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Baltic Sea sediments – A comprehensive ecotoxicological investigation

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Sampling sites

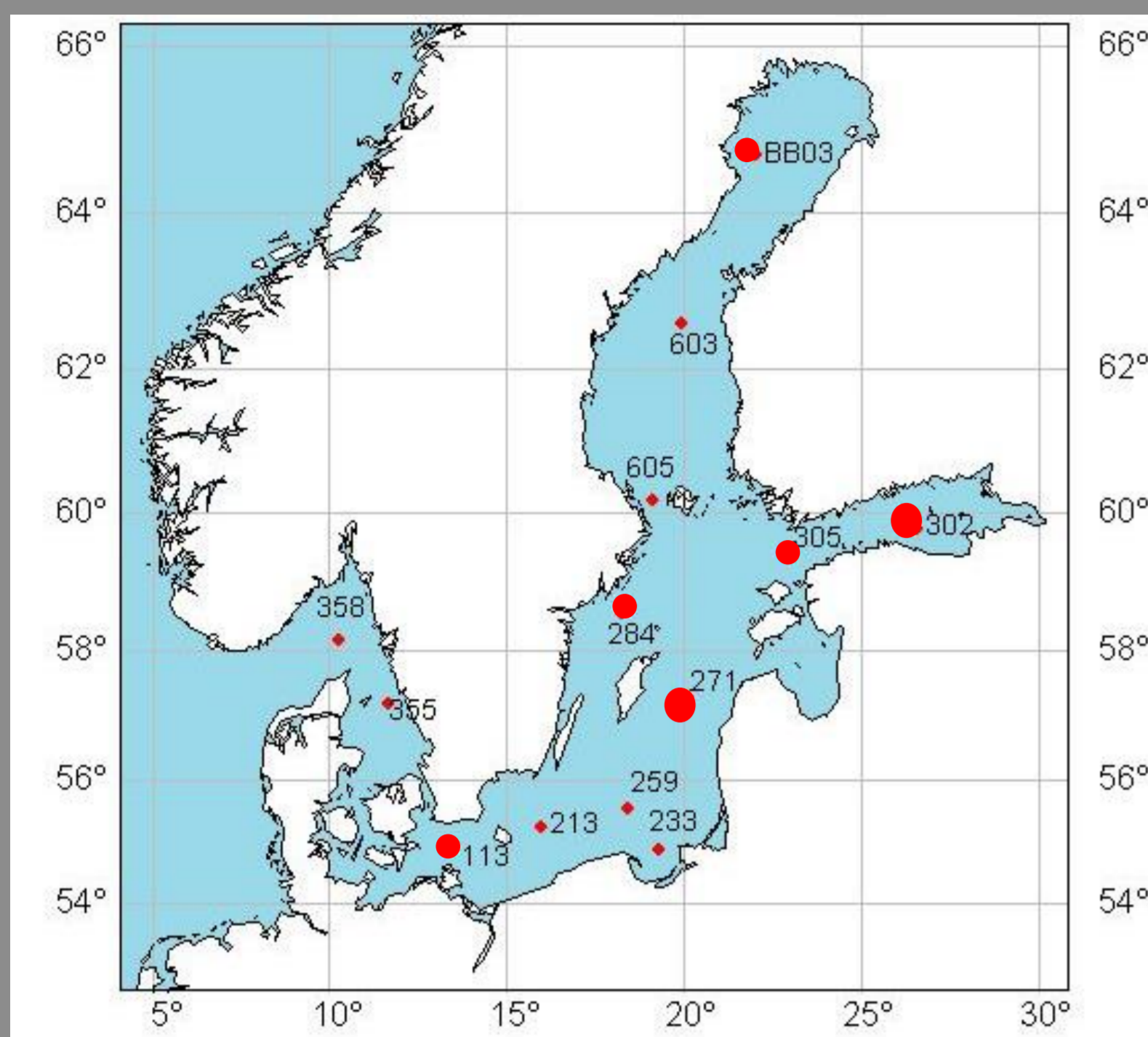
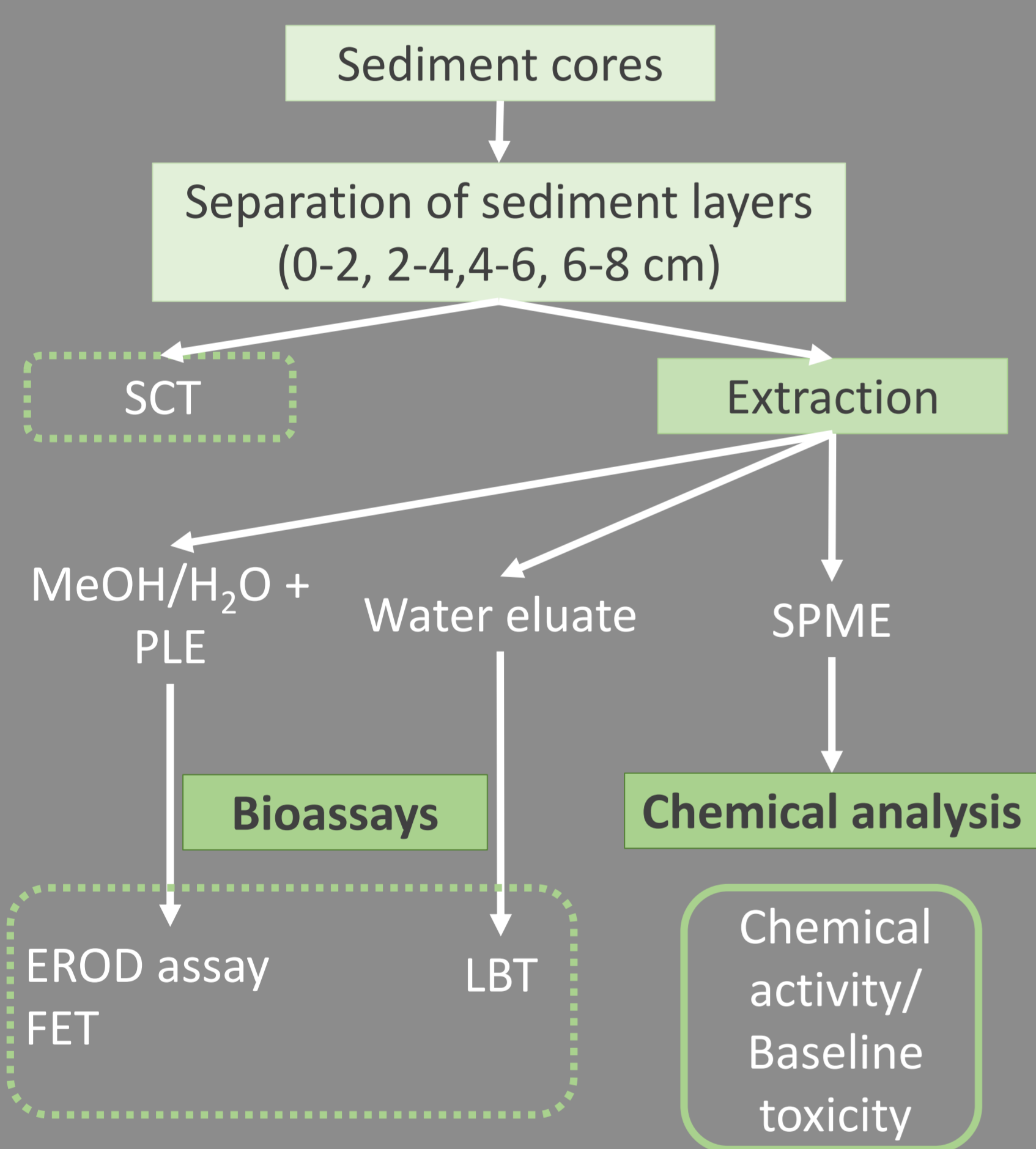


Fig. 1: Location of sampling sites in the Baltic Sea^[1].

- Due to its geographical position the Baltic Sea is heavier polluted than other marine areas.
- PCBs and PAHs belong to the primary components of aquatic contamination.

Concept of the study



Bioassays

SCT: Sediment contact test with *Danio rerio* - acute embryotoxicity of native sediments.
FET: Fish embryo toxicity test with *Danio rerio* - acute embryotoxicity of sediment extracts.

EROD assay: Ethoxyresorufin-*O*-deethylase assay with RTL-W1 cells – dioxin like contaminants in sediment extracts.

LBT: Luminescent bacteria test with *Vibrio fischeri* - inhibition of luminescence affected by dissolved contaminants in water eluates.

[1] Sampling sites:

113	Arkona Sea
213	Bornholm Sea
233	Gdansk Deep
259	Eastern Gotland Sea
271	Eastern Gotland Basin
284	Western Gotland Basin
302	Gulf of Finland
305	Gulf of Finland
355	Kattegat
358	Skagerrak
603	Bothnian Sea
605	Ålandsea
BB03	Bothnian Bay

[2] PAHs:

BaA	Chr
Naph	Chr
Acy	BbF
Ace	BkF
Fl	BaP
Phen	InP
Ant	DBA
Fluo	BghiP
Pyr	

[3] PCB #:

28
52
101
118
153
138
180
209

Results

FET

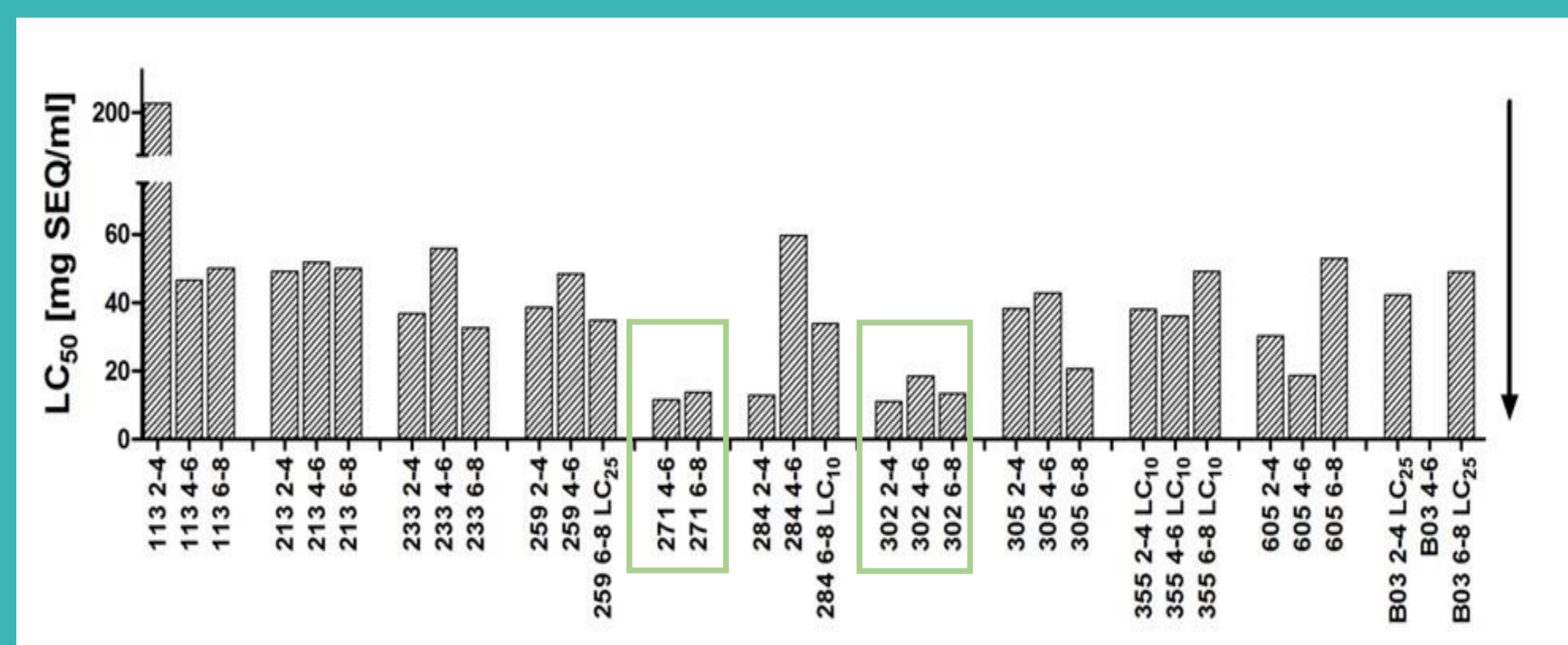


Fig. 2: PLE extracts were investigated in the FET with the highest concentration 50 mg/mL (n=3).

- Station 271 and 302 showed the lowest LC values, thus the highest embryotoxic effects.
- Results from the SCT (n=1) support these findings (data not shown).
- MeOH extracts didn't reveal to be embryotoxic (data not shown).

EROD assay

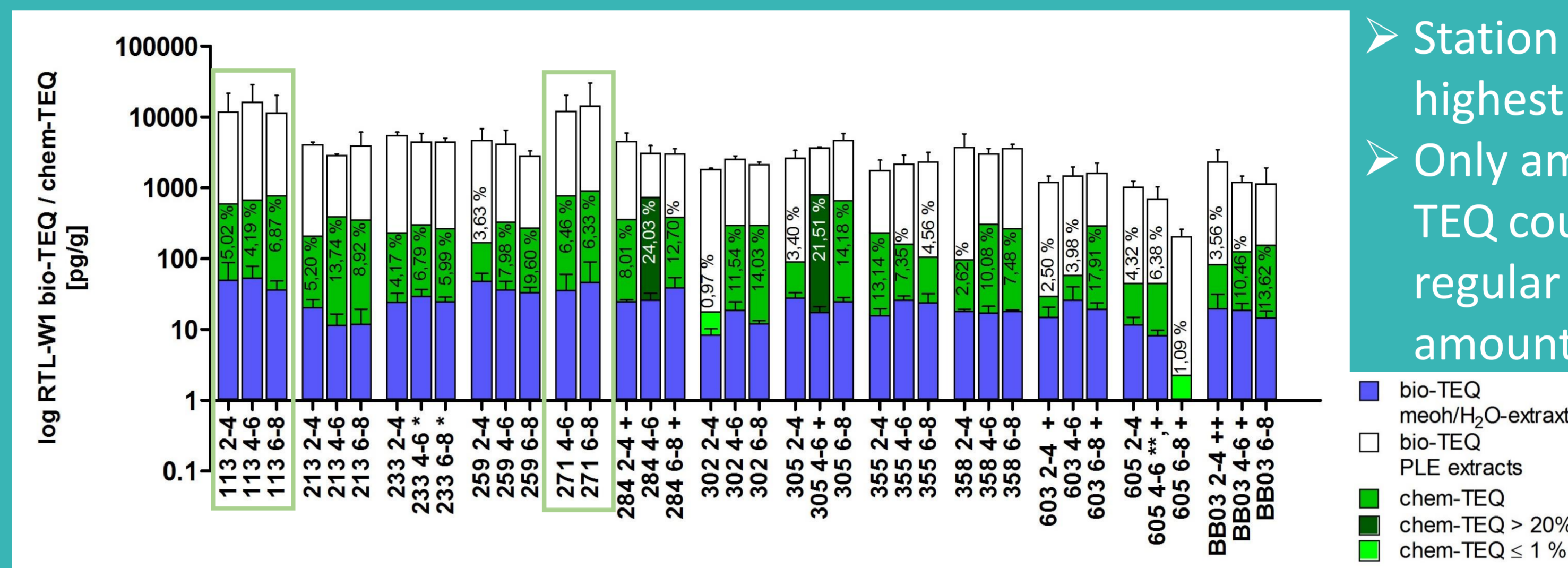
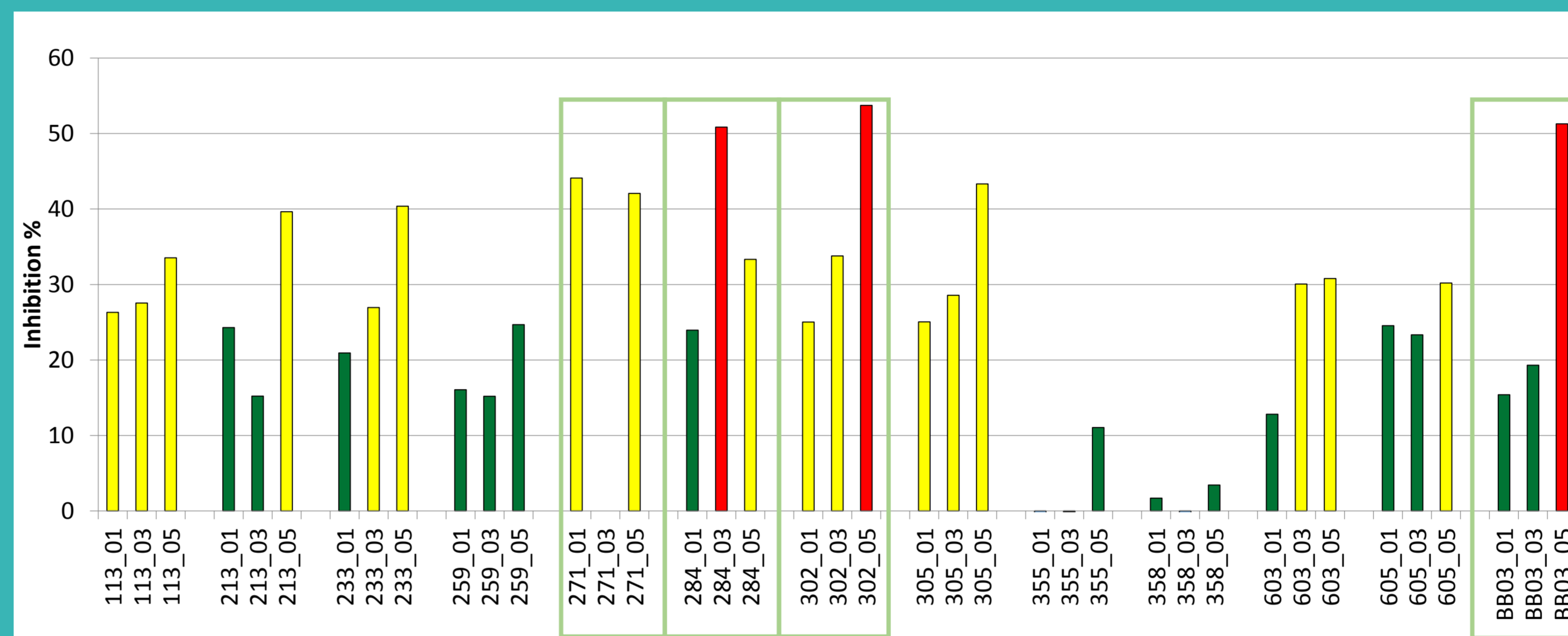


Fig. 3: Comparison of bio-TEQ₂₅ (investigated PLE and due low induction). PLE extracts: (*) bio-TEQ based on MeOH/H₂O extracts in the EROD-assay and chem-TEQ_{EC50} (**) bio-TEQ based on EC₁₀. MeOH/H₂O extracts: (+) The values show the percentage chem-TEQ of bio-TEQ. bio-TEQ based on EC₁₀ (++) bio-TEQ based on EC₅ (n=3) (n=3, except 605 6-8 cm MeOH/H₂O with 1 replicate).

- Station 113 and 271 show the highest dioxin like potential.
- Only among 1 - 24 % of the bio-TEQ could be explained by regular PAH and a very little amount of PCB.

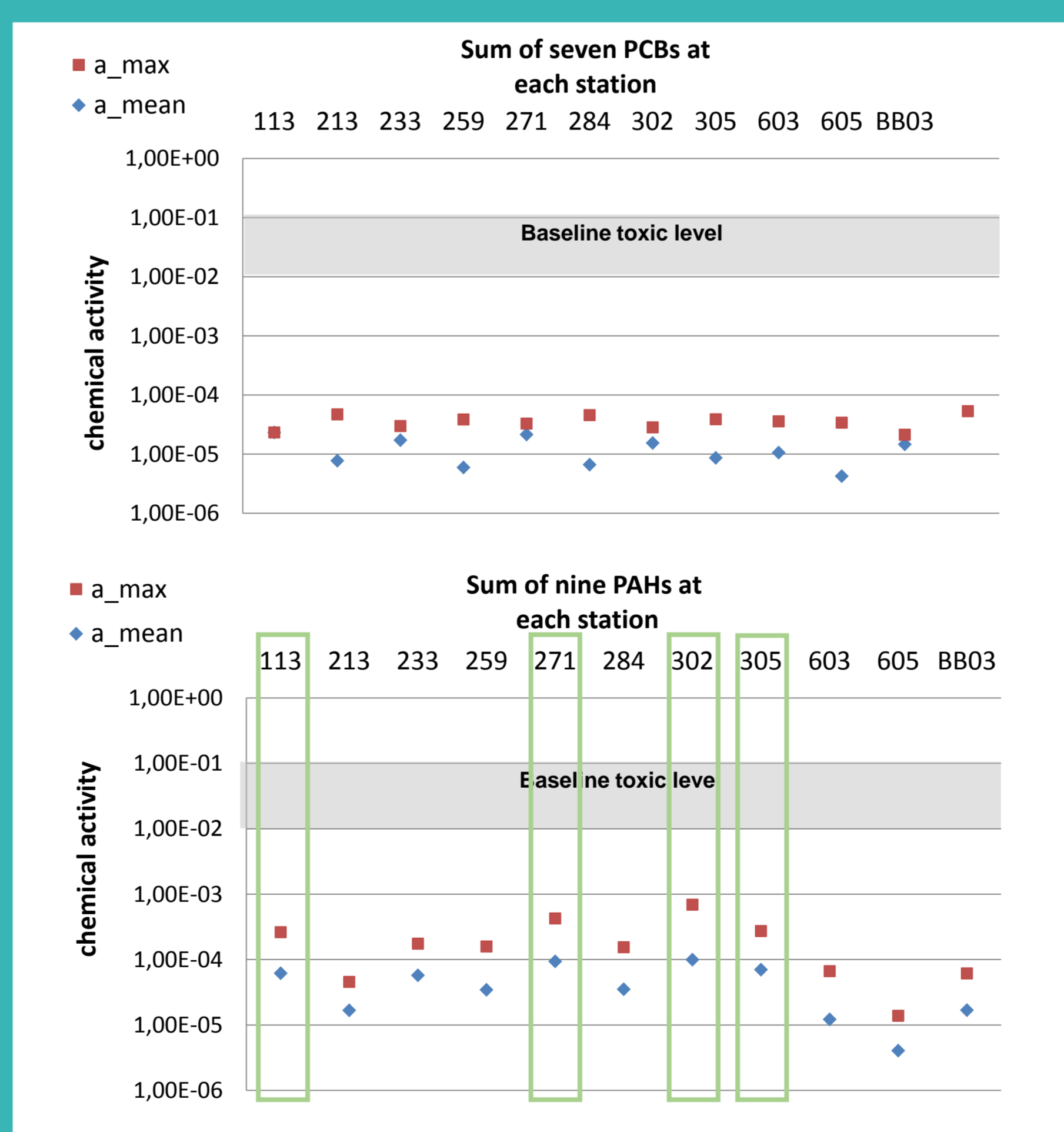
LBT



- Station 271, 302, 284, and BB03 showed the highest effects, however in lower sediment layers.
- Station 271 is noticeable due to similar effects among the depths.

Fig. 4: Water eluates were investigated in the Luminescent Bacteria test (n=3). 2cm sections, e.g. 113_01 equals 0-2 cm depth). (n=3)

Chemical analysis



- 10-fold higher contribution to baseline toxicity from PAHs than from PCBs
- max. values of PCBs are similar
- max. values of PAHs differ
- Contribution of PCBs: 0,07- 0,53 %
- Contribution of PAHs: 0,10 – 5,91 %

- Highest chemical activity of PAHs at station 271 and 302, moderate activity at 113 and 305.

Basic toxicity level (EA50): a toxicant or a mixture reaching the toxic level will cause 50 % mortality of the organisms exposed.

Fig. 5: Chemical activity of each station compared to the effective activity range (EA50) for the sums of PCBs^[3] (A) and PAHs^[2] (B).

Discussion & Conclusion

- Station 271 (Eastern Gotland Basin) und 302 (Gulf of Finland) are highly polluted
 - intense maritime traffic and industrial hot spots contribute to the pollution in these areas [HELCOM].
 - chemical activity of PAHs support these findings.
- Good agreement between chemical activity and bioassay results
 - PAHs have a much higher contribution to biological effects compared to PCBs
- Investigation of the water eluates does not match exactly with PLE extracts
 - compared to water eluates no depth dependency in whole extracts – interference of dissolved contaminants by bound not bioavailable contaminants
 - since water eluates are elaborately the investigation of whole extracts can lead to a suggestion which station is usefull for further investigations.