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'Climate Change Impact on Ecosystem Health

- Marine Sediment Indicators',

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MULTI-PROXY INVESTIGATION OF RECENT SEDIMENTS IN TWO DIFFERENT EUROPEAN COASTAL AREAS (POLAND, NORWAY) - ANTHROPOGENIC IMPACT ON ECOSYSTEM HEALTH

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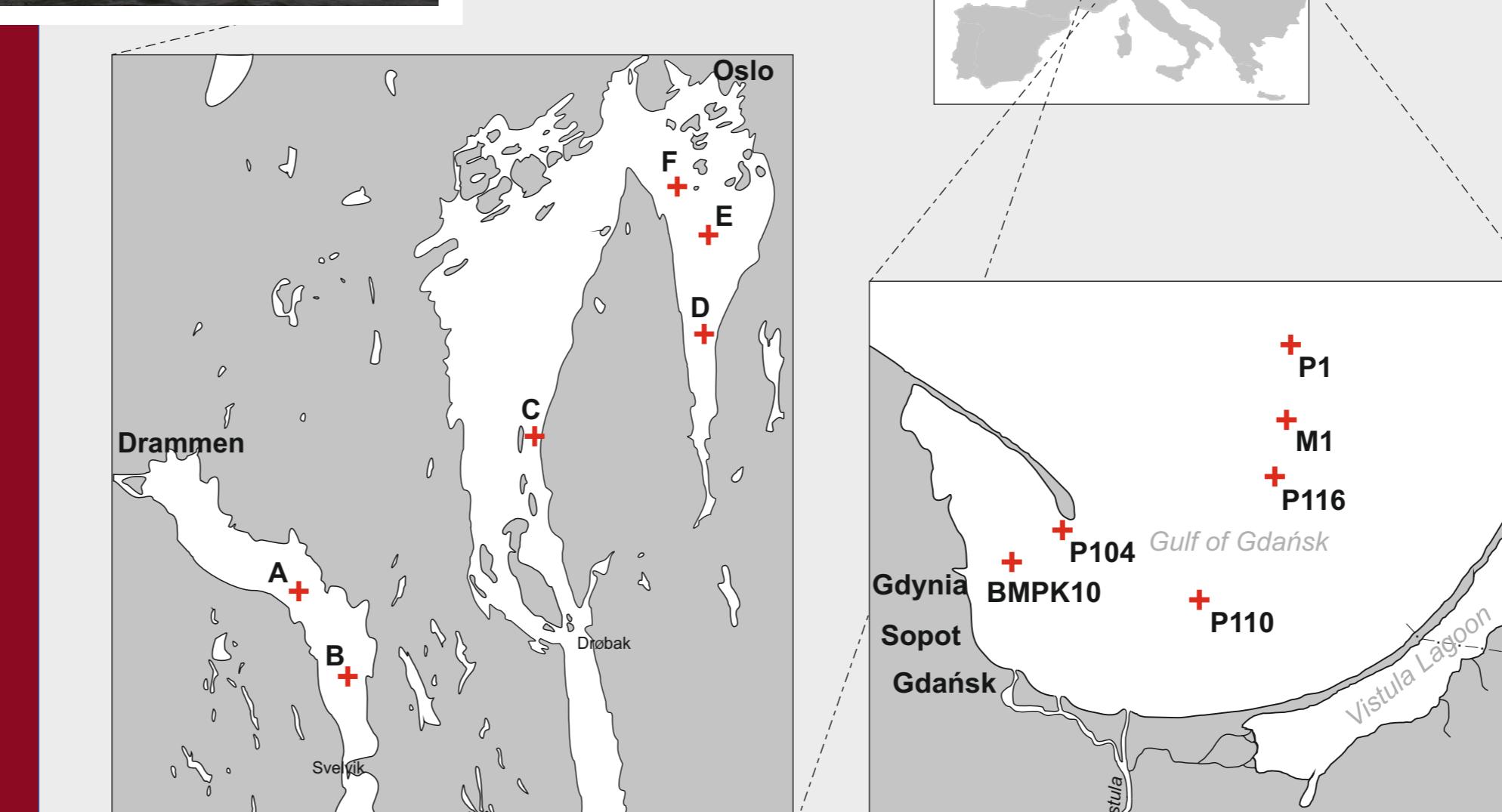
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Abstract

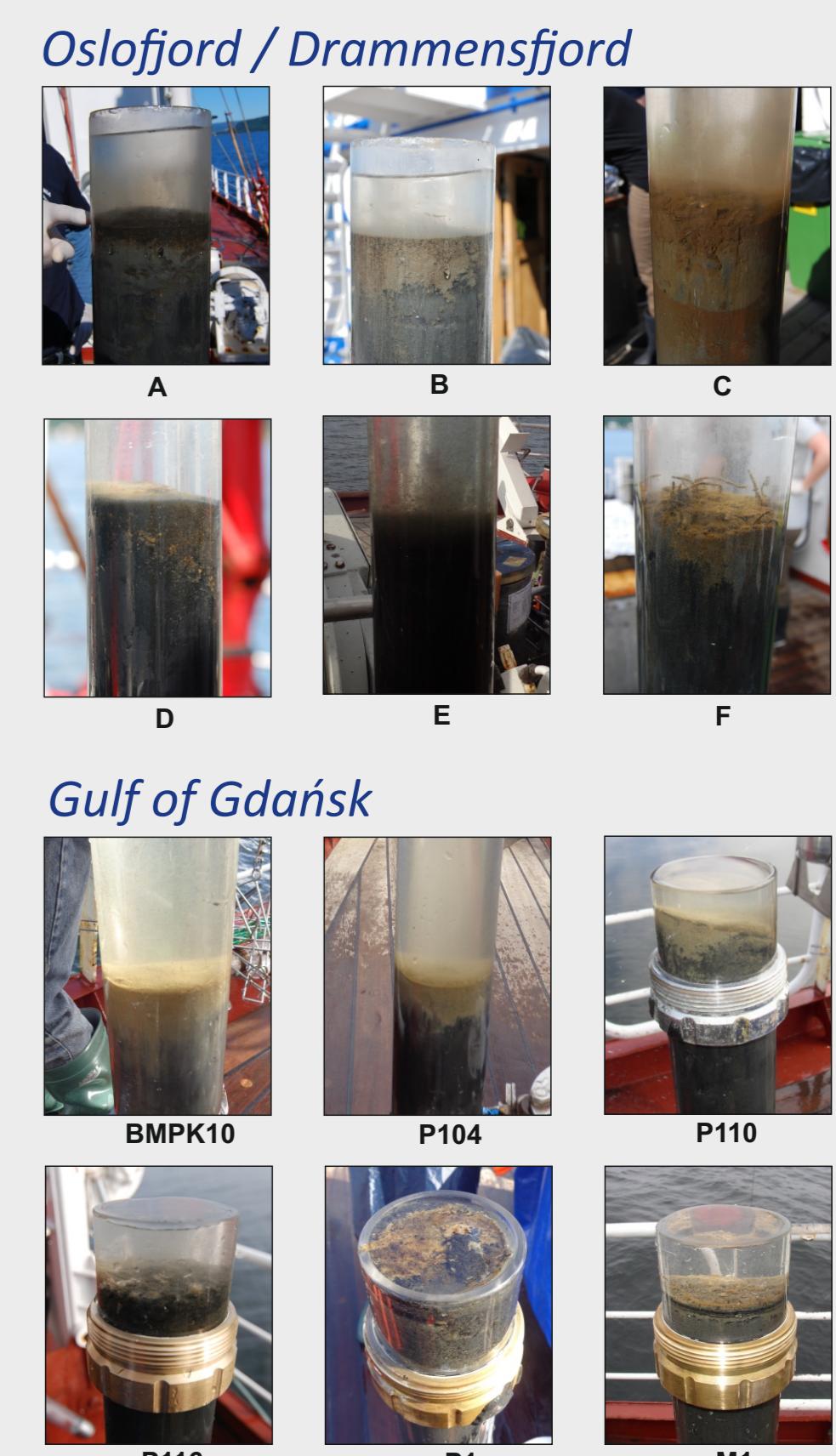
Multi-proxy investigation of recent sediments in two different European coastal areas - the Gulf of Gdańsk (Poland) and the Oslofjord/Drammensfjord (Norway) - was carried out, in terms of eutrophication effects, anthropogenic impact/stress on the marine environment based on contaminant concentrations and sediment toxicity. Sediment cores were collected at 12 stations, 6 in each of the two areas. The sediment samples were analyzed for phytoplankton pigments, organic carbon, black carbon, total nitrogen, stable carbon and nitrogen isotopic composition ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$), grain size, ^{210}Pb activity, biotoxins and toxin-producing phytoplankton organisms, diatoms, chemical elements (Ag, Al, As, Au, B, Ba, Be, Bi, Ca, Cd, Ce, Co, Cr, Cs, Cu, Dy, Er, Fe, Ga, Ge, Hf, Hg, Ho, In, Ir, K, La, Li, Lu, Mg, Mn, Mo, Na, Nb, Nd, Ni, P, Pb, Pr, Pt, Rb, S, Sb, Sc, Se, Si, Sm, Sn, Sr, Ta, Tb, Th, Ti, Tl, Tm, U, V, W, Y, Yb, Zn, Zr), polycyclic aromatic hydrocarbons (PAHs), nonylphenols (NPs), organotin compounds (OTs), as well as mutagenic, genotoxic and endocrine-disrupting activity. In addition, all the stations were characterized by physicochemical parameters of the adjacent water column and near-bottom water, i.e. salinity, oxygen concentration and temperature. Biotic and abiotic factors, and also anthropogenic stress indicators were statistically processed to identify similarities and differences between stations and areas impacted by various stressors.



Sampling areas



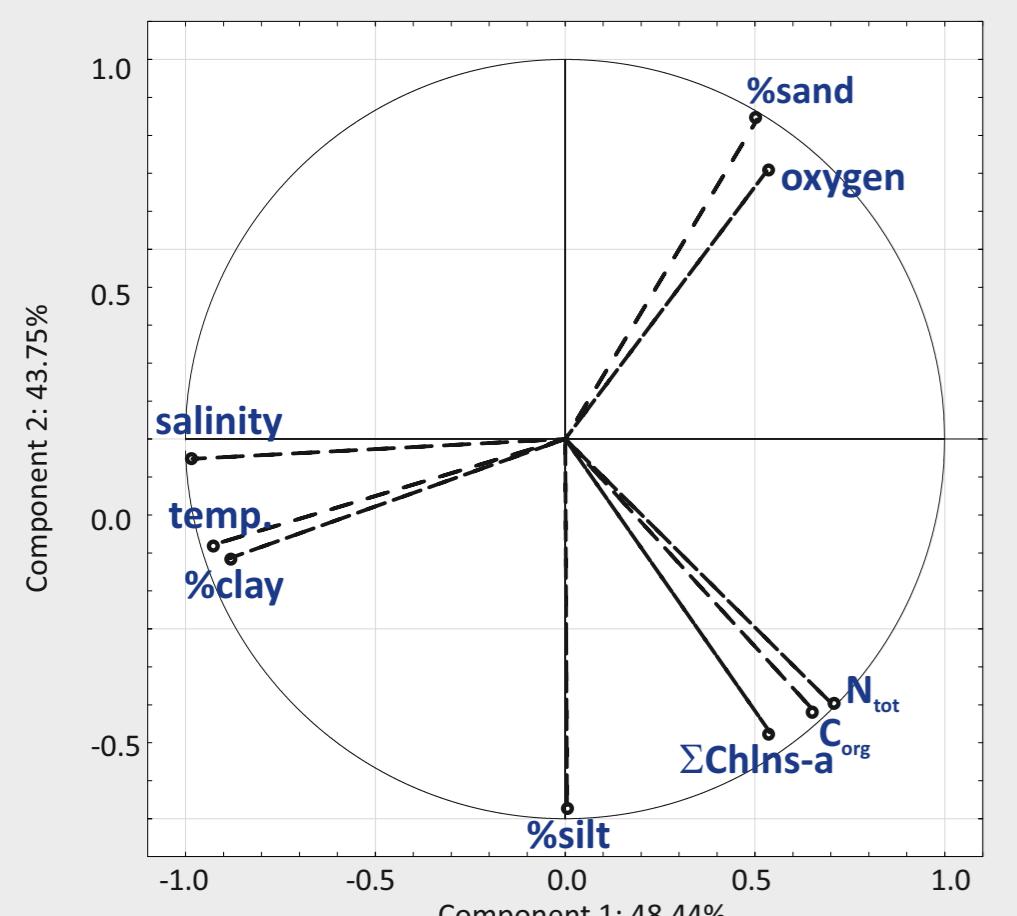
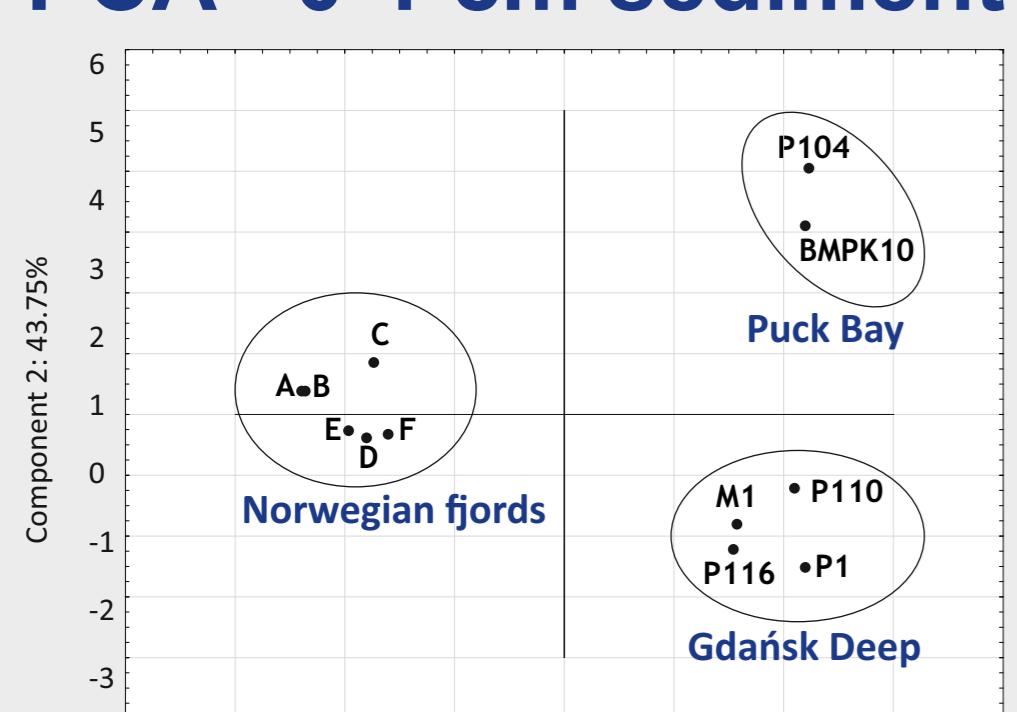
Sediment cores



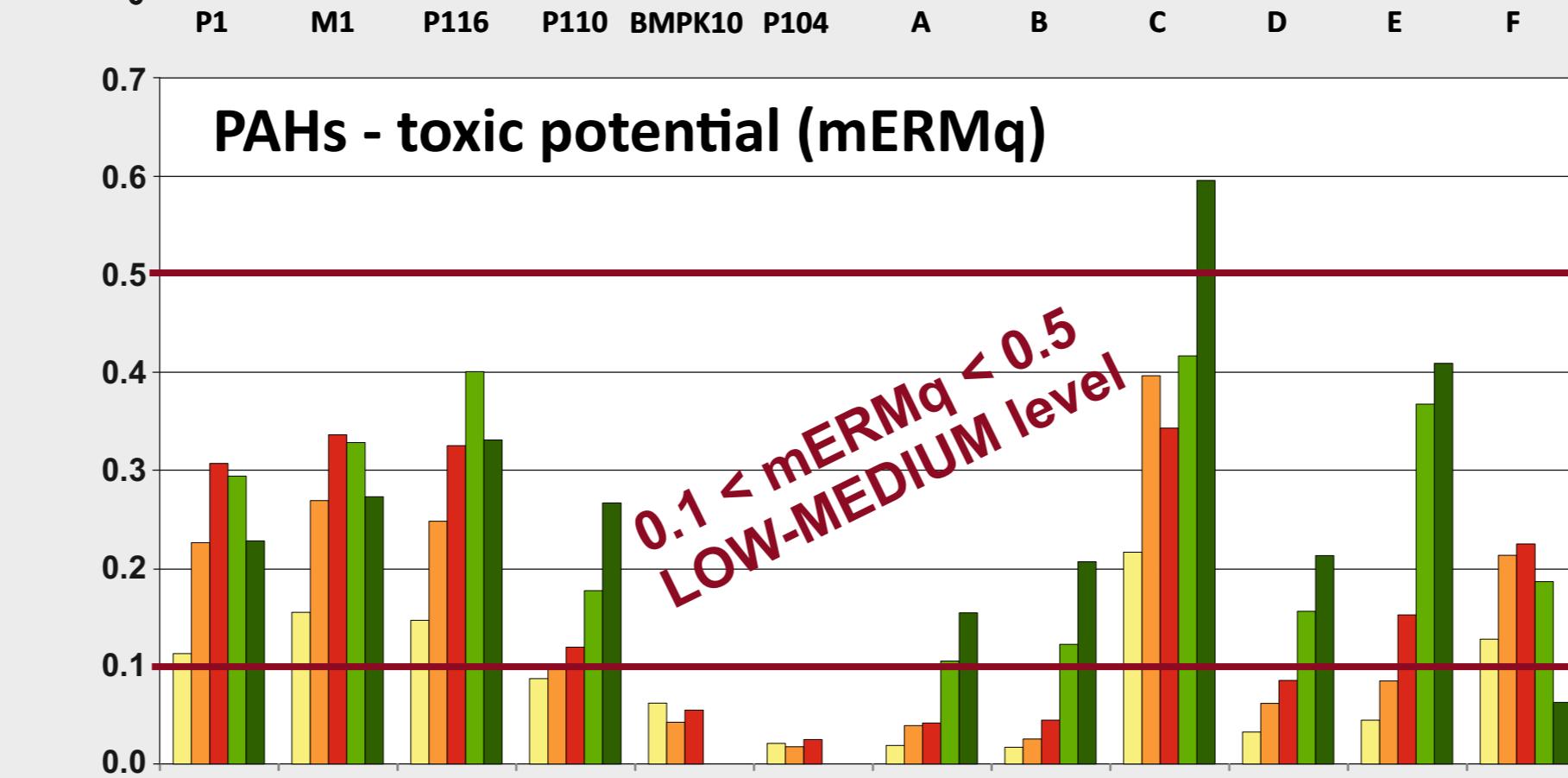
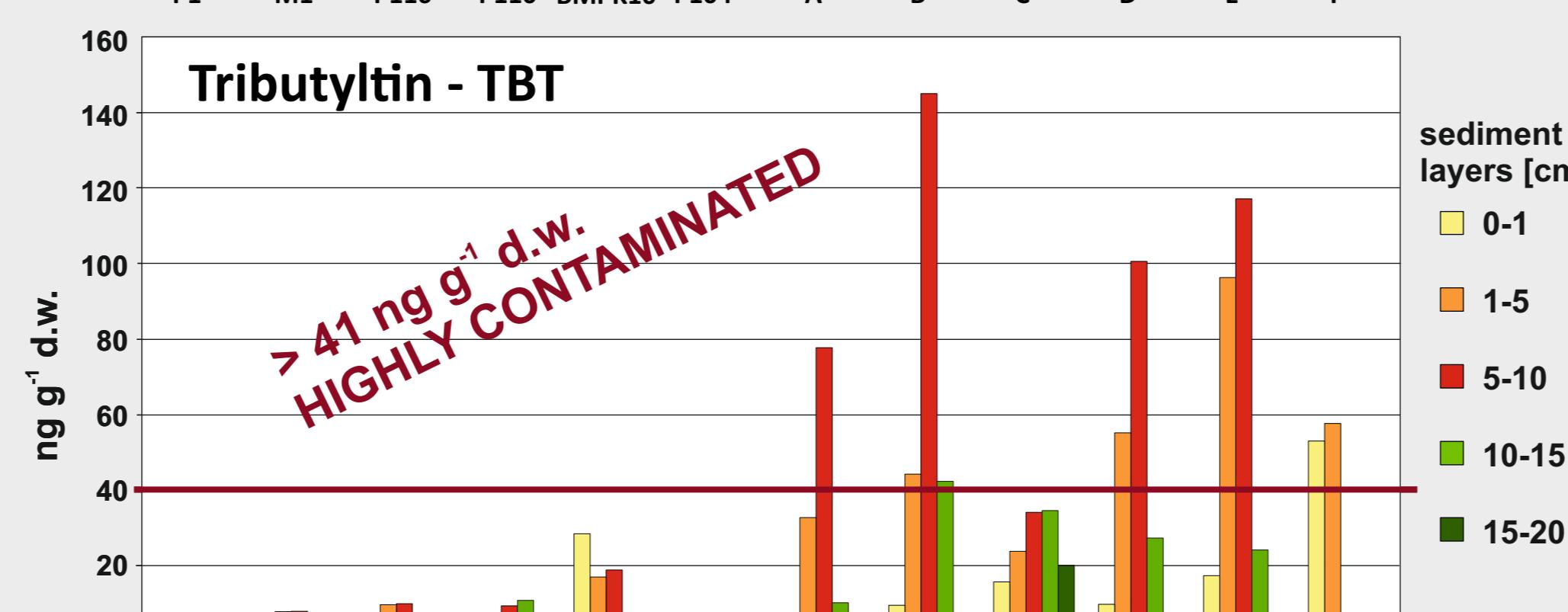
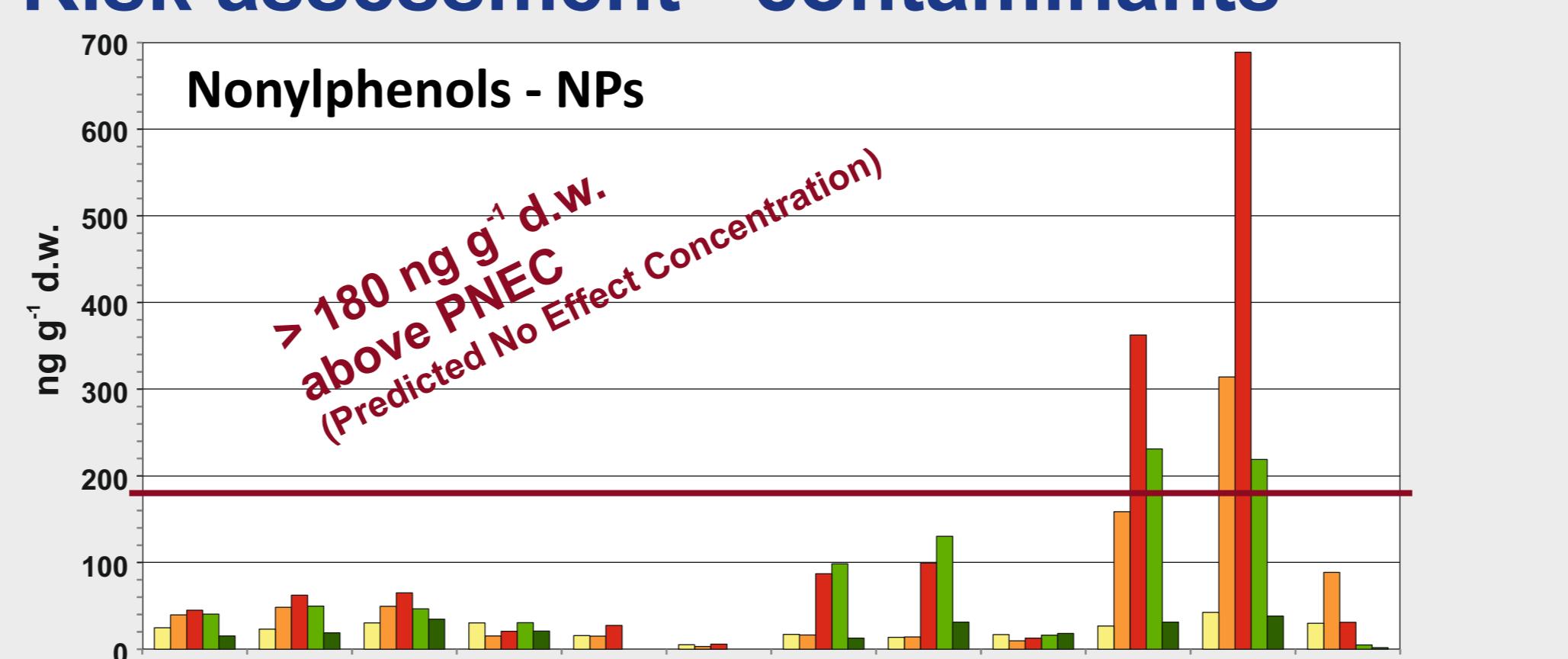
Sampling stations - characteristics

Station	Water depth [m]	Parameters of near-bottom water	Sediment accumulation rate [cm/year]	Sediment mixing depth [cm]
<i>Gulf of Gdańsk (POLAND)</i>				
P1	112	3.4	12.0	0.16 ± 0.01
M1	95	3.9	11.7	0.16 ± 0.01
P116	92	0.5	10.8	0.14 ± 0.01
P110	72	5.4	8.6	0.17 ± 0.02
P104	55	12.1	7.6	no accumulation
BMPK10	31	11.1	7.5	no accumulation or max 0.07 ± 0.01
<i>Oslo-Drammensfjord (NORWAY)</i>				
A	113	0.3	31.2	0.11 ± 0.01
B	122	0.5	31.0	0.27 ± 0.02
C	154-158	9.2	32.3	0.20 ± 0.02
D	152	1.7	32.6	0.10 ± 0.03
E	77	0.2	33.2	0.18 ± 0.01
F	78	1.7	33.6	0.05 ± 0.01

- PCA - 0-1 cm sediment



Risk assessment - contaminants



Risk assessment code (RAC) classification - elements

Location	As	Ba	Cd	Co	Cr	Cu	Fe	Mn	Ni	Pb	Sb	Zn
Oslofjord Norway	A	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊
B	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊
C	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊
D	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊
E	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊
F	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊	😊

Risk Assessment Code (RAC)	Total metal content bounded to labile fraction
No risk	< 1%
Low risk	1 - 10%
Medium risk	10 - 30%
High risk	30 - 50%
Very high risk	>50%



Toxicity - CALUX® Assays

Sample	DR-CALUX® [ng TEQ/kg]	PAH-CALUX® [ng Bla]Peq/g]	ERα-CALUX® [ng 17β-estradiol ec/g]
<i>Gulf of Gdańsk (POLAND)</i>			
P1	15.0	3 000	1.40
M1	31.0	1 000	5.90
P116	21.0	5 800	2.40
P110	8.6	2 400	0.87
BMPK10	6.9	870 000	0.15
P104	2.8	300	0.12
<i>Oslo-Drammensfjord (NORWAY)</i>			
A	5.4	2 300	0.19
B	3.6	900	0.17
C	48.0	6 600	0.15
D	17.0	230 000	1.80
E	67.0	900	0.72
F	29.0	5 700	1.10

in red - considered as toxic
CALUX® - Chemical Activated Luciferase Gene Expression assay