ELSA – Remediation of contaminated Elbe/Labe sediments

Causes and effects of increased PCB-release into the Elbe/Labe in 2015

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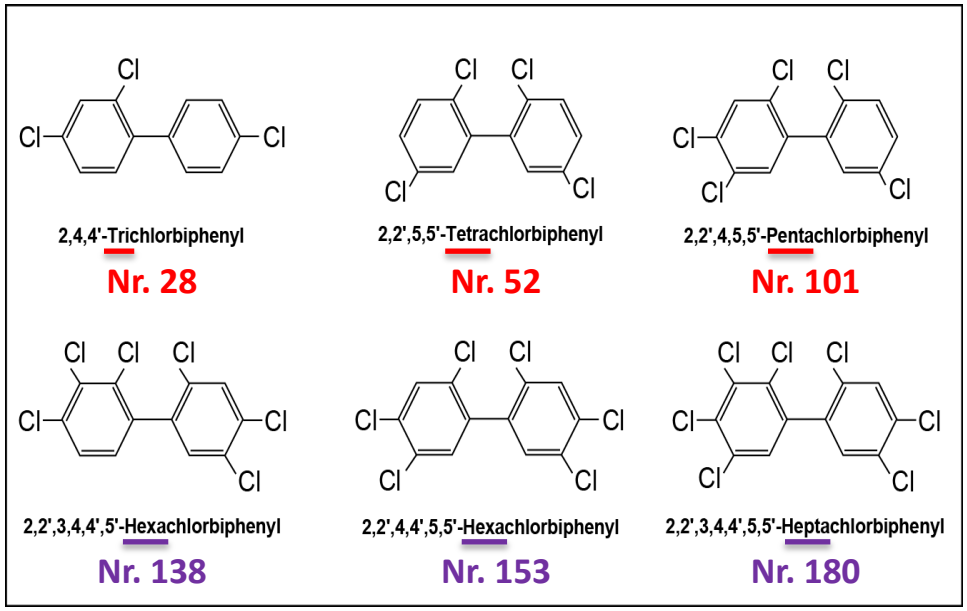
17. Magdeburger Gewässerschutzseminar / Magdeburský seminář o ochraně vod, Dresden, 06.10.2016

Hamburg

Polychlorinated biphenyls (PCB)

Hamburg

Chemical structures of the six guiding PCB-congeners



PCB-No. 28, 52, 101 ≙ low chlorinated PCB-congeners

PCB-No. 138, 153, 180 ≙ high chlorinated PCB-congeners

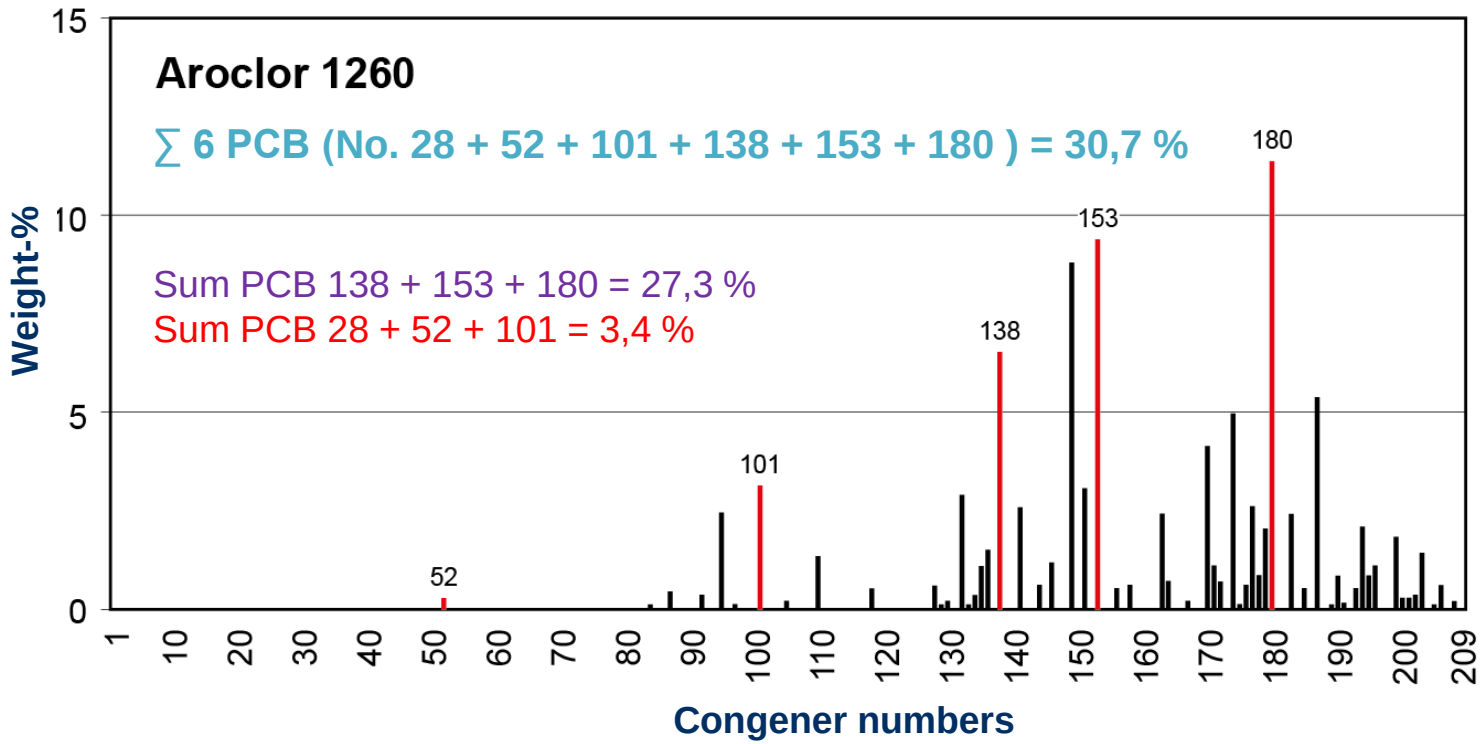
- Group of 209 congeners
- Used in power transformers, hydraulic units, pasticizers, etc.
- Worldwide prohibition of production and application since 2001
- Toxic and cancerogen chlororganic compounds
- Low acute toxicity, but chronic toxicity even in very low concentrations
- Bioaccumulative, adsorptive and persistent
- Accumulation in fat tissue and fine size particulate matter
- Environmental quality standard (EQS) according to German water regulation (OGewV): 20 µg/kg per congener
- Mean load area: Czech Republik (high chlorinated PCB); Tributaries Mulde & Saale (low chorinated PCB)

Ballschmiter and Zell (1980), modified

Production & Application

PCB-Products:

- **Aroclor** (e.g. **Aroclor** 1016, 1221, 1232, 1242, 1248, 1254, **1260**, 1268; Co. MONSANTO, USA)
- **Clophen** (e.g. **Clophen A** 30, 40, 50, **60**; Co. BAYER, BRD)
- **Orophen** (SOLVAY-Werke, DDR)
- **Delor** (e.g. **Delor** 103, 105, **106**; Co. CHEMKO, ČSSR)

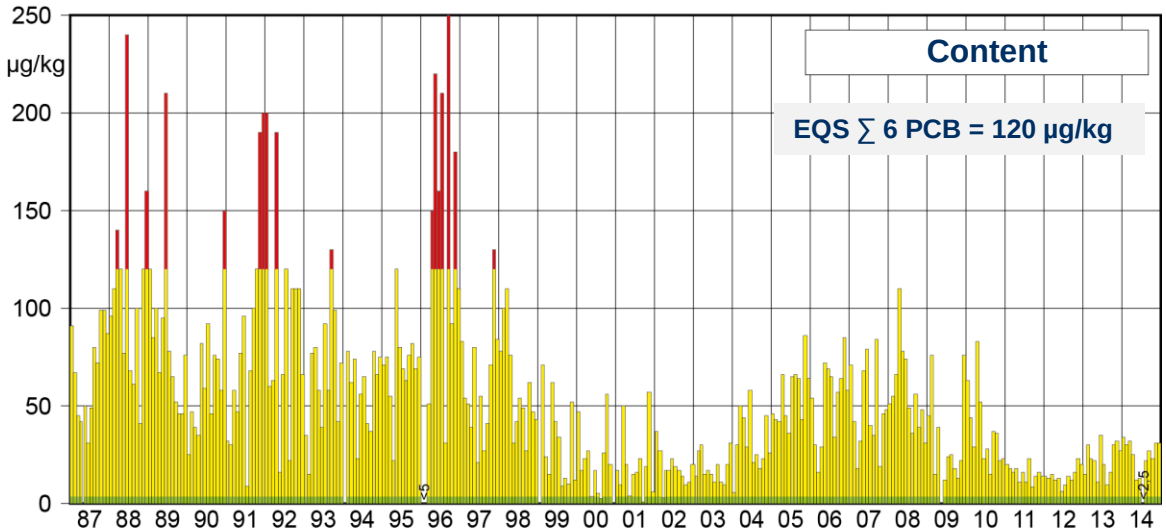


EPA (2012), modified

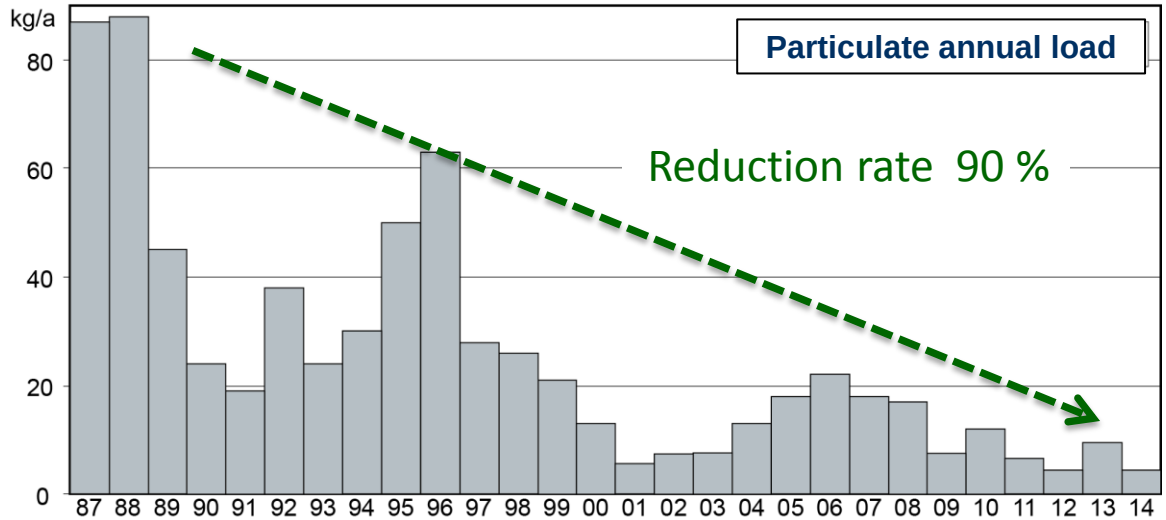
Contents and loads (1987 - 2014)

Hamburg

Schnackenburg
(German navigation km 474.5)



∑ 6 PCB [µg/kg]



∑ 6 PCB [kg/a]

Data: ARGE Elbe, FGG Elbe

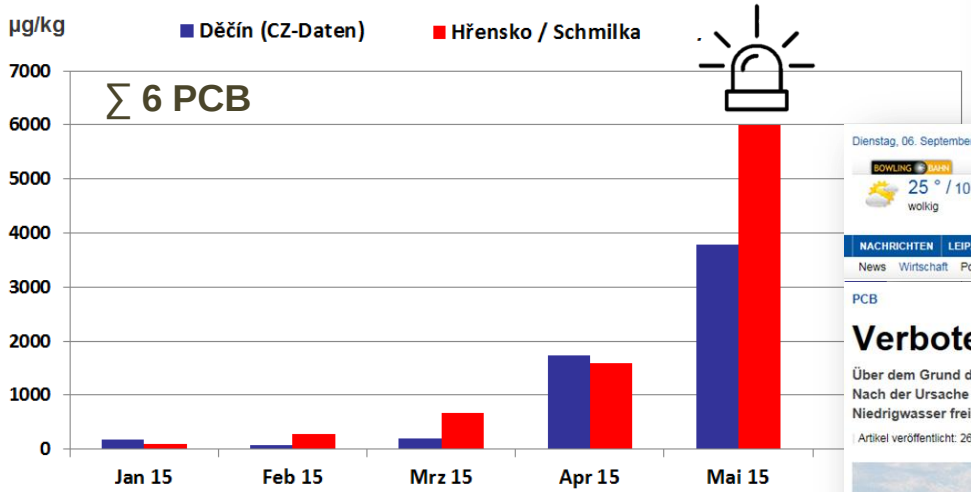
Alarm notes …

Hamburg

May 2015

LANDESAMT FÜR UMWELT, LANDWIRTSCHAFT UND GEOLOGIE | Freistaat SACHSEN

Bestätigung der sächsischen Befunde durch die tschechische Behörde Povodí Labe



LfULG SN (2015)

Sächsische Zeitung
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Nachrichten | Sachsen | Ratgeber | Video | Wetter | Abo | Shop | Anzeigen

› Start › Sachsen › Dresden › Giftige Chemikalie in der Elbe

Giftige Chemikalie in der Elbe

Dresden. Die Ursache für die stark erhöhte Konzentration der verbotenen giftigen Chemikalie PCB in der Elbe ist weiter unklar. Nach erster Analyse befindet sich die Quelle im Raum Usti nad Labem auf tschechischer … Landesamt … landwirt- … ologie … esden am … eilte. Die … chwer was-

Dienstag, 06. September 2016 | Abo & Leserservice | Anzeigen aufgeben | Login | Stichwort eingeben | Suchen

BOWLING BAHN 25 ° / 10 ° wolkig

LEIPZIGER VOLKSZEITUNG

iPhone 6s 16 GB ANZEIGE

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PCB | Kommentieren | Drucken | Text

Verbotene Chemikalie in der Elbe entdeckt

Über dem Grund der Elbe ist eine stark erhöhte Konzentration der verbotenen giftigen Chemikalie PCB entdeckt worden. Nach der Ursache wird in Deutschland und Tschechien gesucht. PCB kann etwa beim Ausbaggern des Flußbetts oder Niedrigwasser freigesetzt werden.

Artikel veröffentlicht: 26. Juni 2015 18:34 Uhr

Samplings

- **Sedimentation trap**
  monthly composite samples,
  suspended fresh sediments

- **Centrifuge**
  individual samples,
  suspended matters

- **Scraping-/ Grabsampling**
  sediments

HU Hamburg; Junge (2015); ELSA (2016)

Spatial and temporal development (2015)

Hamburg

µg/kg MMP*	NI Schnacken-burg	ST Wittenberg	SN Dommitzsch	SN Zehren	SN Schmilka	CZ Děčín
Jan.	34	51	65	112	87	178
Febr.	41	62	81	107	289	68
March	46	85	173	430	662	204
April	57	337	372	709	1.600	1.710
May	103	479	741	1.620	6.010	3.730
June	54	459	697	1.130	1.840	3.600
July	103	386	518	771	1.080	1.450
Aug.	58	322	464	497	1.090	1.440
Sept.	90	354	331	467	666	1.260
Oct.	65	453	381	525	541	1.410
Nov.	73	478	233	331	512	1.480
Dec.	118	439	344	535	1.140	1.990

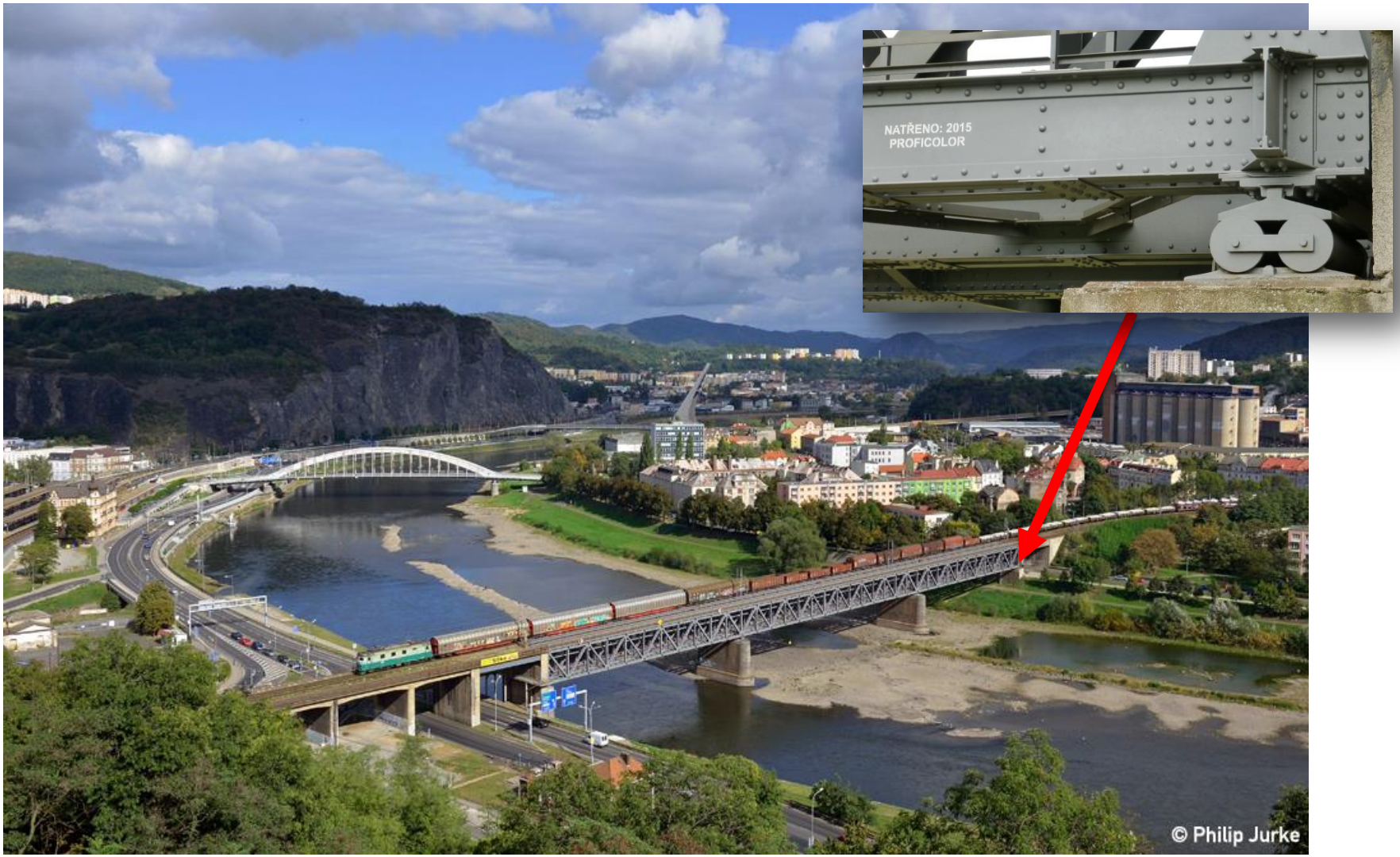
* MMP = monthly composite samples suspended fresh sediments

∑ 6 PCB [µg/kg]

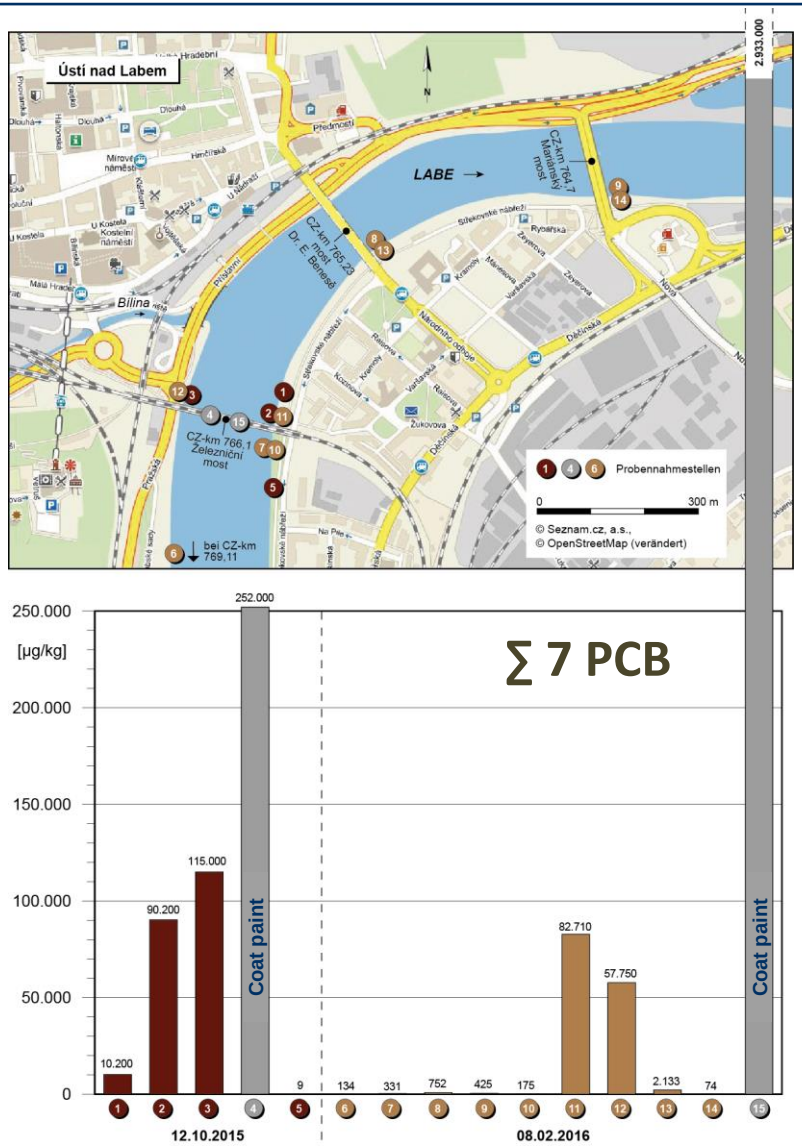
- ∑ 6 PCB ≤ 120 µg/kg, at least one congener > 20 µg/kg
- ∑ 6 PCB ≤ 1.200 µg/kg
- ∑ 6 PCB > 1.200 µg/kg
- ∑ 6 PCB > 6.000 µg/kg

Data: FGG Elbe, Povodí Labe

Cause detection …



Release in Ústí nad Labem (CZ)



- Causation: inappropriate removal of a coat of pcb-containing paint from a railway bridge in Ústí nad Labem
- In spite of the enclosure, release of a relevant proportion of pcb-contaminated grit in combination with intake into the river channel and river bank
- Coat paint from 1960s with a portion ∑ 7 PCB of 2.933.000 µg/kg (equals to 0,3 % ∑ 7 PCB; resp. 1 % total PCB)
- Povodí Labe detected high pcb-contamination of river sediments and floodplain soils nearby the reconstructed bridge
- Objection by the polluter (Co. PROFICOLOR) delays the environmental remediation

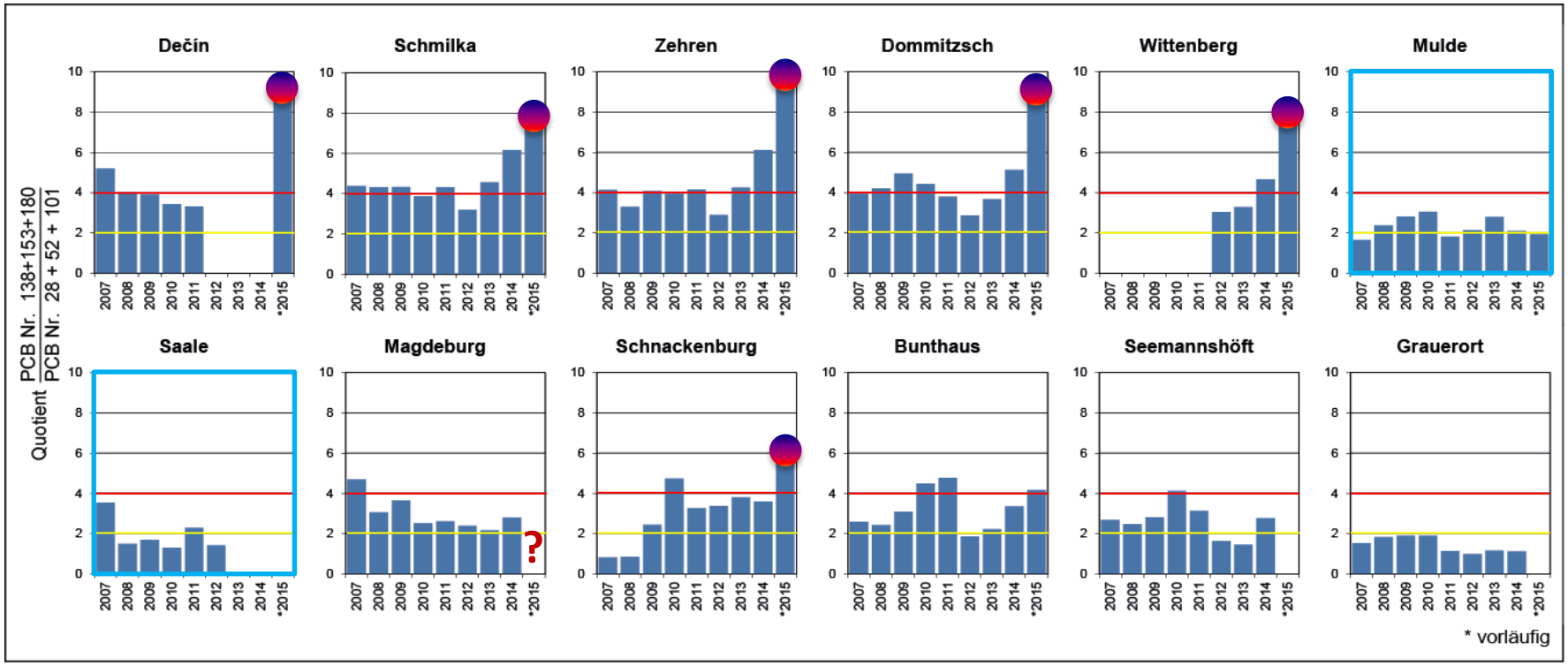
Fig.: ELSA (2016), Data: Povodí Labe

Congeners proportions

Hamburg

$$\frac{\text{sum of high chlorinated Ballschmiter PCB-congeners (138 + 153 + 180)}}{\text{sum of low chlorinated Ballschmiter PCB-congeners (28 + 52 + 101)}}$$

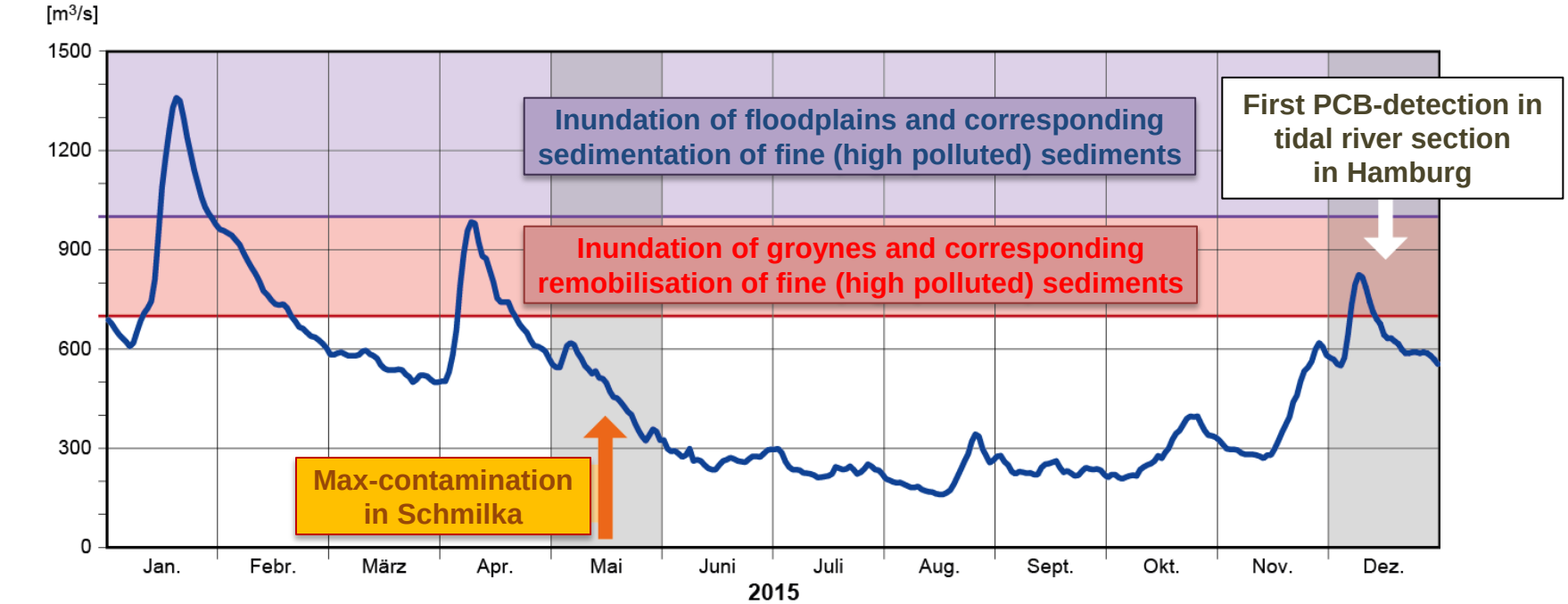
Dataset: Annual mean pcb contents in suspended fresh sediments

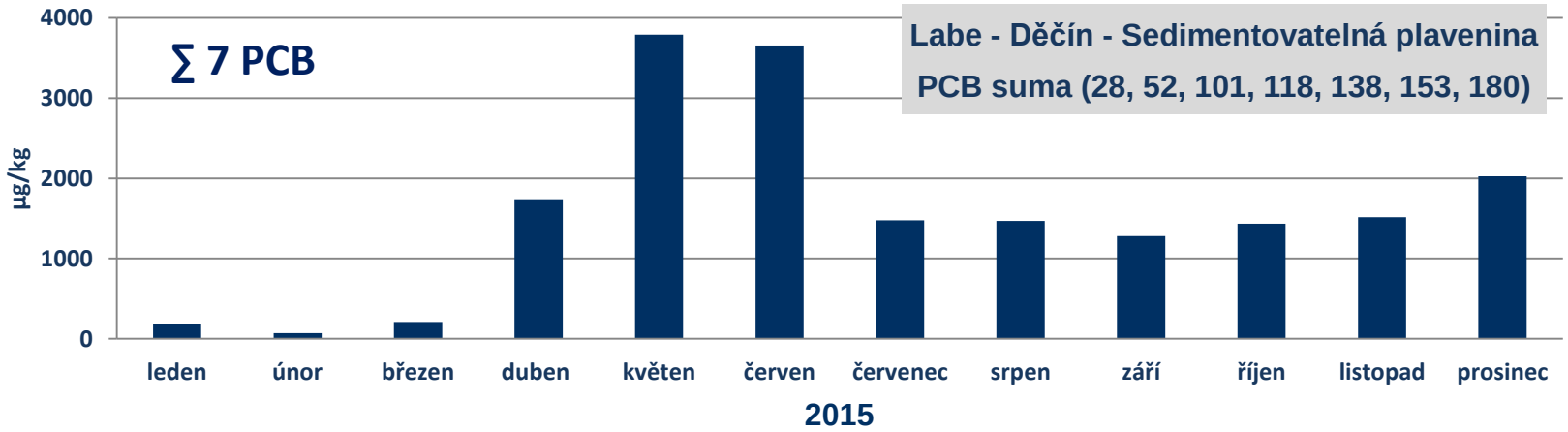


= Significant increased pcb-congeners-proportion *„high-chlorinated to low-chlorinated“*

Data: FGG Elbe

Discharge induced transport



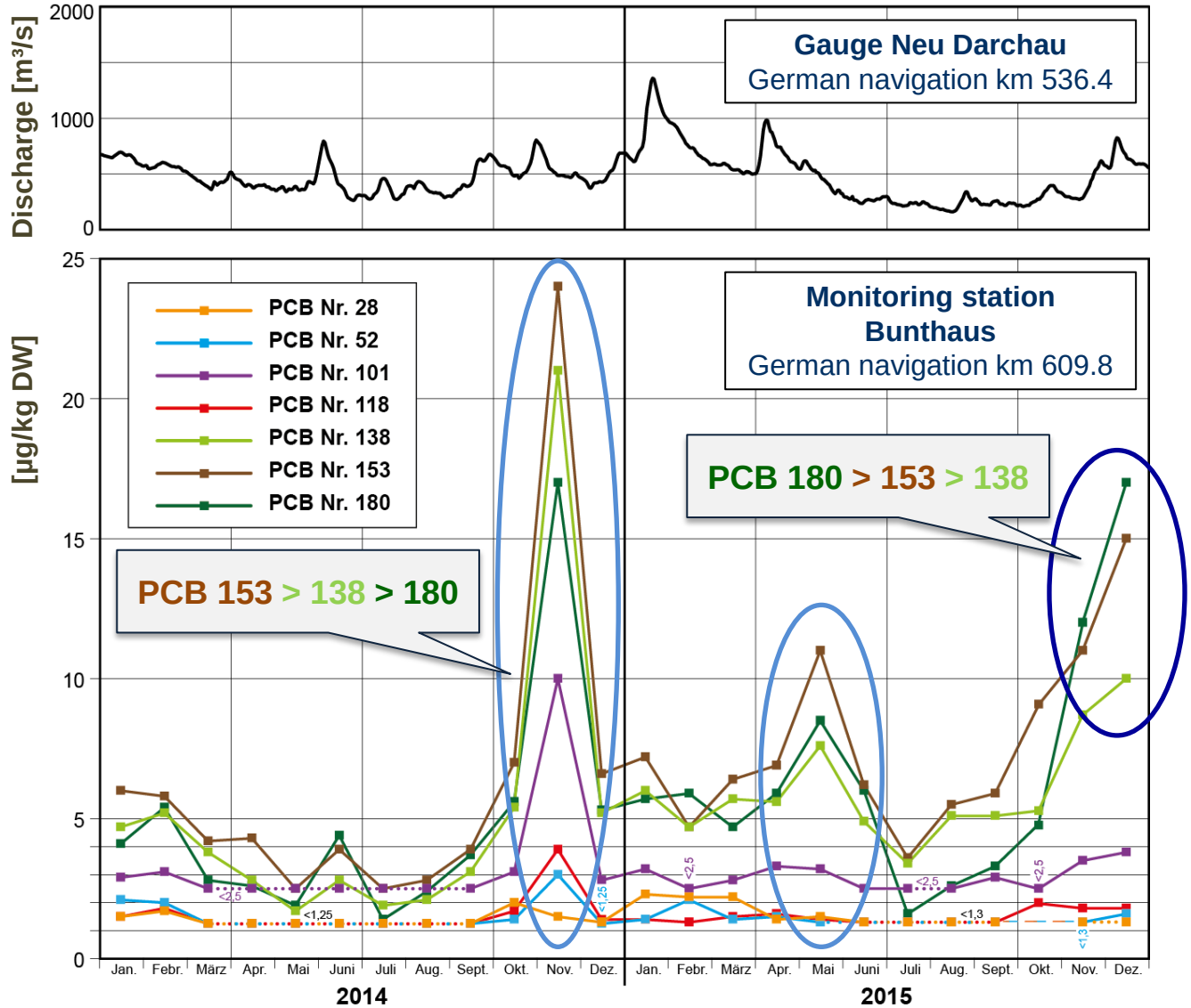


Discharge: WSV Magdeburg, Data: Povodí Labe

Contents in suspended matter, 2014 - 2015

Hamburg

Bunthaus
(German-Navigation-km 609.8)



PCB [µg/kg]

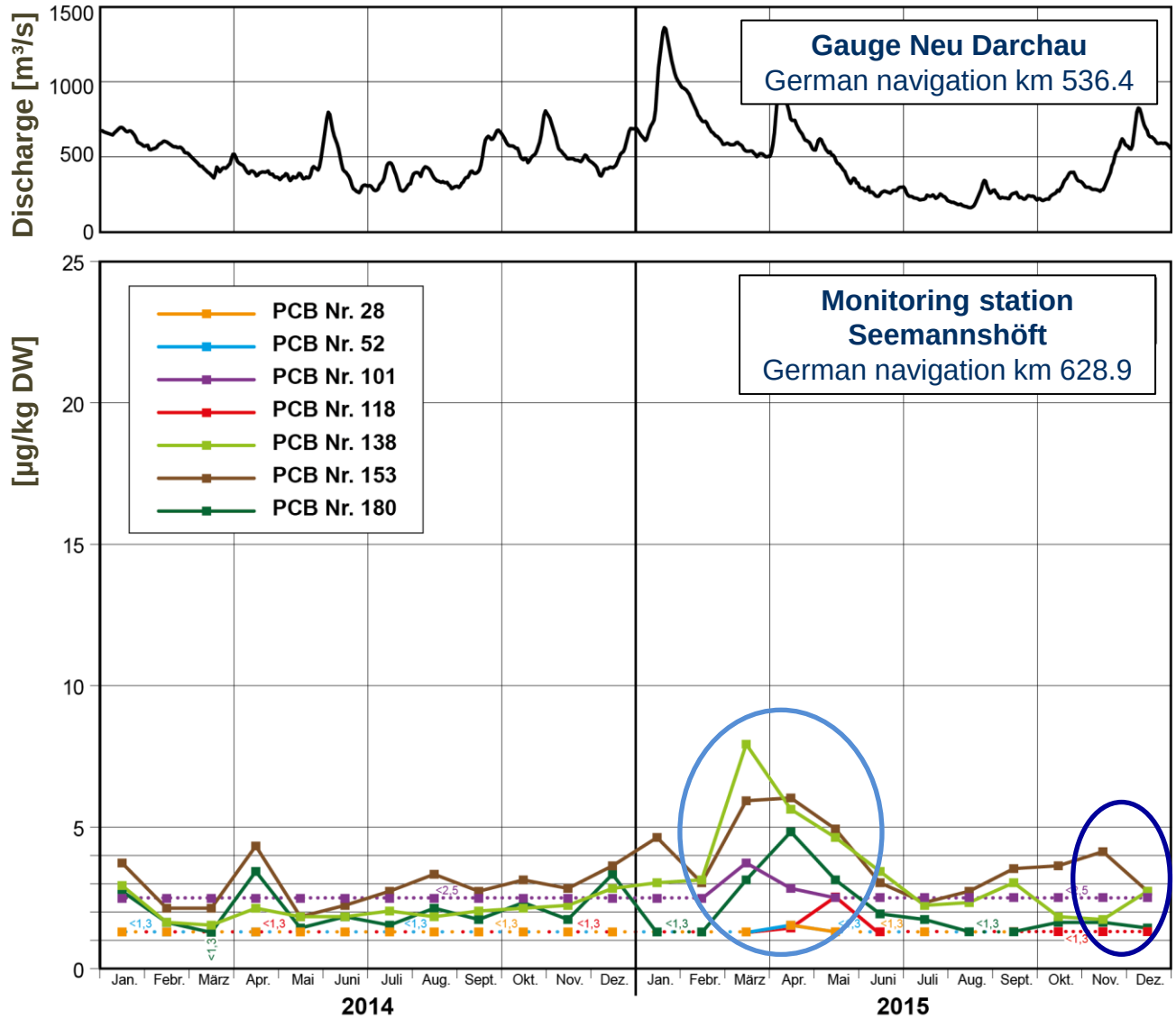
DW = dry weight

Data: HU Hamburg

Contents in suspended matter, 2014 - 2015

Hamburg

Seemannshöft
(German-Navigation-km 628.9)

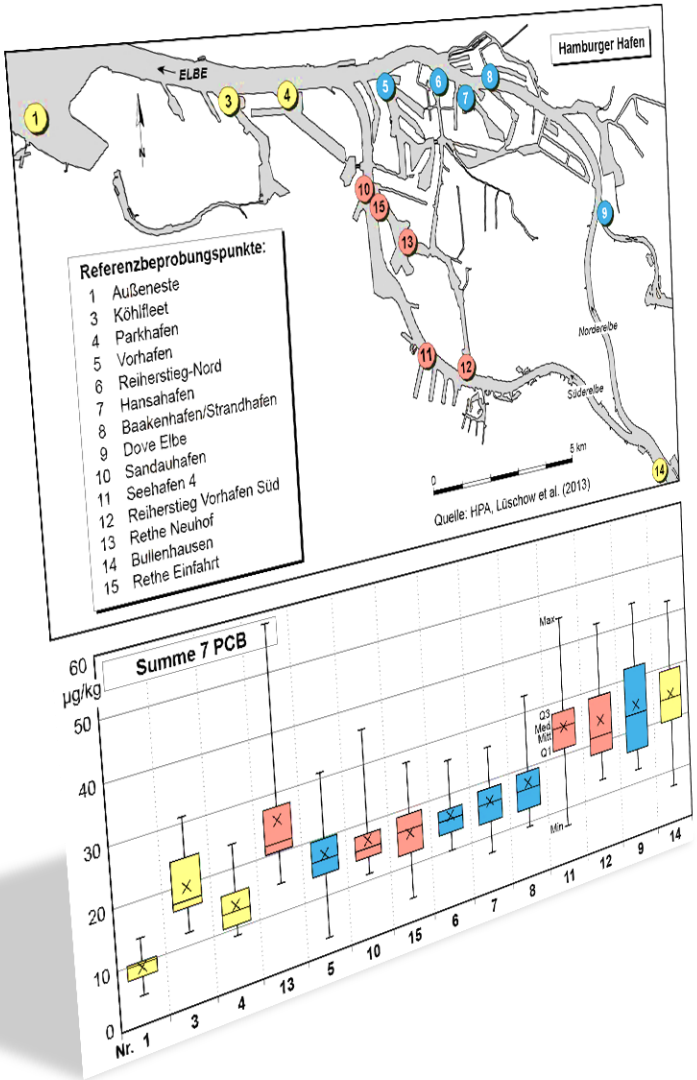


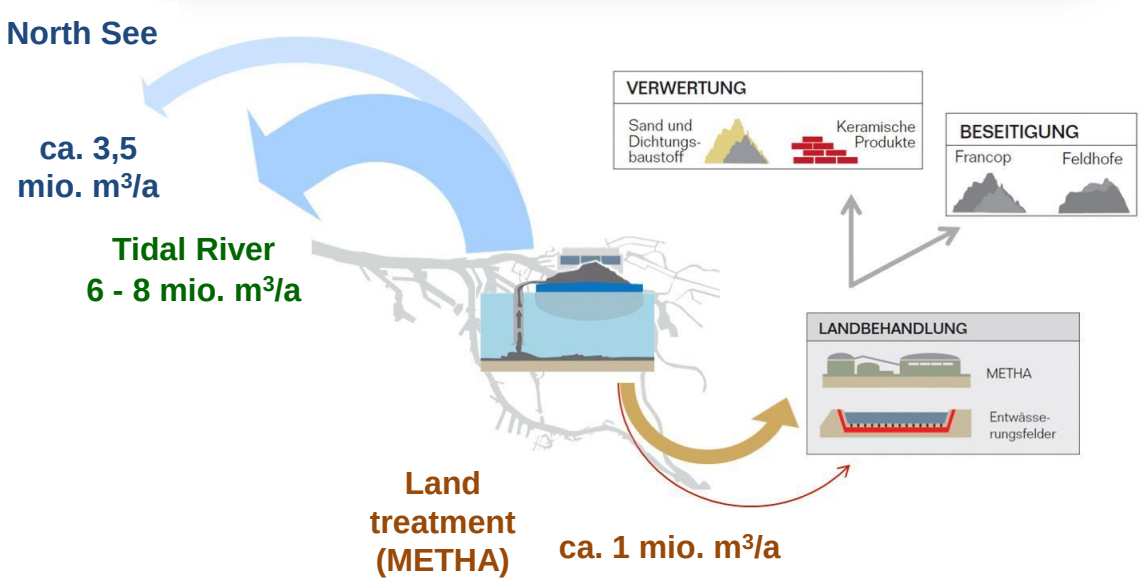
PCB [µg/kg]

DW = dry weight

Data: HU Hamburg

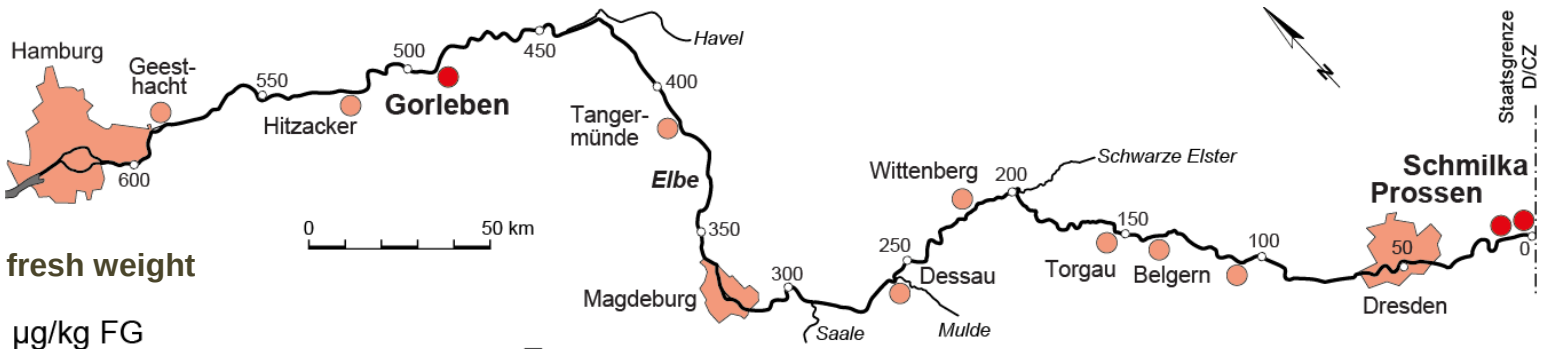
Dredge management in Hamburg port



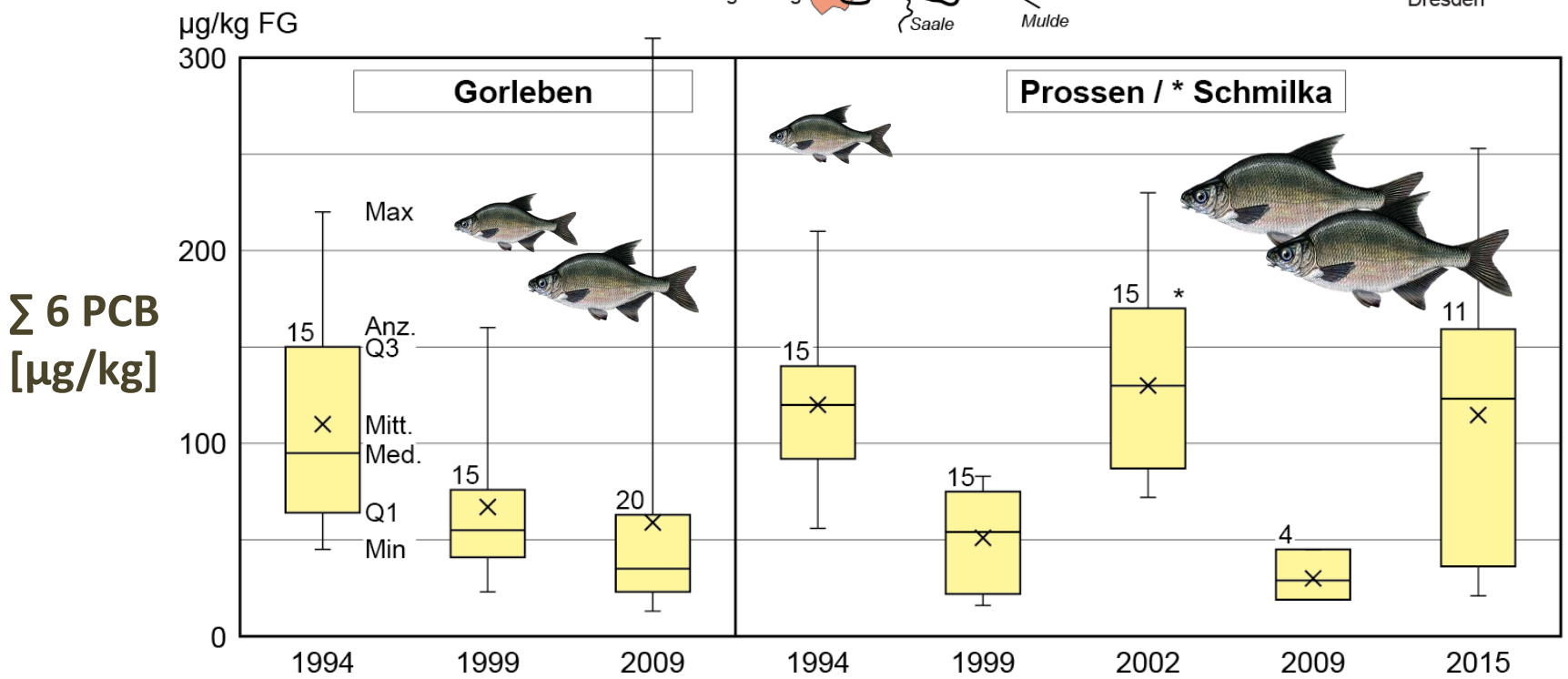


Data: HPA Hamburg

Biomagnification



FG = fresh weight



Data: ARGE Elbe, LfULG SN

Conclusions

ELSA –
Remediation of contaminated sediments

Download of ELSA-Report

„PCB in sediments of the River Elbe – characteristics, occurrence and trends as well as causes and effects of increased release in 2015 “

www.elsa-elbe.de