



# Ocean Networks Canada

## Ferry Maintenance Report – Queen of Alberni

**Date:** December 19, 2014

**Arrival:** 12:45PM sailing to Tsawwassen. We signed in at terminal supervisor at Duke Point.

**Reporter:** Chris Sundstrom (Servicing), Akash Sastri (Science Analysis)

### Reason for Visit

Regular instrument servicing + assessment of Optode Instruments calibration

### Observations

1. As per the last maintenance visit, we observed significant moisture within the SeaKeeper Box and that this moisture can be attributed to condensation on tubing between manifold and instruments.
2. The AADI optode was slightly dirty with some limited sediment/biofilm growth within the housing.
3. The BBFL2 had a partial yet minor layer of sediment in the housing and some minor fouling on the sensing surface. Fouling was noticed on the “bottom” surface of the horizontal housing.
4. The Seabird 45 CT sensor was generally clean.
5. The flex tubing was in good shape.
6. The sea chest showed no signs of leaks.
7. The inline filter (sea strainer) was checked and was found to be moderately dirty and required some cleaning.



**Actions Taken**

1. Opened both boxes and observed function.
2. Powered down and disassembled instruments in lower assembly.
3. Cleaned and checked over instruments in Engineering room.
4. Ran pre- and post- calibration with standard solutions and with pink test stick and blue test stick for Chl fluorescence and CDOM fluorescence, respectively.
5. Measured optode output for instrument 1415 as well as a lab calibrated instrument (#418) using saturated and zero oxygen solutions. Optode 1415 measured significantly lower values at saturation (~75%) relative to the calibrated optode (418).
6. Re-assembled the instruments in the lower box.
7. Checked over Sea chest and valves, no leaks apparent.
8. Checked and cleaned the sea strainer. Removed biofilm and sediment fouling from the strainer.
9. Turned ON the system.
10. No leaks in instrument housing and checked flow output at sea strainer. Flow was good. Visually confirmed flow direction at the BBFL2 and confirmed the volume filled with water and began draining correctly.
11. Signed out at Engineering room.



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#### Discussion of Test Procedures and Results

The test procedures used are documented in the supplemental report, which also provides preliminary analysis of the data and its consequences.

#### PICTURES



Figure 1: Significant condensation along tubing and outer glass surface of the thermosalinograph.



Figure 2: Moderate fouling apparent in the CT unit.



Figure 3: No obvious fouling and sediment on the OPTODE.



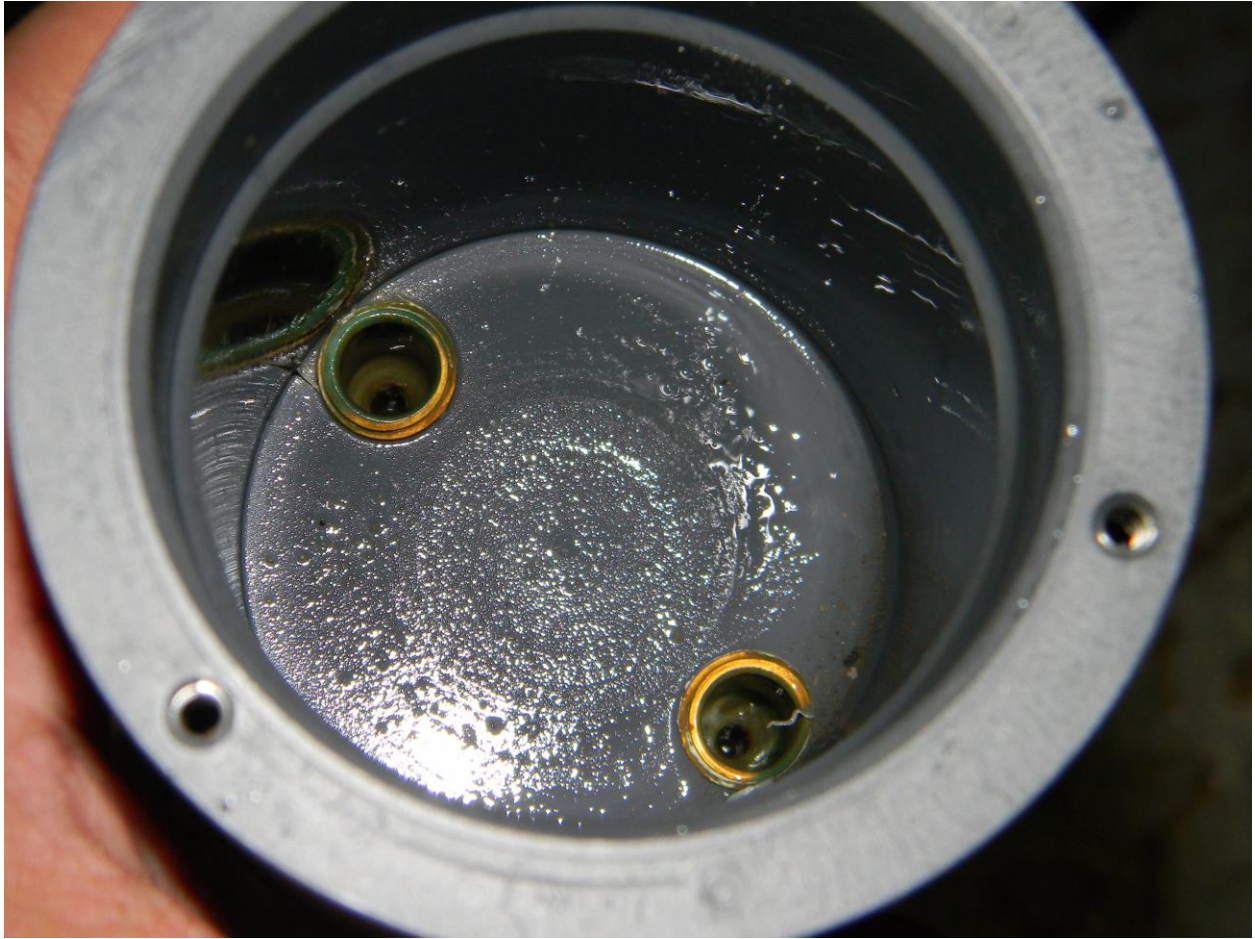


Figure 4: Minor sediment within the OPTODE housing.

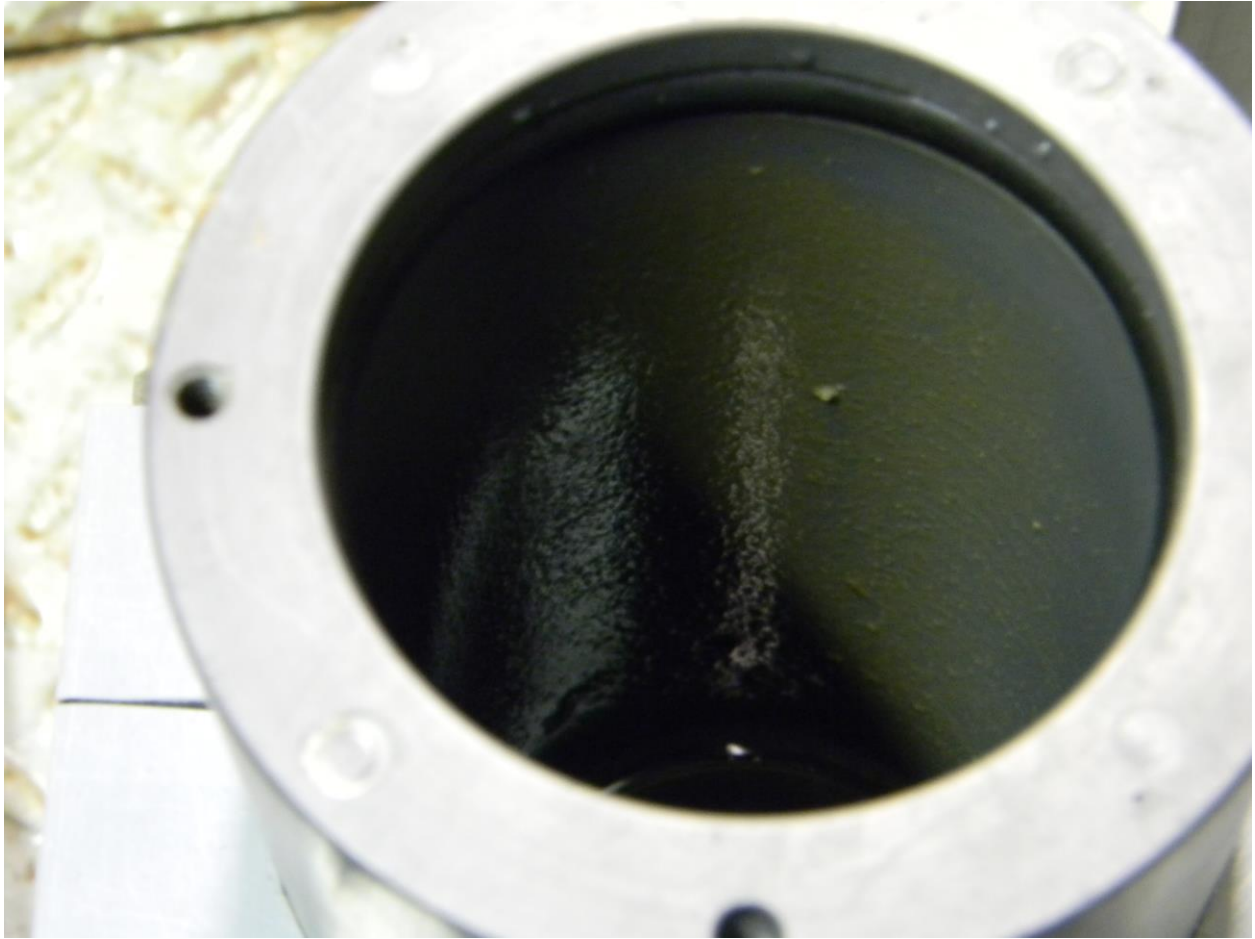


Figure 5: Minor biological growth along the inner BBFL2 housing wall.

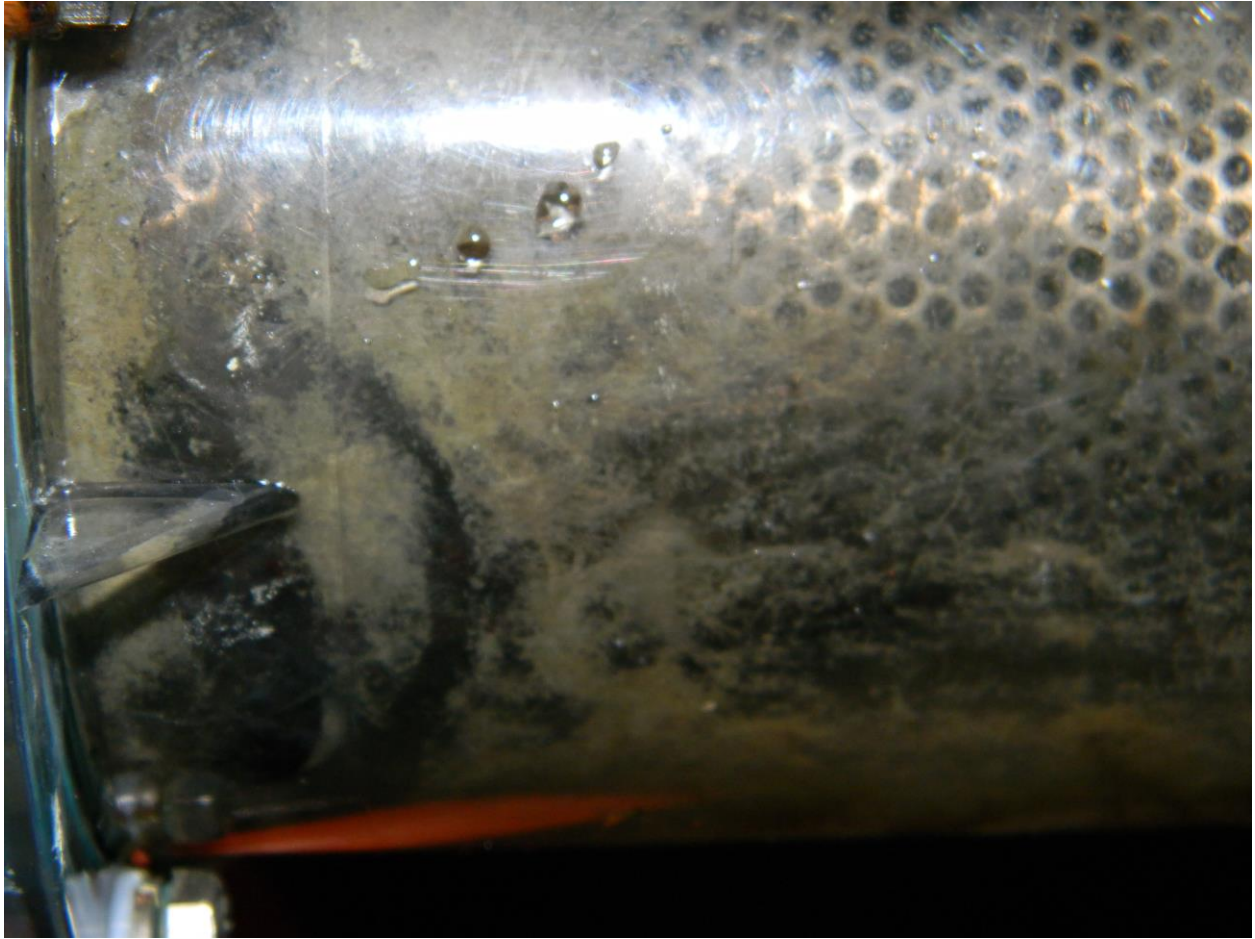


Figure 6: Sea Strainer.



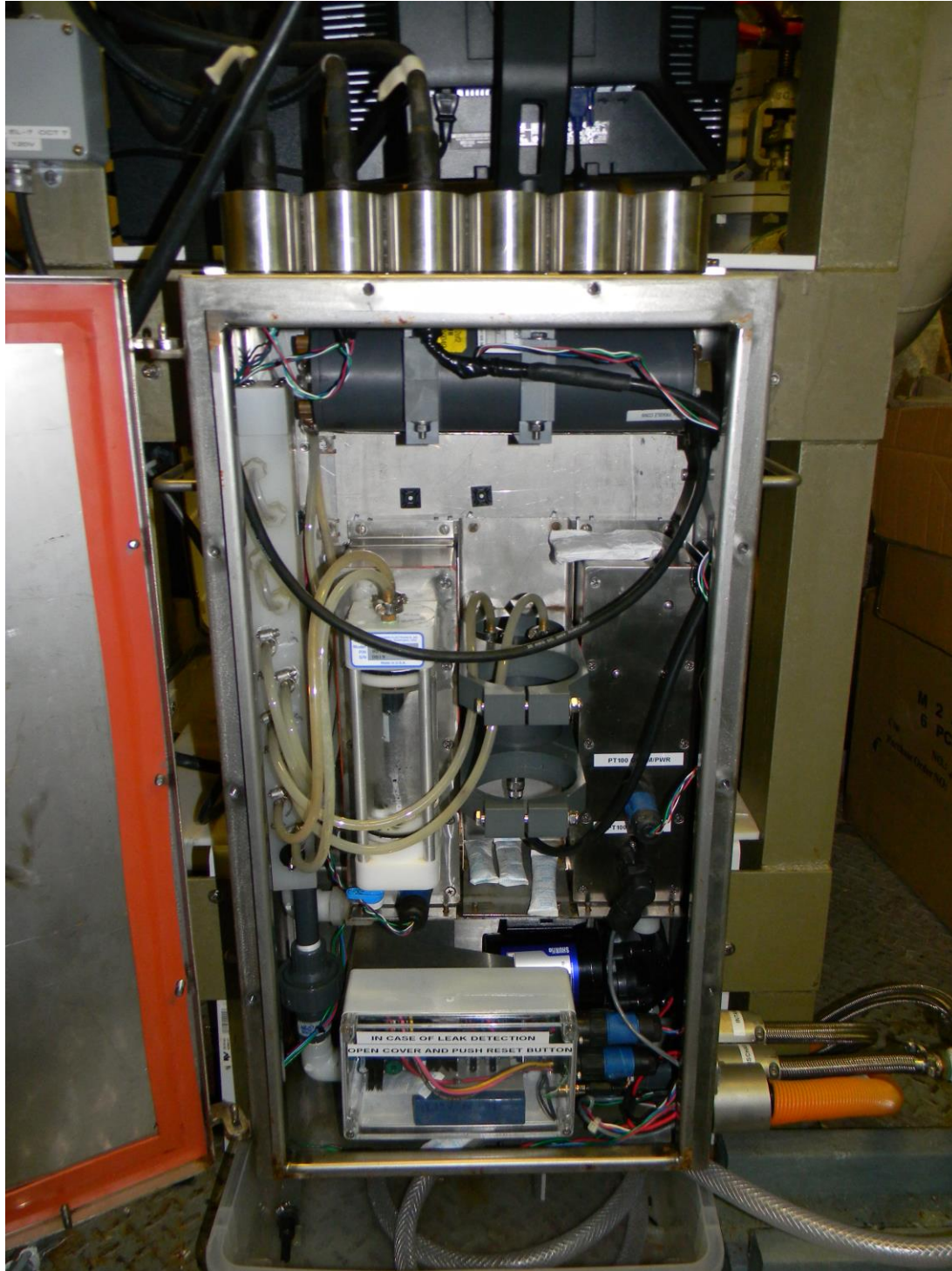


Figure 2: System upon completion.



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#### In situ CDOM and Chlorophyll fluorescence (BBFL2) corrections

December 19, 2014

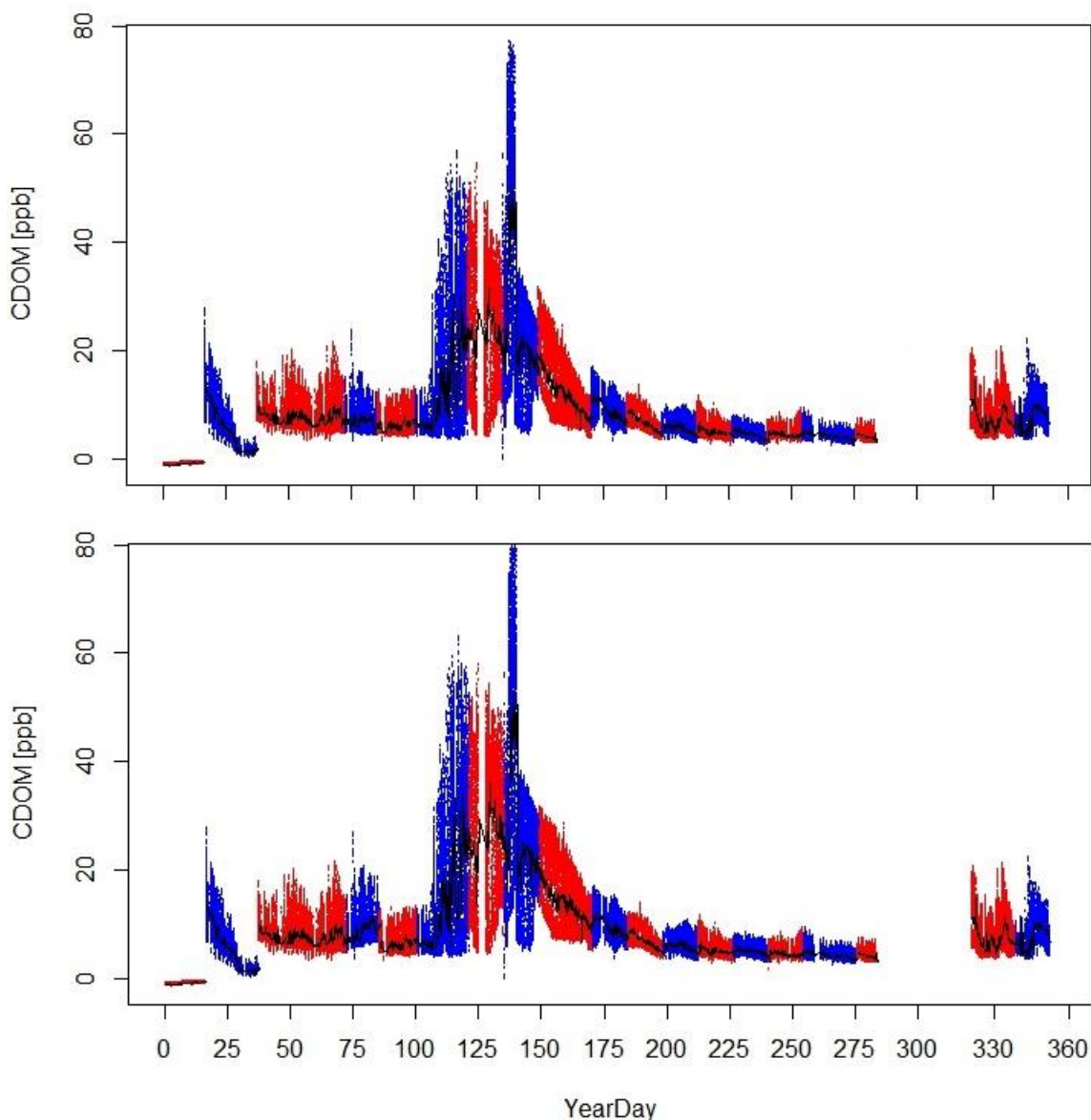


Figure 1. Time series of a) un-corrected; and b) corrected CDOM fluorescence measured en route between Duke Point (Vancouver Island) and Tsawwassen (Mainland, BC) by the BBFL2 unit of the SeaKeeper 1000 instrument suite on board the BC ferry, the Queen of Alberni. Red and blue symbols are used to distinguish between instrument cleaning dates. The difference between pre- and post-cleaning fluorescence of either diluted tonic water or Sprite Zero is typically used to calculate a correction factor (%) which was applied as a linear correction retrospectively between cleaning dates December 6 and December 19, 2014. The most recent cleaning event took place on December 19, 2014. Here we applied a correction based on pre- and post- fluorescence of Tonic Water. Note: an instrument inter-calibration applied to all data following day 149 when BBFL2-786 was swapped out for BBFL2-787.



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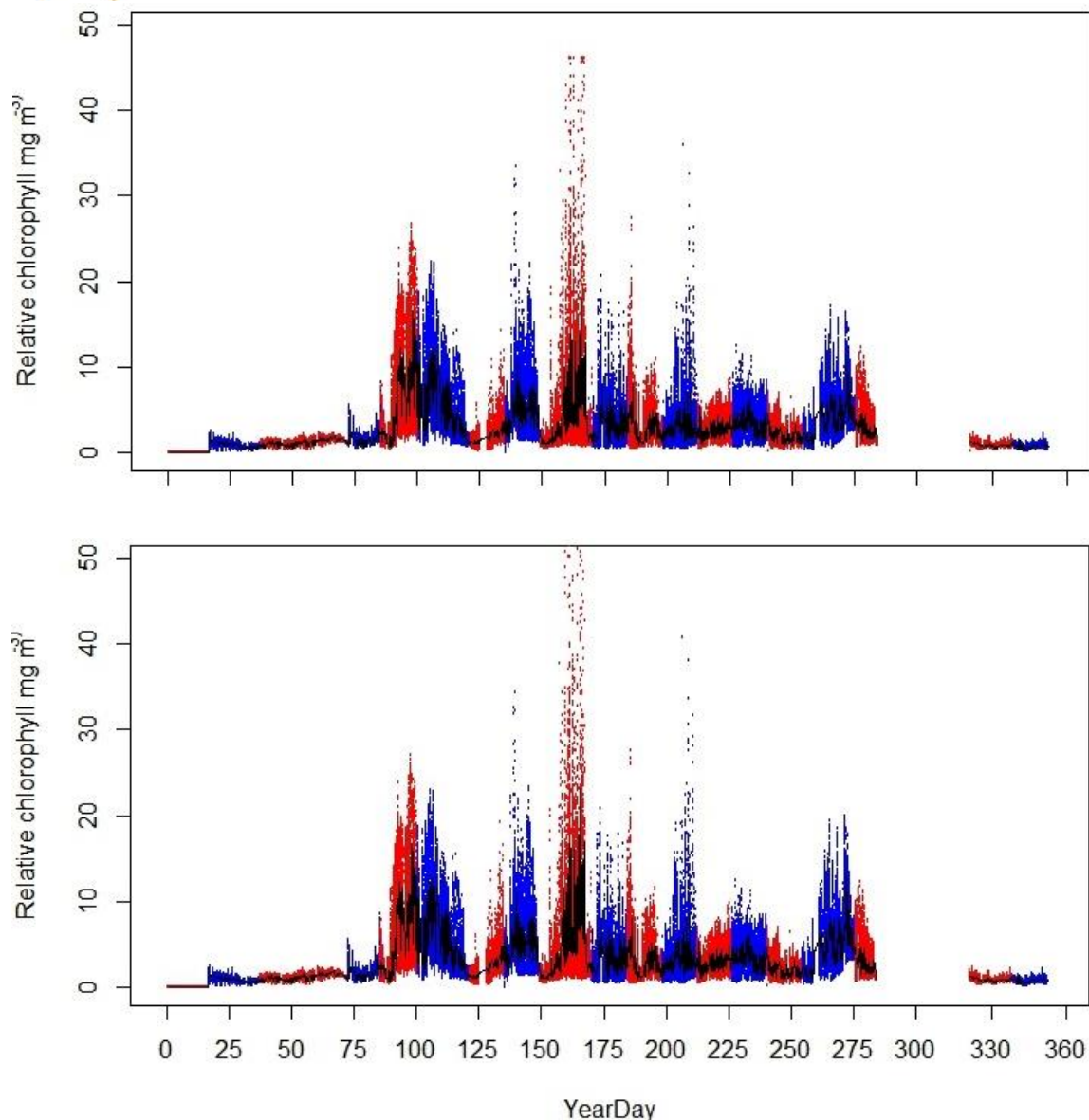


Figure 2. Time series of a) un-corrected; and b) corrected Chl fluorescence measured en route between Duke Point (Vancouver Island) and Tsawwassen (Mainland, BC) by the BBFL2 unit of the SeaKeeper 1000 instrument suite on board the BC ferry, the Queen of Alberni. Red and blue symbols are used to distinguish between instrument cleaning dates. The difference between pre- and post-cleaning fluorescence of diet coke was used to calculate a correction factor (%) which was applied as a linear correction retrospectively between cleaning dates. The most recent cleaning event took place on December 19, 2014. On this date we measured a positive (~5%) response of Diet Coke fluorescence to cleaning (see Table 1). This correction factor was applied retrospectively from December 6 through December 19, 2014. Note: an instrument inter-calibration applied to all data following day 149 when BBFL2-786 was swapped out for BBFL2-787.



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Table 1. December 19, 2014. Mean ( $\pm$ standard error) values of pre- and post-cleaning fluorescence for solutions/fluorescent sticks specific to CDOM and Chlorophyll fluorescence. 'fluor' values for Diet Coke (Chl) and diluted tonic water or Sprite Zero (CDOM) have been used at every cleaning since March 14, 2014 to assess the degree of signal decay between cleanings. The post-cleaning fluorescence values for the pink and blue sticks were lower than pre- values, yielding a negative response to cleaning. Sprite Zero fluorescence measured after cleaning was slightly lower (significantly,  $p < 0.0001$ ) and not used for CDOM corrections applied in Figure 1. All other (solution-based) measurements yielded positive responses to cleaning; however moderate, suggesting minimal bio-fouling since the last cleaning which took place during a complete system maintenance on December 5, 2014.

CDOM/Chl Fluorescence	Method	Pre- (mean $\pm$ SEM)	Post- (mean $\pm$ SEM)	$\Delta$ fluor (%)
CDOM	Diluted tonic water	136.95 $\pm$ 0.03	141.59 $\pm$ 0.015	0.03
CDOM	Sprite Zero	47.32 $\pm$ 0.01	47.13 $\pm$ 0.01	-0.004
CDOM	Blue fluorescent stick	55.72 $\pm$ 0.04	52.45 $\pm$ 0.04	-0.06
Chl	Diet Coke	5.47 $\pm$ 0.006	5.77 $\pm$ 0.002	0.05
Chl	Pink fluorescent stick	11.03 $\pm$ 0.02	8.68 $\pm$ 0.002	-0.27





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Table 2. Comparison of oxygen saturation values between a lab-calibrated instrument (#418) and the instrument aboard the Queen of Alberni (#1415). Mean and standard errors of the means were calculated on values recorded when instrument output stabilized following immersion of the optode into either oxygen saturated (bubbled) or zero oxygen (sodium thiosulfate addition to the saturated solution) water.

	<b>Optode #418 (mean± SEM)</b>	<b>Optode #1415 (mean± SEM)</b>
100% solution	99.66±0.04	74.62±1.36
0% solution	-0.12±0.003	0.64±0.01