Monitoring based substance prioritization – tracing chemical pollution through apex predators

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Introduction

Chemical monitoring is a promising tool for identifying hazardous chemicals under the REACH regulation[1]. While many priority schemes exist to screen for persistent (P), bioaccumulative (B) and toxic (T) substances and their exposure, none of them uses non-target screening (NTS) results of apex predators at an Europe-wide scale. As apex species are good sentinels indicating exposure to PB substances and NTS has rapidly developed recently, we conceptualized a novel prioritization framework linking both.

Objectives

Development of a prioritization and scoring scheme allowing linking HRMS-based suspect screening data from apex species with modelled hazard predictions to flag chemicals:

- → for regulatory follow up assessment and management
- → with mismatch in environment occurrence vs. exposure assessment information
- → for follow up targeted analysis to assess environment concentrations

Methodology

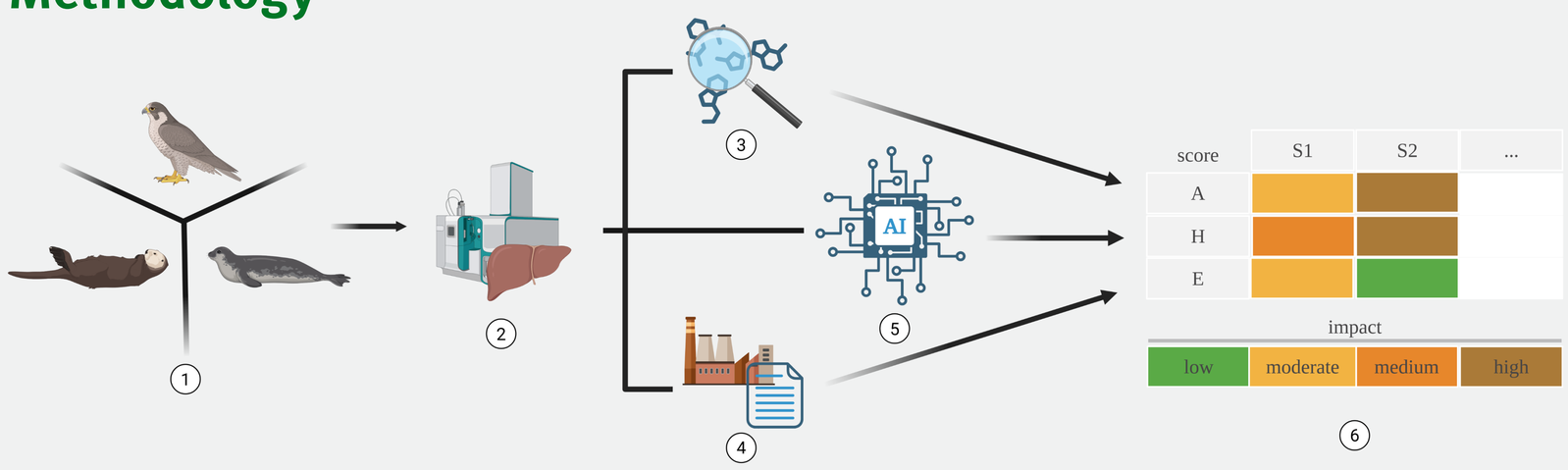

Fig.1: Study design: 1 - apex predators, 2 - HRMS-bases suspect screening, 3 – frequency of appearance (FoA), 4 - registration data, 5 – artificial intelligence (AI) based modeling, 6- substance prioritization: S1 – substance one, S2 – substance two (created with BioRender.com).

Results

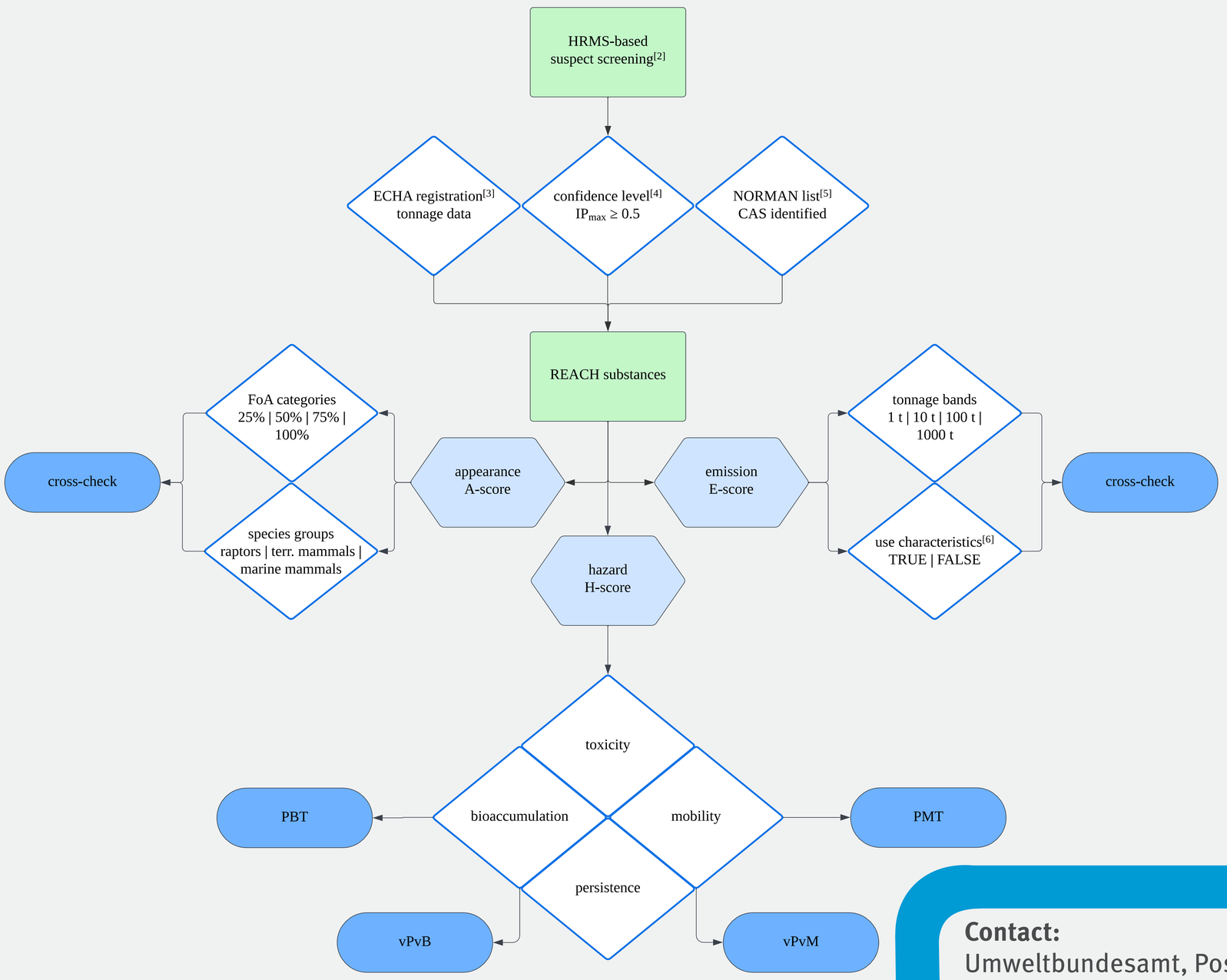

Fig.2: Decision flowchart for the prioritization of REACH substances detected via NTS in apex species: IP_{max} – maximal identification point[2-6] (created in Lucid (lucid.co)).

Outlook

Short-term

- → publication under preparation: Development of a prioritization scheme to link suspect screening data of European apex predators and hazard scoring (Nerlich et al. 2026)
- → list of prioritized chemicals for further activities in the PBT/PMT assessment of the European Chemical Agency (ECHA)

Long-term

- → integrate new AI-based models, consensus models and updated NORMAN NTS data

Literature

[1] https://doi.org/10.1186/s12302-022-00665-5
[2] https://doi.org/10.1016/j.scitotenv.2024.175303
[3] https://echa.europa.eu/de/information-on-chemicals/registered-substances
[4] https://doi.org/10.1016/j.trac.2023.116944
[5] https://www.norman-network.com/nds/susdat/
[6] https://doi.org/10.1016/j.scitotenv.2017.12.305

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