



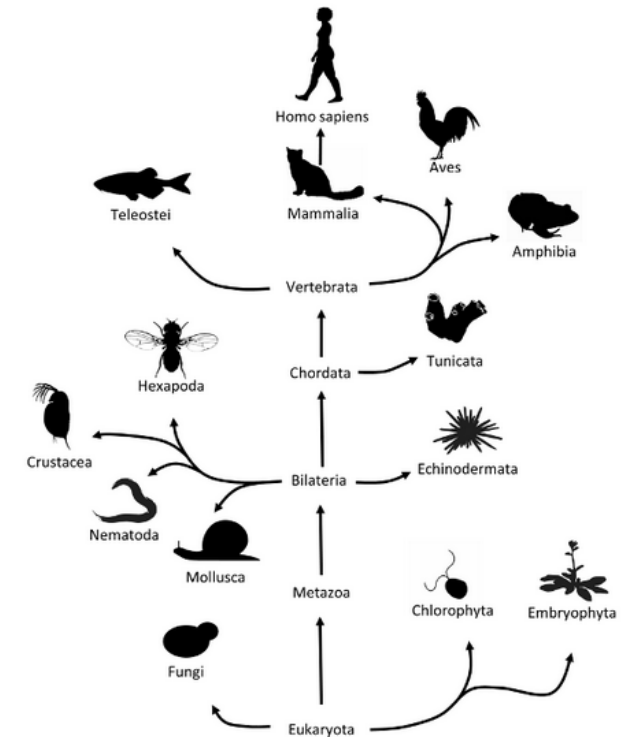
HELCOM Stakeholder Conference 2025
A 'one Baltic' approach towards a sea
unaffected by hazardous substances
31 March 2025

PHARMACEUTICALS IN THE BALTIC SEA: Importance and risks

Daniel Malnes

PHARMACEUTICALS: INTENTIONALLY BIOLOGICALLY RELEVANT

- Animal studies to prove efficiency in humans
 - Assumed that drug targets are conserved
- How far are drug targets conserved through evolution?
- Designed to affect biological processes at low concentrations
- Some pharmaceuticals designed to ‘kill off’ organisms
 - Antibacterials (affecting cyanobacteria?)
 - Antiparasitic products, insecticides and repellents
- Some pharmaceuticals designed to ‘stop’ biological processes
 - Contraception (affecting reproductive success)
 - Epilepsy (reducing unintentional movement)

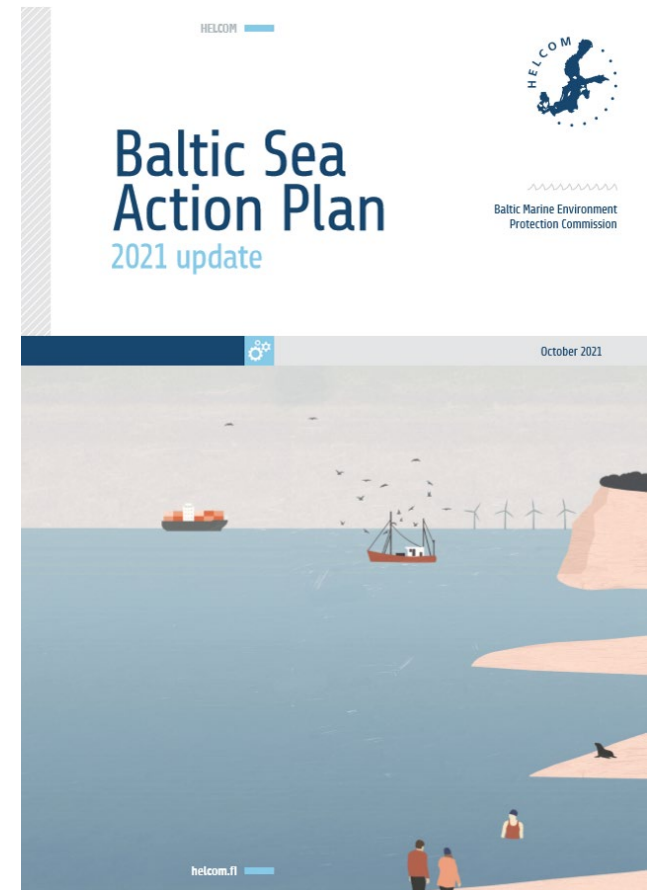


Evolutionary-conserved drug targets
Verbruggen, B., et al. (2018). *Nucleic Acids Research*, 46(D1), D930-D936.



PHARMASEA PROJECT IN BRIEF (NOV 2023 – JAN 2025)

- Baltic Sea Action Plan 2021:
 - **HL22**: Improve the knowledge base on **occurrence of pharmaceutical substances in the environment, their persistence and harmful effects** and ensure availability of this information for a broad expert community by 2025.
 - **HL23**: **Identify priority pharmaceuticals** by 2024 utilising the best available **knowledge on their releases into the aquatic environment, environmental effects and available data on their use in the region**, for efficient risk reduction and for subsequent integration of these substances to HELCOM assessments, as indicators of the state of the Baltic Sea and environmental pressure



TWO DATA PIPELINES FOR SCIENCE-BASED POLICY DECISIONS

Occurrence data

Sales data

Data processing

Environmental hazard assessment

1. Priority substances
2. Substances of concern

1. Environmental matrix screening
2. Wastewater screening

OCCURRENCE DATA

- Proposed priority pharmaceuticals in the Baltic Sea

Pharmaceutical	Group
17 α -ethinylestradiol	Systemic hormonal preparations
17 β -estradiol	Systemic hormonal preparations
Estrone	Systemic hormonal preparations
Azithromycin	Antibacterials
Clarithromycin	Antibacterials
Erythromycin	Antibacterials
Diclofenac	Non-steroidal anti-inflammatory drugs
Ibuprofen	Non-steroidal anti-inflammatory drugs
Carbamazepine	Antiepileptics

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Systemic hormonal preparations

- Reduces likelihood of pregnancy (“toxic to reproduction”)
- Some of natural origin (e.g., 17 β -estradiol, estrone)
- Others synthetic (17 α -ethinylestradiol)

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Antibacterials/antibiotics

- Used against bacterial infections
- Affects cyanobacteria
- Can promote development of antimicrobial resistance

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Non-steroidal anti-inflammatory drugs

- To treat pain, inflammation, and reduce high body temperature
- Sometimes available as creams/ointments

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Antiepileptics

- Reduces involuntary shaking
- EQS based on reproductive success in *Daphnia*

OCCURRENCE DATA

- Proposed pharmaceuticals of concern in the Baltic Sea

Pharmaceutical	Group
Metformin	Drugs used in diabetics
Clotrimazole	Antifungal
Norethisterone	Systemic hormonal preparations
Amoxicillin	Antibacterials
Ciprofloxacin	Antibacterials
Ofloxacin	Antibacterials
Sulfamethoxazole	Antibacterials
Tetracycline	Antibacterials
Trimethoprim	Antibacterials
Venlafaxine and O-desmethylvenlafaxine	Antidepressants
Cypermethrin	Antiparasitics



SALES DATA

- 33% of Baltic Sea population included in assessment
- A total of 1,470 pharmaceuticals were assessed
- Precautionary approach showed 38 pharmaceuticals of interest
 - May be reduced after further 'desk-work'
 - Remaining pharmaceuticals subject to environmental/wastewater screening



HSC
2025
SALES DATA

Pharmaceutical group	Number of pharmaceuticals of interest
Antibiotics/Antibacterials	13
Drugs used in erectile dysfunction	1
Hormonal preparations	1
Antineoplastic and immunomodulating agents	4
Anti-acne preparations	2
Antidepressants	2
Calcium channel blockers	2
X-ray contrast media	2
Antidiarrheals, intestinal anti-inflammatory/antiinfective agents	1
Antifungals	1
Antihypertensives	1
Antiinfectives and antiseptics	1
Antipsychotic	1
Antithrombotic agents	1
Hypnotics and sedatives	1



PharmaSea Draft Report: Summary

- PharmaSea draft report results propose:
 - Priority substances (exceeding marine EQS)
 - Substances of concern (exceeding other EQS/PNECs)
 - Potential pharmaceuticals for sampling in
 - Environmental matrices
 - Wastewaters



THANK YOU FOR THE ATTENTION
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