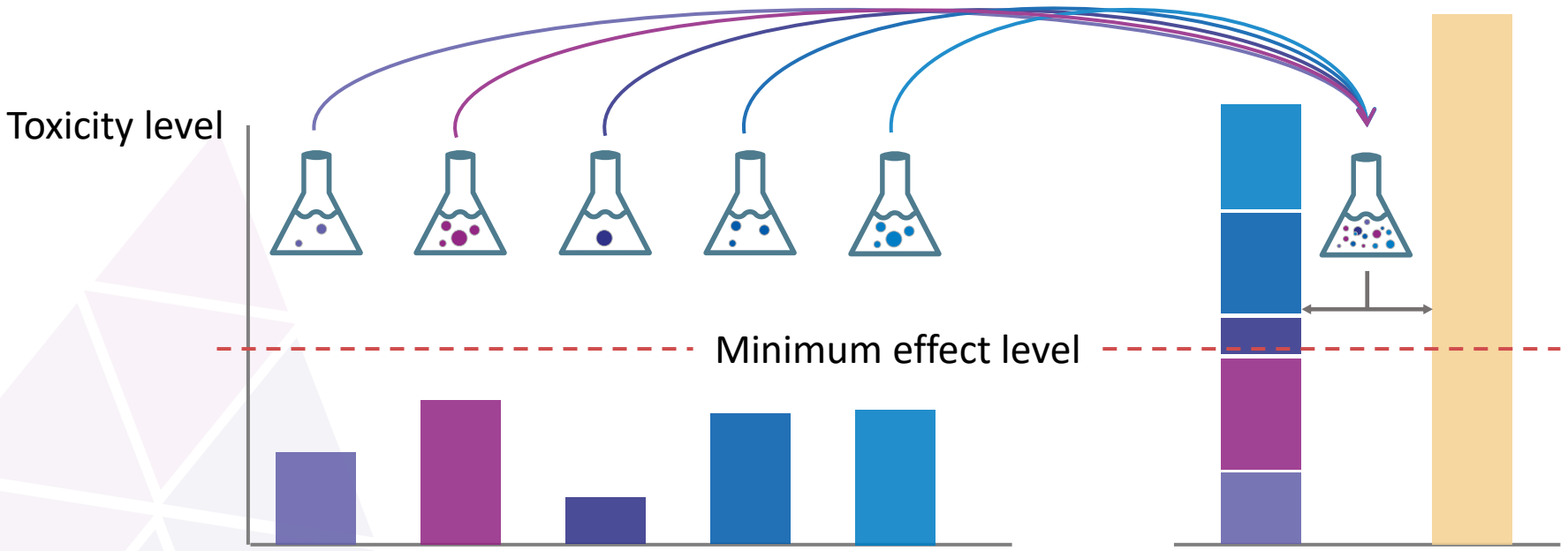

Single substances

Concentrations below defined safe threshold

Mixtures

Substances at concentrations below its individual accepted levels

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WHAT IS THE "COCKTAIL EFFECT"?

From nothing, to something potentially harmful

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WHAT IS THE "COCKTAIL EFFECT"?

Toxicity level

Credit: Environ. Sci. Technol. - Smith et al. 2013

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ACOUNTING FOR MIXTURE EFFECTS

THE BIOLOGICAL EFFECTS APPROACH

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ACOUNTING FOR MIXTURE EFFECTS

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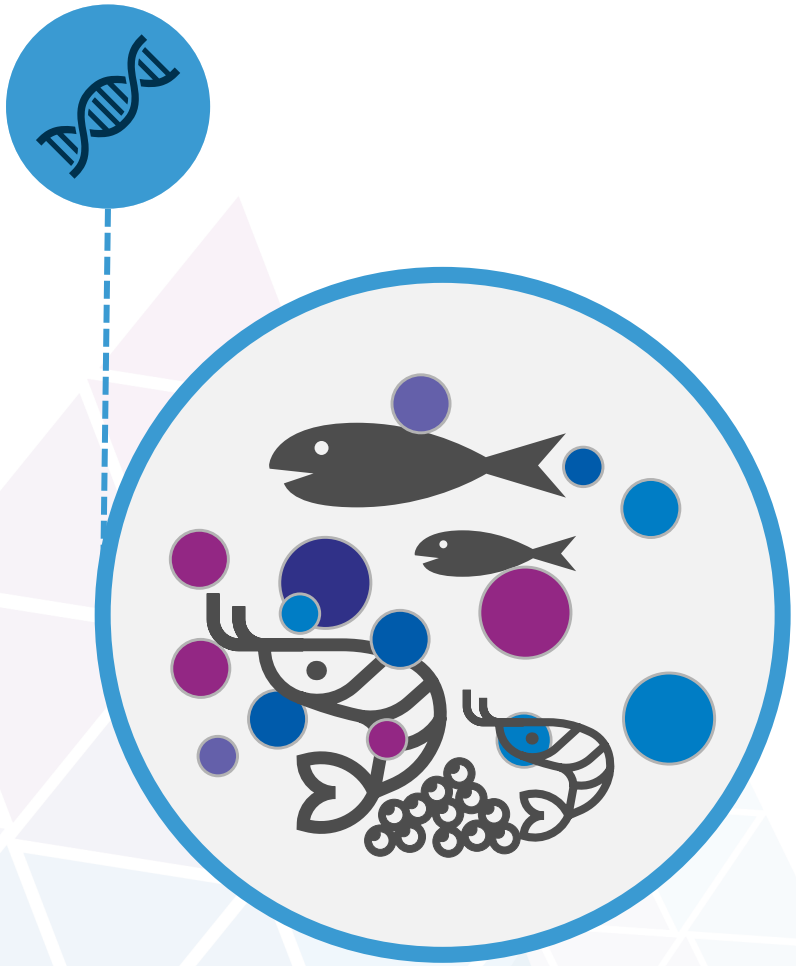
ACOUNTING FOR MIXTURE EFFECTS

THE BIOLOGICAL EFFECTS APPROACH



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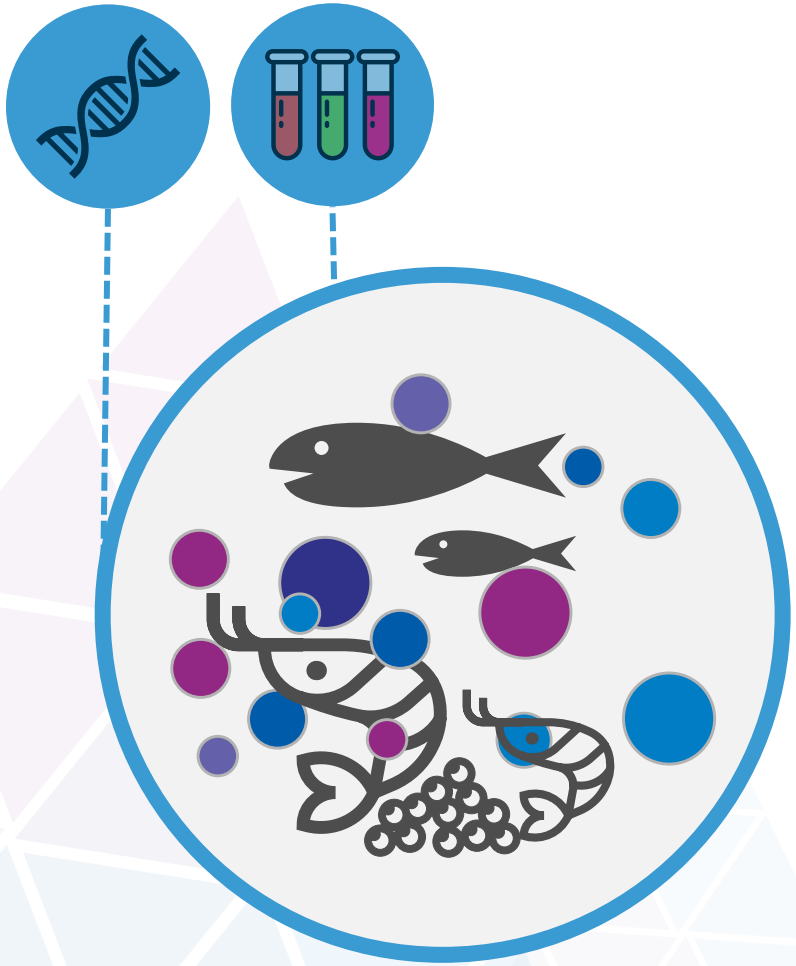
ACOUNTING FOR MIXTURE EFFECTS

THE BIOLOGICAL EFFECTS APPROACH



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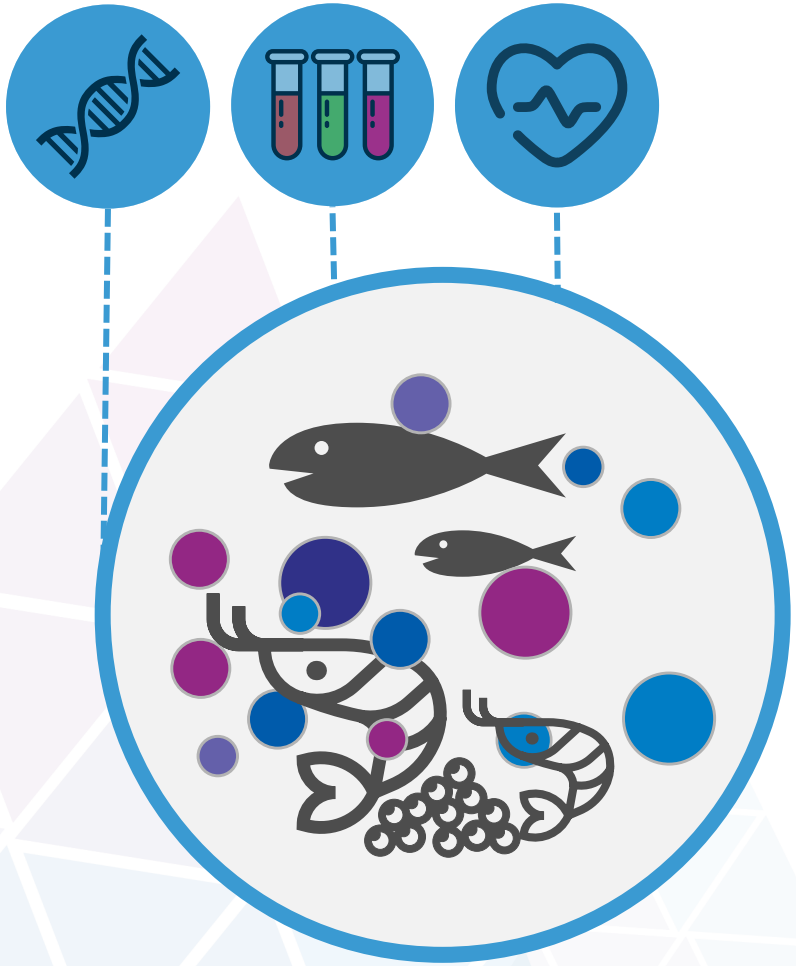
ACOUNTING FOR MIXTURE EFFECTS

THE BIOLOGICAL EFFECTS APPROACH



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ACOUNTING FOR MIXTURE EFFECTS

THE BIOLOGICAL EFFECTS APPROACH

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ACOUNTING FOR MIXTURE EFFECTS

THE BIOLOGICAL EFFECTS APPROACH

BE can identify contaminat-related impacts and mixture effects

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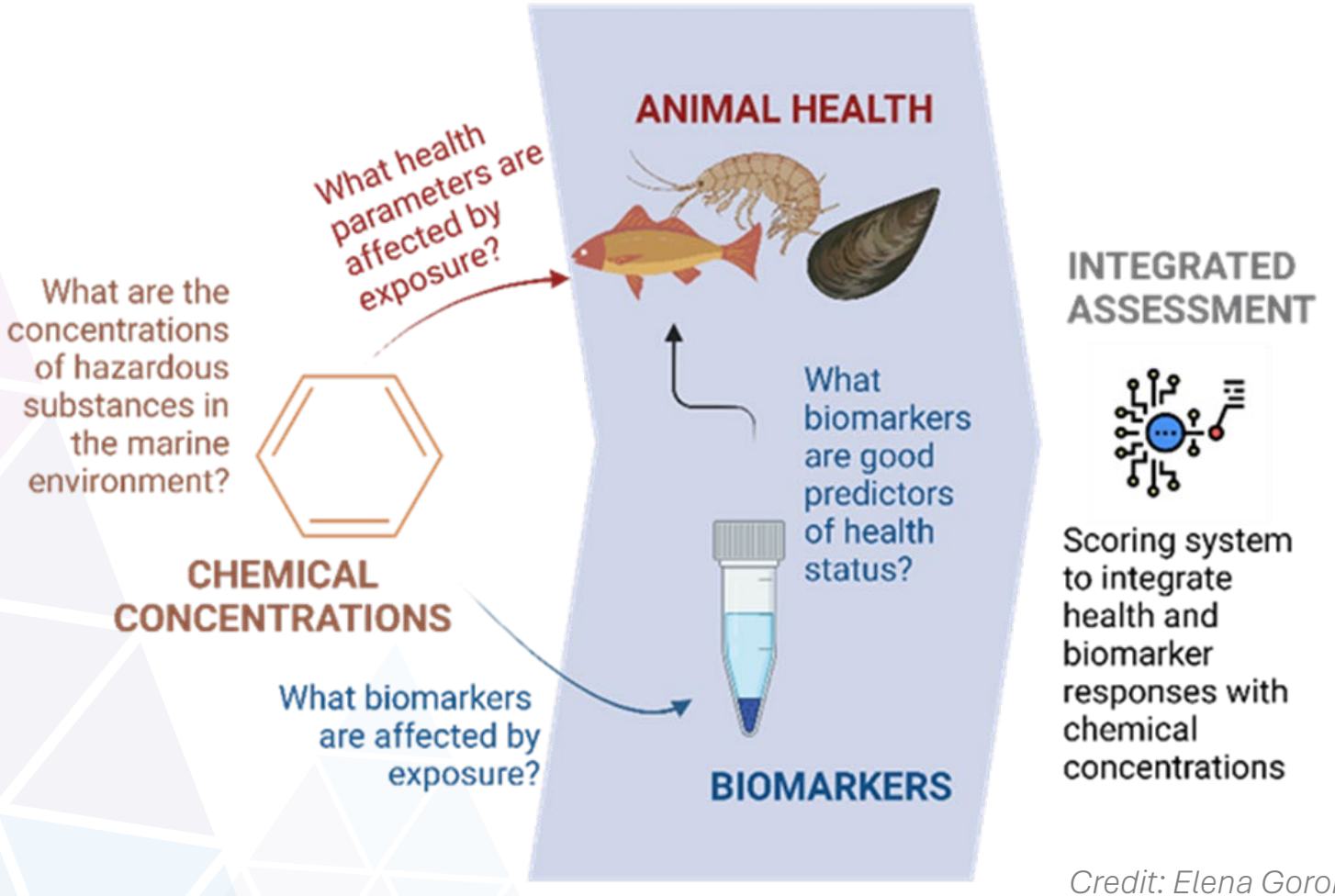
BIOLOGICAL EFFECTS
IN THE BALTIC SEA



Credit: Elena Gorokhova

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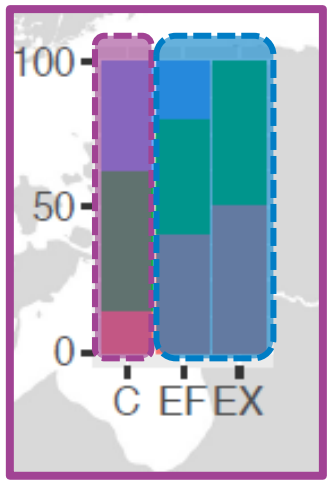
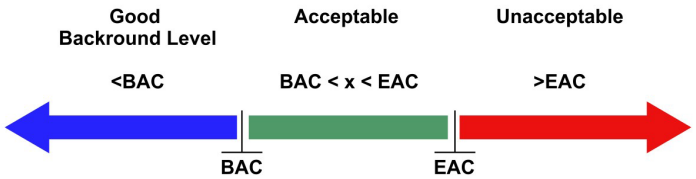
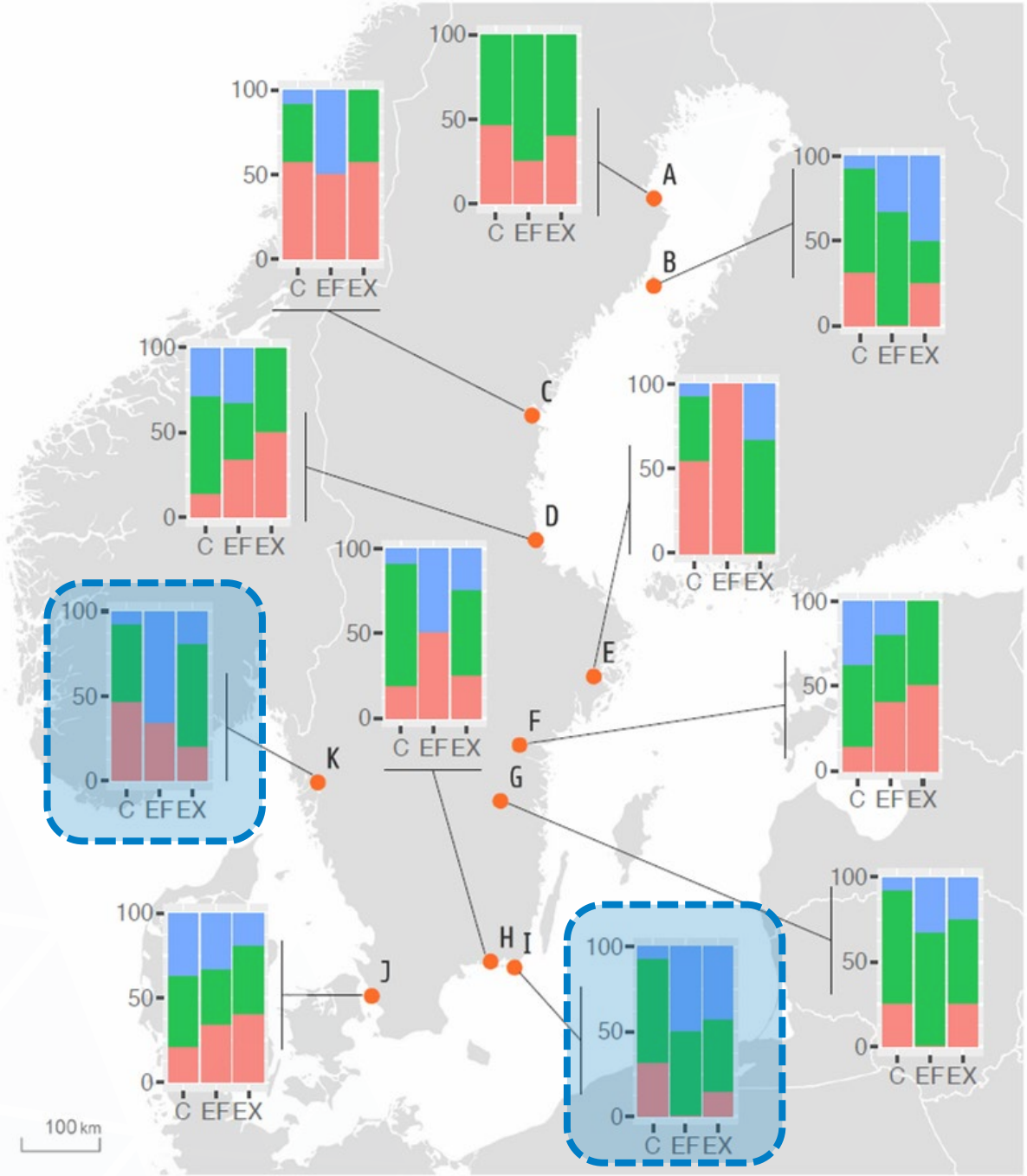


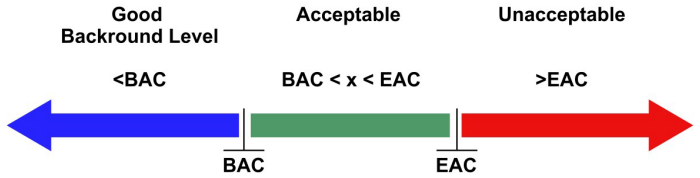


THIRD HELCOM
HOLISTIC ASSESSMENT
OF THE BALTIC SEA
2016-2021

HOLAS 3

HSC 2025

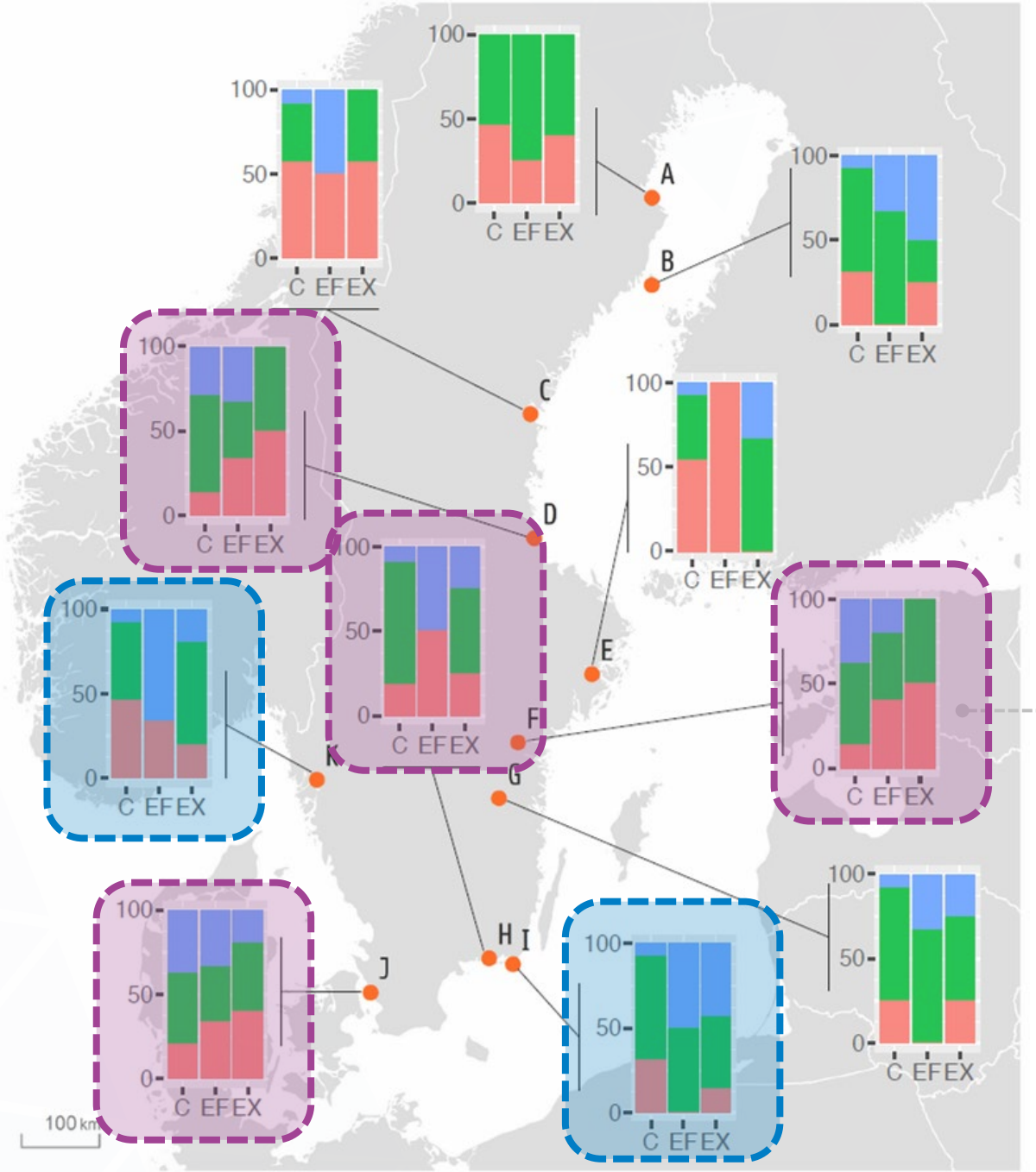


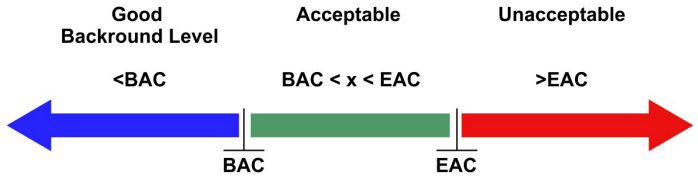


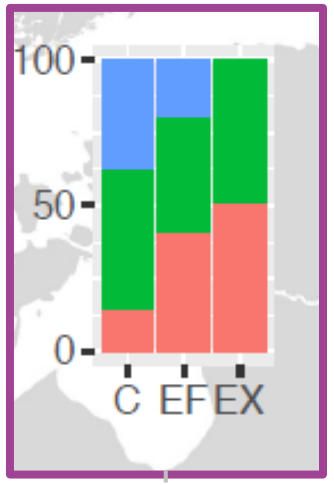
THIRD HELCOM
HOLISTIC ASSESSMENT
OF THE BALTIC SEA
2016-2021

HOLAS 3

HSC 2025







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OF THE BALTIC SEA
2016-2021

HOLAS 3

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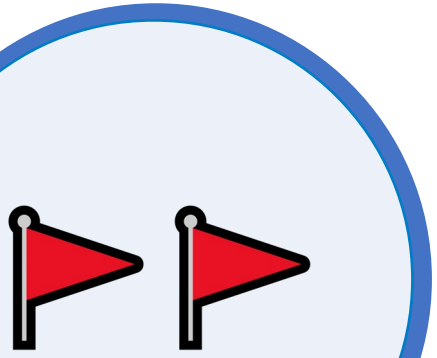
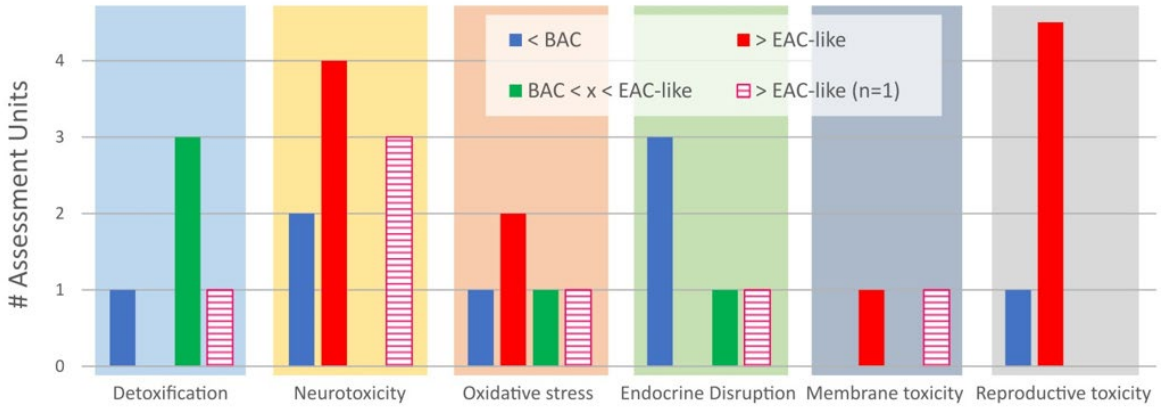
BIOLOGICAL EFFECTS

GENERAL TOXICITY MECHANISM

AU EXCEDING ASSESSMENT CRITERIA



EROD GLU	→	Detoxification
AChE	→	Neurotoxicity
Vitellogenin Imposex	→	Endocrine Disruption
TBARS	→	Oxidative stress
Lysosomal Membran Stability	→	Membrane toxicity
Embryo Malformation	→	Reproductive toxicity



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SUBSTANCE	MOA	ASSESMENT UNIT			
		25 Bornholm Basin SE			28 Bornhom Basin DE
4.4-DDE	Neuroactive, Endocrine	0 (s)	96s (sb)	U	63b (b)
Pilocarpine	Neuromuscular system	U	X	U	X
2.4-DDT	Neuroactive	U	100sb (sb)	U	58b (b)
Lindane (gamma-Hexachlorocyclohexane); gamma-HCH;	Neuroactive, Cancerogen	U	8s (sb)	X	0 (wb)
Heptachlor	Neuroactive	X	U	X	22b (b)
DDD (p,p')	Neuroactive	U	92s (sb)	X	0 (b)
Gabapentin	Neuroactive	0 (b)	X	X	16w (w)
Chlorpyrifos	Neuromuscular system	X	U	X	U
Cypermethrin	Neuroactive	X	X	X	U
Carbamazepine	Neuroactive	X	X	X	0 (w)
Camphor	Neuroactive	100b (sb)	X	0 (b)	X
Risperidone	Neuroactive	X	X	X	X
DDT (p,p')	Neuroactive	U	0 (wsb)	X	0 (wb)
Flecainide	Cardiovascular system, Neuromuscular system	0 (s)	X	U	X
Dicofol	Neuroactive	X	X	X	100b (b)
Dieldrin	Neuroactive	X	0 (w)	X	0 (wb)
Venlafaxine	Neuroactive	0 (s)	X	U	0 (w)
oxazepam	Neuroactive	X	X	X	0 (w)
Permethrin-cis+trans	Neuroactive	X	X	X	X
tricresyl phosphate, tritolyl phosphate (m-TMPP)	Neuroactive	X	X	X	X
Clothianidin	Neuroactive,	X	X	X	U
Thiacloprid	Neuroactive	X	X	X	U
Endrin	Neuroactive	X	0 (w)	X	0 (wb)
Pirimicarb	Neuromuscular system	X	X	X	U
Ethanimidamide	Neuroactive	X	X	X	U
furosemide	Cardiovascular system, Neuroactive	X	X	X	X
Primidone	Neuroactive	X	X	X	0 (w)
tramadol	Neuroactive	0 (sb)	X	0 (b)	0 (w)
Thiamethoxam	Neuroactive	X	X	X	U
Delta-HCH	Neuroactive	X	X	X	0 (wb)
O-desmethylvenlafaxine	Neuroactive	0 (sb)	X	0 (b)	X

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SUBSTANCE	MOA	ASSESMENT UNIT			
		25 Bornholm Basin SE			28 Bornhom Basin DE
4.4-DDE	Neuroactive, Endocrine	0 (s)	96s (sb)	U	63b (b)
Pilocarpine	Neuromuscular system	U	X	U	X
2.4-DDT	Neuroactive	U	100sb (sb)	U	58b (b)
Lindane (gamma-Hexachlorocyclohexane); gamma-HCH;	Neuroactive, Cancerogen	U	8s (sb)	X	0 (wb)
Heptachlor	Neuroactive	X	U	X	22b (b)
DDD (p,p')	Neuroactive	U	92s (sb)	X	0 (b)
Gabapentin	Neuroactive	0 (b)	X	X	16w (w)
Chlorpyrifos	Neuromuscular system	X	U	X	U
Cypermethrin	Neuroactive	X	X	X	U
Carbamazepine	Neuroactive	X	X	X	0 (w)
Camphor	Neuroactive	100b (sb)	X	0 (b)	X
Risperidone	Neuroactive	X	X	X	X
DDT (p,p')	Neuroactive	U	0 (wsb)	X	0 (wb)
Flecainide	Cardiovascular system, Neuromuscular system	0 (s)	X	U	X
Dicofol	Neuroactive	X	X	X	100b (b)
Dieldrin	Neuroactive	X	0 (w)	X	0 (wb)
Venlafaxine	Neuroactive	0 (s)	X	U	0 (w)
oxazepam	Neuroactive	X	X	X	0 (w)
Permethrin-cis+trans	Neuroactive	X	X	X	X
tricresyl phosphate, tritolyl phosphate (m-TMPP)	Neuroactive	X	X	X	X
Clothianidin	Neuroactive	X	X	X	U
Thiacloprid	Neuroactive	X	X	X	U
Endrin	Neuroactive	X	0 (w)	X	0 (wb)
Pirimicarb	Neuromuscular system	X	X	X	U
Ethanimidamide	Neuroactive	X	X	X	U
furosemide	Cardiovascular system, Neuroactive	X	X	X	X
Primidone	Neuroactive	X	X	X	0 (w)
tramadol	Neuroactive	0 (sb)	X	0 (b)	0 (w)
Thiamethoxam	Neuroactive	X	X	X	U
Delta-HCH	Neuroactive	X	X	X	0 (wb)
O-desmethylvenlafaxine	Neuroactive	0 (sb)	X	0 (b)	X
		X	0 (w)	X	0 (w)
[Neurotoxicants such as organophosphates and carbamates or similar]	neurotoxicants				

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BIOLOGICAL EFFECTS
IN THE BALTIC SEA

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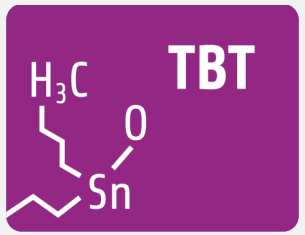
HELCOM INDICATORS
BIOLOGICAL EFFECTS



BIOLOGICAL EFFECTS
IN THE BALTIC SEA

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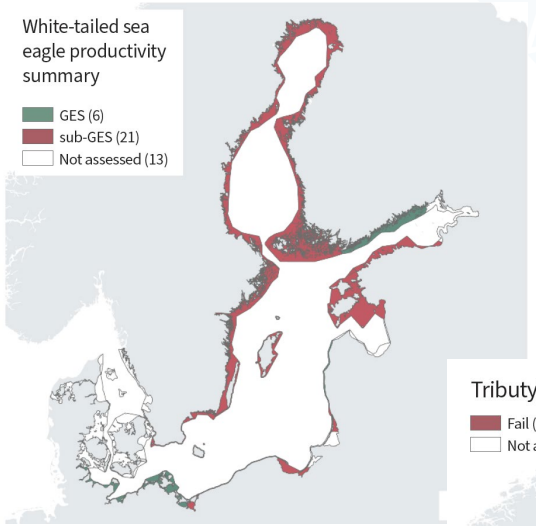
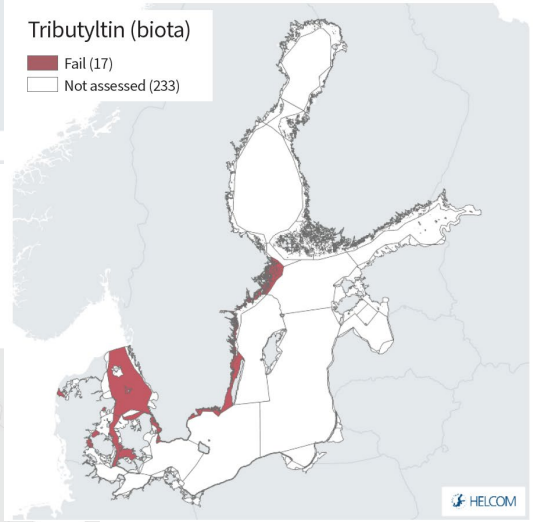
HELCOM INDICATORS

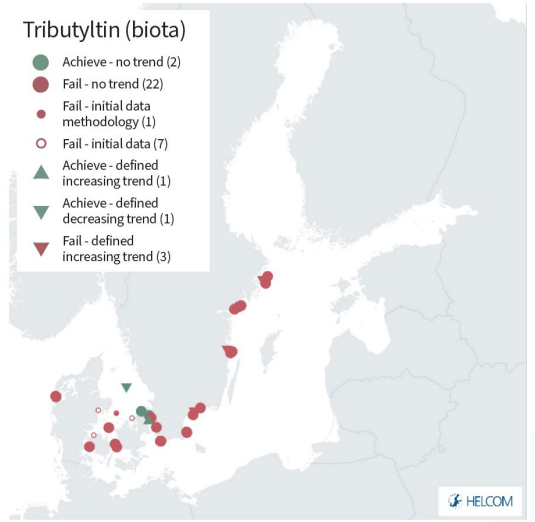
BIOLOGICAL EFFECTS

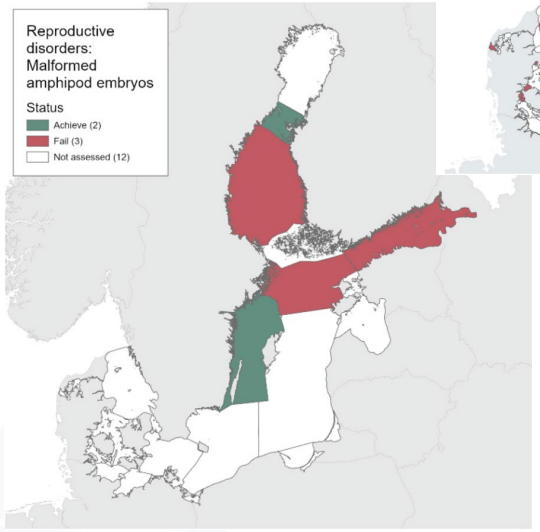
TBT

BIOLOGICAL EFFECTS IN THE BALTIC SEA









THIRD HELCOM HOLISTIC ASSESSMENT OF THE BALTIC SEA 2016–2021

HOLAS 3

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BIOLOGICAL EFFECTS IN THE BALTIC SEA

HELCOM

NEFCO

H-BEC

ICES International Council for the Exploration of the Sea

CIEM Conseil International pour l'Exploration de la Mer

OSPAR COMMISSION

SGEFF

Interreg Baltic Sea Region

Co-funded by the European Union

SUSTAINABLE WATERS BEACON

BEACON

biodiversa+ European Biodiversity Partnership

D2P

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Hazardous substances assessment requires shifting from a single-chemical view towards a holistic regional approach that includes the "cocktail effects“ and integrates biological effect of contaminants

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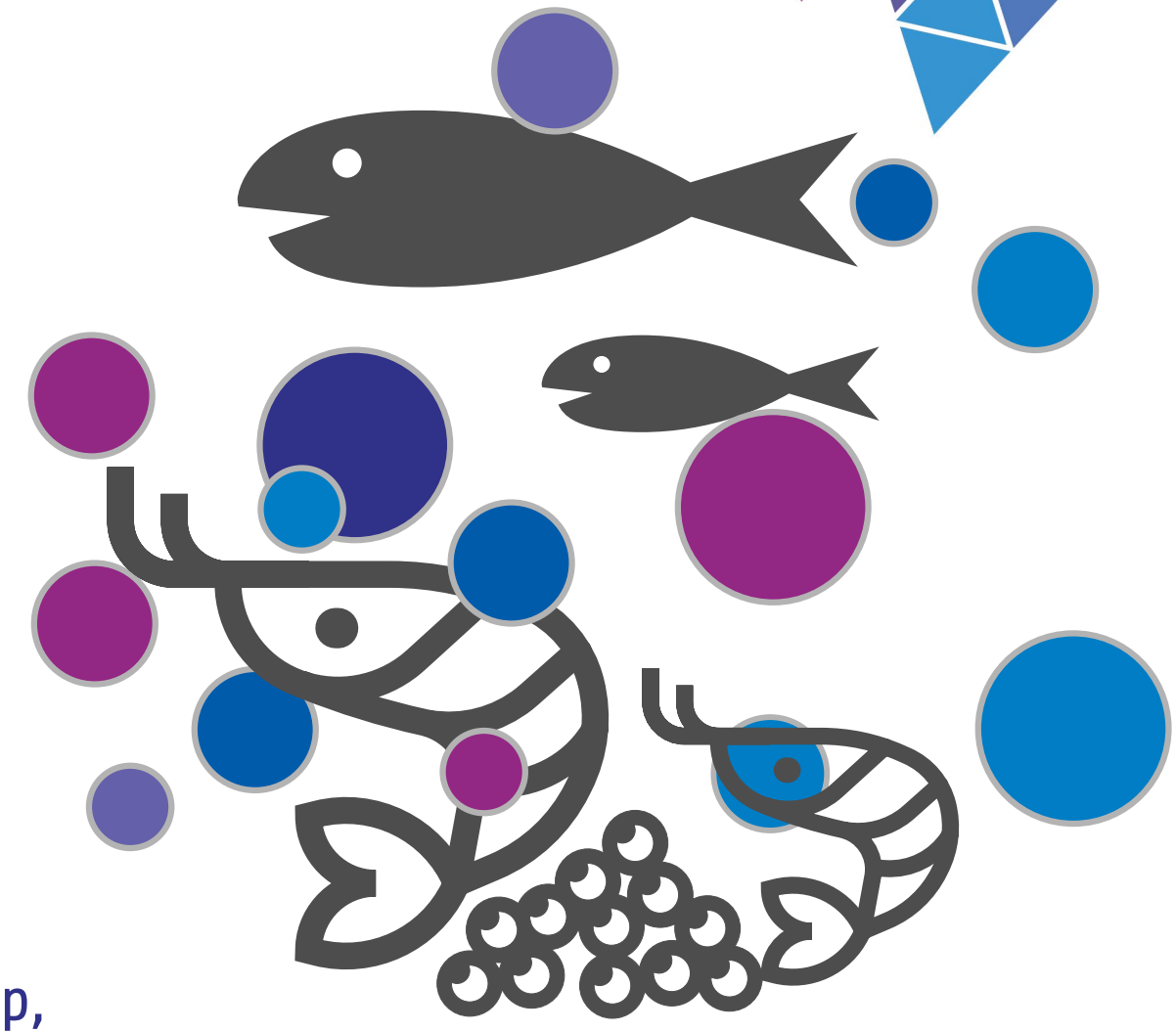
HELCOM Stakeholder Conference 2025
A 'one Baltic' approach towards a sea unaffected by hazardous substances
31 March 2025



Thanks!

Acknowledging the work of members of EG Haz, EG Haz BE subgroup, SGEFF