Pathogenic biofilms on Baltic Sea microplastics

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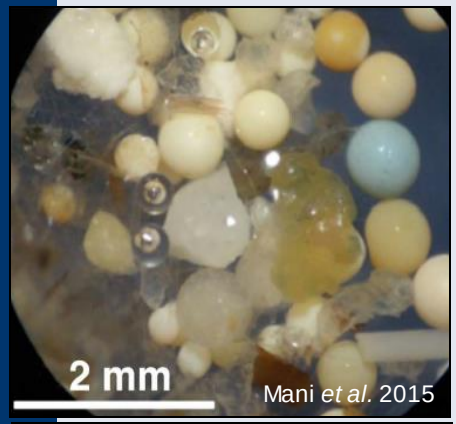
The relation of microplastics and microorganisms is long-known

Plastics on the Sargasso Sea Surface

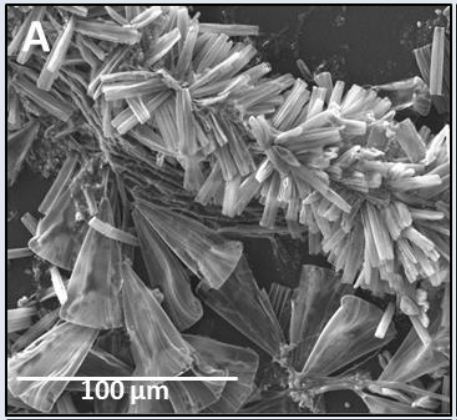
Abstract. *Plastic particles, in concentrations averaging 3500 pieces and 290 grams per square kilometer, are widespread in the western Sargasso Sea. Pieces are brittle, apparently due to the weathering of the plasticizers, and many are in a pellet shape about 0.25 to 0.5 centimeters* → *The particles are surfaces for the attachment of diatoms and hydroids. Increasing production of plastics, combined with present waste-disposal practices, will undoubtedly lead to increases in the concentration of these particles. Plastics could be a source of some of the polychlorinated biphenyls recently observed in oceanic organisms.*

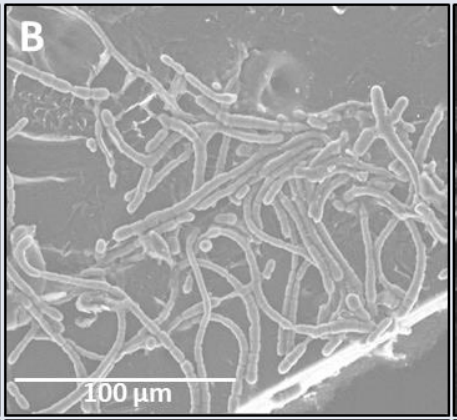
Carpenter & Smith **(1972)** Science 175(4027): 1240-1241

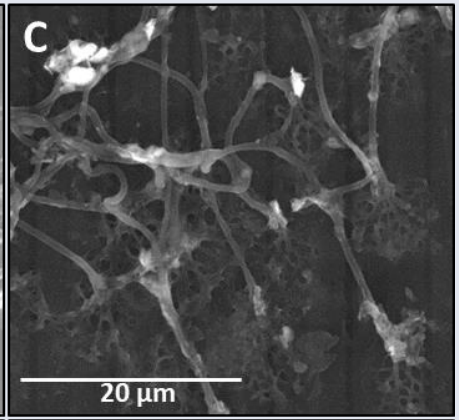
Oberbeckmann *et al.* 2014 FEMS

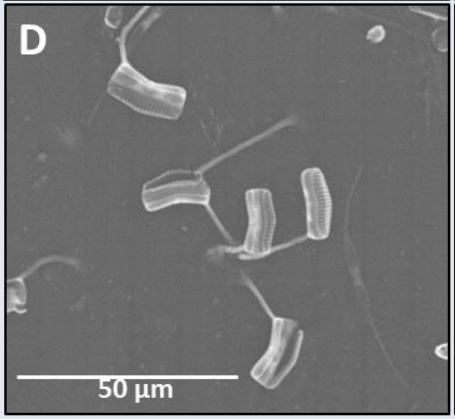


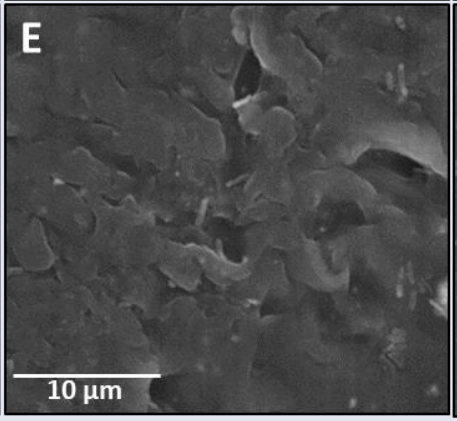
Mani *et al.* 2015

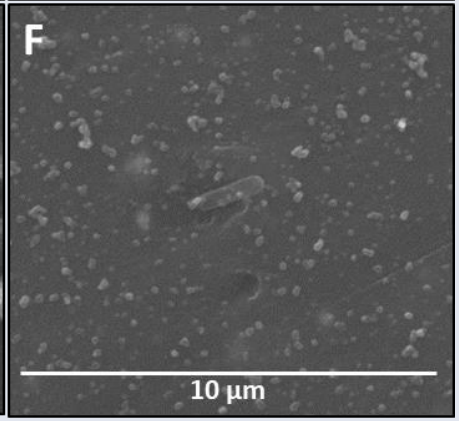












Hazard potential of plastic biofilms

Drifting plastic debris as a potential vector for dispersing Harmful Algal Bloom (HAB) species*

MERCEDES MASÓ, ESTHER GARCÉS, FRANCESC PAGÈS and JORDI CAMP

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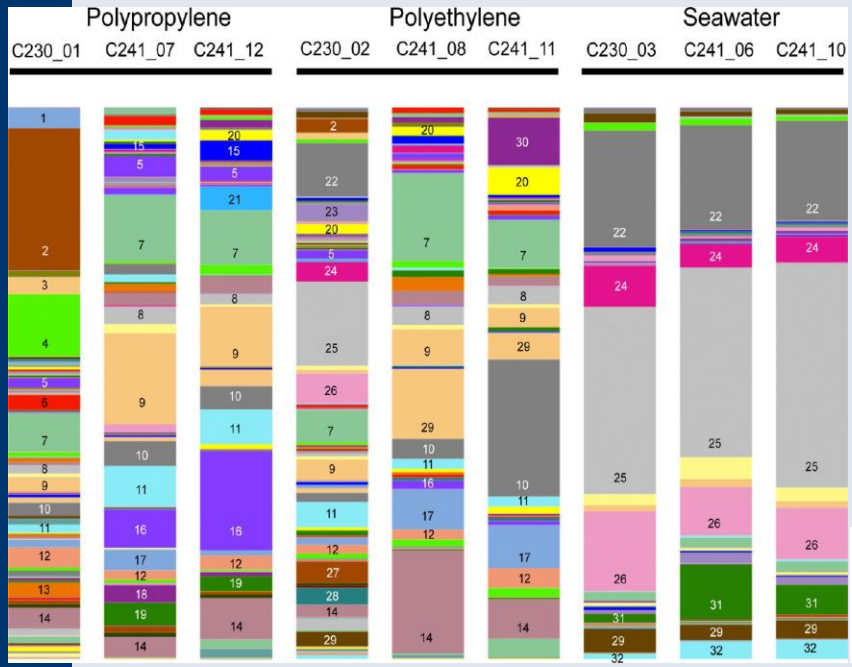

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Marine Environmental Research

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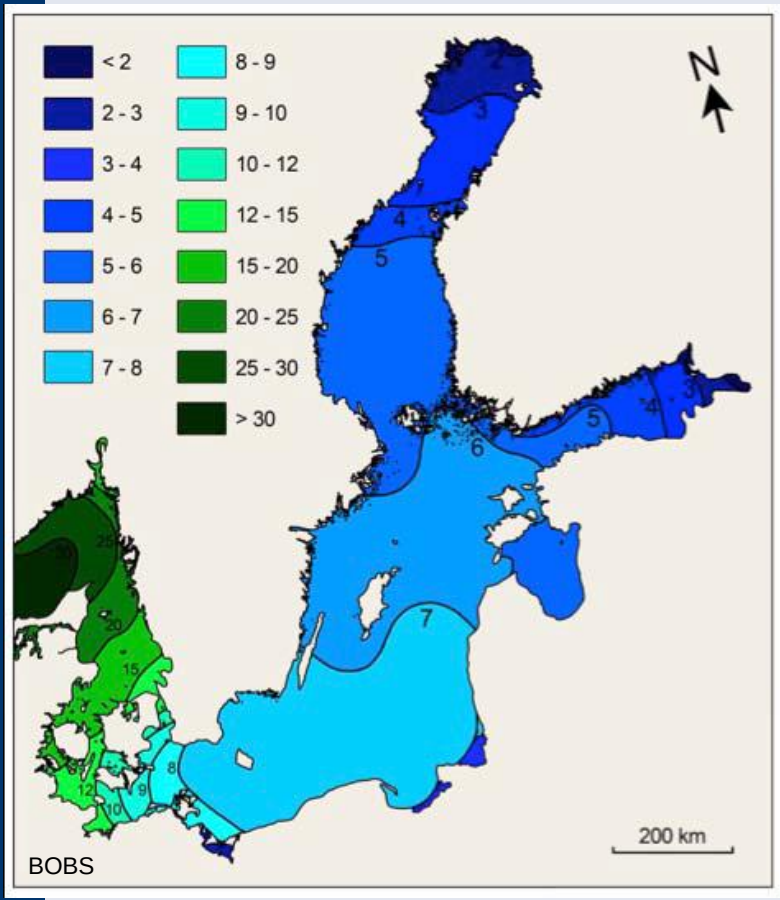
Dangerous hitchhikers? Evidence for potentially pathogenic *Vibrio* spp. on microplastic particles

Inga V. Kirstein [a, *, 1], Sidika Kirmizi [a, 1], Antje Wichels [a], Alexa Garin-Fernandez [a], Rene Erler [a], Martin Löder [a, b], Gunnar Gerdts [a]

'…dominance of a member of the genus *Vibrio* that constituted nearly 24% of the PP sample' **Zettler *et al* 2013**

Hazard potential of plastic biofilms in the Baltic Sea



Baltic Sea is optimal habitat for *Vibrio* spp.

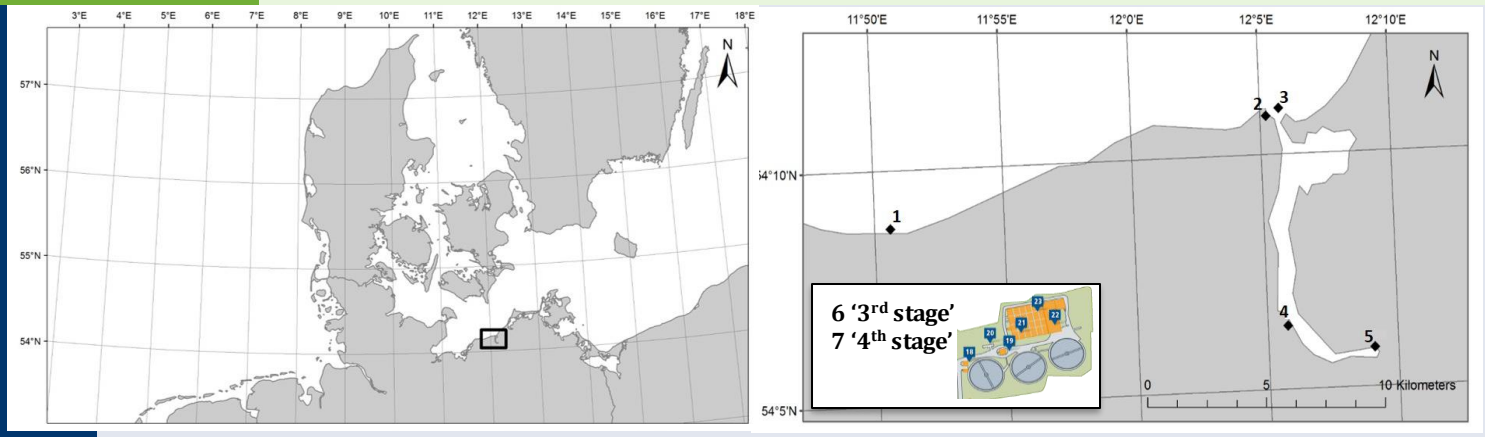
→ do they use MP as vector?

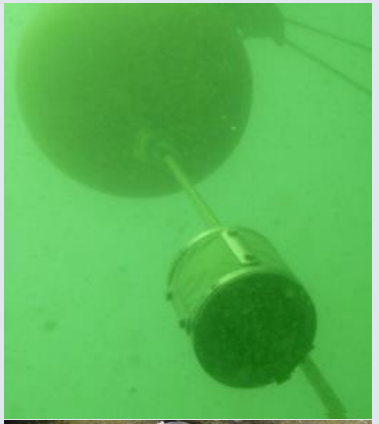
Centers for Disease Control and Prevention (CDC)

Research question: What is the relevance of microplastics (MP) as vector for specific microbial assemblages?

Mikr MIK

Incubation of plastic and natural pellets along gradient





2 weeks incubation

PE, PS, wood ø 3mm

Water (3µm, 0.2µm)

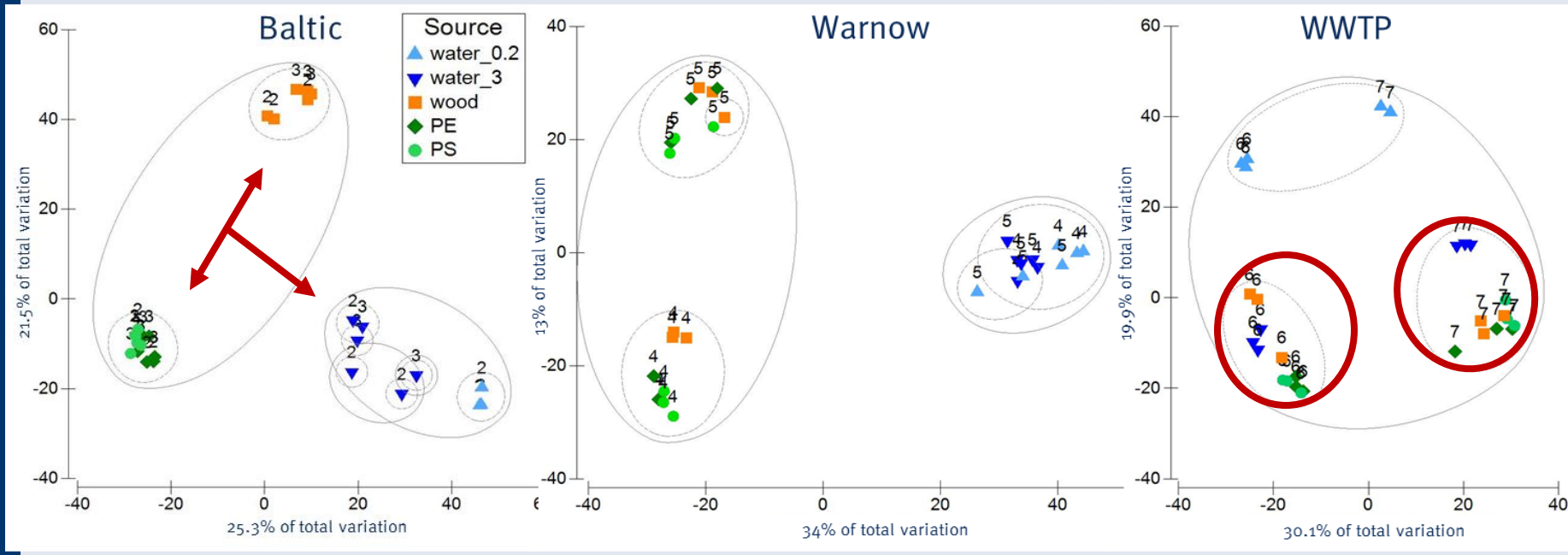
16S, 18S, Metagenomes, Metaproteomes, Cultivation

Environmental metadata

Microplastics can serve as vector for specific assemblages

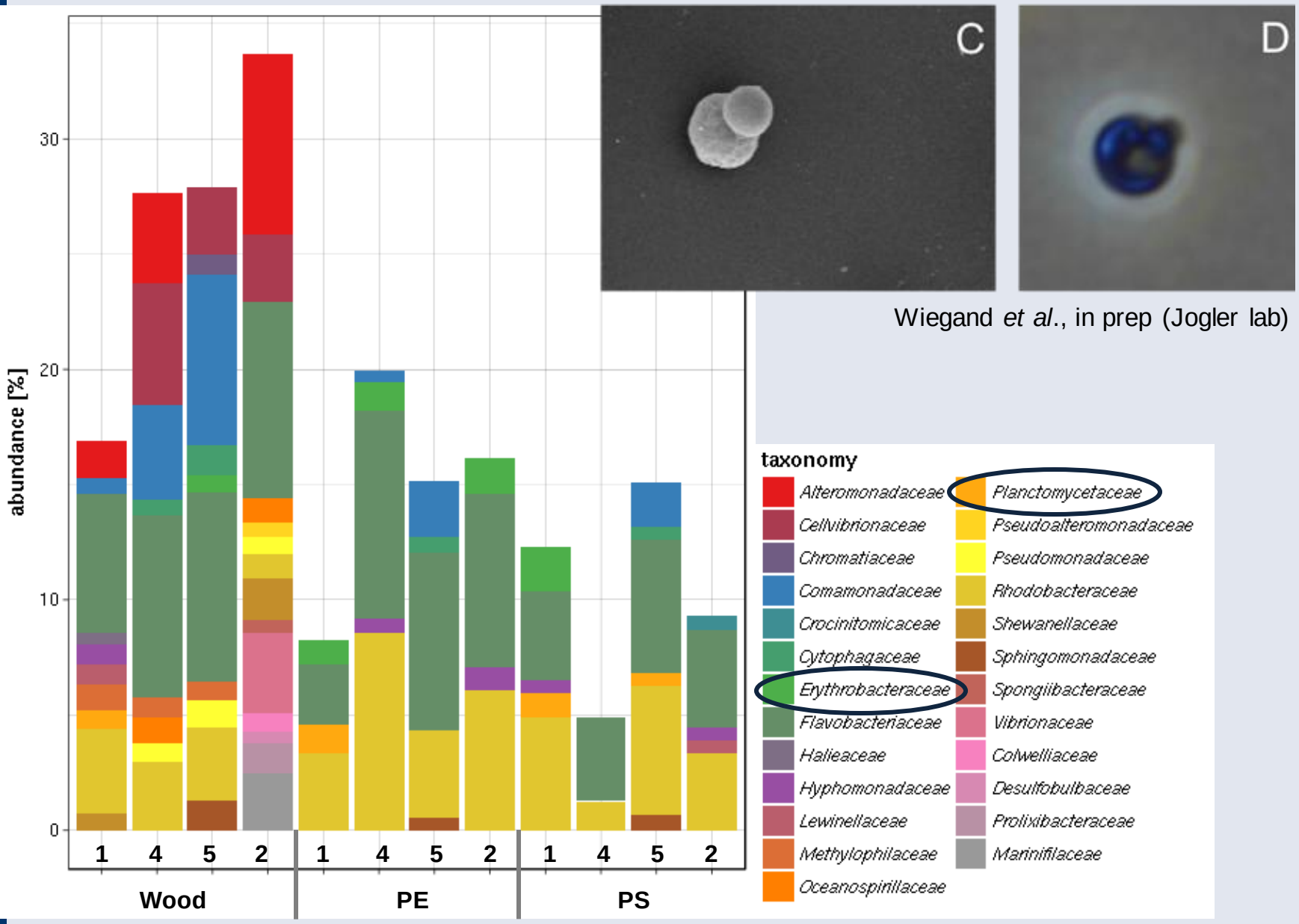
Nutrients

Salinity



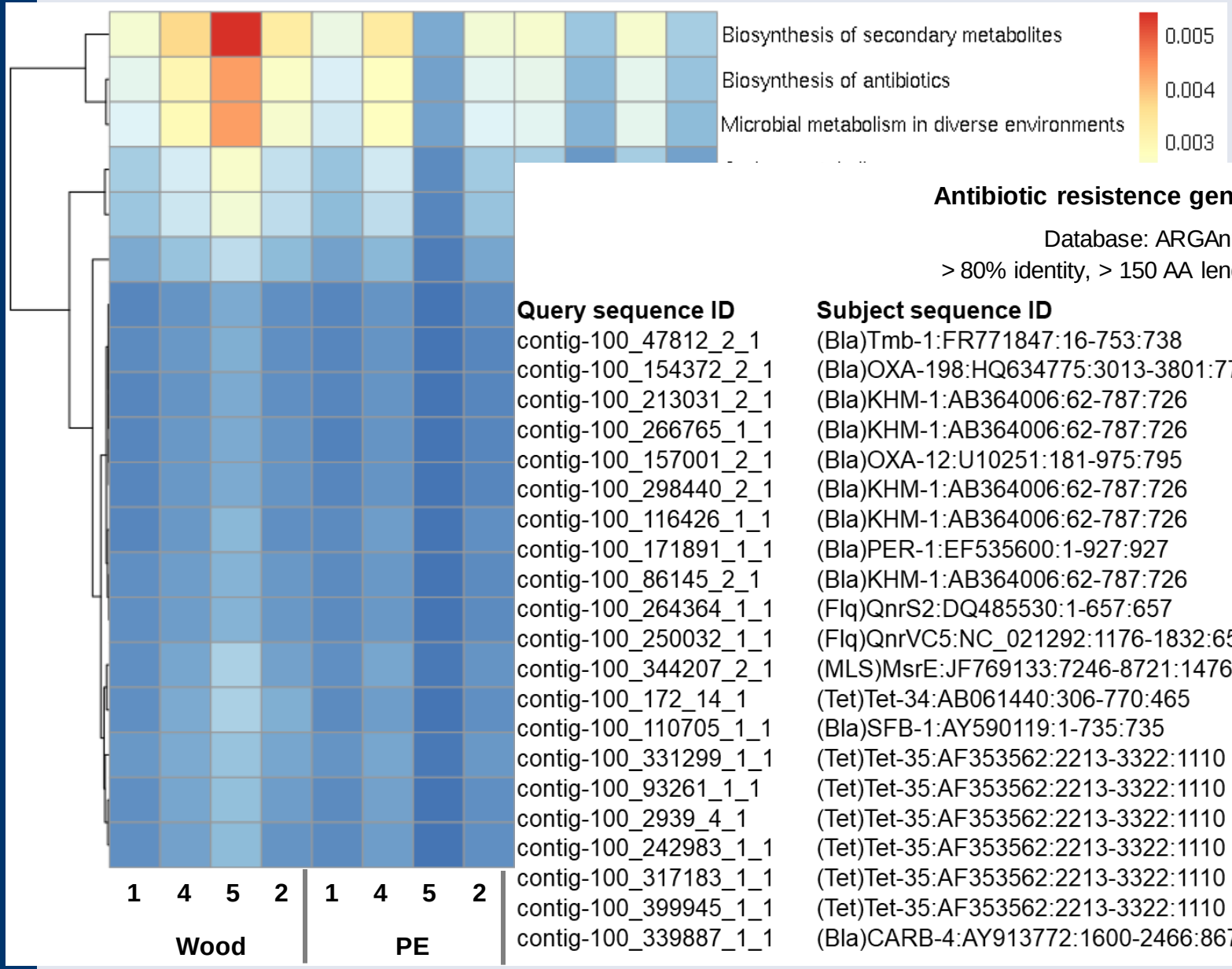
Oberbeckmann *et al*. 2018 Front Microbiol

Most abundant prokaryotic taxa (metagenome)



Wiegand *et al*., in prep (Jogler lab)

Functional overview (metagenomes)



Antibiotic resistence genes

Database: ARGAnnot
> 80% identity, > 150 AA length

Query sequence ID	Subject sequence ID
contig-100_47812_2_1	(Bla)Tmb-1:FR771847:16-753:738
contig-100_154372_2_1	(Bla)OXA-198:HQ634775:3013-3801:779
contig-100_213031_2_1	(Bla)KHM-1:AB364006:62-787:726
contig-100_266765_1_1	(Bla)KHM-1:AB364006:62-787:726
contig-100_157001_2_1	(Bla)OXA-12:U10251:181-975:795
contig-100_298440_2_1	(Bla)KHM-1:AB364006:62-787:726
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contig-100_171891_1_1	(Bla)PER-1:EF535600:1-927:927
contig-100_86145_2_1	(Bla)KHM-1:AB364006:62-787:726
contig-100_264364_1_1	(Flq)QnrS2:DQ485530:1-657:657
contig-100_250032_1_1	(Flq)QnrVC5:NC_021292:1176-1832:657
contig-100_344207_2_1	(MLS)MsrE:JF769133:7246-8721:1476
contig-100_172_14_1	(Tet)Tet-34:AB061440:306-770:465
contig-100_110705_1_1	(Bla)SFB-1:AY590119:1-735:735
contig-100_331299_1_1	(Tet)Tet-35:AF353562:2213-3322:1110
contig-100_93261_1_1	(Tet)Tet-35:AF353562:2213-3322:1110
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contig-100_317183_1_1	(Tet)Tet-35:AF353562:2213-3322:1110
contig-100_399945_1_1	(Tet)Tet-35:AF353562:2213-3322:1110
contig-100_339887_1_1	(Bla)CARB-4:AY913772:1600-2466:867

Wood

PS

Take home message

- Vector function of MP for pathogenic bacteria and ARG low compared to natural substrate

- Important processes on MP: photosynthesis, transport

- Relevance of MP as vector for specific assemblages depends on environmental conditions

- **Further investigations of ecological role crucial, esp. in low-nutrient, high-plastic-concentration areas**

Acknowledgement

Many thanks to…

All project partners MikrOMIK

Leibniz Association

Group Environmental Microbiology

Sonja Oberbeckmann, Daniel Bartosik, Stephanie Markert, Bernd Kreikemeyer, Sixing Huang, Boyke Bunk, Jörg Overmann, Claudia Hirschfeld, Dörte Becher, Daniel Wibberg, Jörn Kalinowski, Johannes Werner, Therese Kettner, Hans-Peter Grossart, Thomas Schweder

…and you for the attention!

BONUS MICROPOLL has received funding from BONUS (Art 185), funded jointly by the EU and Baltic Sea national funding institutions.

BONUS
Science for a better future of the Baltic Sea region