



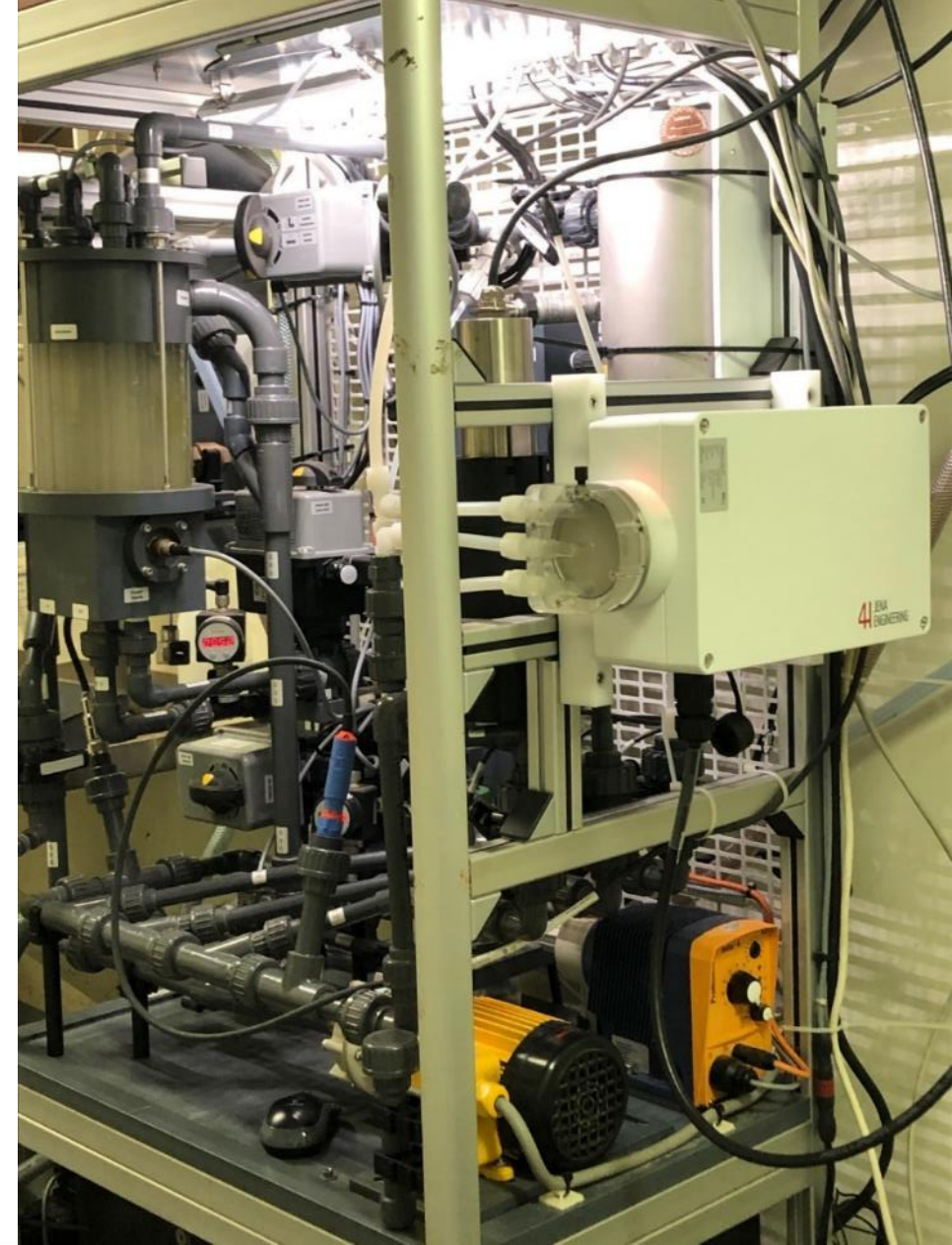
AlgaeOnlineAnalyzer as part of a FerryBox: technical improvements and results for the German Wadden Sea

Dagmar Daehne, Lara Luitjens
Forschungsstelle Küste

FerryBox Sensors on RV Burchana

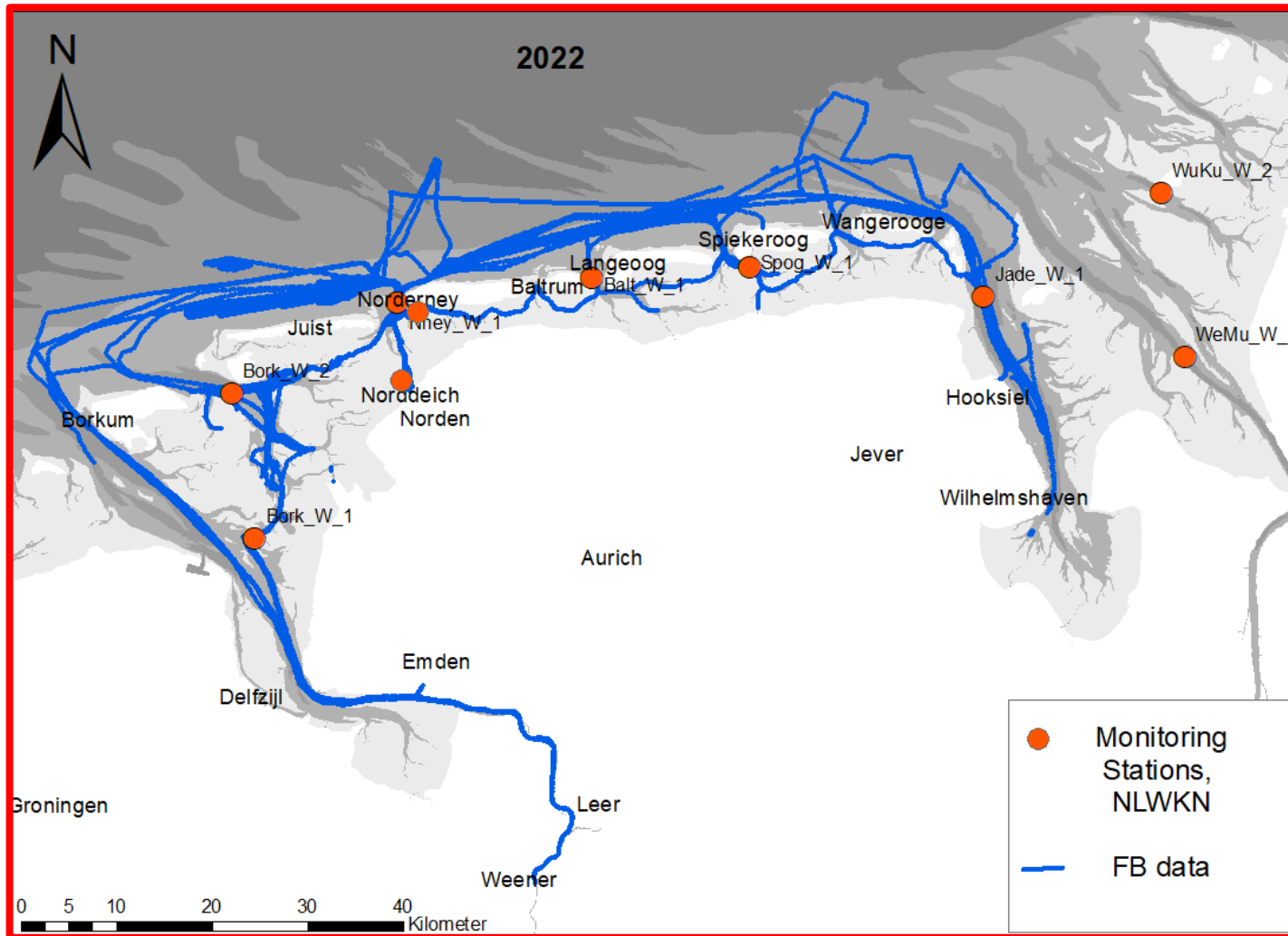


- pH (Meinsberg)
- dissolved oxygen and oxygen saturation (aanderaa)
- temperature and salinity (SeaBird Electronics)
- turbidity (Hach Lange)
- chlorophyll a and algae groups (AlgaeOnlineAnalyzer from bbe Moldaenke)
- pCO₂ (Contros)
- anorganic nutrients (wet-chemistry analyzers from Systea)
- Water Sampler (ICSO) for 24 samples





Operation Area of RV Burchana



- Wadden Sea between Ems and Weser
- Waterdepth in Wadden Sea 1.5 – 15 m
- high turbidity
- Discharge from Ems und Weser with high nutrient loads
- Monitoring stations for WFD: long term measurements for nutrients, chl a, phytoplankton taxonomy, water quality etc.



Measurements of Algae Groups

FerryBox - AlgaeOnlineAnalyzer (bbe moldaenke):

- determines the algae content as *chl a* [$\mu\text{g/l}$] by chlorophyll fluorescence using excitation by light sources (six different LEDs at particular frequencies)
- A complex spectral analysis of characteristic pigments in the algae leads to the allocation of the fluorescence signal to the group of yellow substances (CDOM) and to particular algae groups:

diatoms/flagellates (brown), green algae, blue algae and cryptophyta

WFD-Monitoring - Taxonomy by a reversal 2D-Microscope (Utermöhl, 1958)

- Long-term measurements since 1999 for taxonomy at determination rank of species
- Determination of abundance by counting, determination of cell volume and biovolume by measuring 2D
- → Estimation of biomass of cellular carbon [$\mu\text{g/l}$] relating to biovolume

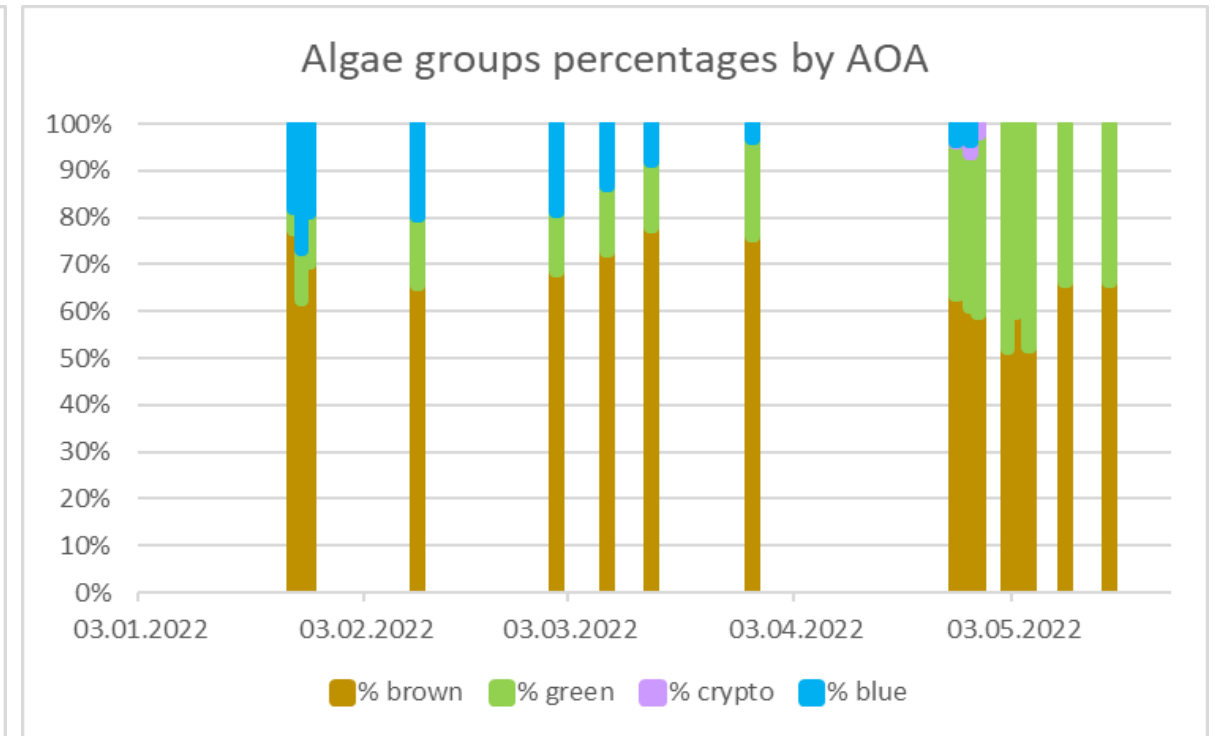
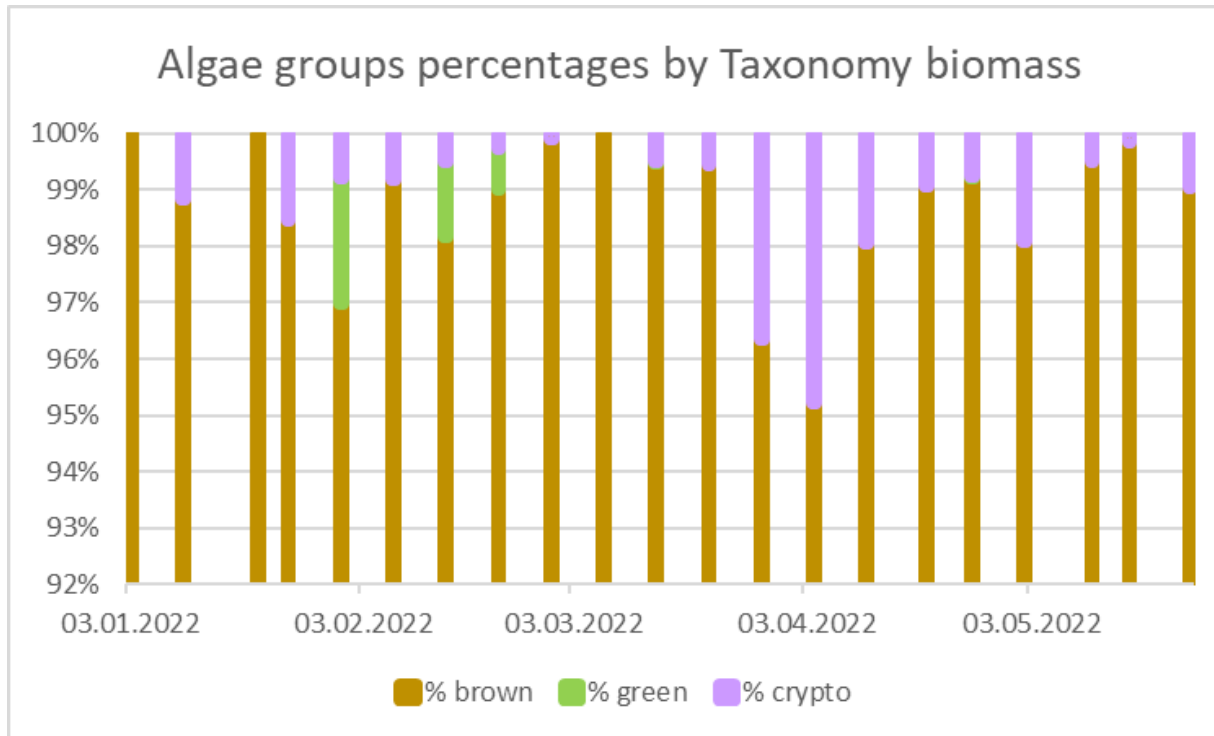
Questions:

→ Are the measurements comparable?

→ If yes - HOW?

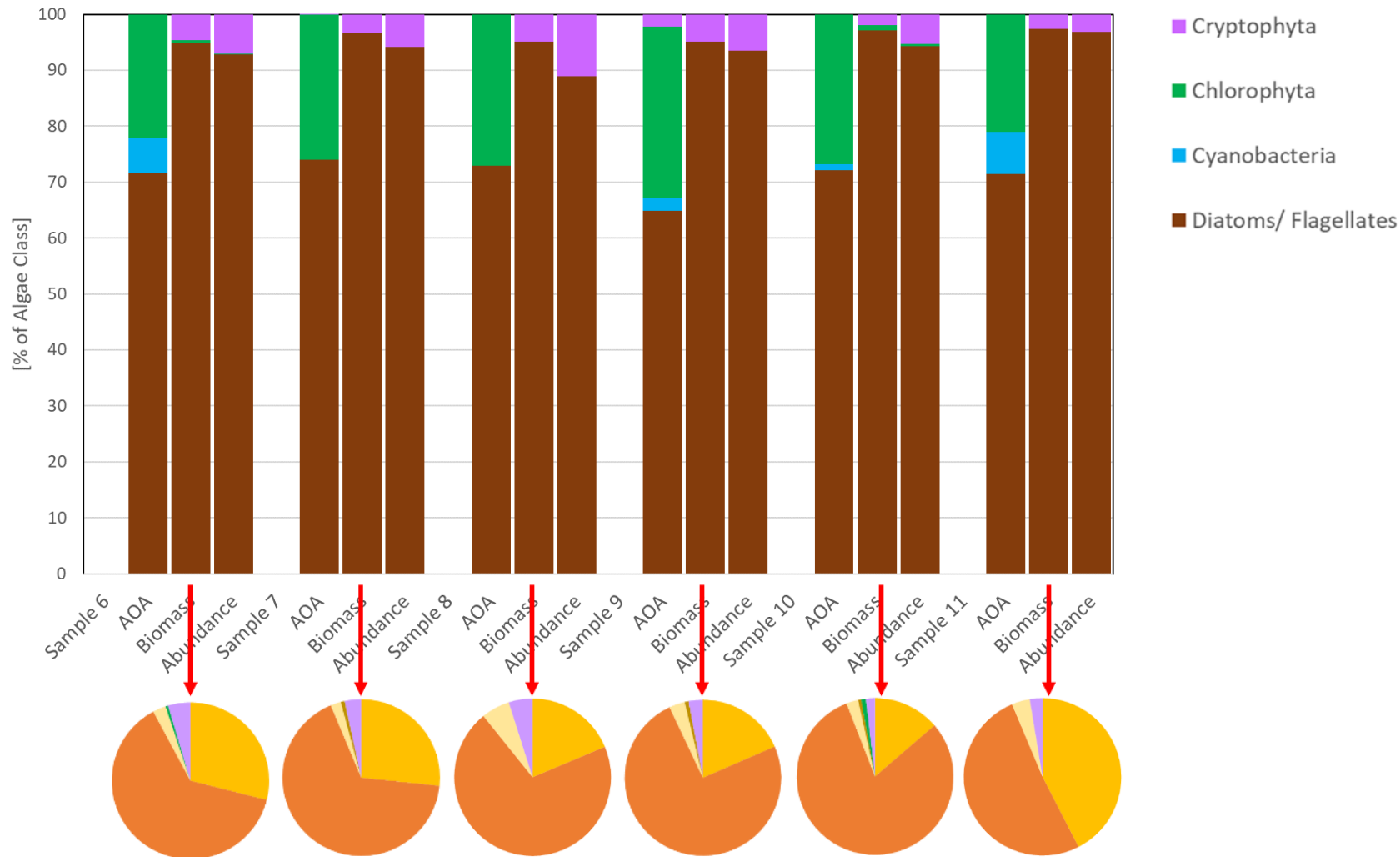
Mc

-





Composition of Algae Groups AOA (factory settings) and Taxonomy



21.04.2022:

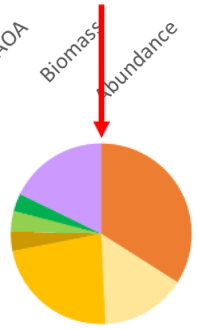
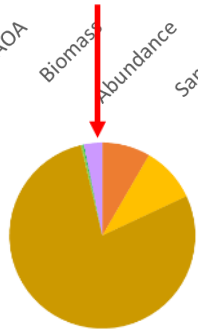
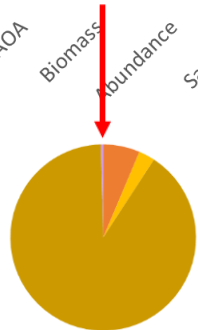
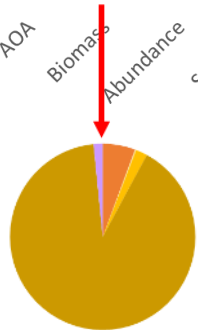
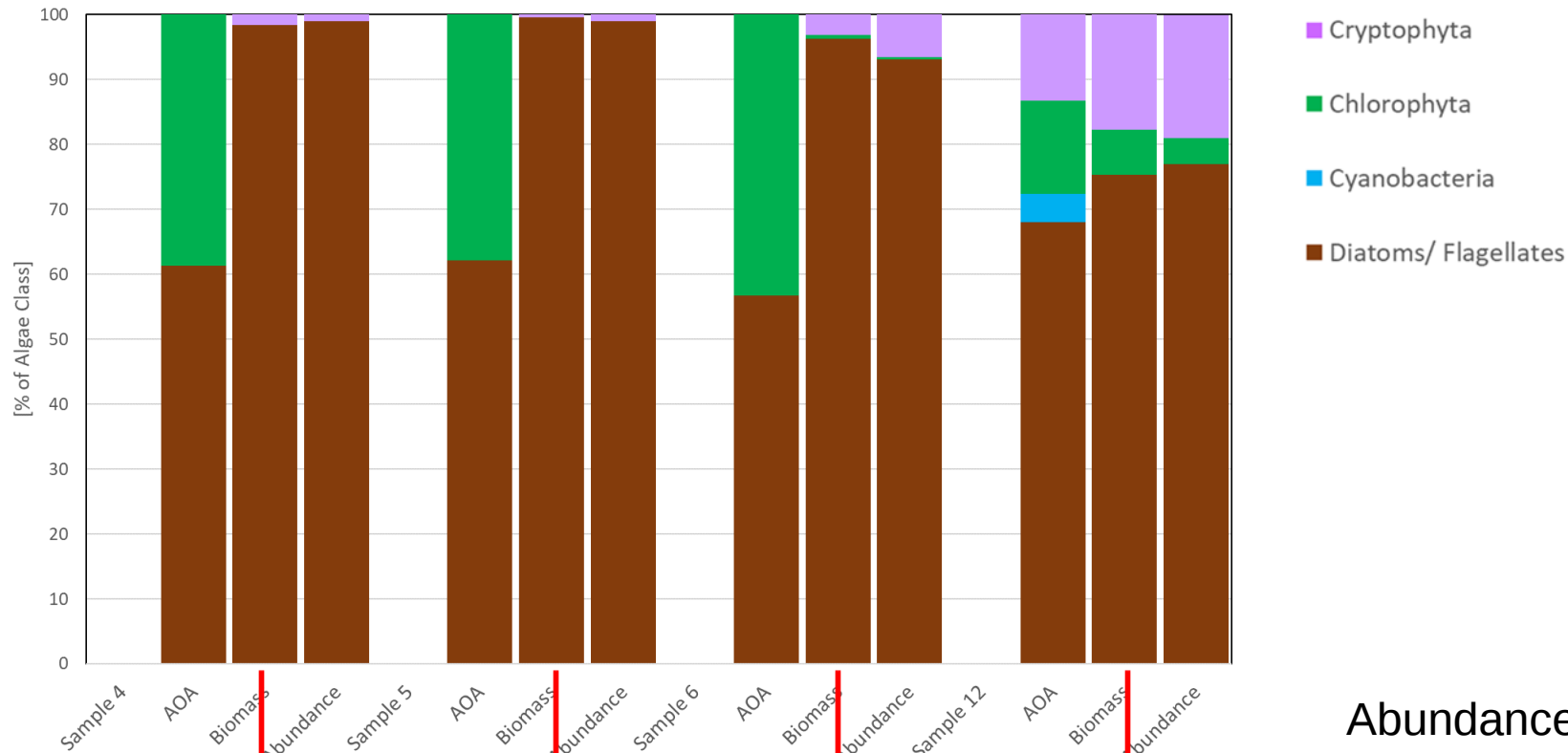
Samples 6-11 before bloom of *Phaeocystis* sp

Composition of algae groups by chlorophyll a (AOA) and by biomass and abundancy (Taxonomy)

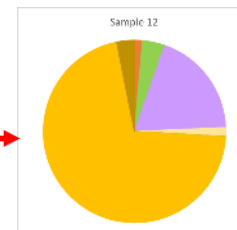
% biomass of subphylum



Composition of Algae Groups AOA (factory settings) and Taxonomy



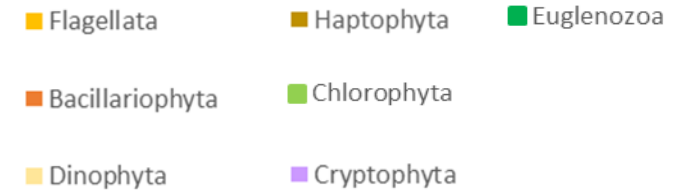
Abundance



04.05.2020:
Samples 4-6 during bloom of
Phaeocystis sp
02.07.2020:
Sample 12 after bloom of
Phaeocystis sp

Composition of algae groups
by chlorophyll a (AOA) and by
biomass and abundancy
(Taxonomy)

% biomass of subphylum





First Results (AOA factory setting)

- Overestimation of chlorophyta, worst results during bloom of Phaeocystis with 40% green algae instead of 0%
- Cryptophyta are not recognized at all, except after algae bloom in summer
- Subphylums of the brown algae group overlay obviously the signal of cryptophyta, but not specifically one of the subphylums
- Cyanobacteria are wrongly recognized, they are not expected in the Wadden Sea. The reason could be that they have a similar fingerprint to yellow substances
- Caution! Taxonomy doesn't capture Nanoplankton and Picoplankton.

→ consulting bbe moldaenke

Recalibration of AOA

- Factory setting: Calibration of four algae groups

Diatoms: *Cyclotella meneghiniana*

Bluegreen algae: *Microcystis aeruginosa*

Green algae: *Chlorella vulgaris*

Cryptos: *Cryptomonas sp.*

- New:** Calibration of *Isochrysis galbana* with a similar fingerprint to *Phaeocystis*
- Software: four classes can be selected for the fitting calculation
 - activate *Isochrysis* instead of diatoms

Parameter

Historie
Vorlagen
Neuberechnung

Parameterhistorie

Wählen Sie einen Parametersatz anhand seines Erstelldatums aus. Der ausgewählte Parametersatz kann in eine andere Datenbank exportiert werden. Er kann auch in die Zwischenablage kopiert werden. "Senden" lädt den ausgewählten Parametersatz in das Gerät.

Exportieren Clipboard
Matrix Senden
Vorlage

Erstelldatum des Parametersatzes 05.02.2024 08:20:21 Original

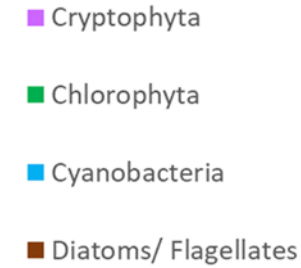
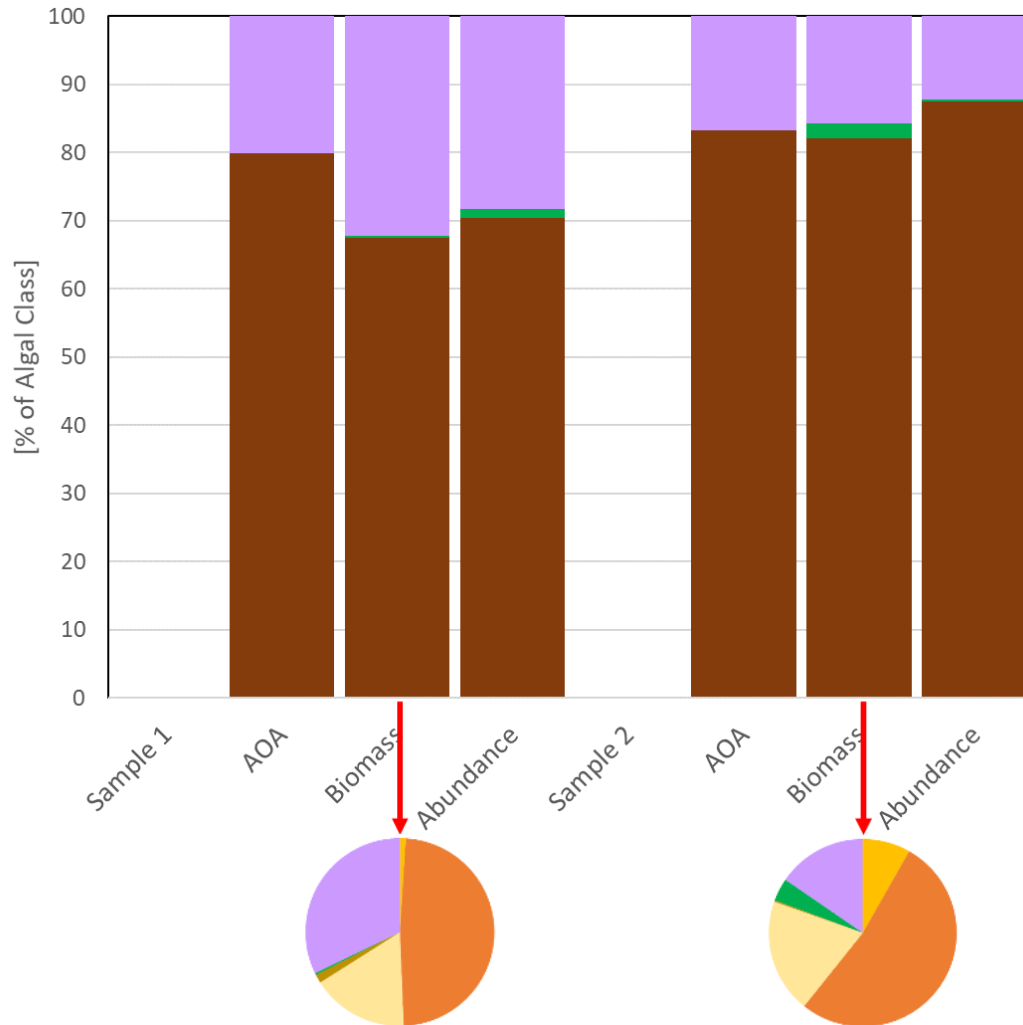
Ablaufparameter | Alarmparameter | Allgemeine Parameter | Fitparameter | Unit parameters | Messparameter

Name	Wert	Einheit
Name Klasse 1	Green Algae	
Name Klasse 2	Bluegreen	
Name Klasse 3	Diatoms	
Name Klasse 4	Cryptophyta	
Name Klasse 5	Isochrysis sp.	
Name Klasse 6	#6	
Name Klasse 7	#7	
Name Klasse 8	Yellow substances	
Green Algae aktiviert für Fitberechnung	ja	
Bluegreen aktiviert für Fitberechnung	ja	
Diatoms aktiviert für Fitberechnung	nein	
Cryptophyta aktiviert für Fitberechnung	ja	
Isochrysis sp. aktiviert für Fitberechnung	ja	
#6 aktiviert für Fitberechnung	nein	
#7 aktiviert für Fitberechnung		

OK Abbrechen Übernehmen



Composition of Algae Groups AOA (recalibrated) and Taxonomy



04.07.2024:
Sample 1-2 after bloom of
Phaeocystis sp

Composition of algae groups
by chlorophyll a (AOA) and by
biomass and abundancy
(Taxonomy)

% biomass of subphylum





Conclusion

- With further calibration of *Isochrysis* and using the fingerprint of *Isochrysis* instead of diatoms in the AOA for the internal fitting calculation we improved the percentages of the different algae groups compared to taxonomy analysis (percentages of diatoms and cryptophyta are in the same order of magnitude of taxonomy now, cyanobacteria are not detected anymore)
- (little) fraction of chlorophyta is not detected
- Further investigations are necessary to assess the composition of algae groups in phytoplankton during the algae bloom



Thank you for
your attention!