

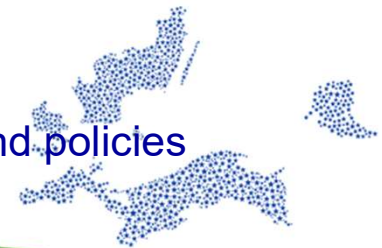


Cluster On Anaerobic digestion environmental Services and nutrients removal

Nutrients and heavy metals in seaweed

event: COASTAL Biogas 4th conference
Biogas and digestate from cast seaweed – regulations and policies

editor: M. Sc. Sebastian Foth



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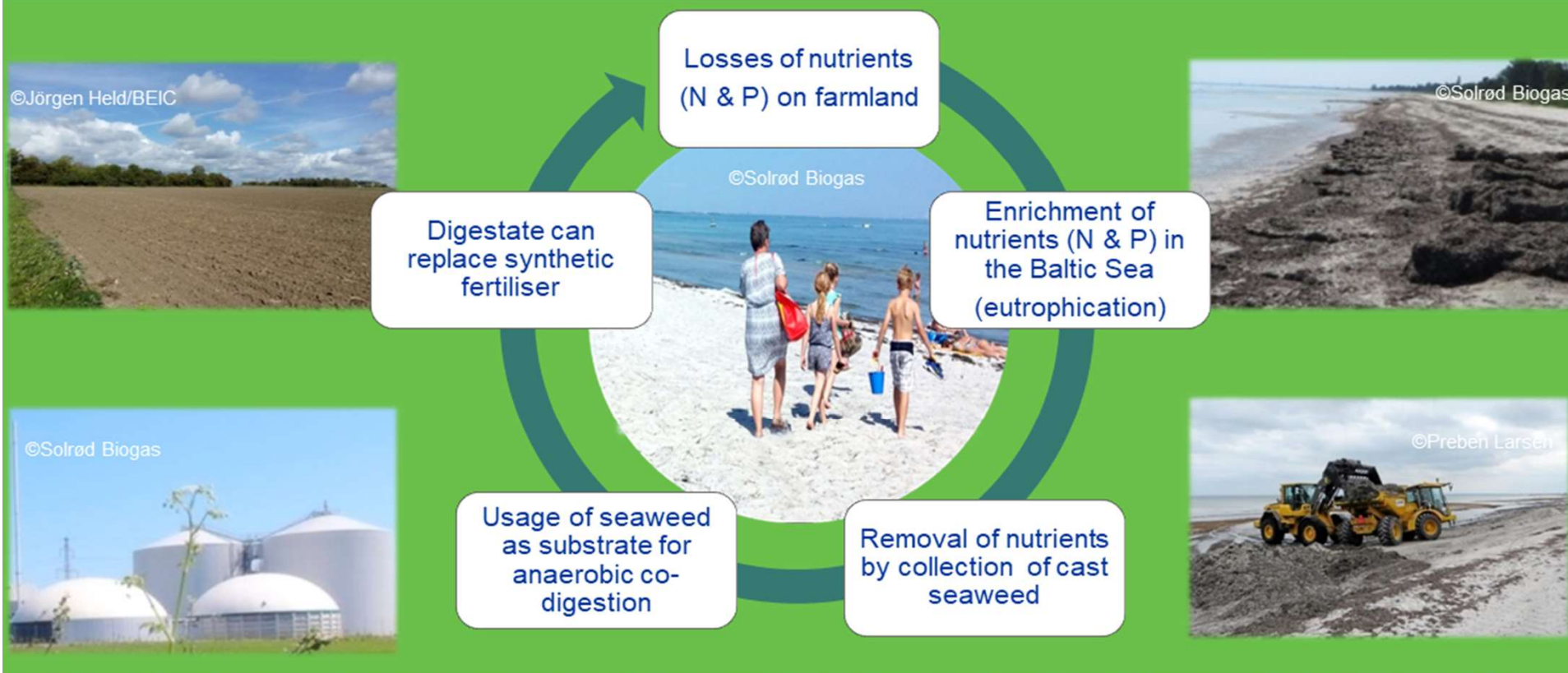


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Background



Cast seaweed – nuisance or resource?



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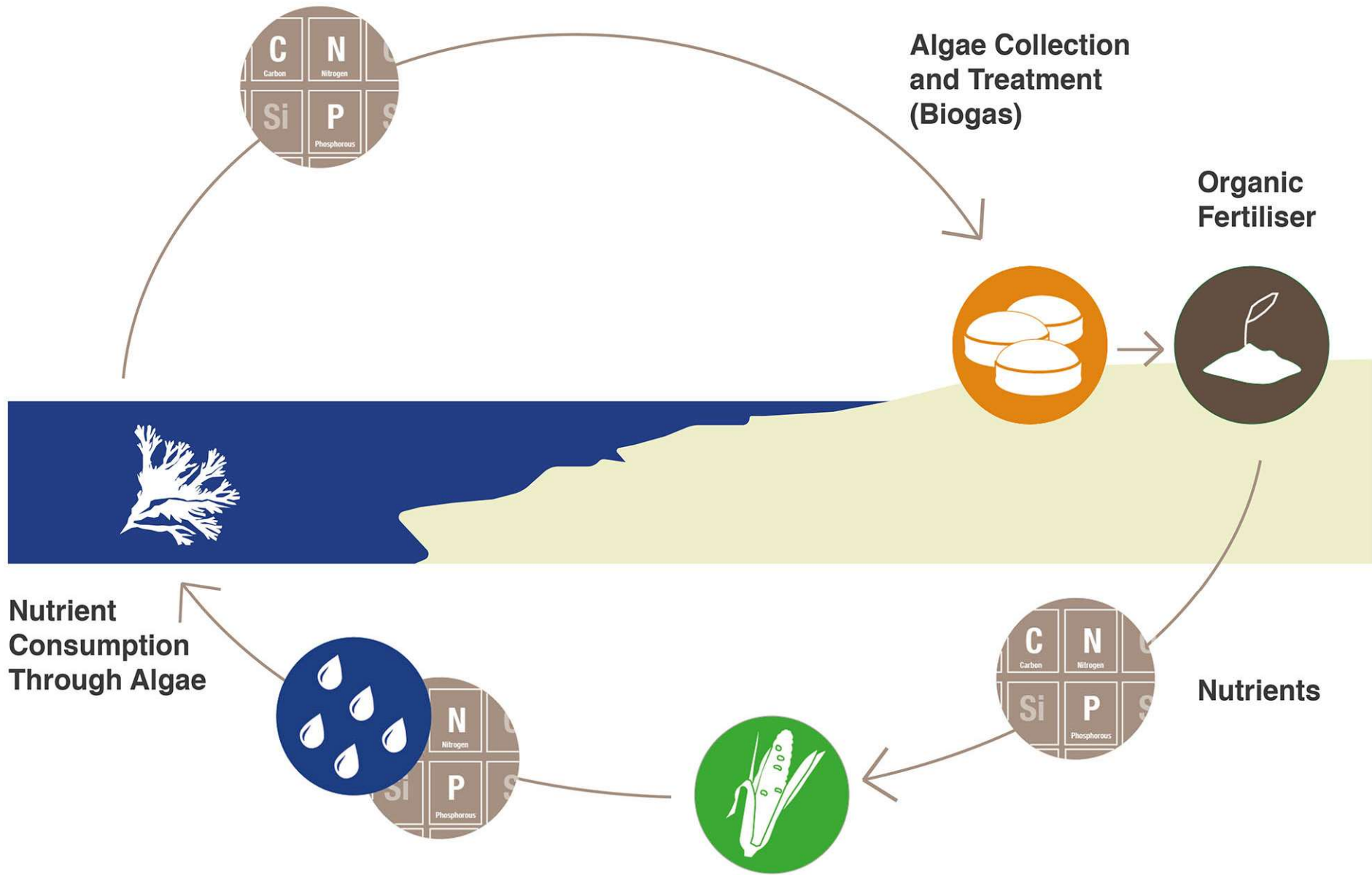
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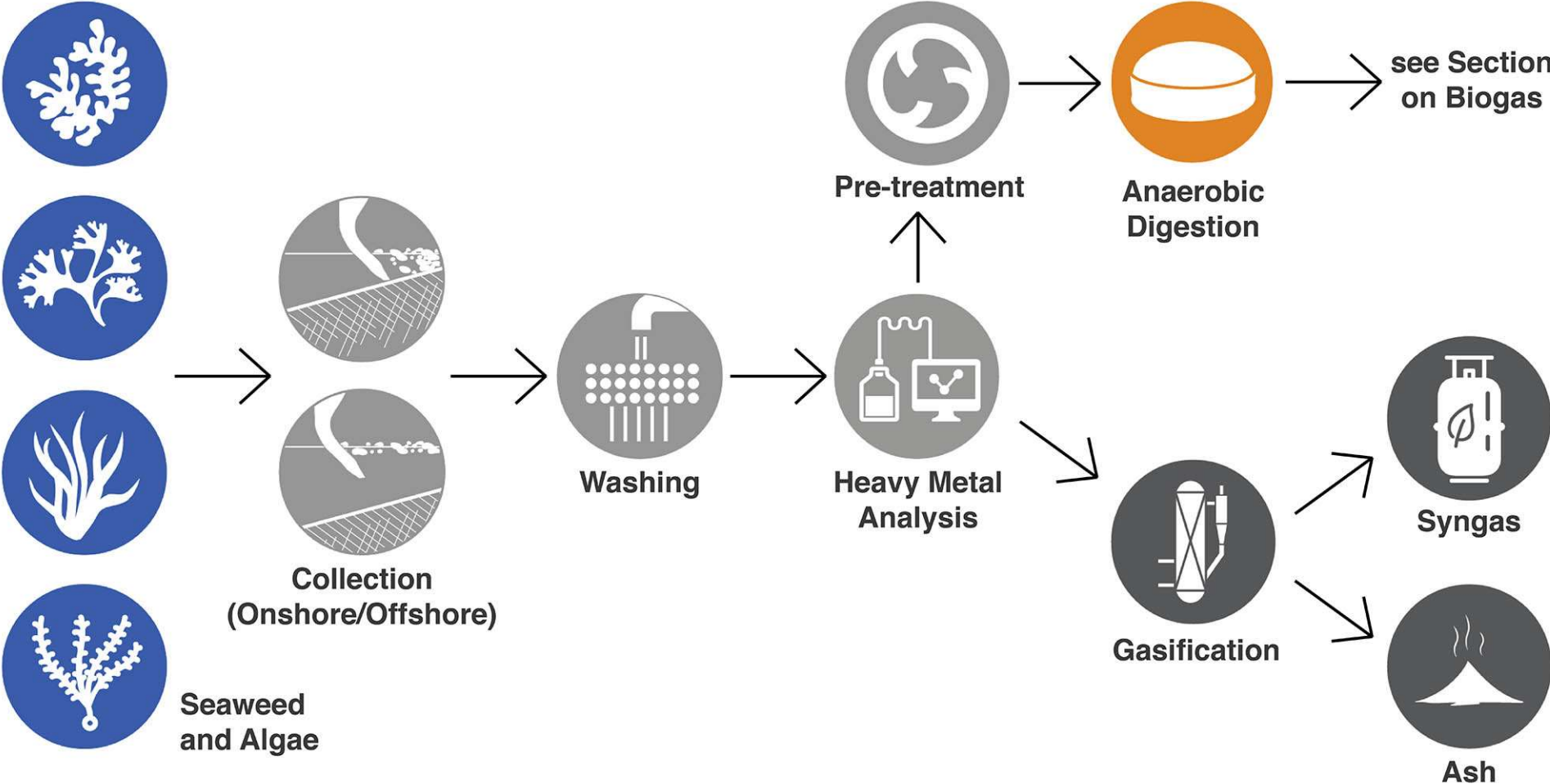


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Legal framework



EU

Waste Framework Directive
2008/98/EC

Nitrates Directive
91/676/EEC

Germany

Bio-Waste Ordinance
BioAbfV

National Fertilizer Ordinance
DümV

	BioAbfV mg/kg	DüMV mg/kg
Pb – Lead	150	150
Cd – Cadmium	1,5	1,5
Ife – iron	-	400
Mn - Manganese	-	200
Cu – Copper	100	900
Na – Sodium	-	1,5
N – Nitrogen	-	15

obligation to label

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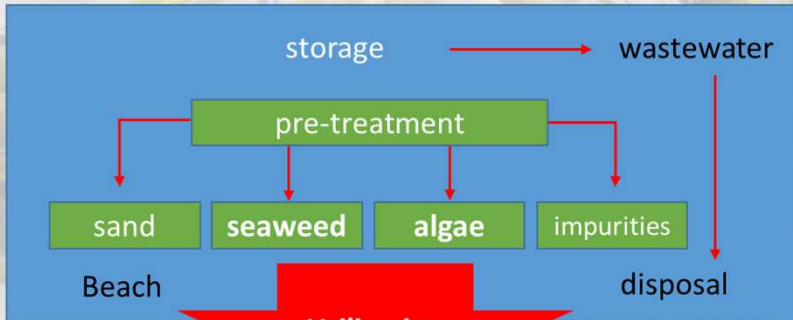
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Beach Wrack
(seaweed, sand, water, foreign materials)

fresh matter of seaweed and further plant material

beach cleaning



Utilization

energetic utilization

- anaerobic digestion
- thermic recovery

electricity, heat, fuel

material recovery

- construction material
- cosmetics
- composting
- fertilizer

direct agricultural use

	BioAbfV mg/kg	DüMV mg/kg
Pb – Lead	150	150
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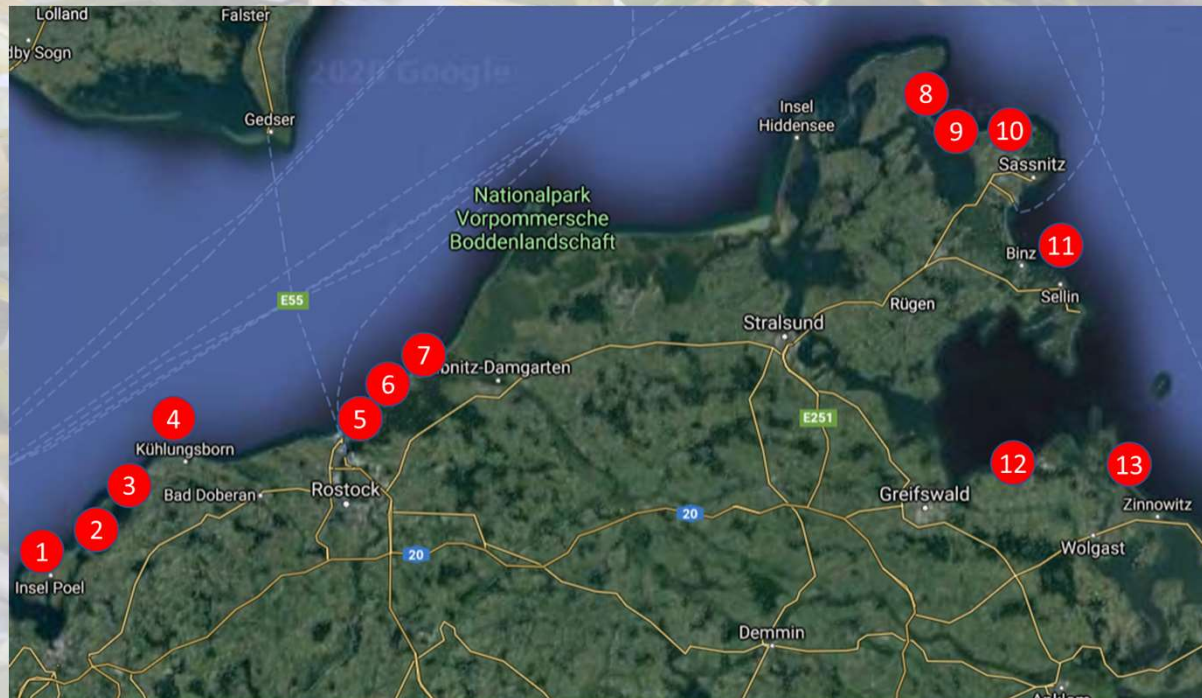


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Focus of investigation



- 1) Poel
- 2) Pepelow
- 3) Rerik
- 4) Kühlungsborn
- 5) Hohe Düne
- 6) Markgrafenheide
- 7) Torfbrücke
- 8) Juliusruh
- 9) Glowe
- 10) Lohme
- 11) Binz
- 12) Lubmin
- 13) Zempin

Focus of investigation:

macronutrients: phosphorus (P), nitrogen (N), carbon (C)

alkali metals: potassium (K), sodium (Na)

heavy metals: lead (Pb), cadmium (Cd), iron (Fe), manganese (Mn), copper (Cu)

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sampling, pre-treatment, analysis



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Results



Nutrition and heavy metal content

Name	Macronutrients			Alkali metal		Heavy metal				
	g P/kg	g N/kg	% C in DM	g K/kg	mg Na/kg	mg Pb/kg	mg Cd/kg	mg Fe/kg	mg Mn/kg	mg Cu/kg
Poel	1,9	23,8	32,37	15,7	18,7	0,8	0,73	536,7	111	6,6
Pepelow	1,19	17,1	35,5	3	5	1,9	0,51	1547,6	253,2	10,7
Rerik	4	31,5	39,91	20,7	16,7	1,86	0,68	644,4	684,5	10,1
Kühlungsborn	1,9	24,3	38,72	9,8	17,1	1,52	1,6	655,6	240,2	6,5
Hohe Düne	1,5	22,4	39,55	19,5	13,5	1,31	1,7	263,6	497,6	14,2
Markgrafenheide	1,5	20,3	32,73	4,6	12,3	5,1	1,2	3129,6	246,6	11,5
Torfbrücke	1,1	20,9	34,03	5	13	2,56	0,57	1315,3	245,7	11
Juliusruh	2,52	23,7	37,1	23	16,1	1,2	1,5	613,3	209,6	5,9
Glowe	1,42	20,7	31,45	5,9	7,6	2,2	1,9	1538,6	253,8	5,3
Lohme	1,93	21,3	35,1	10,3	12,2	3,79	2	1069,6	408,8	6,5
Binz	2,75	21,1	38	23,6	14,2	0,7	1,1	437,4	210,9	5,8
Lubmin	2,3	22,6	34,7	11,6	12,8	3,18	1,3	2146,2	472,5	6
Zempin	2,44	23,6	34	12,5	8	1,7	1,4	999,2	340,1	4,4

macronutrients: phosphorus (P), nitrogen (N), carbon (C)

alkali metals: potassium (K), sodium (Na)

heavy metals: lead (Pb), cadmium (Cd), iron (Fe), manganese (Mn), copper (Cu)

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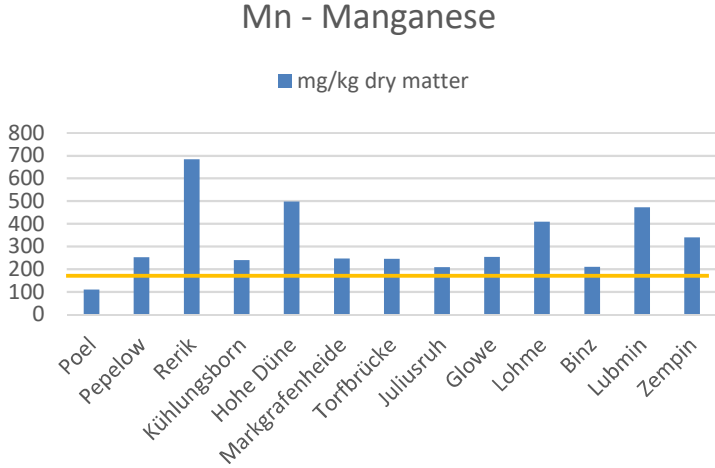
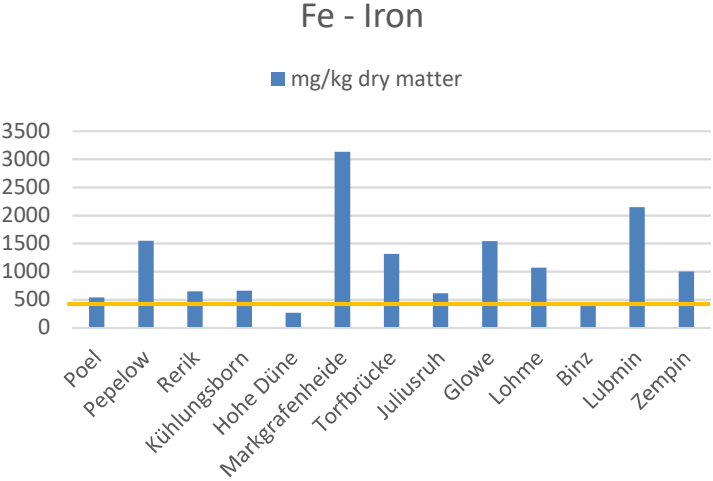
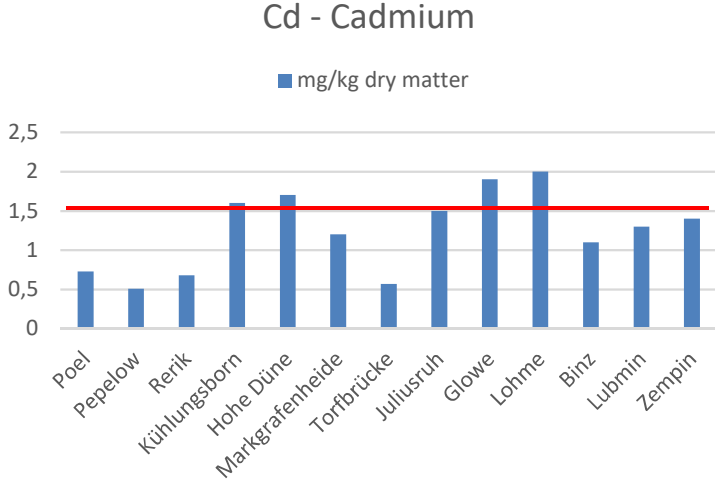
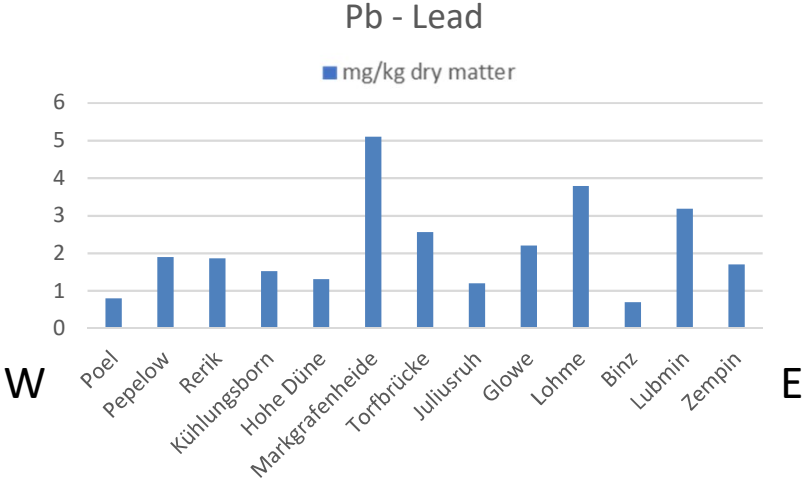


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Nutrients and heavy metal in seaweed



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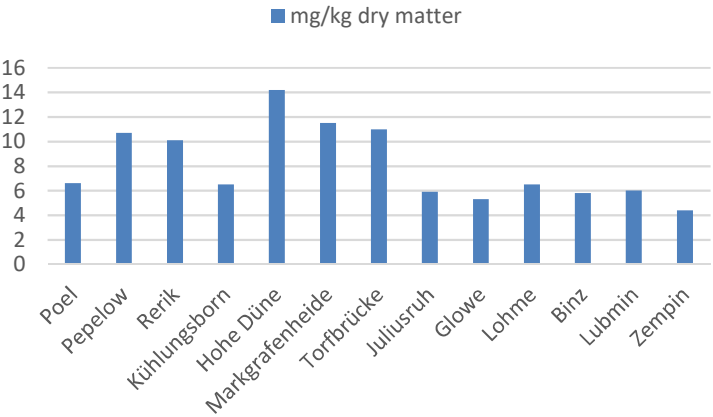


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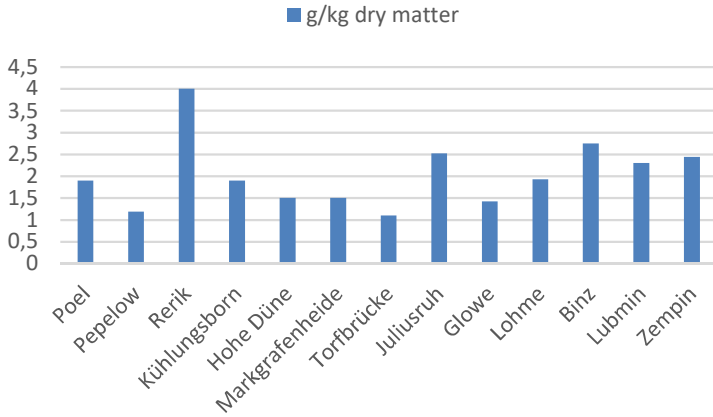
Nutrients and heavy metal in seaweed



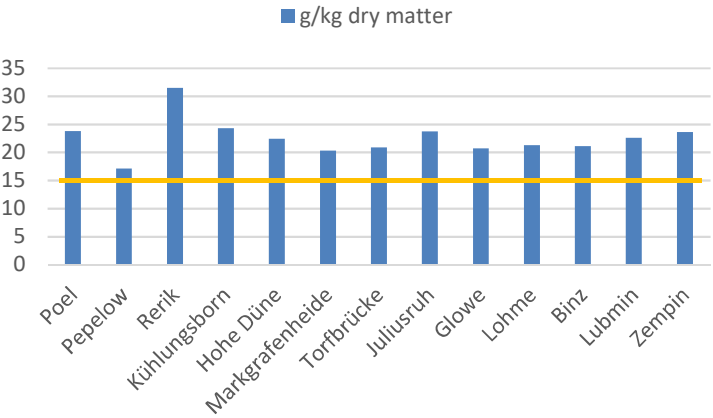
Cu - Copper



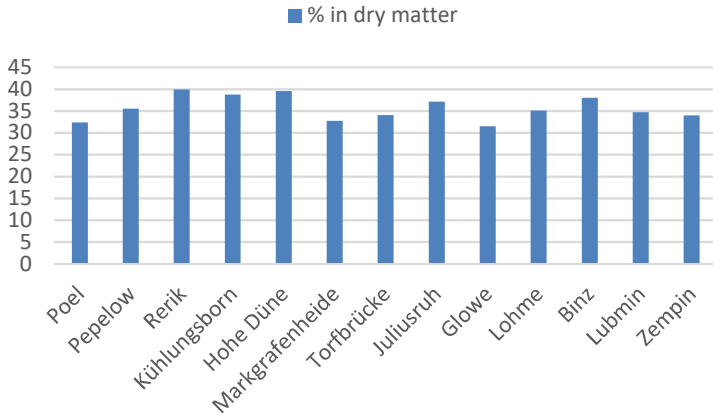
P - Phosphorus



N - Nitrogen



C - Carbon



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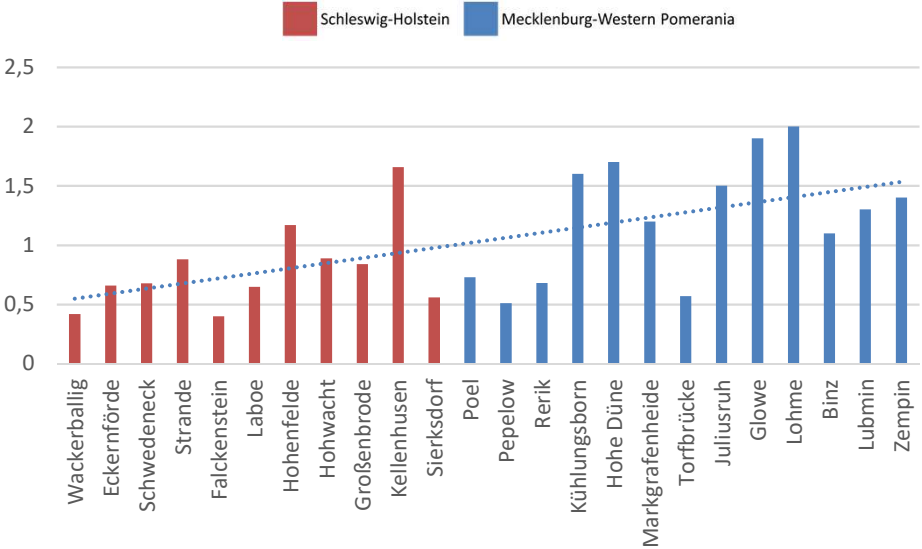


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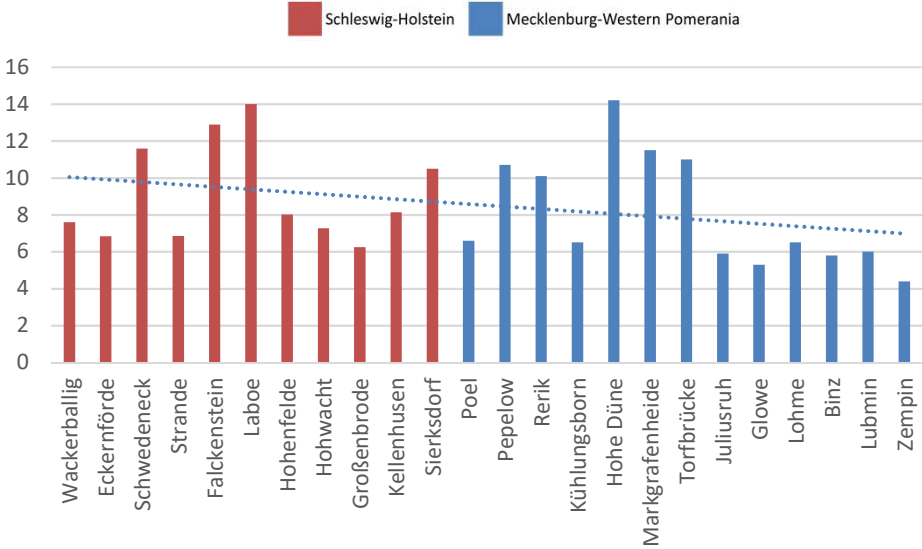
Comparison heavy metals



Cd - Cadmium



Cu - Copper



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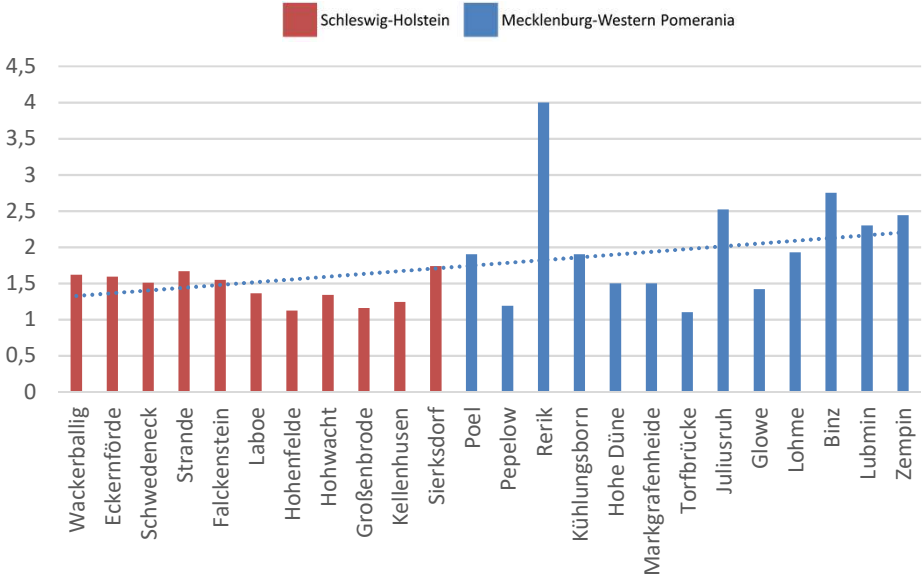


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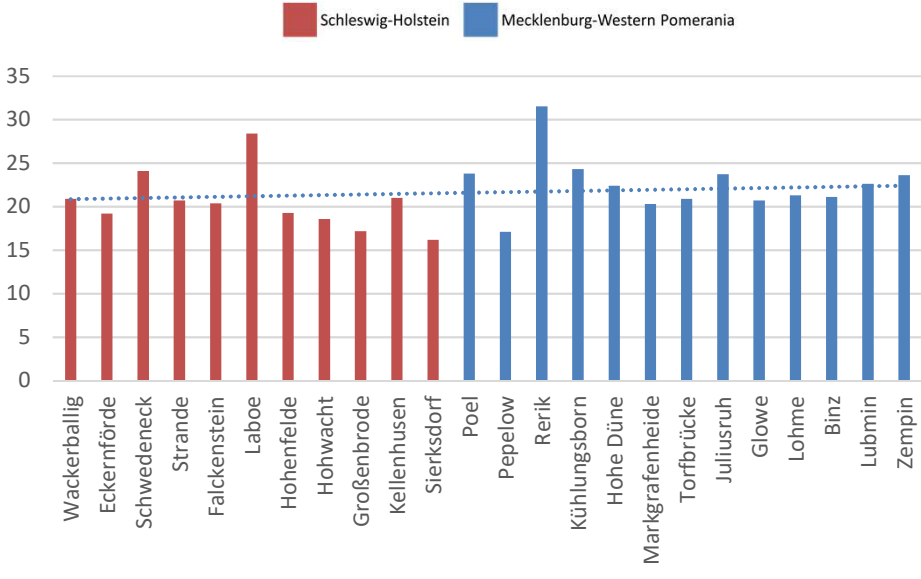
Comparison Nutrients



P - Phosphorus



N - Nitrogen



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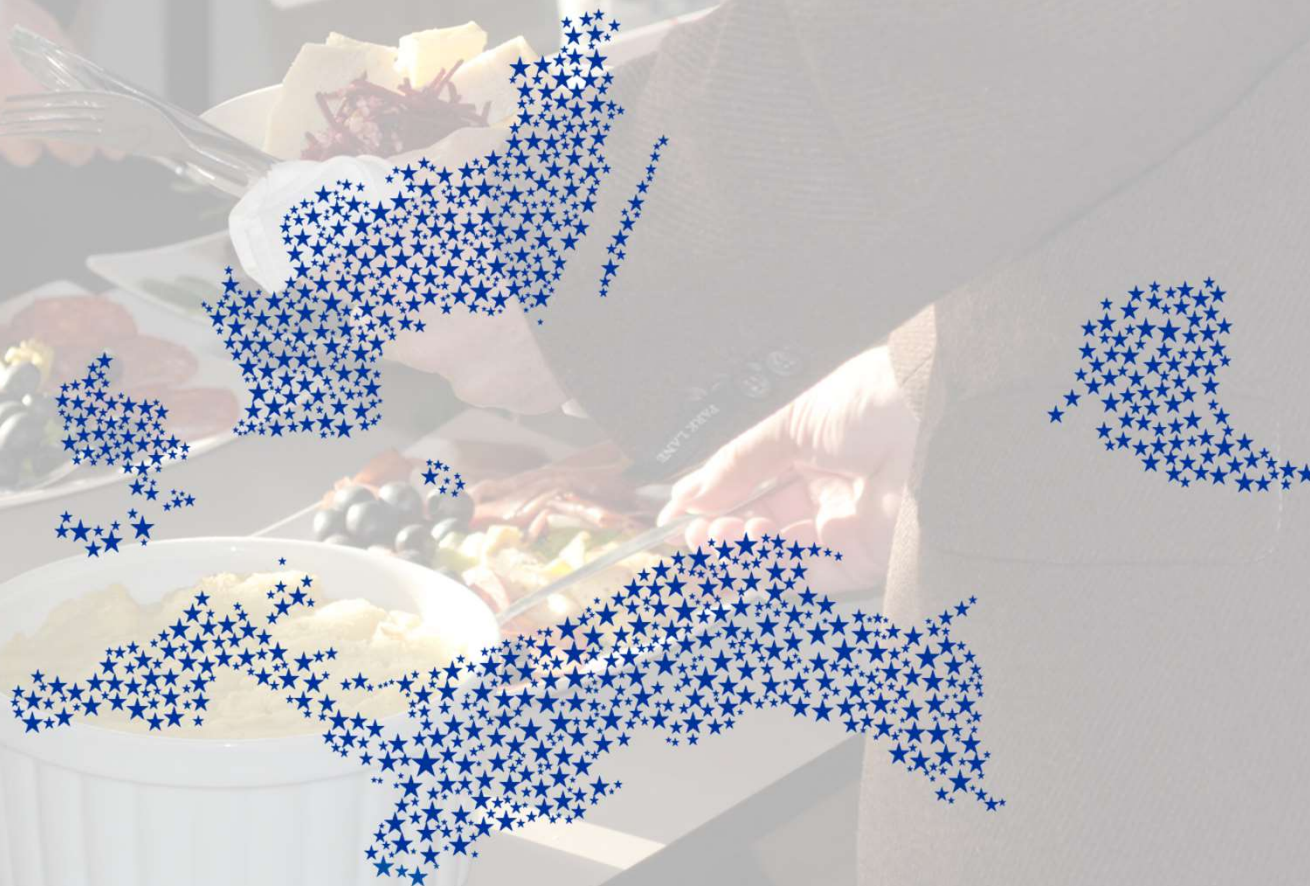


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Questions ?



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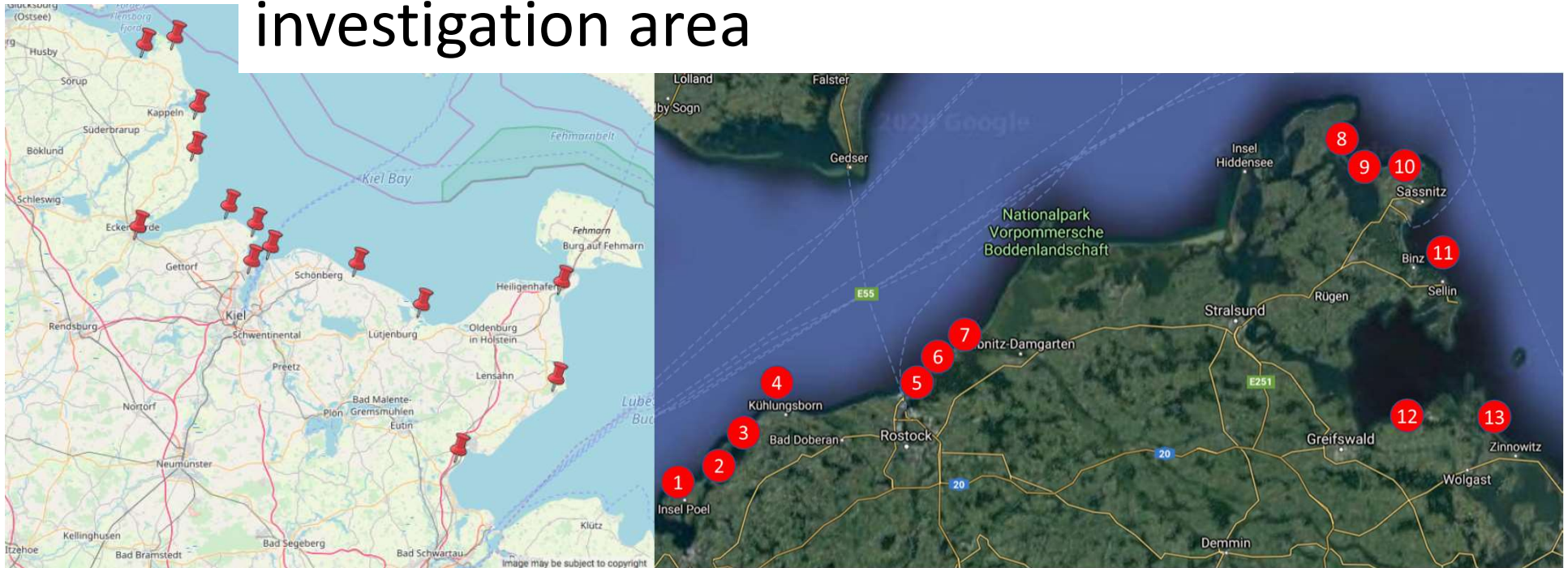


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investigation area



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