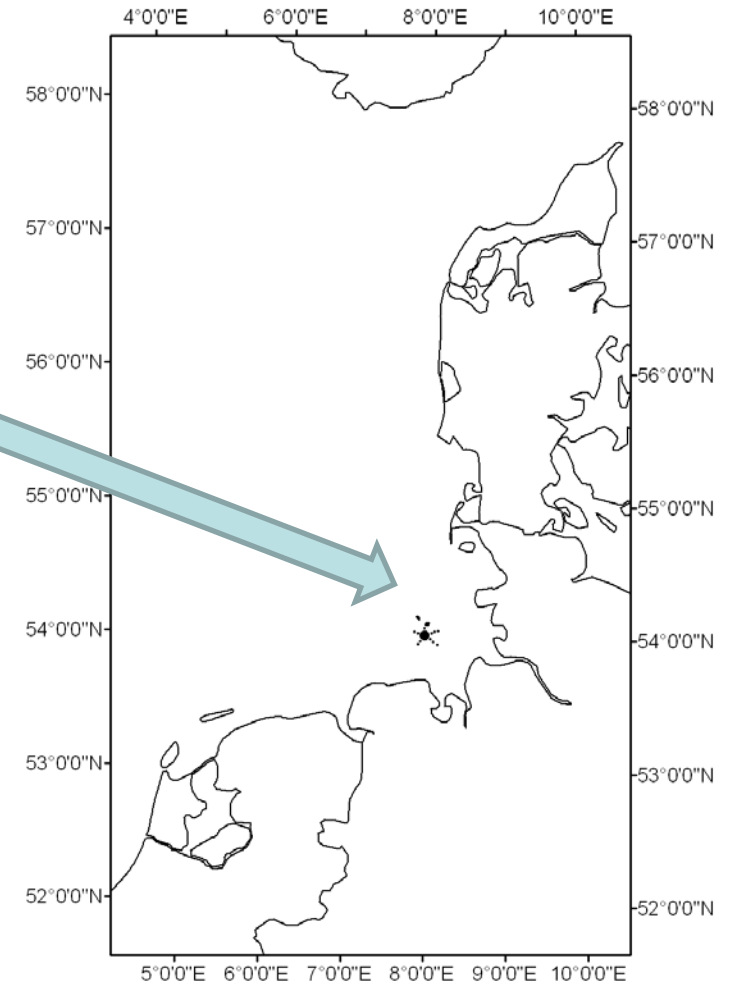
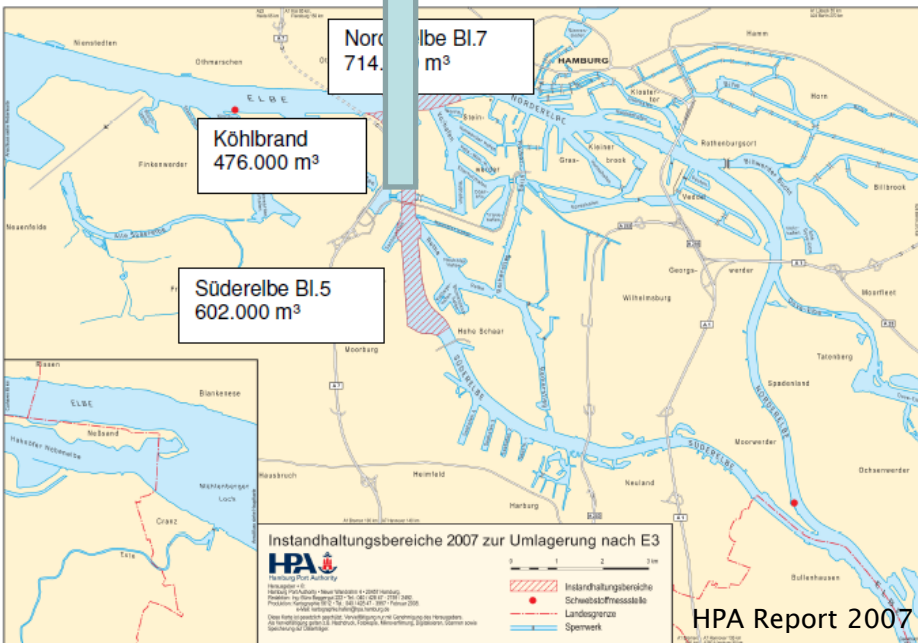


Marine Bakteriengemeinschaften unter dem Einfluss von Elbbaggergut

Rebecca Störmer

Dr. Gunnar Gerdts, Dr. Antje Wichels

LLUR Symposium, 15. März 2012



Seit 2005: ~ 6Mio m³ Sediment

Makrozoobenthos



Fischfauna



Chemische Analysen



Monitoringprogramm



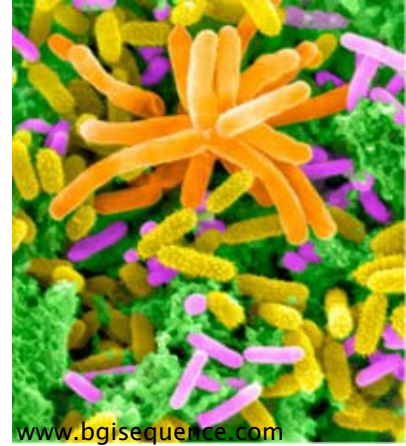
Ökotoxikologische Analysen



Bakterien



Bakterielle Gemeinschaft

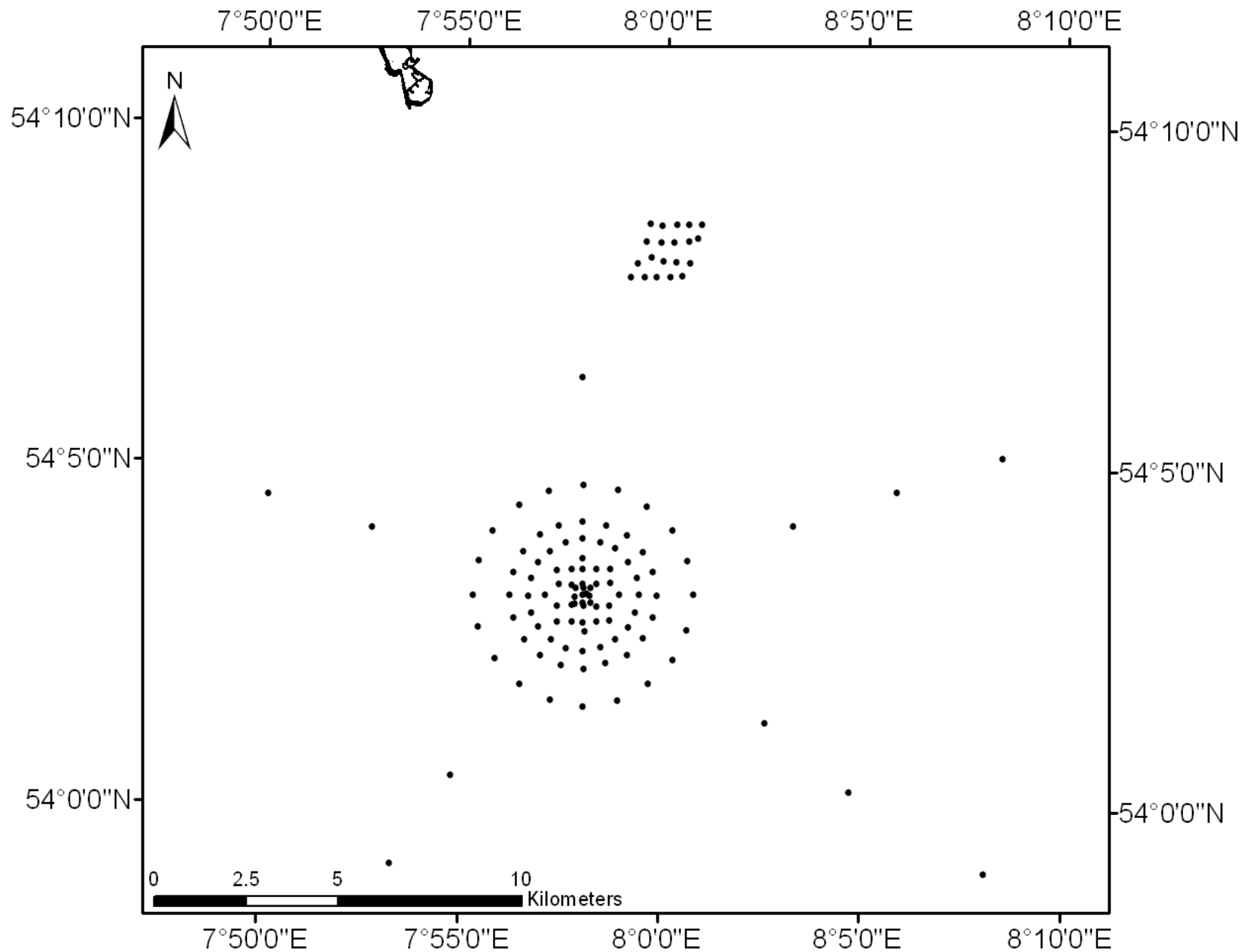


- Häufigsten Sedimentorganismen
- Fähigkeit sich schnell an verändernde Umweltbedingungen anzupassen
 - Veränderungen der Gemeinschaftsstruktur

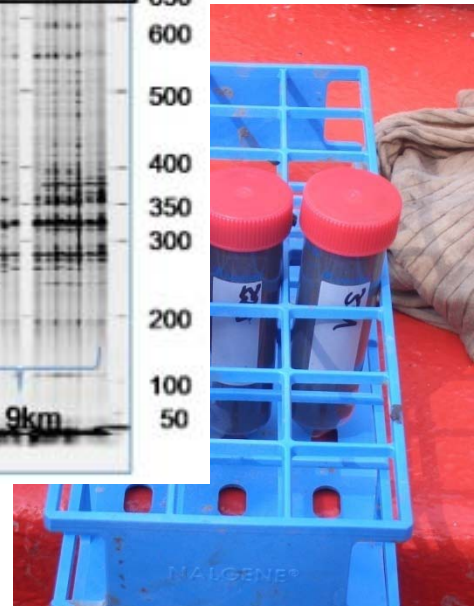
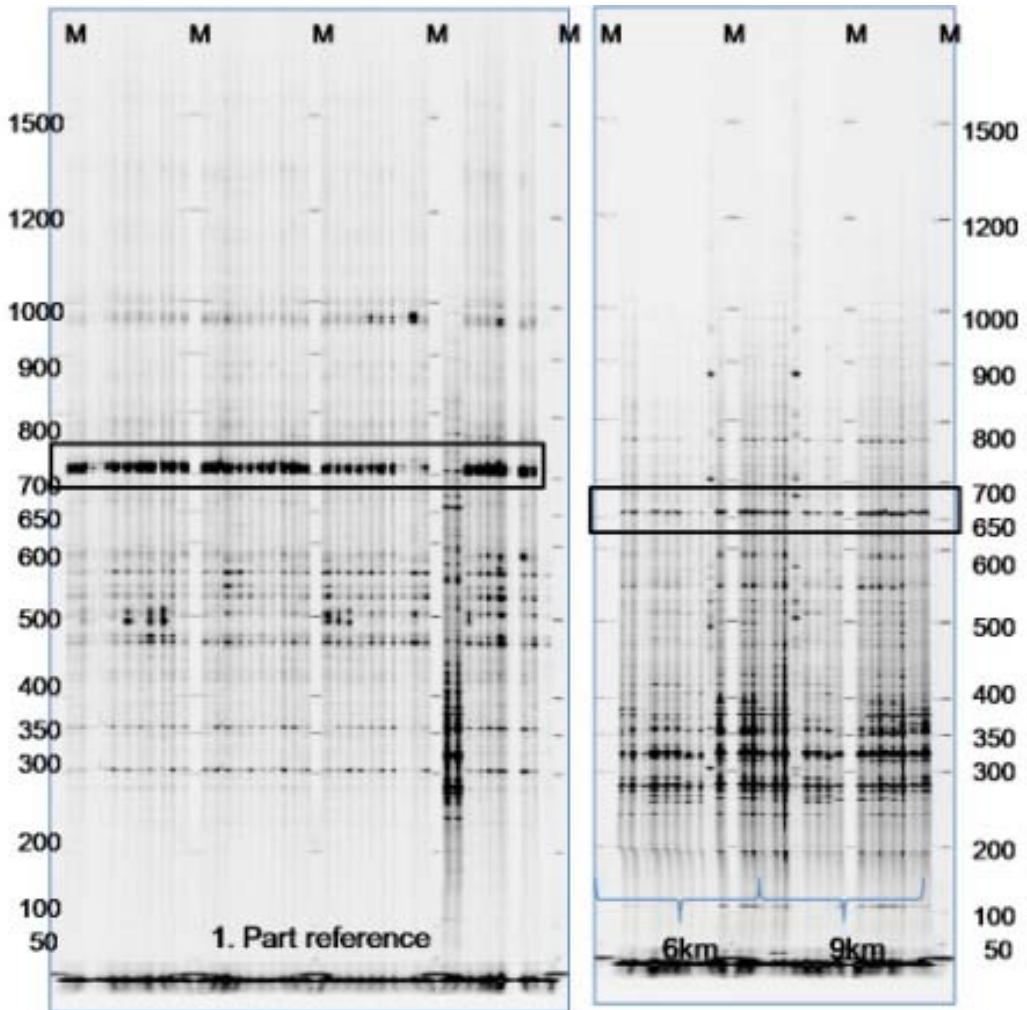
⇒ **Kann man Gemeinschaftsanalysen als Proxy für Umweltveränderungen einsetzen?**

Fragestellungen

- Unterscheiden sich Bakteriengemeinschaften an Einbringstelle und Referenzgebiet?
- Welche kontextuellen Parameter können die Verteilung der Bakteriengemeinschaften erklären?
- Welche Bakteriengruppen können in ausgewählten Proben ermittelt werden?

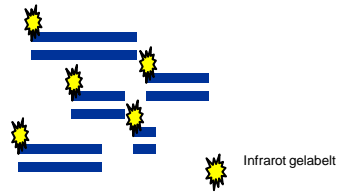
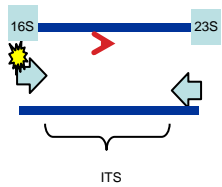
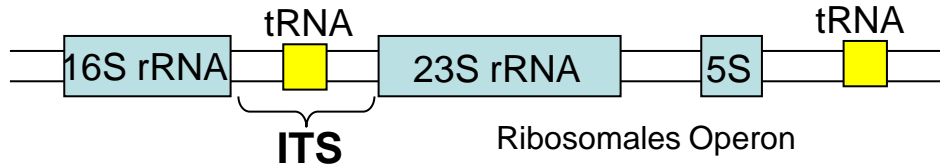




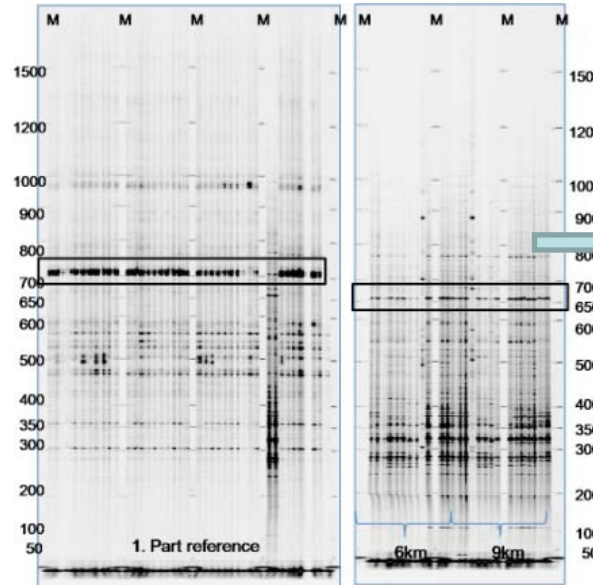


Molekulare Fingerprintmethode

Automated Ribosomal Intergenic Spacer Analysis



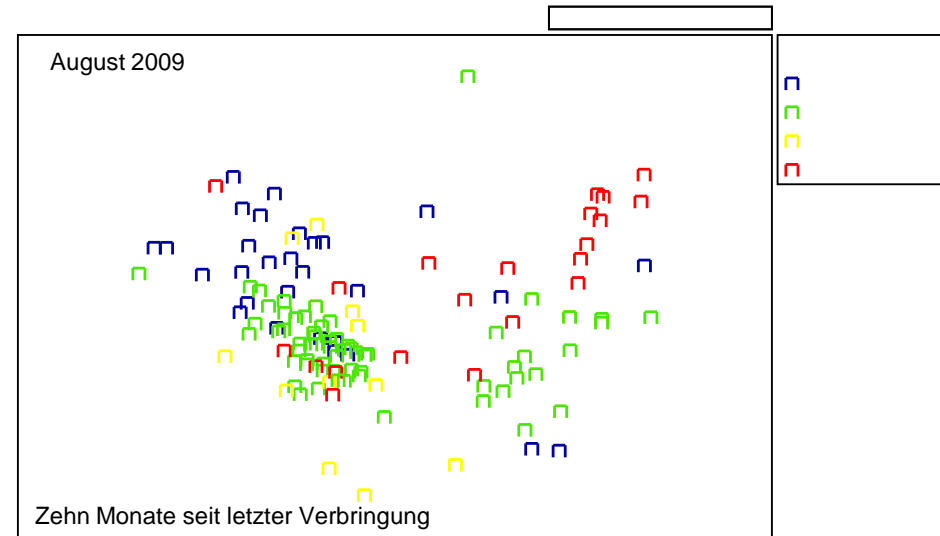
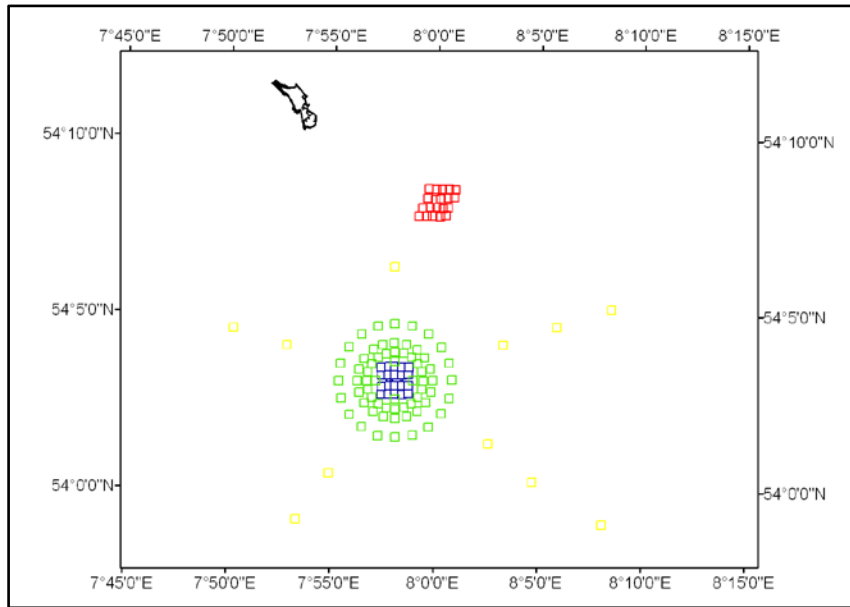
Gemeinschaftsprofile



Konvertierung der Profile in numerische Daten

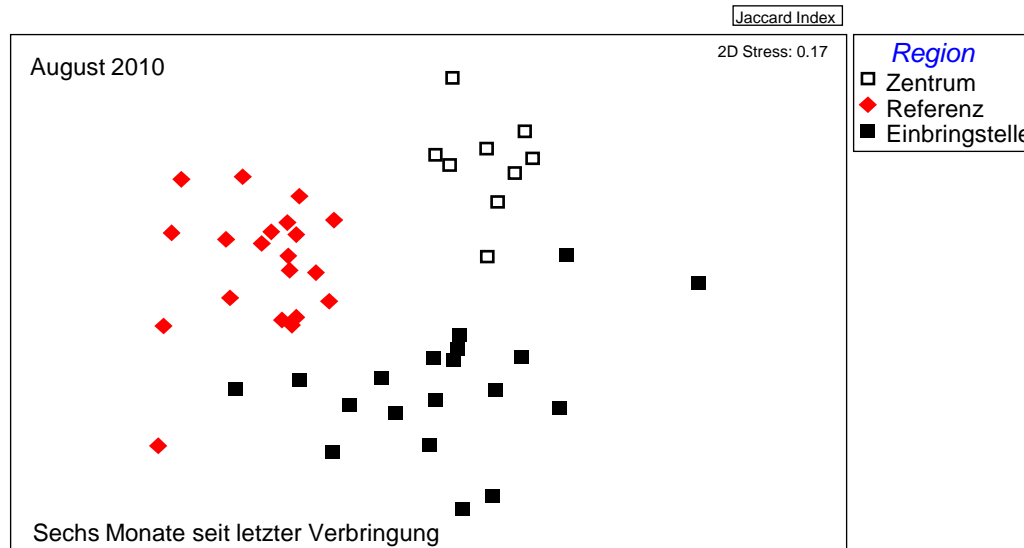
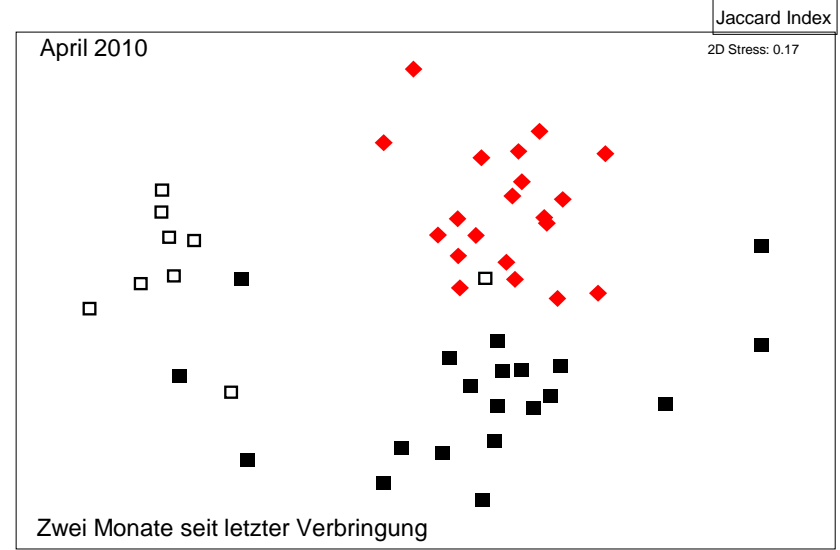
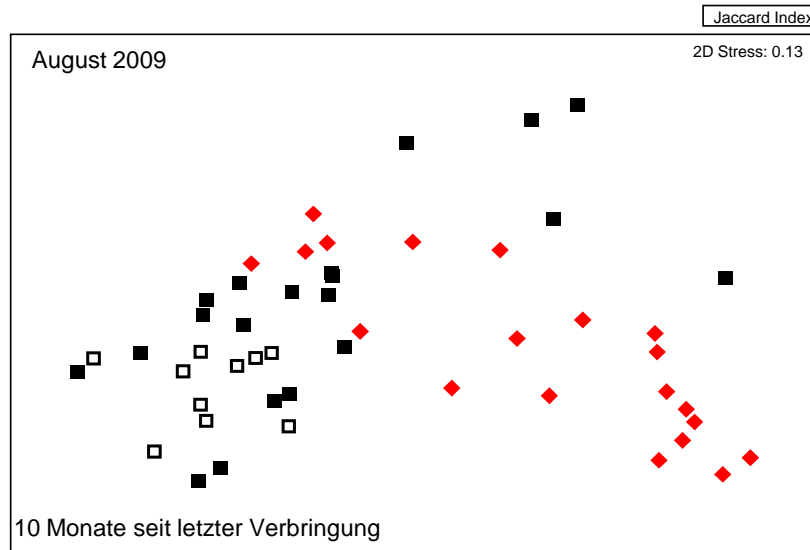
Sample	262	265	268	271	274	277	280
1	1	1	1	1	1	1	1
3	1	0	1	1	1	1	0
5	0	1	1	1	1	1	1
7	0	0	0	0	0	0	1
9	0	1	0	0	1	0	1
10	0	1	0	0	1	0	1
11	0	0	1	0	0	0	1
12	0	1	0	0	1	0	1
13	0	1	0	0	1	0	1
14	0	1	1	1	1	1	1
15	0	0	0	0	0	0	1
16	1	1	1	1	1	1	1
18	1	1	1	1	1	1	0
20	0	1	1	1	1	0	1
21	1	1	1	0	0	1	1
25	1	1	1	0	1	0	1
28	0	1	1	0	1	0	1
33	0	0	0	0	0	0	1
37	1	1	1	1	0	1	1
41	1	1	1	0	1	0	1
45	1	1	1	1	1	1	1
48	0	0	0	0	0	0	1
53	0	0	0	0	0	0	1
55	0	0	0	0	0	1	0

Bakteriengemeinschaftsstruktur (NMDS)...



Große Variabilität innerhalb der Gemeinschaften

Einbringstelle vs Referenzgebiet(NMDS)...



...und in Bezug zu kontextuellen Daten Redundanzanalyse (RDA)

Gemeinschaftsinformation

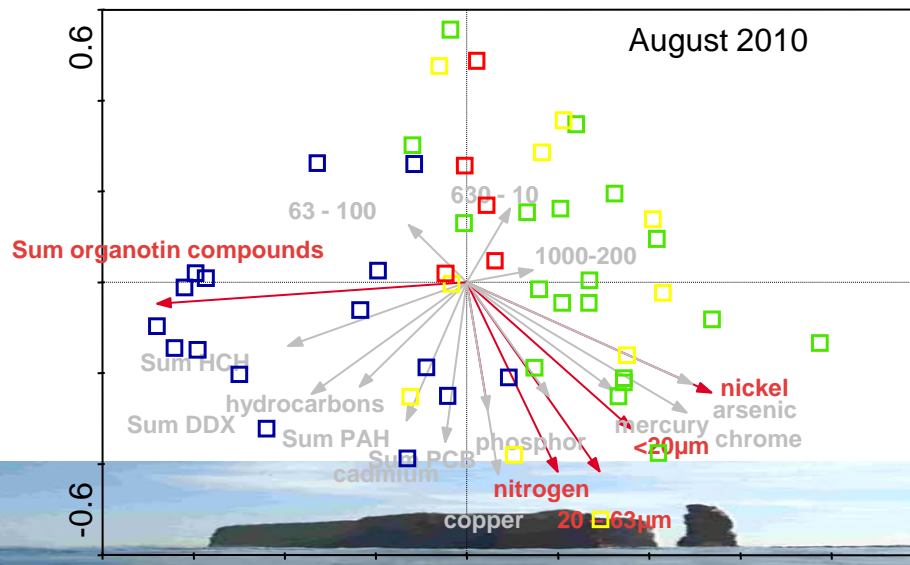
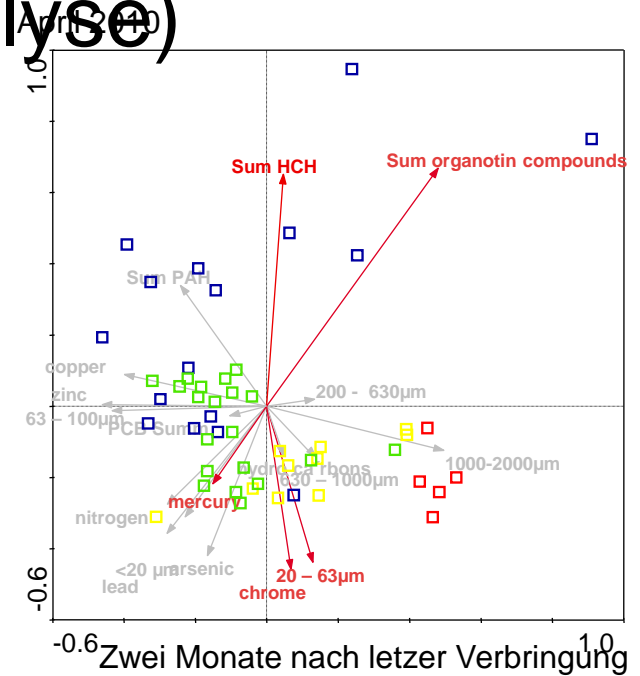
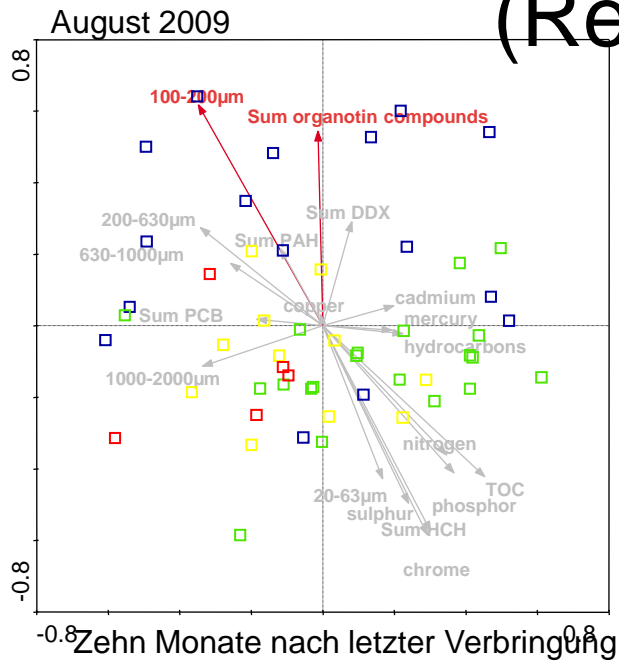
Sample	262	265	268	271	274	277	280
1	1	1	1	1	1	1	1
3	1	0	1	1	1	1	0
5	0	1	1	1	1	1	1
7	0	0	0	0	0	0	1
9	0	1	0	0	1	0	1
10	0	1	0	0	1	0	1
11	0	0	1	0	0	0	1
12	0	1	0	0	1	0	1
13	0	1	0	0	1	0	1
14	0	1	1	1	1	1	1
15	0	0	0	0	0	0	1
16	1	1	1	1	1	1	1
18	1	1	1	1	1	1	0
20	0	1	1	1	1	0	1
21	1	1	1	0	0	1	1
25	1	1	1	0	1	0	1
28	0	1	1	0	1	0	1
33	0	0	0	0	0	0	1
37	1	1	1	1	0	1	1
41	1	1	1	0	1	0	1
45	1	1	1	1	1	1	1
48	0	0	0	0	0	0	1
53	0	0	0	0	0	0	1
55	0	0	0	0	0	1	0

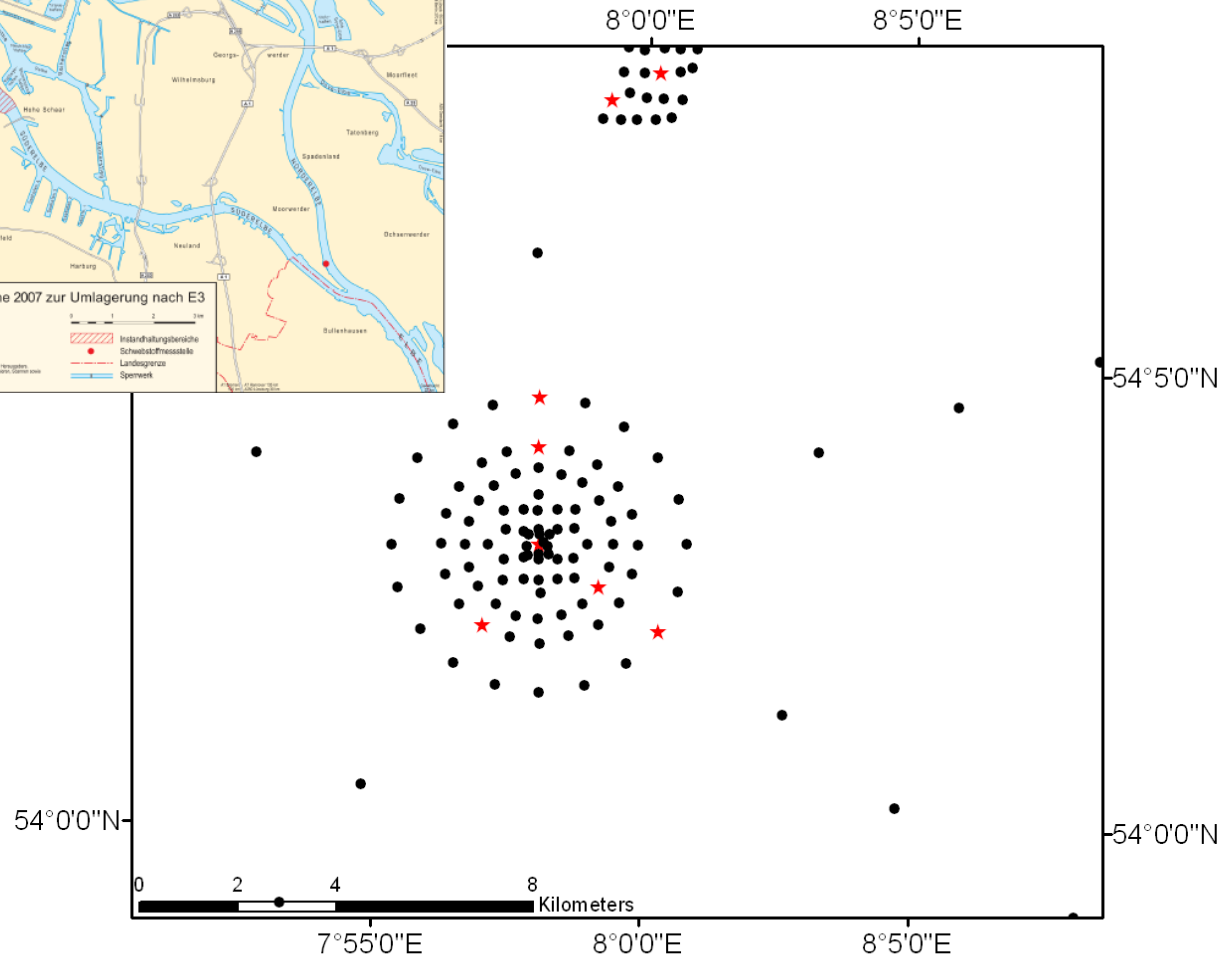
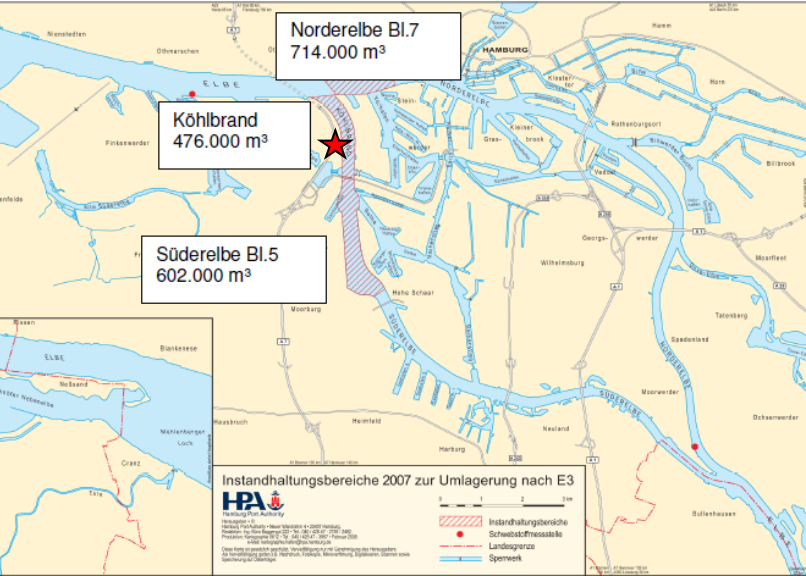


Kontextuelle Information

Sample	TOC	<20µm	20-63µm	63-100µm	100-200µm	200-630µm	630-1000µm
1	1.1	35	19.6	29.2	9.6	2.9	0.4
3	1.3	43.6	20.4	22.7	10.7	2.2	0.3
5	0.95	28.1	21.5	33.1	13.9	2.9	0.4
7	0.73	17.6	13.4	31.7	31.9	4.7	0.3
9	0.67	17.8	13.2	23	34.4	10.1	0.9
10	0.9	25.8	19.2	28.6	21.4	4.5	0.3
11	1.2	36.8	16.6	25	17.5	3.3	0.3
12	0.72	19.2	13.1	25	31.5	10.9	0.2
13	0.72	19.3	15.5	32.7	25.8	6.5	0.1
14	0.95	24.1	19.1	35.9	19.1	1.5	0.2
15	1.2	39.8	23.4	23.1	9.5	3	1
16	1.4	42.3	21.4	22.8	9.9	3	0.4
18	1.2	45.4	26.5	19.4	5.5	1.7	1.3
20	1.2	41.8	23.6	22	7.9	3	1.2
21	1.2	50.1	29.1	12.8	5.6	2.1	0.2
25	1.2	46.3	21.7	21.8	6.1	2.9	1
28	1.1	36.2	21.9	31.5	8.2	1.4	0.4
33	0.93	36.3	18.2	35.1	8.1	1.7	0.3
37	1.3	50.2	16.6	21.3	9	2.6	0.2
41	1.4	46.2	32	14.1	4.7	2.1	0.5
45	1.4	44	22.8	23.2	7	2.4	0.5
48	1	37.1	17.5	37.9	5.8	1.5	0.2
53	0.65	27.4	10.9	27	24.3	6.9	2.4
55	0.88	31.2	16	37	9.9	5.7	0.1

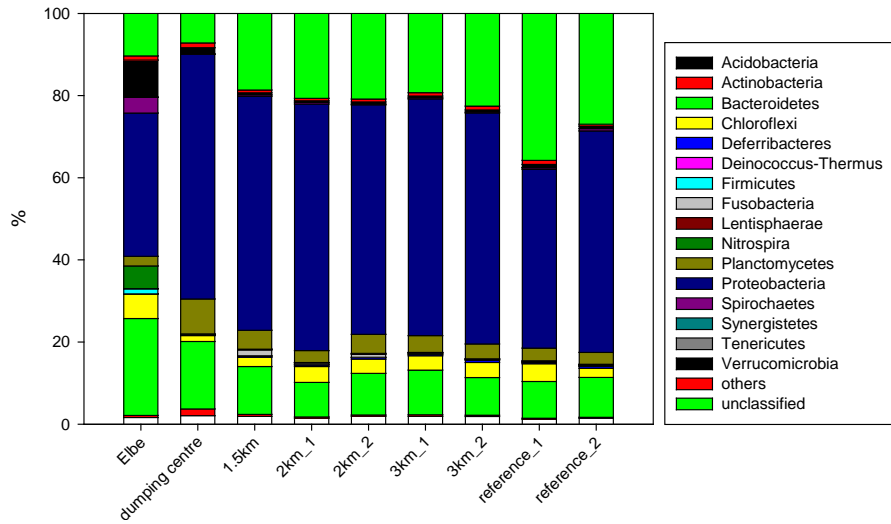
...und in Bezug zu kontextuellen Daten (Redundanzanalyse)



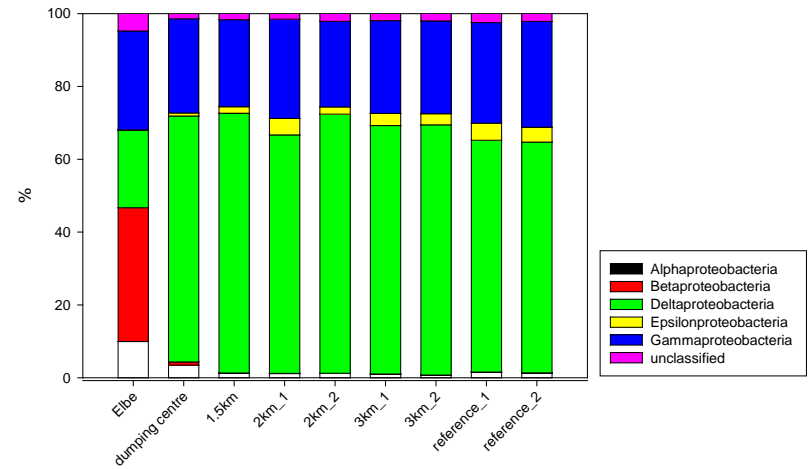


Sequenzierung der hoch konservierten 16S Region (V1-V6)

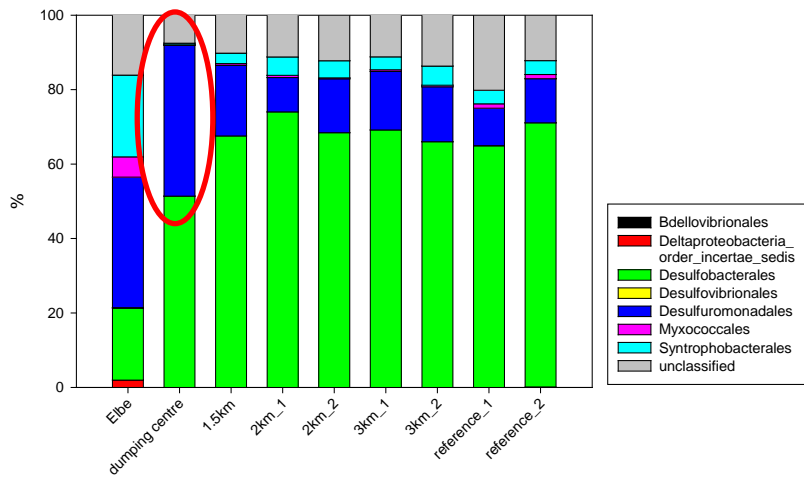
Phyla distribution



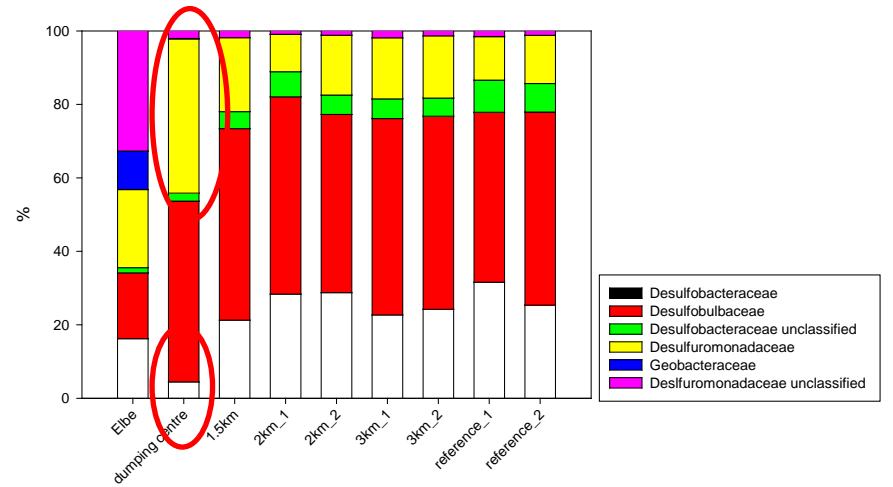
Class distribution Proteobacteria



Order distribution Deltaproteobacteria



Family distribution Desulfobacterales and Desulfuromonadales



Zusammenfassung


- Bakteriengemeinschaften der Einbringstelle und des Referenzgebietes:
 - Unterscheiden sich signifikant
 - Erneute Verbringung von Sedimenten führte wahrscheinlich zu signifikant verschiedenen Bakteriengemeinschaften des Zentrums und des Außenbereichs der Einbringstelle
- Korngrößenverteilungen und Schadstoffe bilden starken Gradienten:
 - Signifikante konditionale Effekte von Organozinnverbindungen in allen Analysen

Zusammenfassung

- Zusammensetzung der Bakteriengemeinschaften:
 - Fluviales und marines Milieu unterscheiden sich signifikant
 - Einbringstelle und andere marine Stationen unterscheiden sich signifikant
 - Unterschiede auf höherer taxonomischer Ebene sichtbar
 - Betrifft vor allem sulfatreduzierende Bakteriengruppen der Deltaproteobakterien
 - An der Einbringstelle stärker vertretene Gruppen konnten bereits in anderen Studien mit dem Abbau von organischen Schadstoffen in Verbindung gebracht werden

Schlussfolgerung

- Der Eintrag von Elbsedimenten beeinflusst die Struktur und Zusammensetzung der Bakteriengemeinschaften
 - Proxy Funktion
- Einbeziehung und Weiterentwicklung von Analysen der Bakteriengemeinschaften in künftige Umweltmonitoringprogramme

A sunset scene over the ocean with a rocky cliff in the foreground. The sun is low on the horizon, creating a bright glow and reflecting on the water. The sky is a mix of orange and yellow, and the water is dark with a shimmering path of light from the sun.

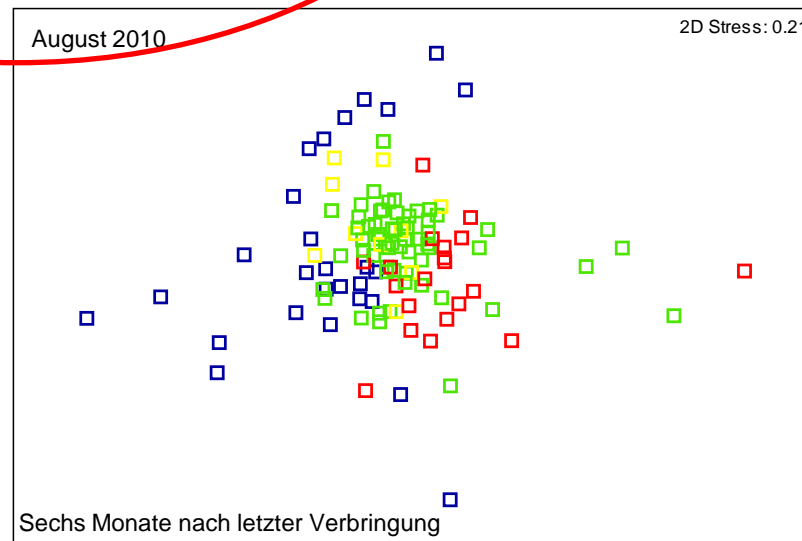
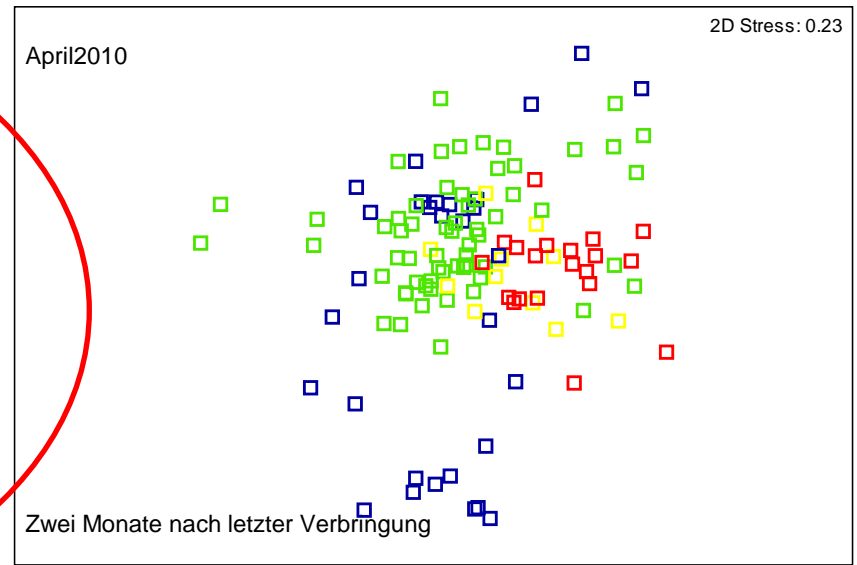
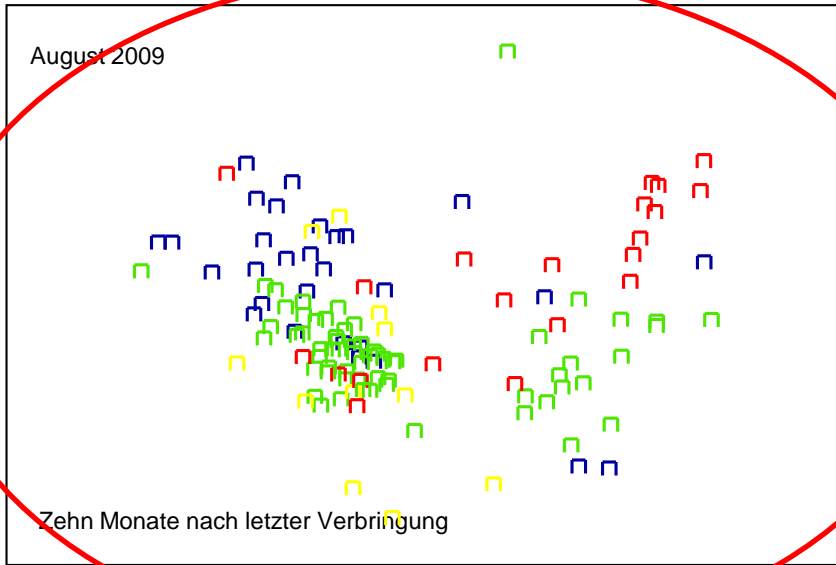
Vielen Dank für Ihre Aufmerksamkeit!!!

ACKNOWLEDGMENTS

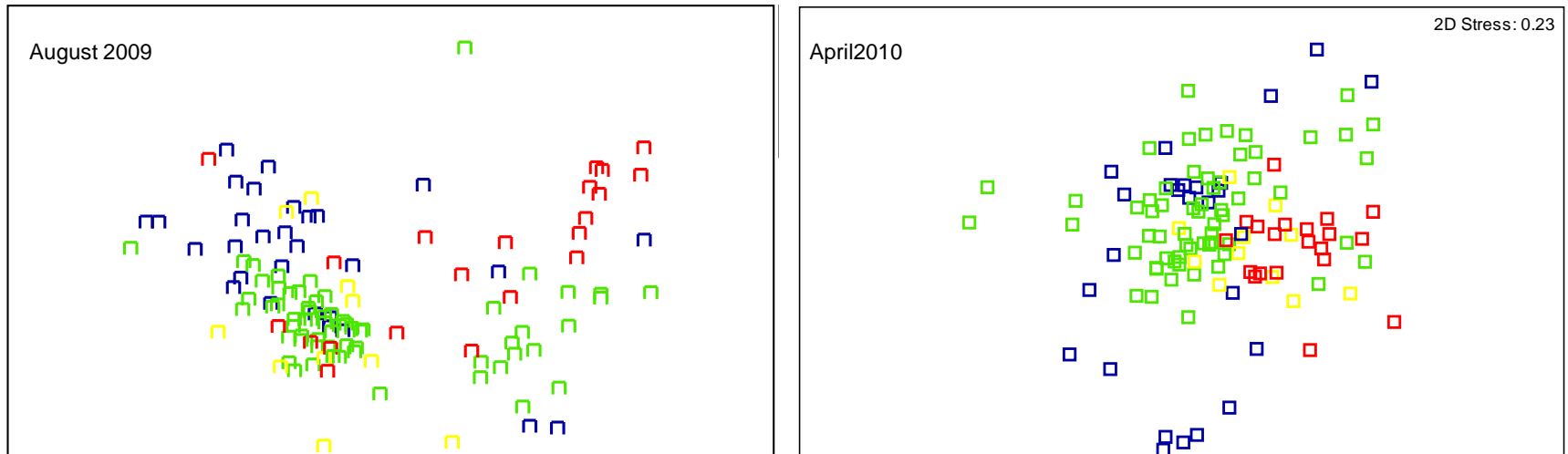
- Mathis von Ahnen (Bachelor student)
 - „E3 sampling crew“
 - Dr. Maja Karrasch, Rolf Lüschow
- Finanzierung:
 - HPA, LLUR, BfG, NLWKN
 - Graduate School POLMAR

Additional material

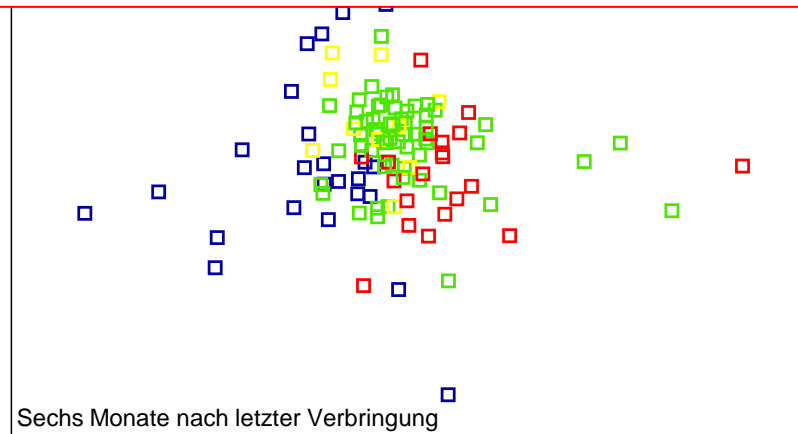
Bakteriengemeinschaftsstruktur (nMDS)...



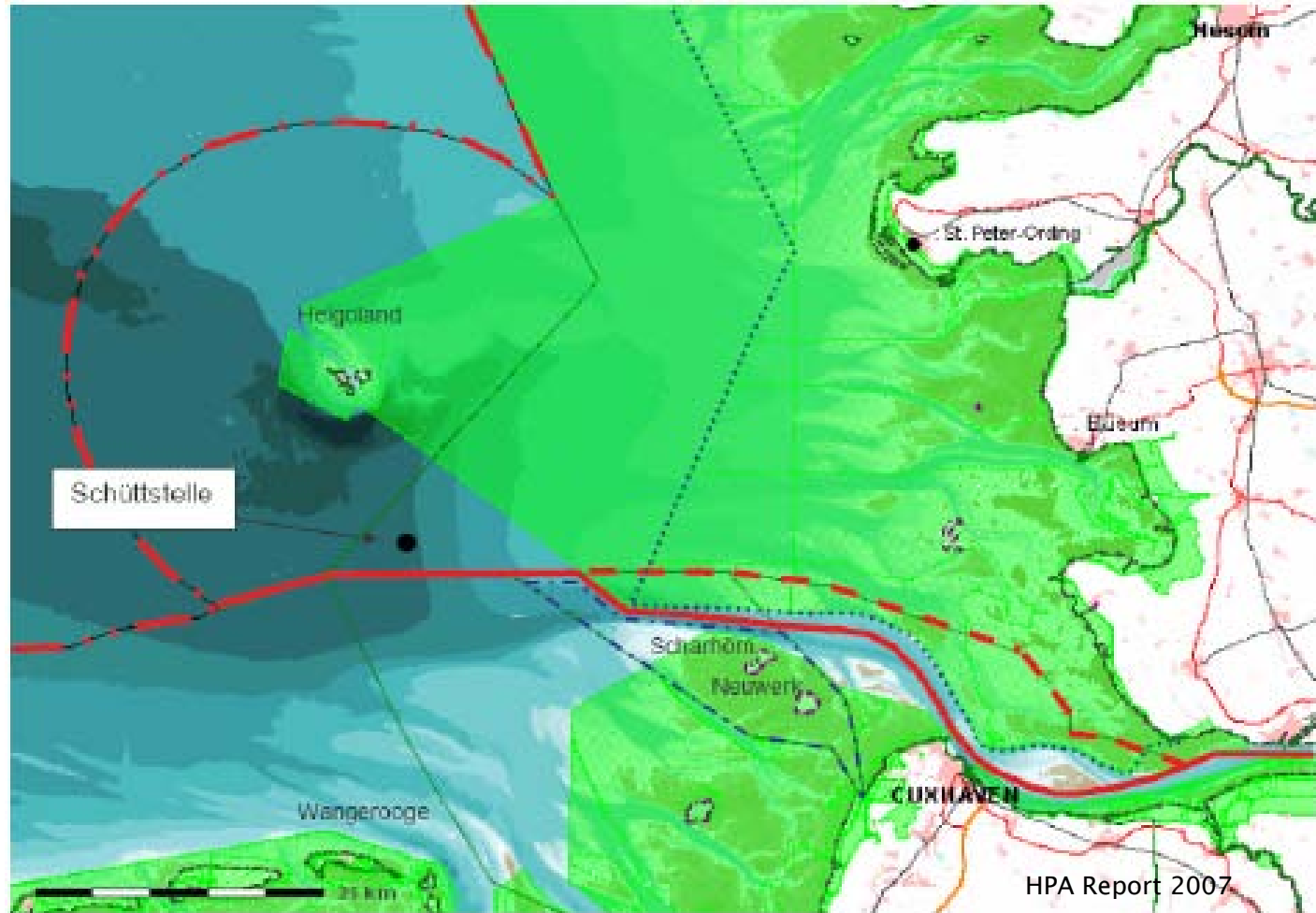
Bakteriengemeinschaftsstruktur (nMDS)...

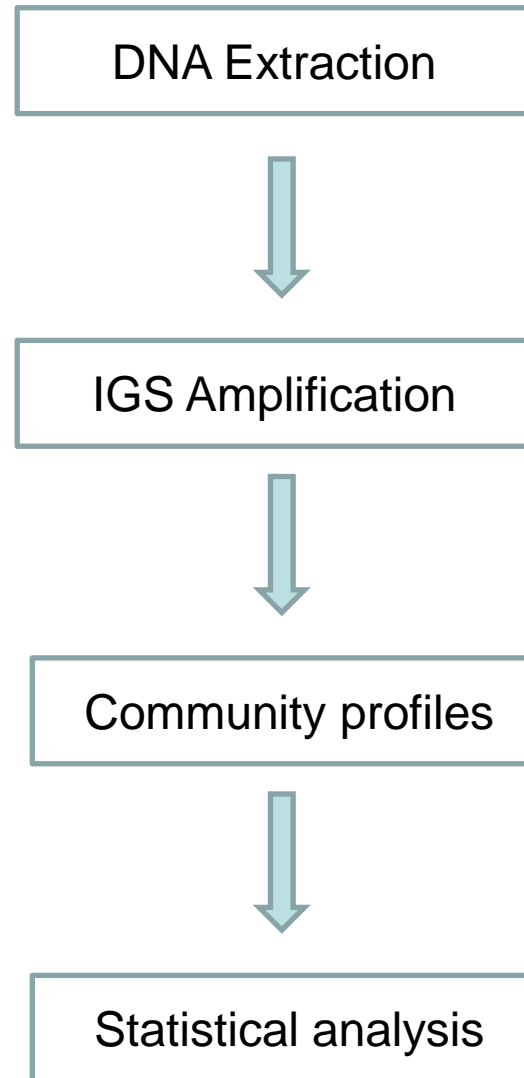
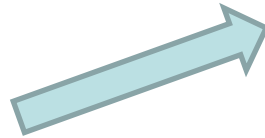


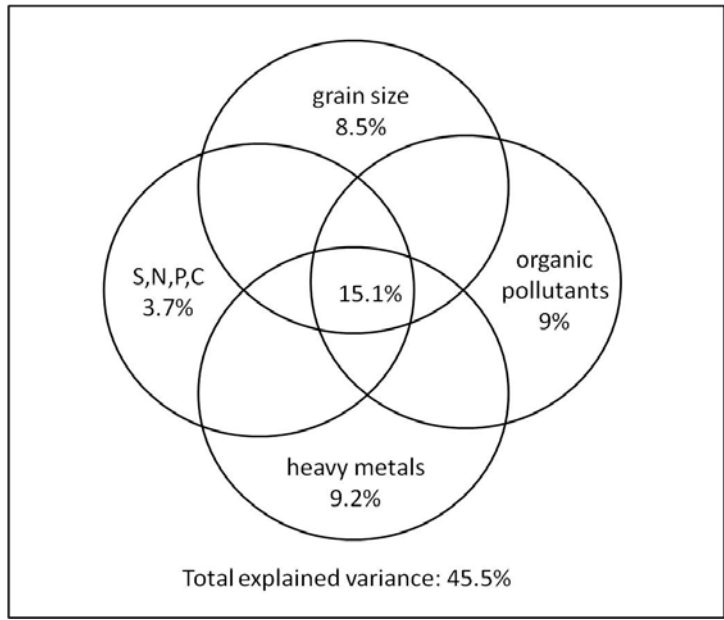
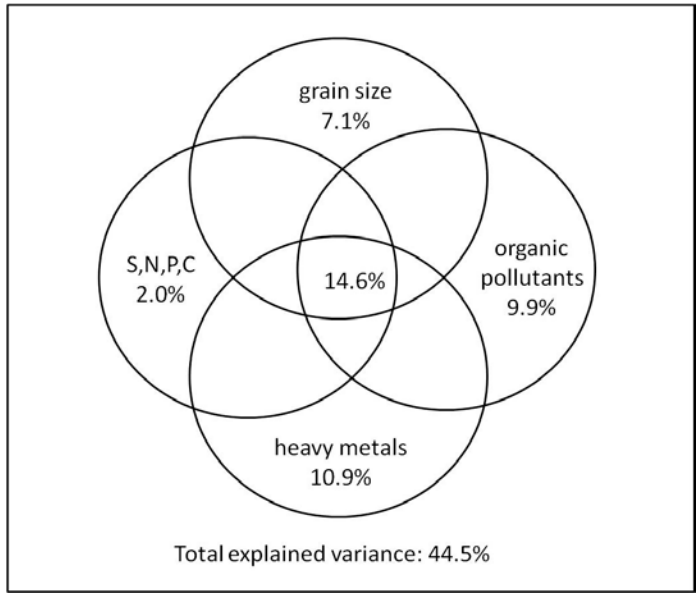
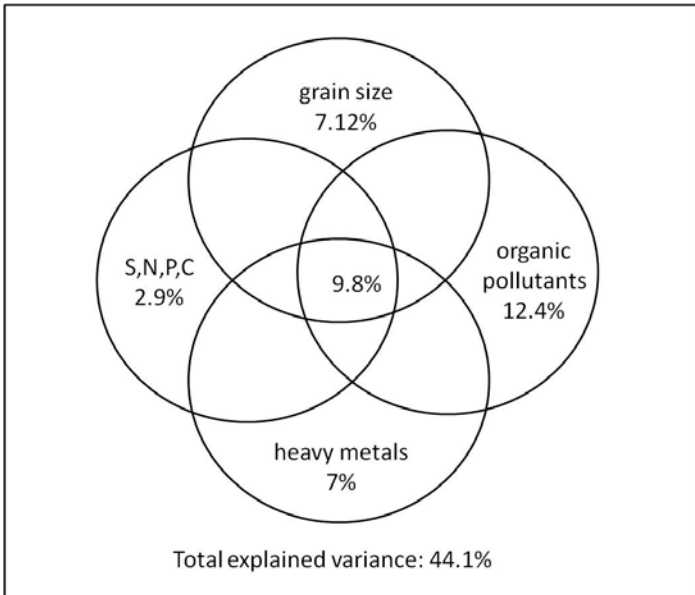
Unterschiedliche Gemeinschaftsstrukturen der jeweiligen Beprobungskampagnen



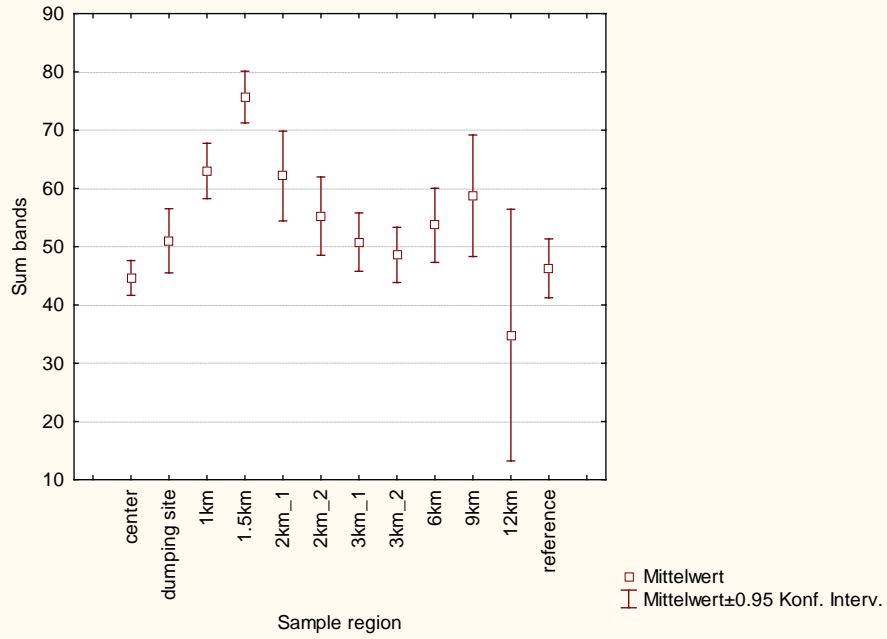
Location of the dumping site



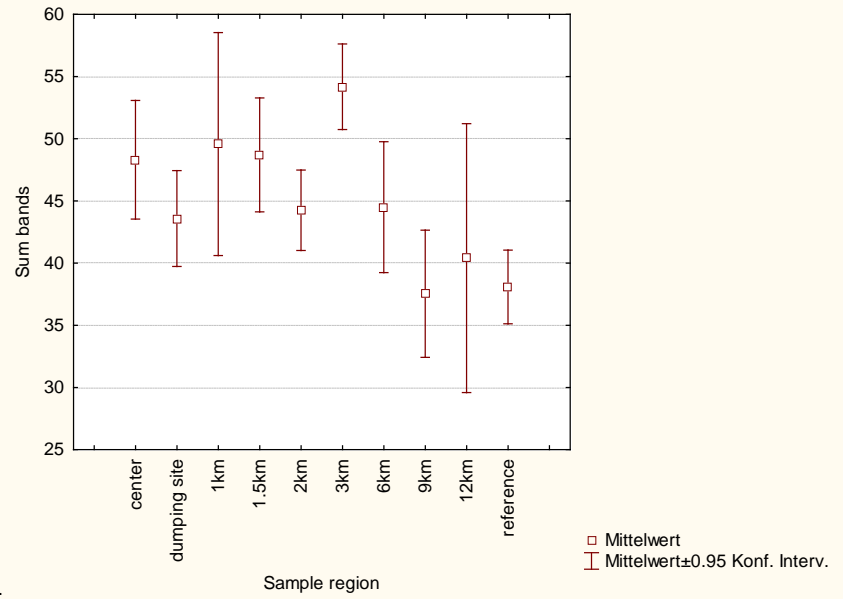




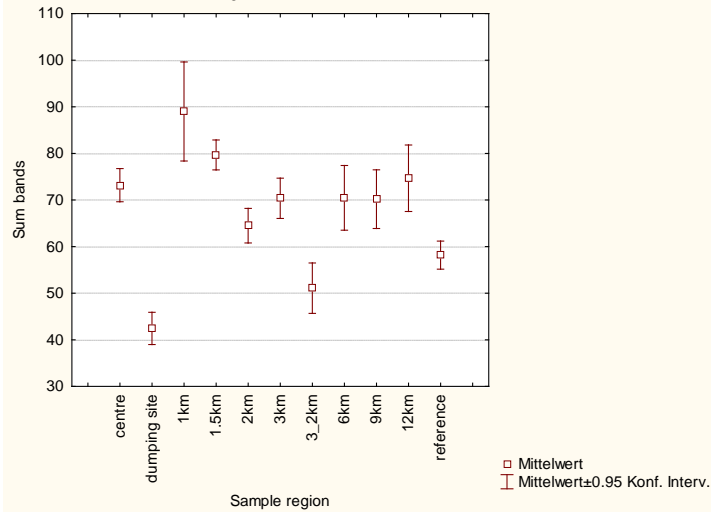
August 2009



April 2010



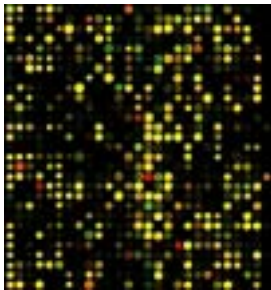
August 2010



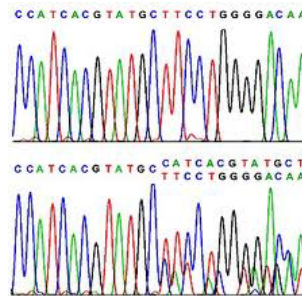
Current research

- Revealing function and identity of representative microbial communities
- Detailed investigation of the seasonal succession in microbial communities in the German Bight

GeoChip Array



454 Sequencing



grain size fractions

< 20µm
20-63µm
63-100µm
100-200µm
200-630µm
630-1000µm
1000-2000µm

S, N, P, C

TOC
nitrogen
sulfur
phosphor

hydrocarbons

Sum Polycyclic Aromatic Hydrocarbons (PAH)

naphthaline
fluorene
phenanthrene
anthracene
fluoranthene
pyrene
benz(a)anthracene
chrysene
benzo(b)fluoranthene
benzo(k)fluoranthene
benzo(a)pyrene
dibenz(ah)anthracene
benzo(ghi)perylene
indeno(1.2.3cd)pyrene

Sum chlorinated diphenyls (PCB)

PCB28
PCB52
PCB101
PCB118
PCB138
PCB153
PCB180

Sum Hexachlorocyclohexane (HCH)

alphaHCH
betaHCH
gammaHCH
deltaHCH

Sum DDX

ppDDE
opDDD
ppDDD
opDDT
ppDDT

Sum organotin compounds

MBT
DBT
TBT
tetrabutyltin

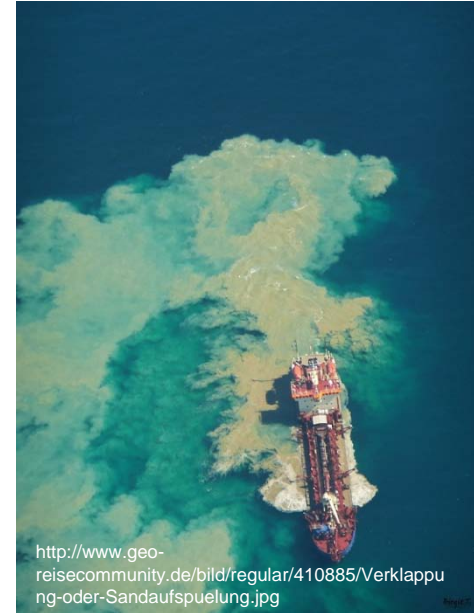
Heavy metals

arsene
plumb
cadmium
chrome
copper
nickel
mercury
zinc

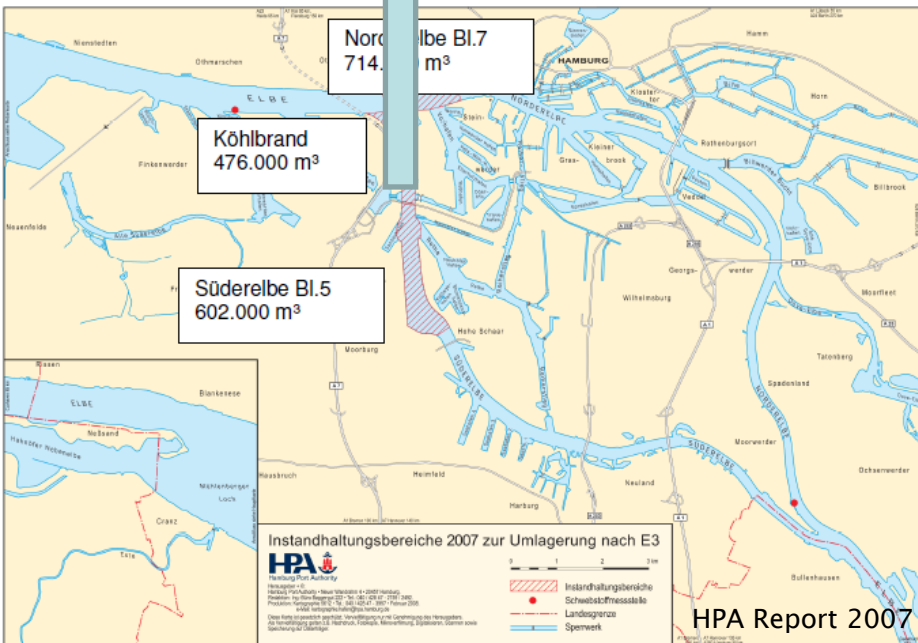
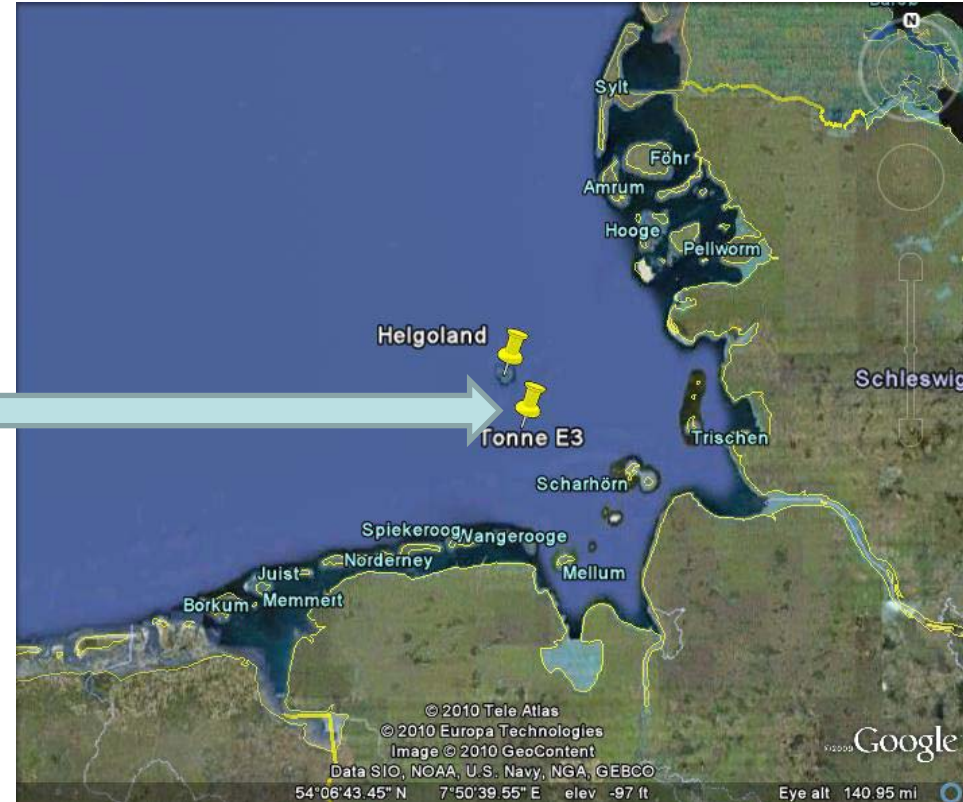
Ocean dumping

- Liquid wastes
 - Dilute acid, sludge (prohibited in Germany)
- Dredged material
 - Dredging of harbours and rivers

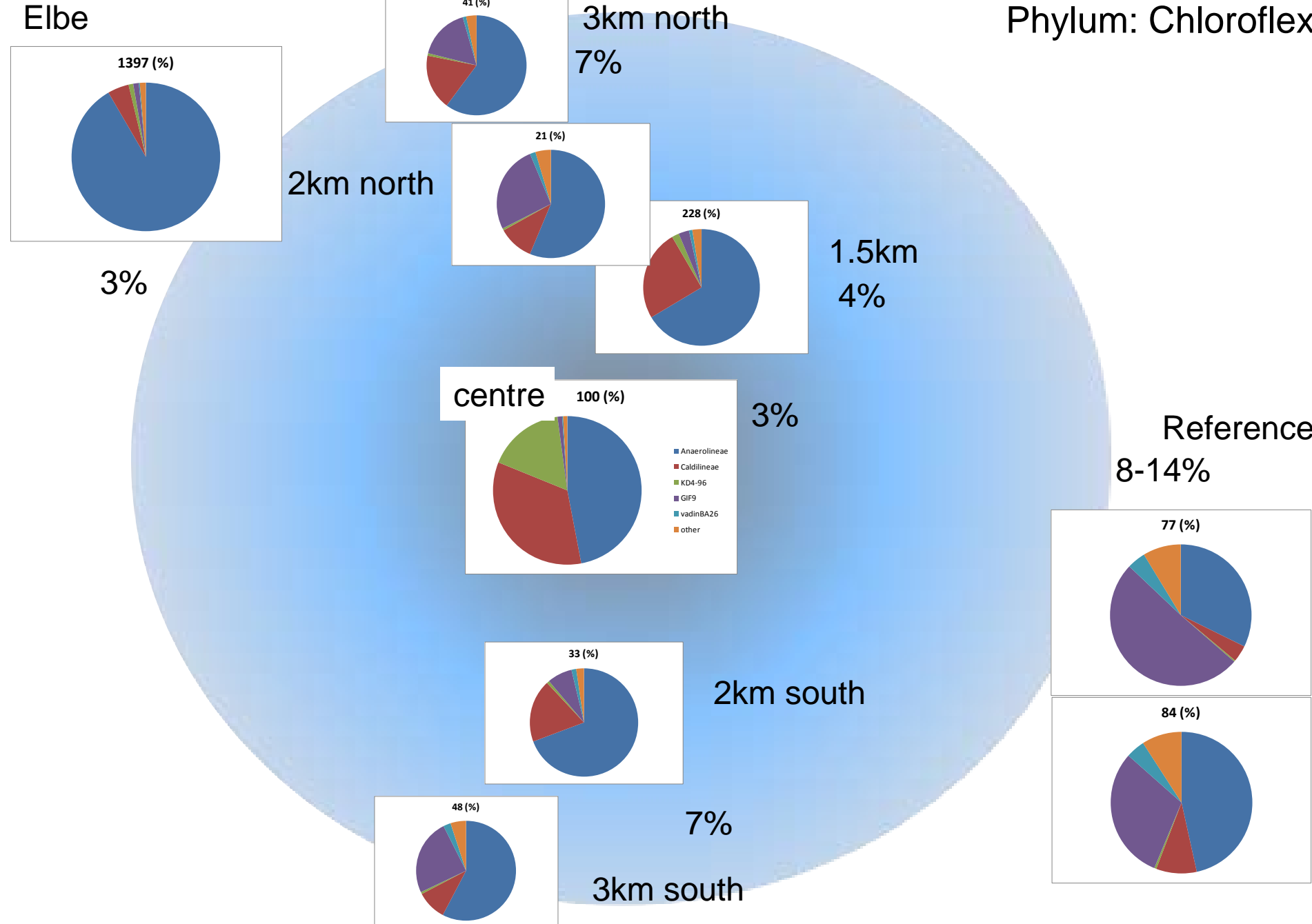
➔ Threats for ecosystems



Origin of the sediment

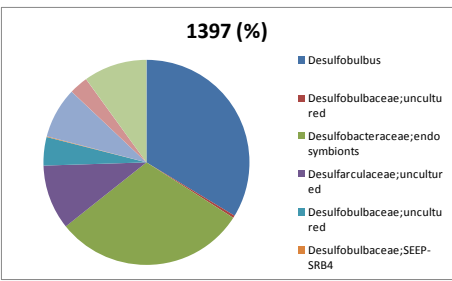


Since 2005: appr. 5mio m³ material

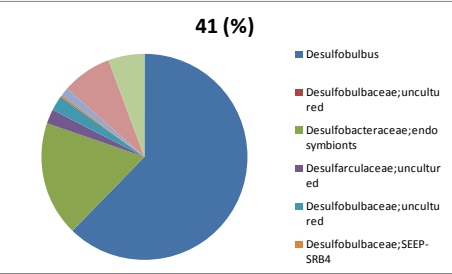


Ordo: Desulfarculale

Elbe 0.8%

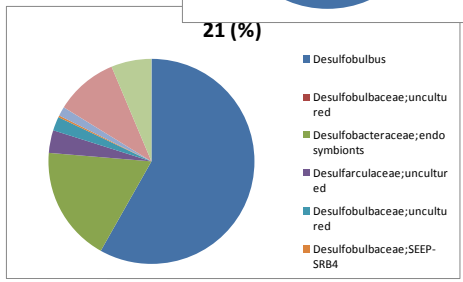


3km north

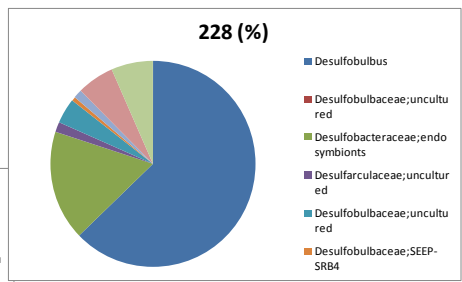


28%

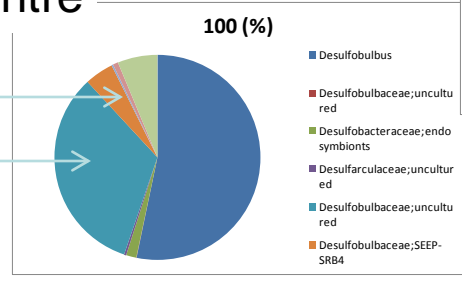
2km north



1.5km



centre



20%

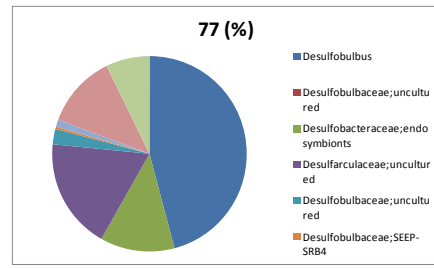
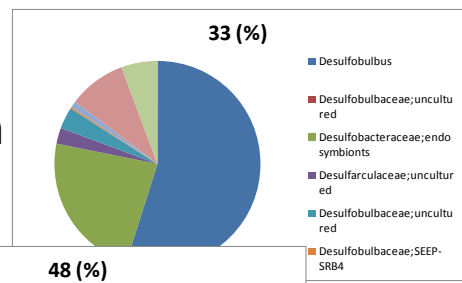
Reference

28%

Degradation higher hydrocarbons

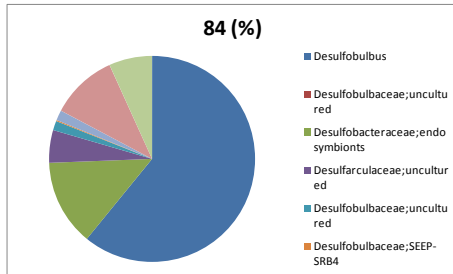
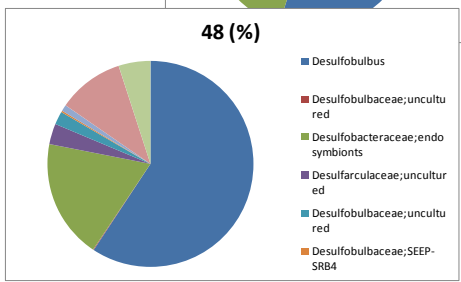
Degradation higher hydrocarbons?

2km south



28%

3km south



Distribution: Genus