Sustainable North Sea Region
http://northsearegion.eu/sullied-sediments

Comparing conventional and integrated sediment-quality assessment of three North Sea region waterways

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Background

SedNet Workshop 2018 in Hamburg on sediment classification and management decisions[1]

- contained a short exercise mostly restricted to chemical data
- differences in the evaluation of data especially for sediments of low to moderate quality

- variability in decision-making even more pronounced when ecotoxicity data is considered in the decision making

- issue of sediment management guidelines continues to be a relevant topic

→ further work on these aspects appears to be timely and necessary

- different approaches applied to a data set generated within project Sullied Sediments

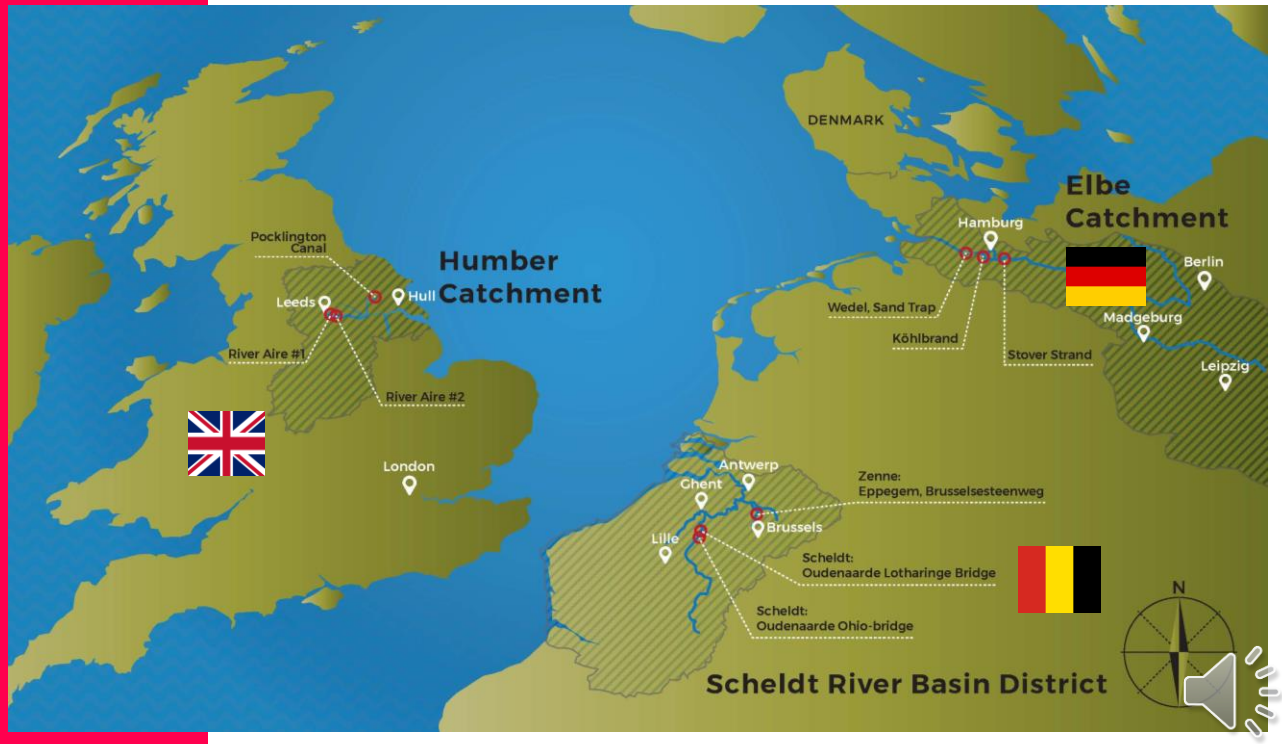
Samples

6 campaigns

1 autumn 2017
2 spring 2018
3 summer 2018
4 autumn 2018
5 spring 2019
6 summer 2019

3 countries, 3 sites each

Belgium	A, B, C
Germany	D, E, F
United Kingdom	G, H, I

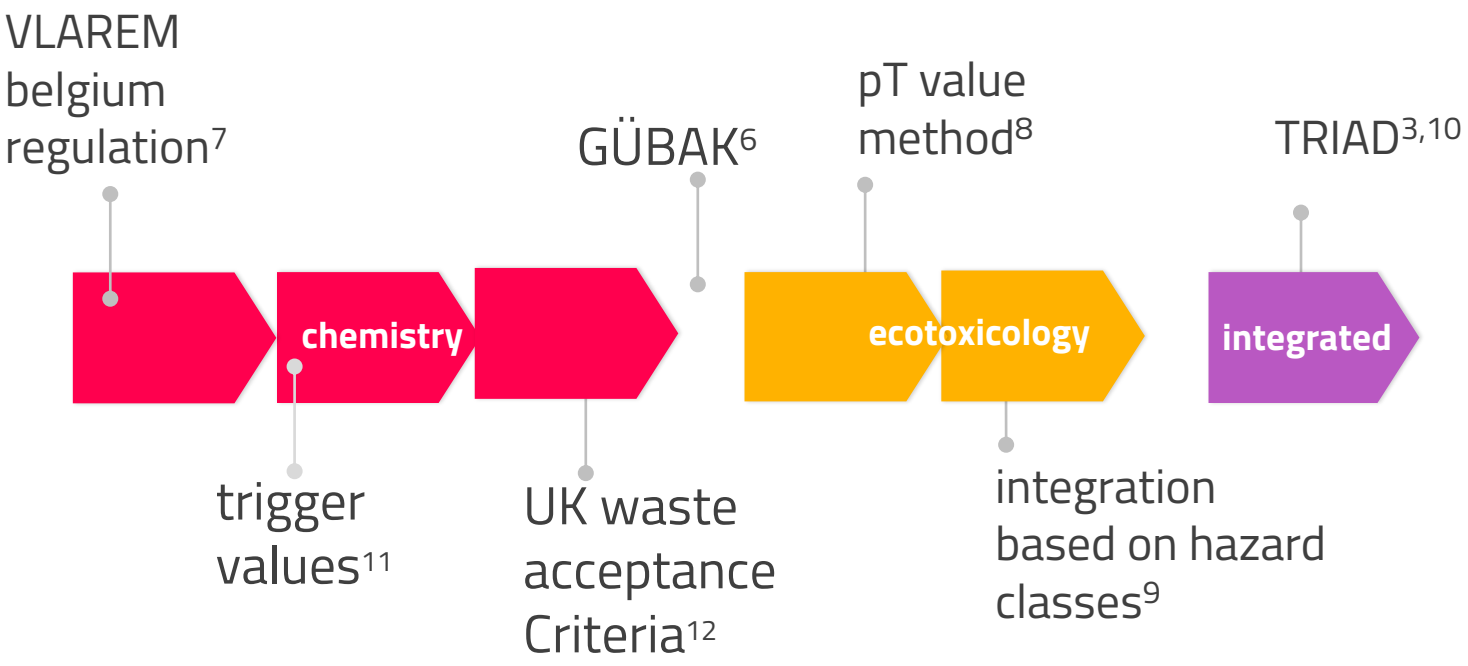


Analysis of samples in 3 lines of evidence (LOEs)

Sediment chemistry	Ecotoxicity	Benthic community structure	Physico-chemical
125 compounds ▪ 26 metals & metalloids ▪ 119 organic contaminants: ▪ 28 hydrocarbons (nC10-37) ▪ 17 dioxins and furans, ▪ 8 organotins ▪ 1 BFRs (α-,β-,γ-HBCDD) ▪ 16 PAHs ▪ 7 PCBs ▪ 19 pesticides ▪ 3 emerging contaminants (diclofenac, triclosan, PFOS)	1. algae growth inhibition test (AGI) elutriate 2. luminescence bacteria test 3. (LBT), elutriate & extracts 4. bacteria contact test (BCT) 5. sediment test *H. azteca* 6. sediment test *L. variegatus* 7. sediment test *M. aquaticus* 8. nematode test 9. sediment test ostracods 10. pore water Thamnocephalos	1. macrozoobenthos (Belgian Sediment Index, BSI, SPEAR) 2. meiobenthos (NemaSPEAR[%]-index) 3. bacterial community (functional diversity)	▪ grain size distributions ▪ pH, O_2, redox ▪ dry weight ▪ organic carbon ▪ nutrients (N,P)

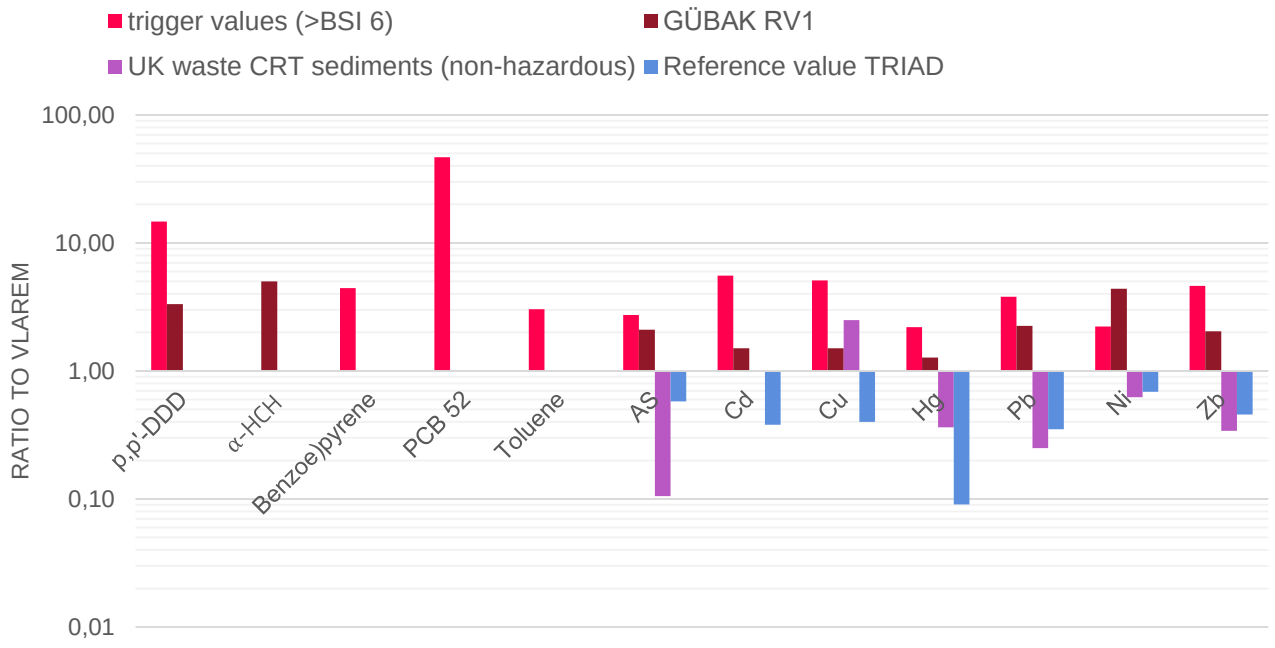
Note: data not complete for all campaigns

Overview

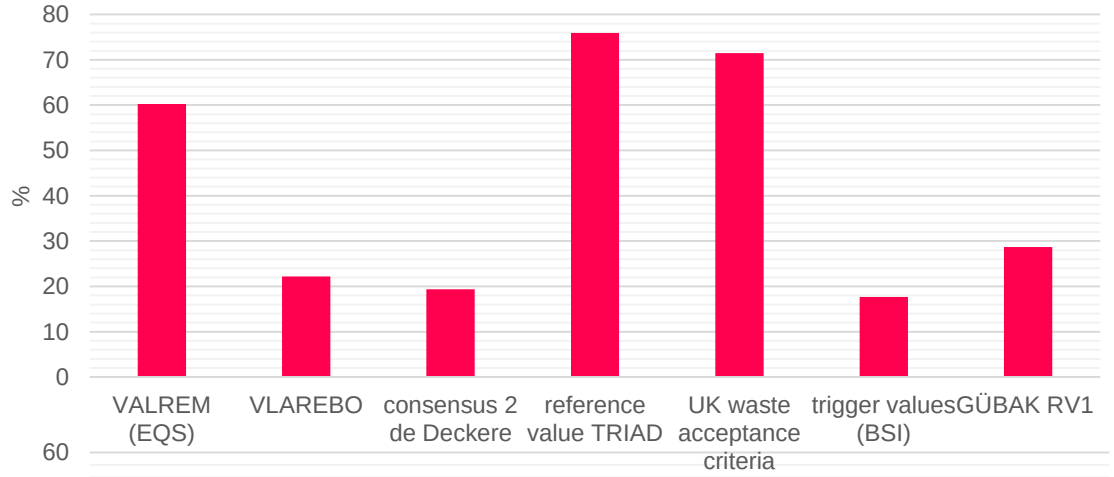

VLAREM belgium regulation[7]
chemistry
trigger values[11]
GÜBAK[6]
UK waste acceptance Criteria[12]
pT value method[8]
ecotoxicology
integration based on hazard classes[9]
TRIAD[3,10]
integrated

1.
Chemical assessment

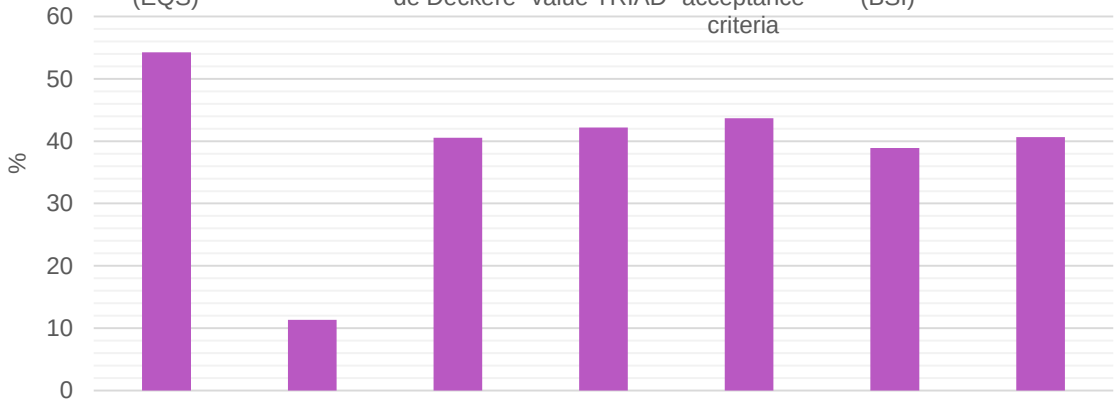
Comparing limit values of different regulations



Percentages of samples exceeding limit values



- average % of how many samples > limit value of a substance



- average % of how many measured values > respective limit value in a sample

2.
Ecotoxicological assessments

Classification based on integrated assessment and worst single test result[4,9]

toxic category	*No or low impact*	*Moderate impact*	*severe impact*
Number of assigned samples based on worst outcome of single test	2	18	34

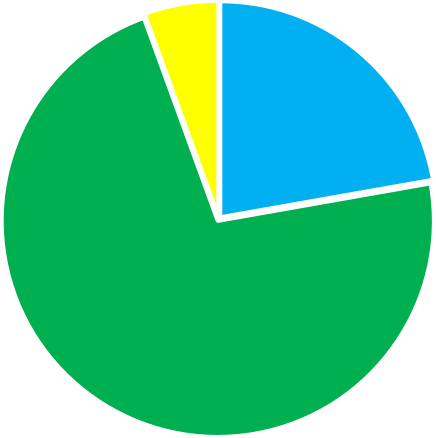
hazard class	*1*	*2*	*3*	*4*
number of assigned samples based on integrative assessment of bioassays	7	10	26	11

- $n = 54$

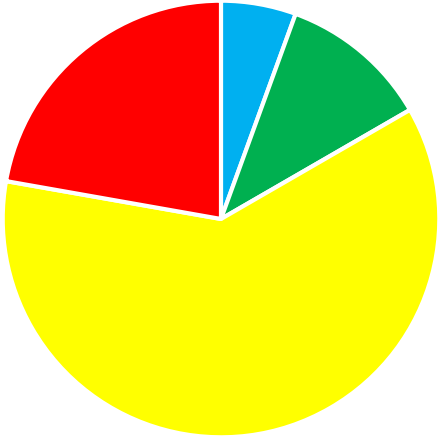
Comparing ecotoxicity evaluations

classes				
	1	no pollution /hazard/ impact		
	2	of no concern	potential hazard	mild acute impact
	3	critically polluted	moderate hazard	acute impact
	4	Dangerous / high/ severe hazard or impact		

pT value (*n*=18)



hazard classes (*n*=18)



ecotox classes TRIAD (*n*=3)

3. Integrative assessment

TRIAD
Integration of 3 LOEs

Sample	Chemical	Ecotox	Ecology	quality	Global class	GÜBAK	trigger BSI >6
A4	-	+	+	poor	3	case 3	
B4	+	+	-	poor	3	case 3	
C4	+	+	+	very poor	4	case 3	
D4	+	+	-	poor	3	case 3	
E4	-	+	+	poor	3	case 3	
F4	-	+		moderate	2	case 3	
G4	+	+	-	poor	3	case 3	
H4	-	+	+	poor	3	>63µm>90%	
I4	-	+	-	moderate	2	case 3	

Summary

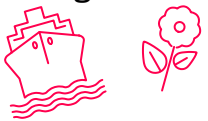
- different types and numbers of chemical, ecotoxicological and ecological parameters considered
- different assessment procedures and limit values used

- varying results of bioassays between laboratories and frameworks
- less samples classified as highly toxic with integrative approaches

- final quality classes of samples differ
- classes colour coded/ named differently

difficult to compare the sediment qualities between the countries

- well chosen, harmonized (not standardized) framework with regards to implementation of the WFD and the management of dredged material



Thank you for your attention!

work group
Applied Aquatic Toxicology

SedNet

Universiteit Antwerpen

ecossa ecological sediment & soil assessment

FLANDERS ENVIRONMENT AGENCY

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Institut Dr. Nowak Analytik · Beratung · Gutachten

SOCOTEC

Any questions, remarks or comments?

Contact me @: sonja.faetsch@haw-hamburg.de

References

- Literature

[1] SedNet (2019) Workshop on sediment classification and management Decisions – in situ and ex situ, Hamburg, Sep 20-21 2018; [2] de Deckere et al. (2011) Development of sediment quality guidelines for freshwater ecosystems J Soils Sediments (2011) 11:504–517; [3] Chapman (1997) Marine Pollution Bulletin, Vol. 34, No. 6, pp. 368-372, 1997 Environ Int 33:492-501; [4] Heise et al. (2020) Sullied Sediments Report: Development of a BEBA-based-classification system for sediments; [6] GÜBAK-WSV (2009) Joint transitional agreements for the handling of dredged material in German federal coastal waterways; [7] VLAREM II Annex 2.3.1.a/1. Environmental quality standards for water bottoms; [8] Krebs et al. (2000), Small-scale Freshwater Toxicity Investigations 2:281-304; [9] Ahlf and Heise (2005) J Soils & Sediments 5 (1) 16 – 20; [10] VMM Flemish Environment Agency (2000) Handbook for the characterization of the soils of the Flemish waterways, TRIAD; [11] VMM (2020) Waterbodem trigger voor verder onderzoek; [12] UK Environmental agency (2015), Guidance on the classification and assessment of waste WM3;

- Project Sullied Sediments: https://northsearegion.eu/sullied-sediments/
- Icons: https://www.slidescarnival.com/