Bacterial community analysis in environmental monitoring programs: a useful approach?

Introduction
From 2005 to 2010 6 mio m³ of dredged material were dumped 15 kilometres south off Helgoland in the German Bight (North Sea). Dumping activities may cause physical disturbance, including burial of benthic organisms and changes in substrate matter, affecting the whole benthic communities. The monitoring programs of dumping sites base on international conventions (London convention) for dredged material handling. These recommend the assessment of defined physical, chemical and biological parameters to examine the impact of the disposal. Benthic bacterial communities are disregarded by these recommendations. In an interdisciplinary project with environmental agencies we investigated benthic bacterial community in response to dumping activity. Our study aims to assess the suitability of bacterial community analysis as a proxy for environmental perturbation and consequently the applicability for mandatory monitoring programs.

We applied ribosomal community analyses (ARISA fingerprints, 16S ribosomal tag-sequencing) and functional gene arrays (GeoChip 4.2) to investigate structure and function of benthic bacterial communities at the dumping site.

Results
Dumping centre:
- Low alpha-diversity as revealed by automated ribosomal intergenic spacer analysis (ARISA) and ribosomal tag-sequencing
- Highest number of sequences affiliated to Desulfuromonadaceae
- Significantly lower diversity in functional genes as compared to a reference site, exemplarily shown for functional genes involved in organic remediation

Ribosomal tag-sequencing

GeoChip 4.2 approach

Conclusion
- Perturbation caused by dumping activities affects structure and function of bacterial communities favoring a less diverse but possibly more specialised bacterial community
- Bacterial community analyses represent a promising tool for the assessment of environmental perturbation
- We recommend the inclusion of bacterial community analyses in mandatory monitoring programs