Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency

April 24th, 2019, Genua: Ferry Box Workshop 2019

Dagmar Daehne & Anne Ritzmann

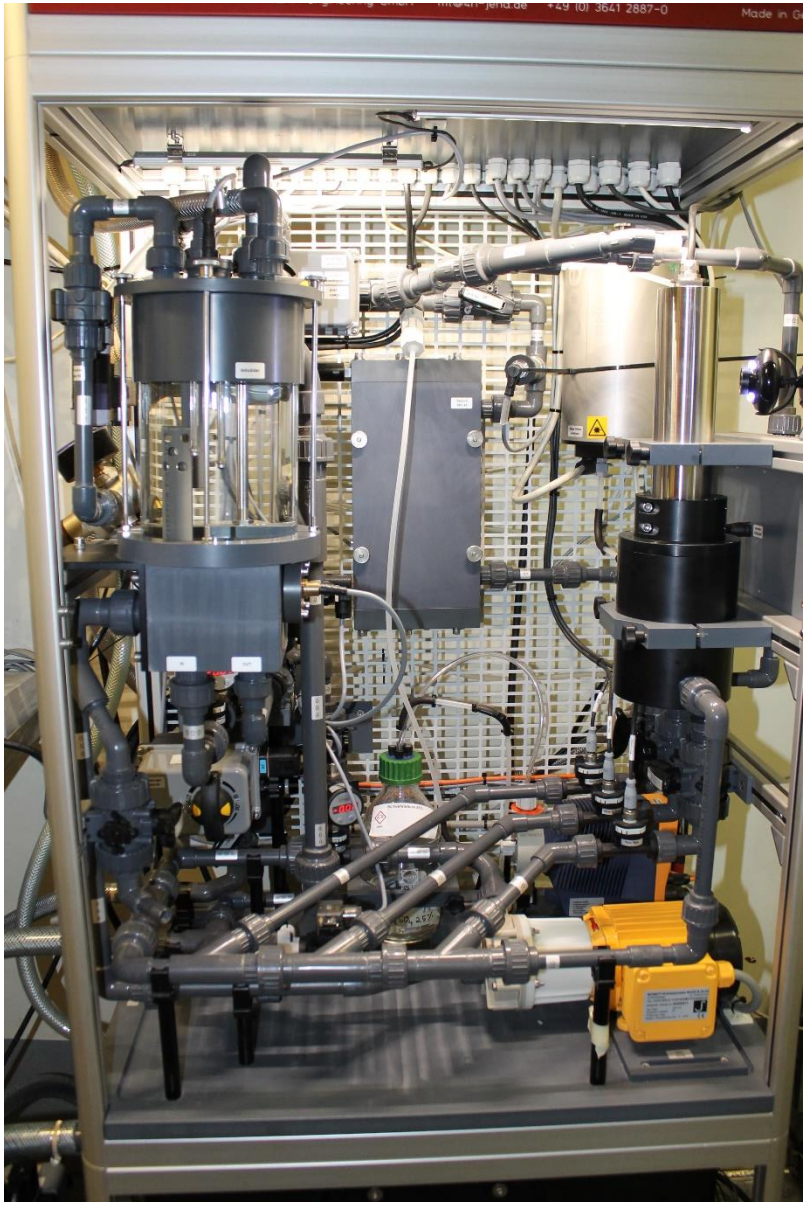
Experiences with a FerryBox on a research vessel operating in the Wadden Sea

Photo: CRS

Content

- Special conditions for our FerryBox operating in the Wadden Sea
- Modifications and improvements in our FerryBox
- Sensitivity study and validation for nutrient analysers

Sensors



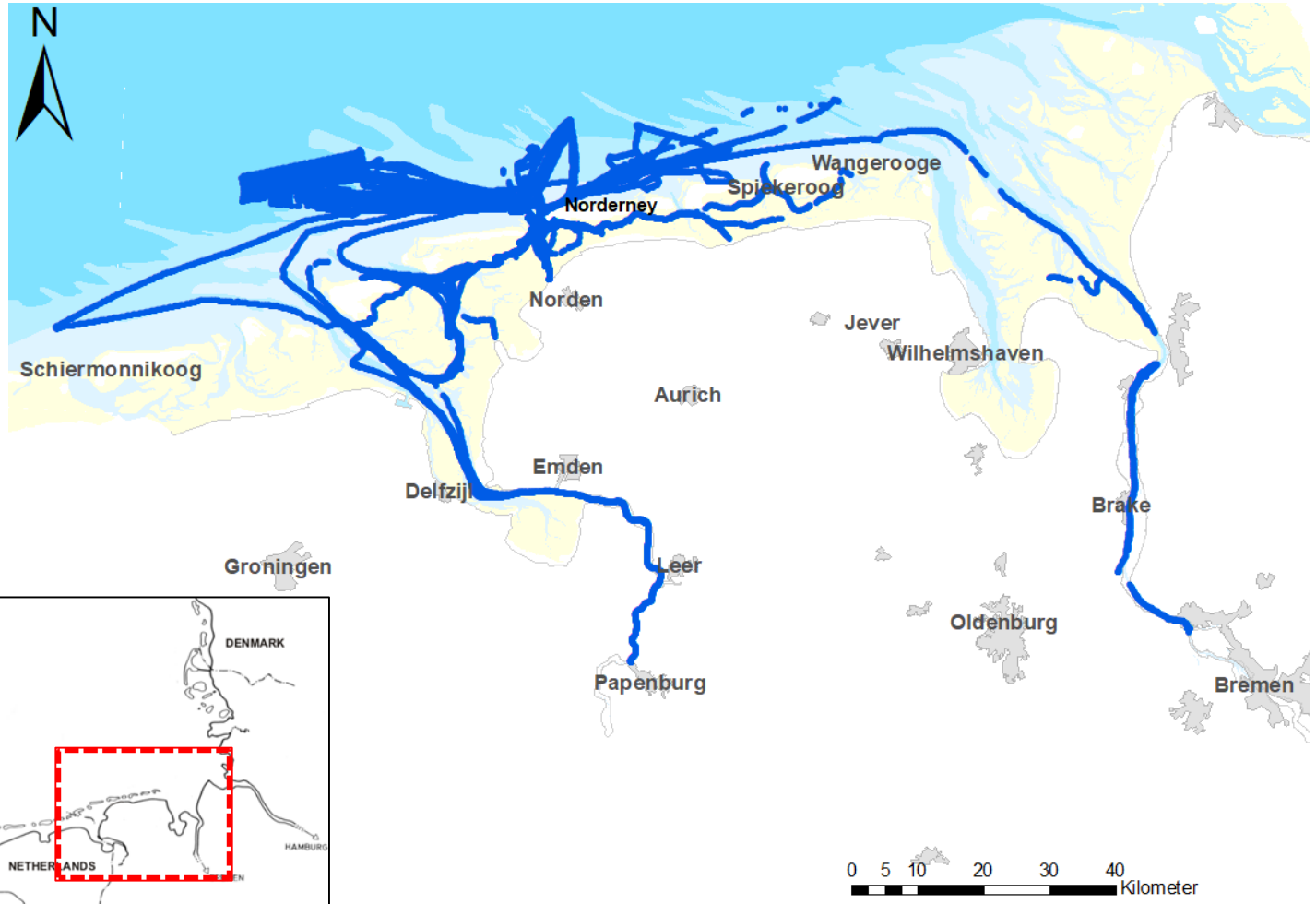
- Temperature (SBE 38, Seabird)
- Thermosalinograph (SBE45, Seabird)
- pH electrode (Xylem)
- Turbidity Sensor (Hach Lange)
- Oxygen Optode (Aandera)
- Algae Online Analyser (bbe)
- Wet-chemistry analysers for anorganic nutrients (Systea)

Differences to offshore operations

- FerryBox is installed on a governmental research vessel “Burchana” instead on a ferry
- Frequent changes in active and non-active times
- When the crew is off-duty, the FerryBox has to be standby and seacocks have to be closed

Operating in turbid coastal waters and estuarine rivers (Ems, Weser)

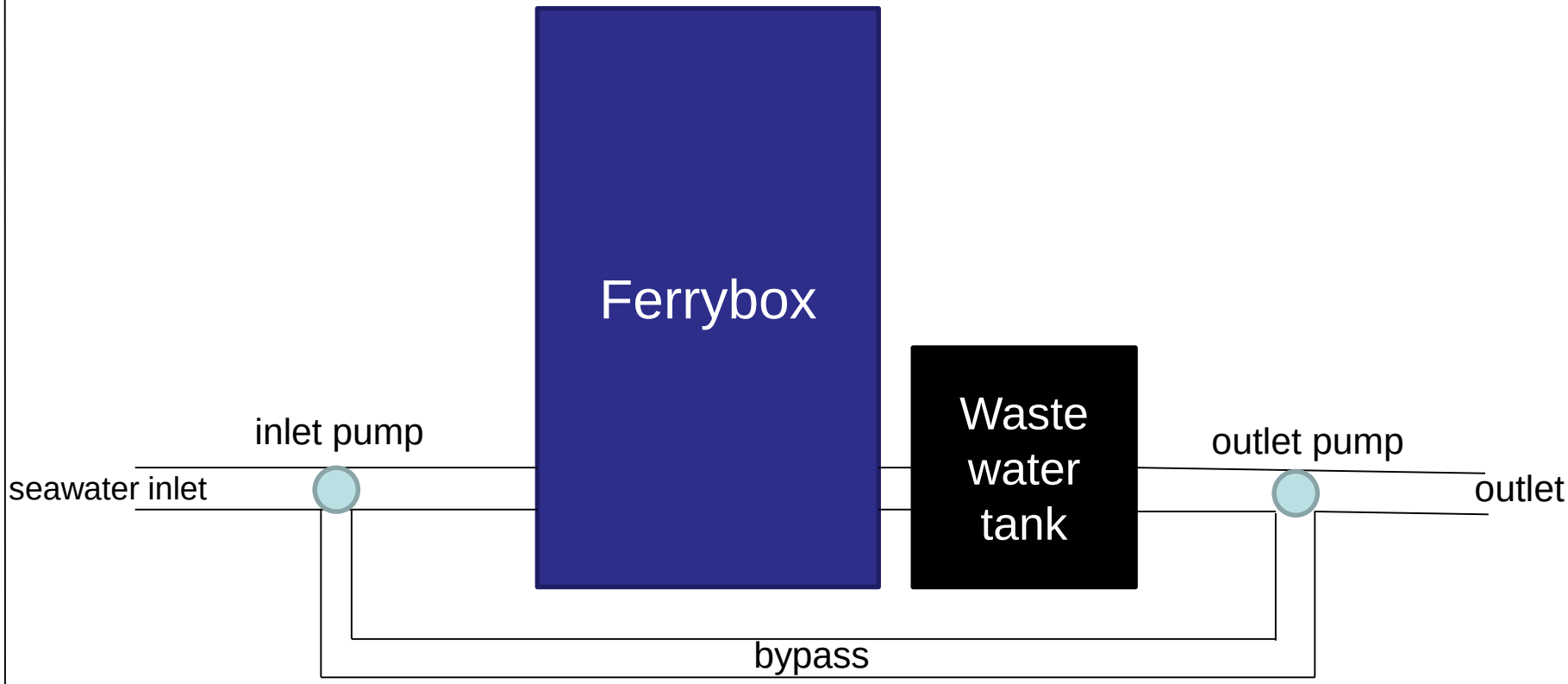
Vessel is not sailing on fixed routes like ferries: Area of operation in 2018 and 2019



FerryBox operating in the Wadden Sea

Most problems we had were created by the turbid water containing a high level of suspended matter !!

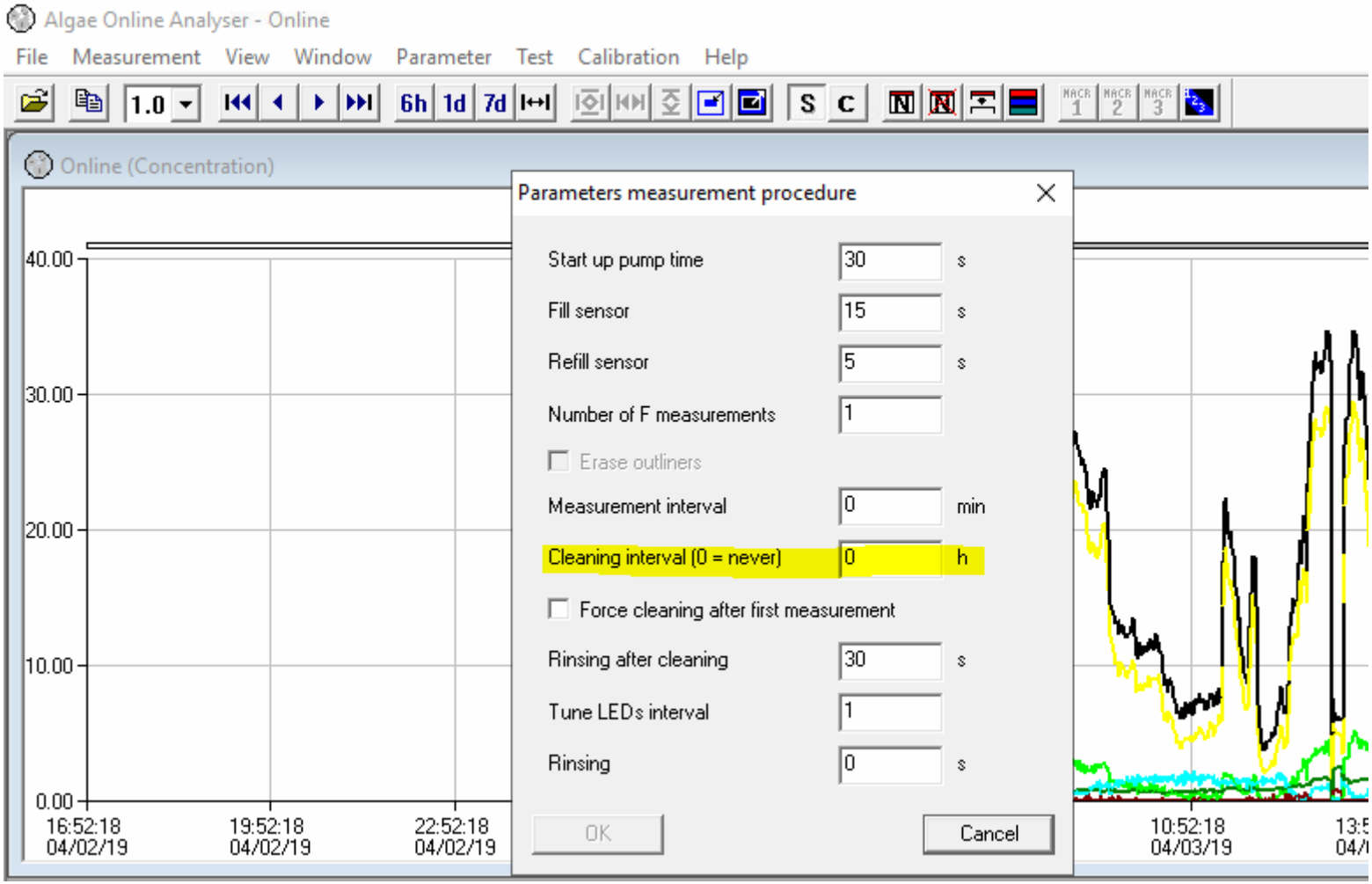
Modifications and improvements - Bypass



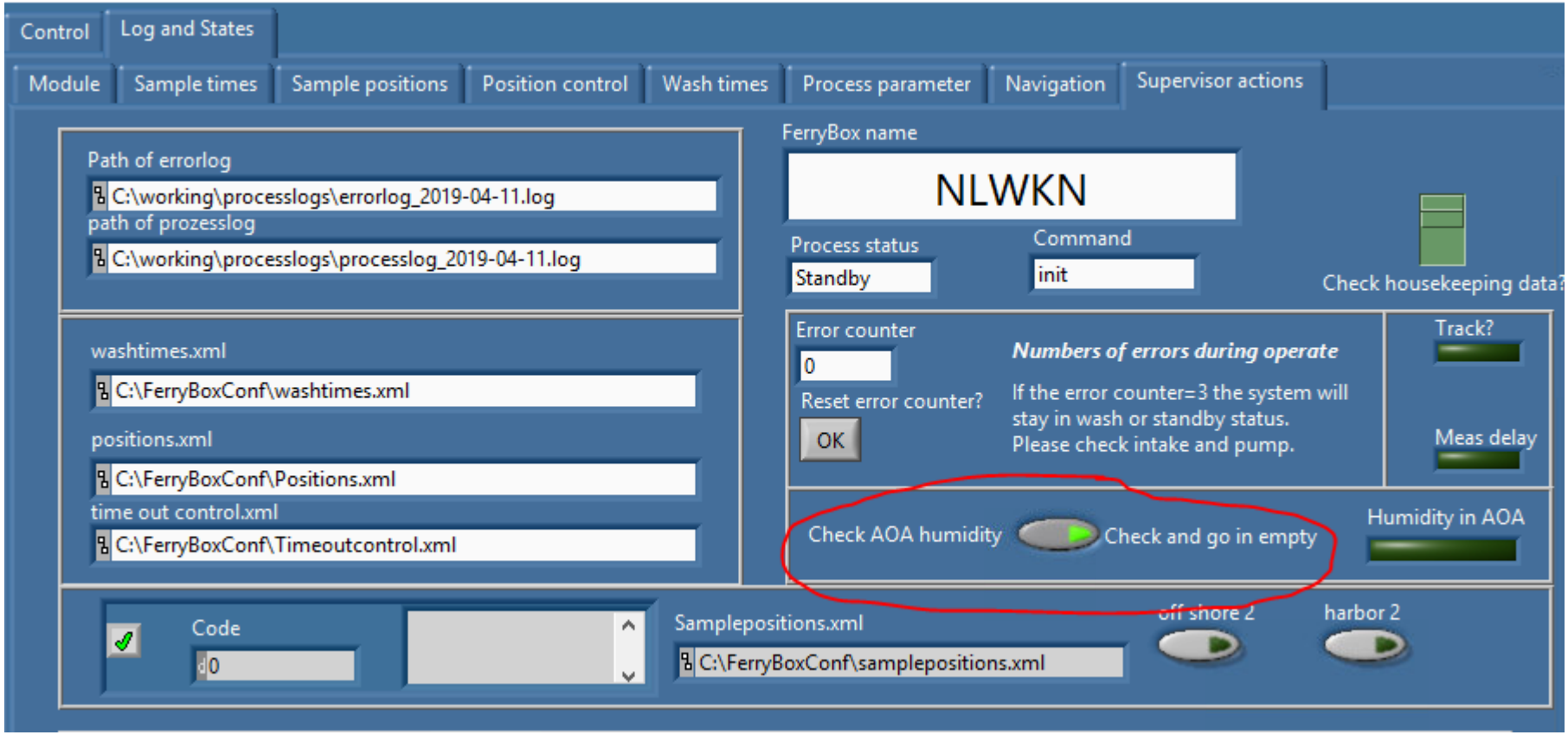
The bypass is used in the first 30 seconds of each track to prevent the inlet of sediments into the FerryBox system.

Scratched Cuvette in the Algae Online Analyzer

Modification of cleaning interval - Algae Online Analyzer

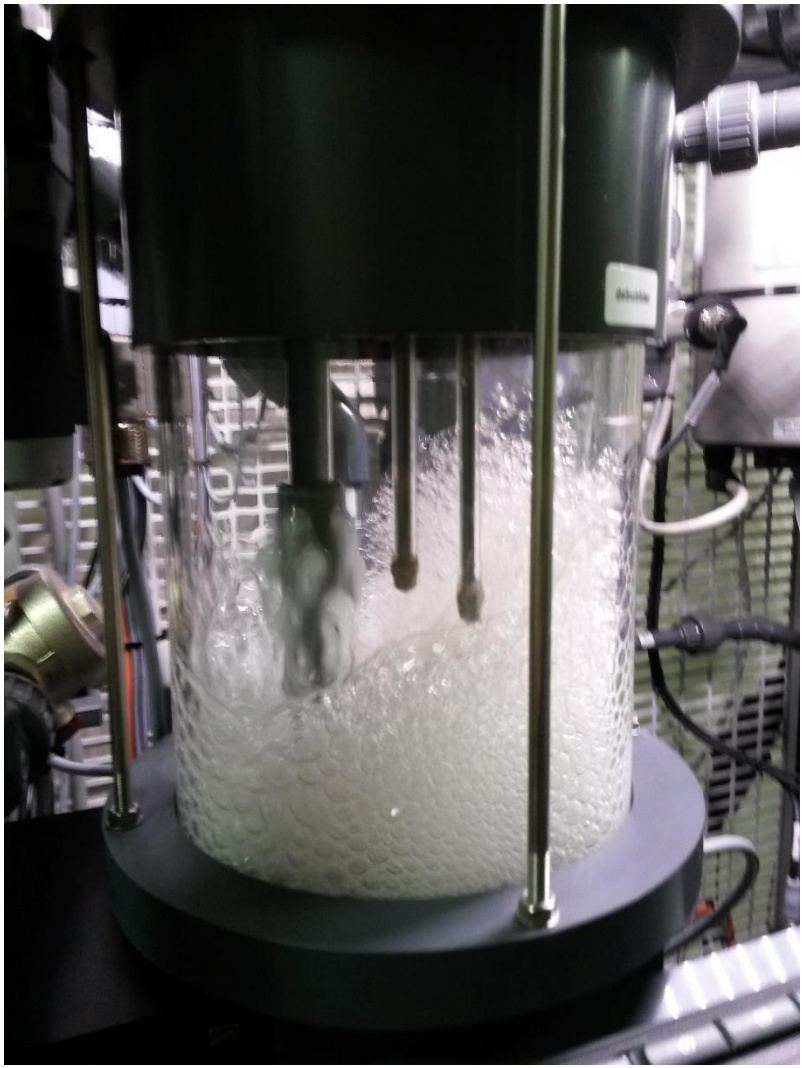


Installation of humidity check - Algae Online Analyzer

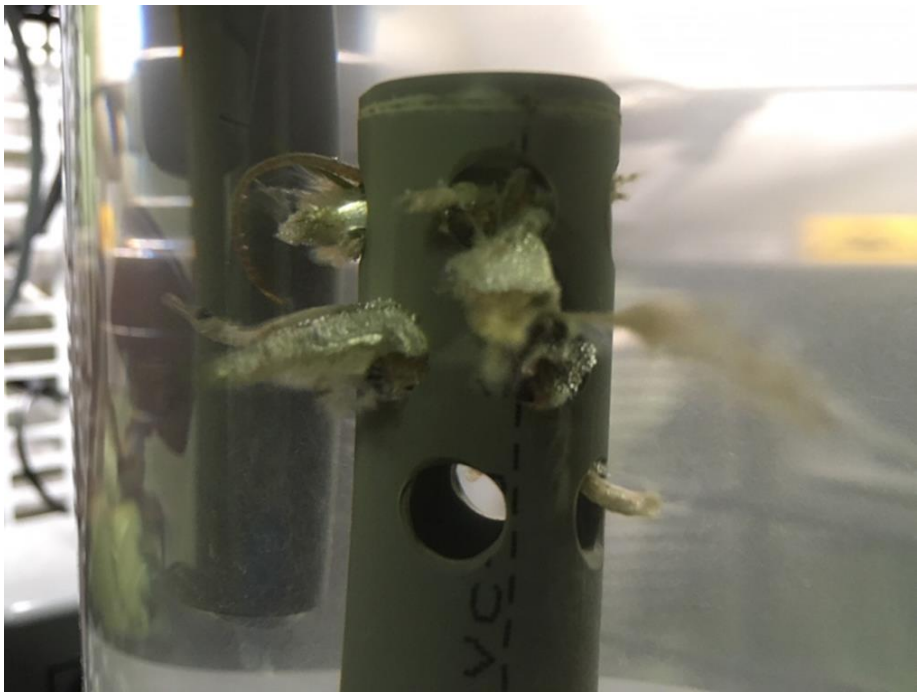


Shallow Inlet for the FerryBox

Effects of missing sea chest



Effects of missing sea chest



Temp_SBE45

Effects of missing sea chest

Temperatur [°C]

4
3.5
3
2.5
2
1.5
1
0.5
0

8:52 9:00 9:07 9:14 9:21 9:28 9:36 9:43 9:50 9:57

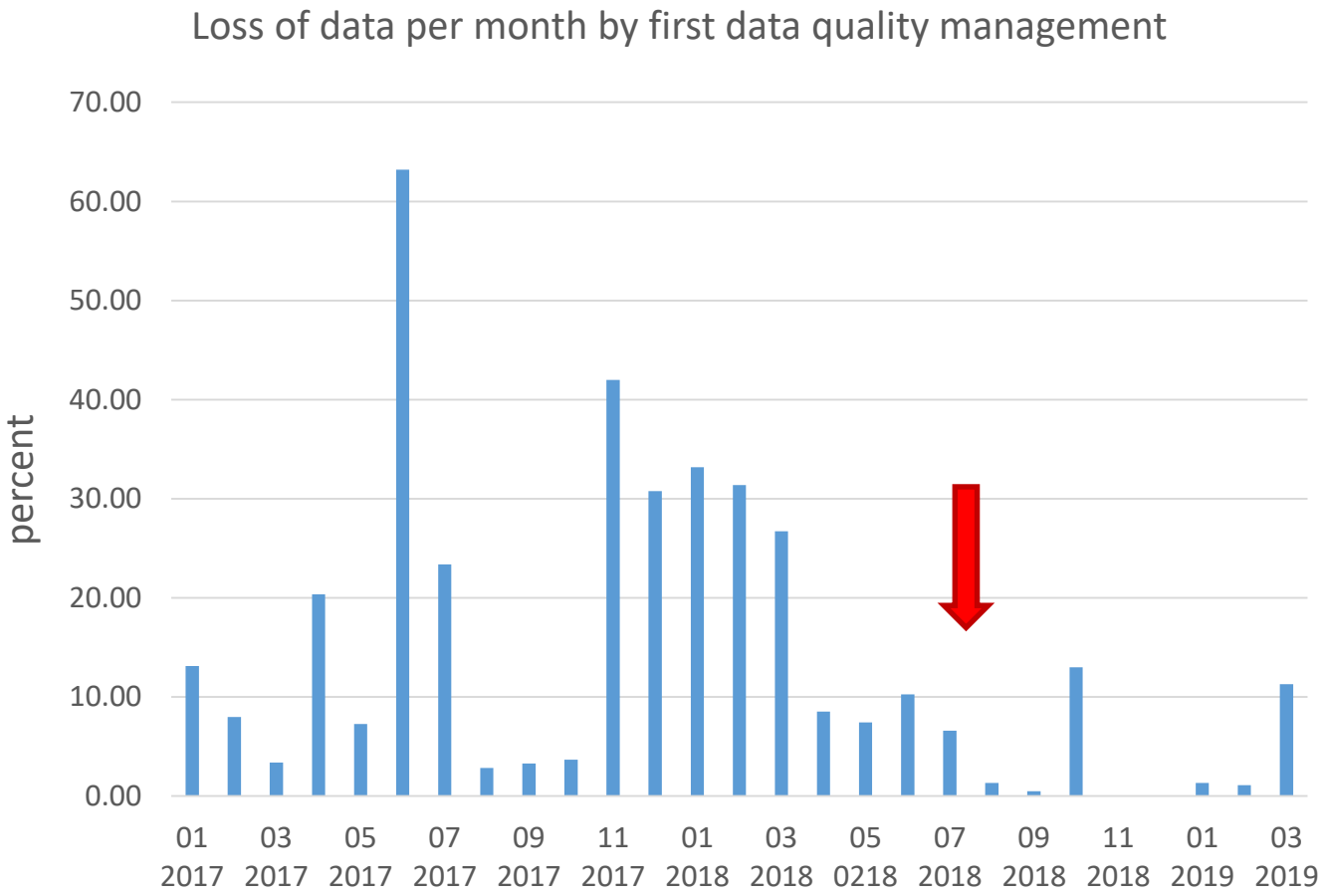
Time

Temp_SBE45

Improvements by the sea chest

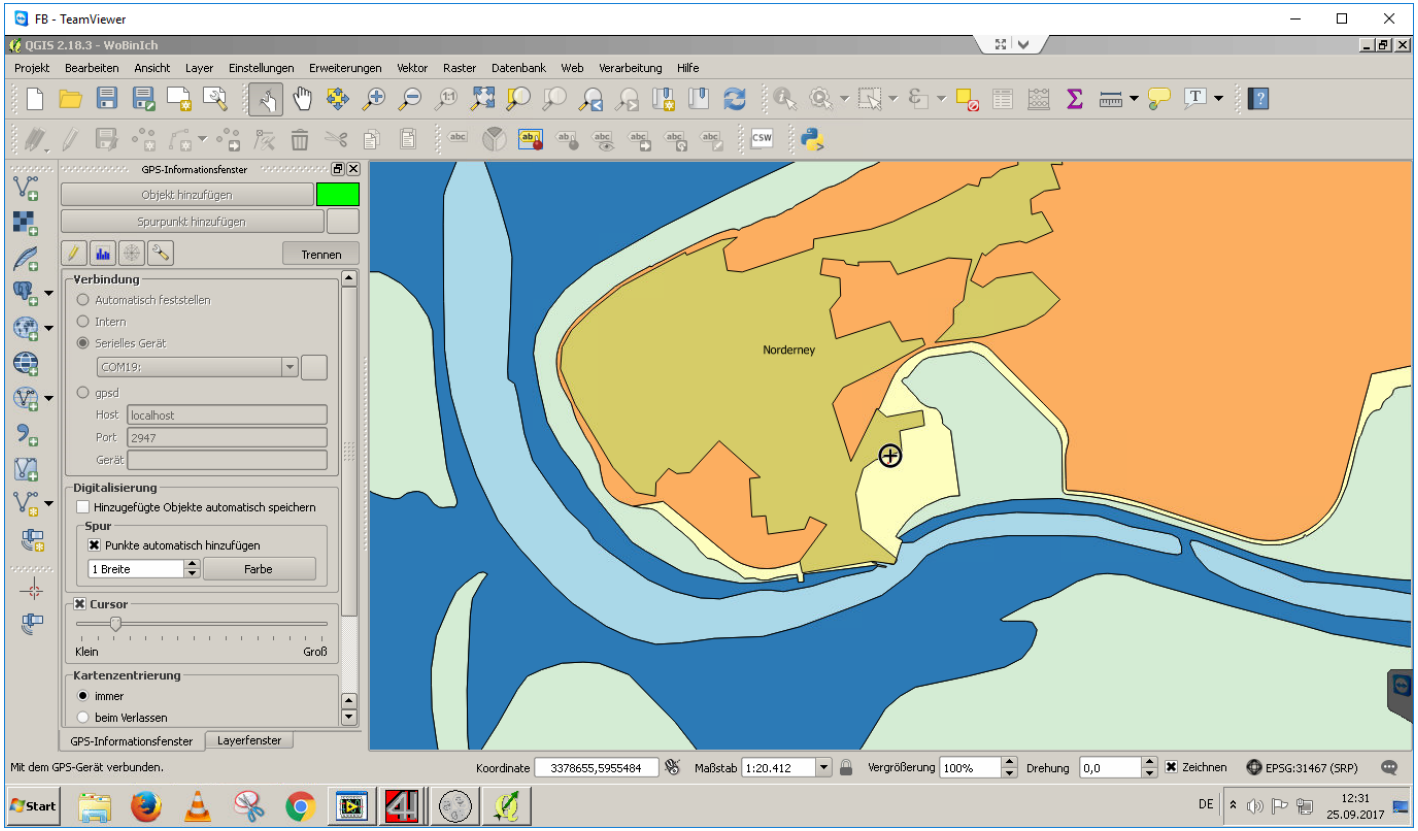
- calming the incoming water, less bubbles in the debubbler and in the pipes
- The coarse-meshed grit in front of the sea chest prevents fishes coming in
- Less data losses caused by bad housekeeping values

Improvements by the sea chest – better quality of data



Webcam for remote monitoring

COM-Port splitter (VSPE) for on site position control using QGIS



- Serial port data can be used by one application only
- With the port splitter we can use GPS-data also for Quantum GIS
- Display the exact position on the FerryBox monitor

Validation and sensitivity study for anorganic nutrients

- Analysers are situated in our laboratory
- Samples are taken by the water sampler

Sensitivity study of anorganic nutrients

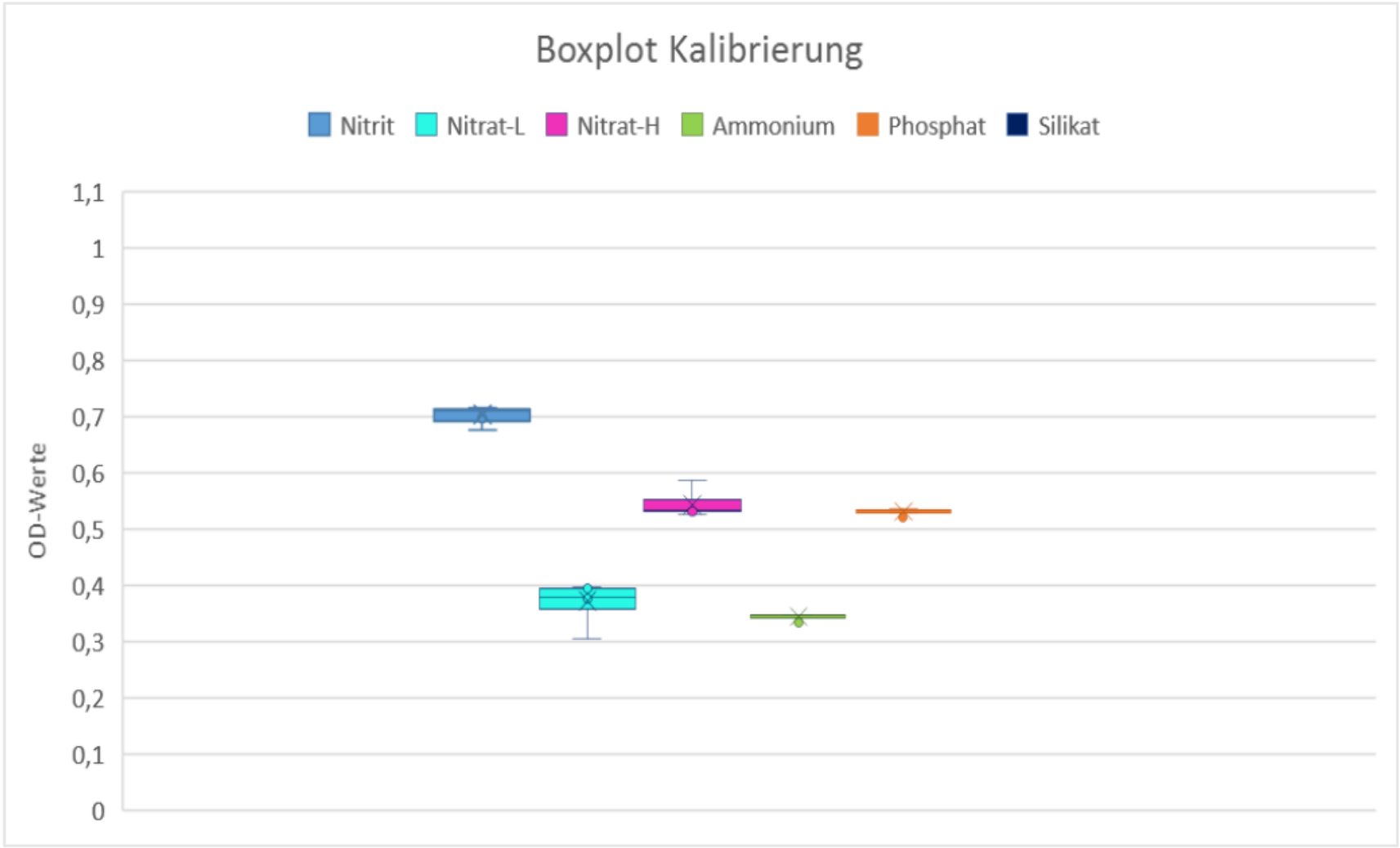
Parameter	Calibration Range [µmol/L]	Limit of Linearity SYSTEA [µmol/L]	Limit of Linearity Lab tests [µmol/L]
$P\text{-}PO_4$	0 - 6,45	19,3	24
$N\text{-}NH_4$	0 - 30	47,1	40
*$N\text{-}NO_3$ LOW	1,12 - 35	46	50
*$N\text{-}NO_3$ HIGH	20,71 - 714,3	714,3	712
$N\text{-}NO_2$	1 - 7,14	9,3	11
$Si\text{-}SiO_2$	0 - 17,86	24,9	30

Our limit is set within a deviation of 10 %

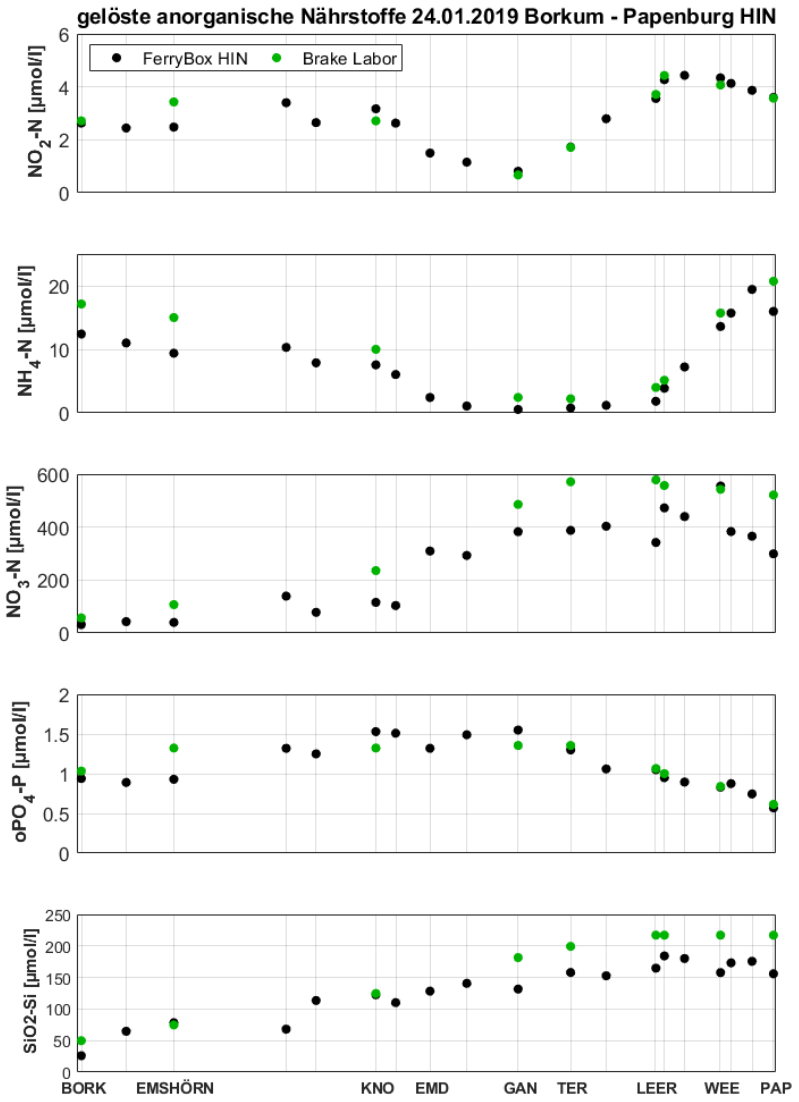
Sensitivity study of anorganic nutrients – measured in dilution

Parameter	Calibration Point Dilution [µmol/L]	Limit of Linearity Dilution [µmol/L]	Limit of Linearity Lab tests [µmol/L]	Deviation [%]
$P\text{-}PO_4$	no dil.	-	-	-
$N\text{-}NH_4$	30 - 76,8	142,9	120	< 10
*$N\text{-}NO_3$ LOW	35 - 129,5	214	-	100: 17 120: 28
*$N\text{-}NO_3$ HIGH	no dil.	no dil.	-	
$N\text{-}NO_2$	7,14 - 33	33	-	10: 40 20: 40
$Si\text{-}SiO_2$	17,86 - 141,6	141,6	120	<10

Nutrients: Scattering range of calibration values



Validation of nutrient analyser data at measurement campagne



- Analyses for PO_4, NH_4 and NO_2 match those from the laboratory
- NO_3: lower concentrations than lab analyses, but mostly same trend
- Analysis for SiO_2 match only in the lower range up to 120 µmol/l

Conclusions for nutrient analysis quality check

- Exact measurements for PO_4 and NH_4 (and NO_2)
- For NO_3 measurements it‘s good to know the approximate quantity
- NO_3 low method up to 50 µmol/l useful
- No accuracy for SiO_2 measurements in freshwater
- The trend of the concentrations are well represented
- Measuring in dilution usually results in measurement uncertainty