



# Ocean Networks Canada

## Ferry Maintenance Report – Queen of Alberni

**Date:** January 9, 2015

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

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

**Attending Personnel:** Chris Sundstrom (ONC-Operations), Akash Sastri (ONC-Science)

### Reason for Visit

Regular instrument servicing + Calibration/comparison of Optode Instruments measurements  
Replacement of failed Optode instrument

### Observations

1. There was slight moisture in the Instrument Box. The moisture, from all indications, came from condensation.
2. The AADI optode was slightly dirty with some limited sediment/biofilm growth within the housing.
3. The BBFL2 had a partial 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 mildly dirty, with no mussels found growing within the housing on the sensor outlet port.
5. The flex tubing was dirty and too short to re-terminate. All tubing was replaced with new longer lengths.
6. The sea chest showed no signs of leaks.
7. The inline filter (sea strainer) was checked and was found to be slightly dirty and required cleaning.



### **Actions Taken**

1. Opened both boxes and observed function. The system was functioning normally upon arrival.  
The pump motor was louder than normal (recording made) and filling of the system by the pump seemed slower than normal; suggested to watch the pump motor for possible early failure.
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 Orange test stick and blue test stick for CDOM fluorescence and Chl fluorescence.
5. Re-assembled the instruments in the lower box.
6. Checked over Sea chest and valves, no leaks apparent.
7. Checked and cleaned the sea strainer. Removed biofilm and sediment fouling from the strainer.
8. Installed replacement OPTODE system (SN 418).
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. Noted that flow was lower than expected.
11. Signed out at Engineering room.

### **Future Actions**

1. Monitor pump condition, bringing fitted-out spare for possible installation.



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### **Discussion of Test Procedures and Results**

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

### **PICTURES**



**Figure 1: Instrument Box upon arrival**





Figure 2: CT Unit. Note condensation on tubing



Figure 3: Optode fouling

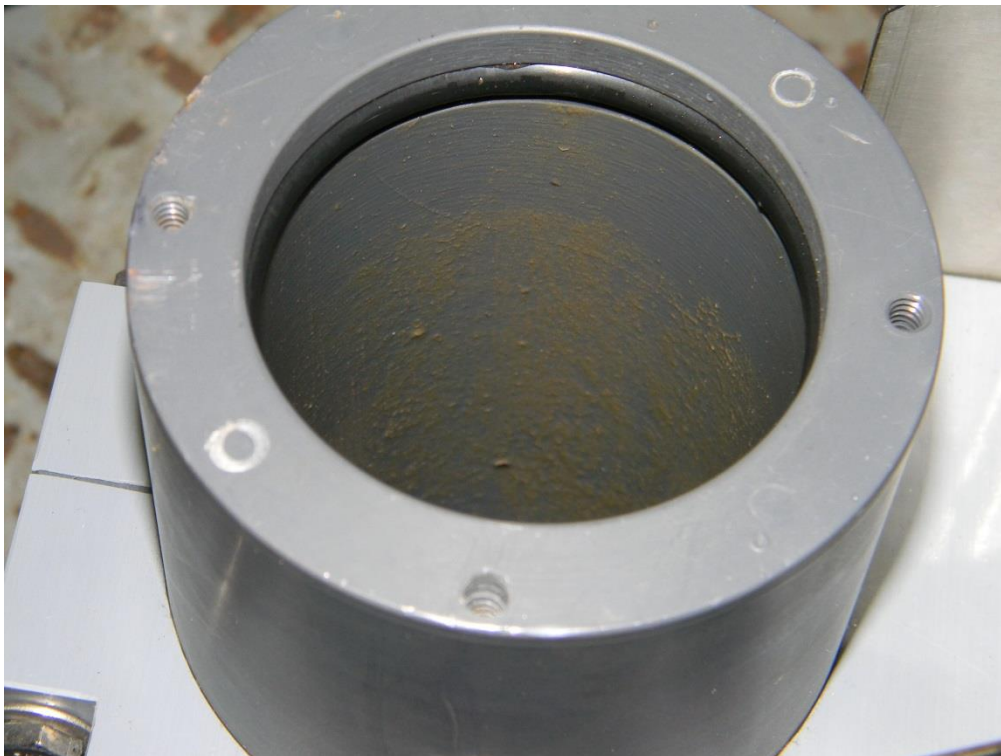


Figure 4: BBFL2 Fouling





Figure 5: New Optode Mounted



Figure 6: Sea Strainer

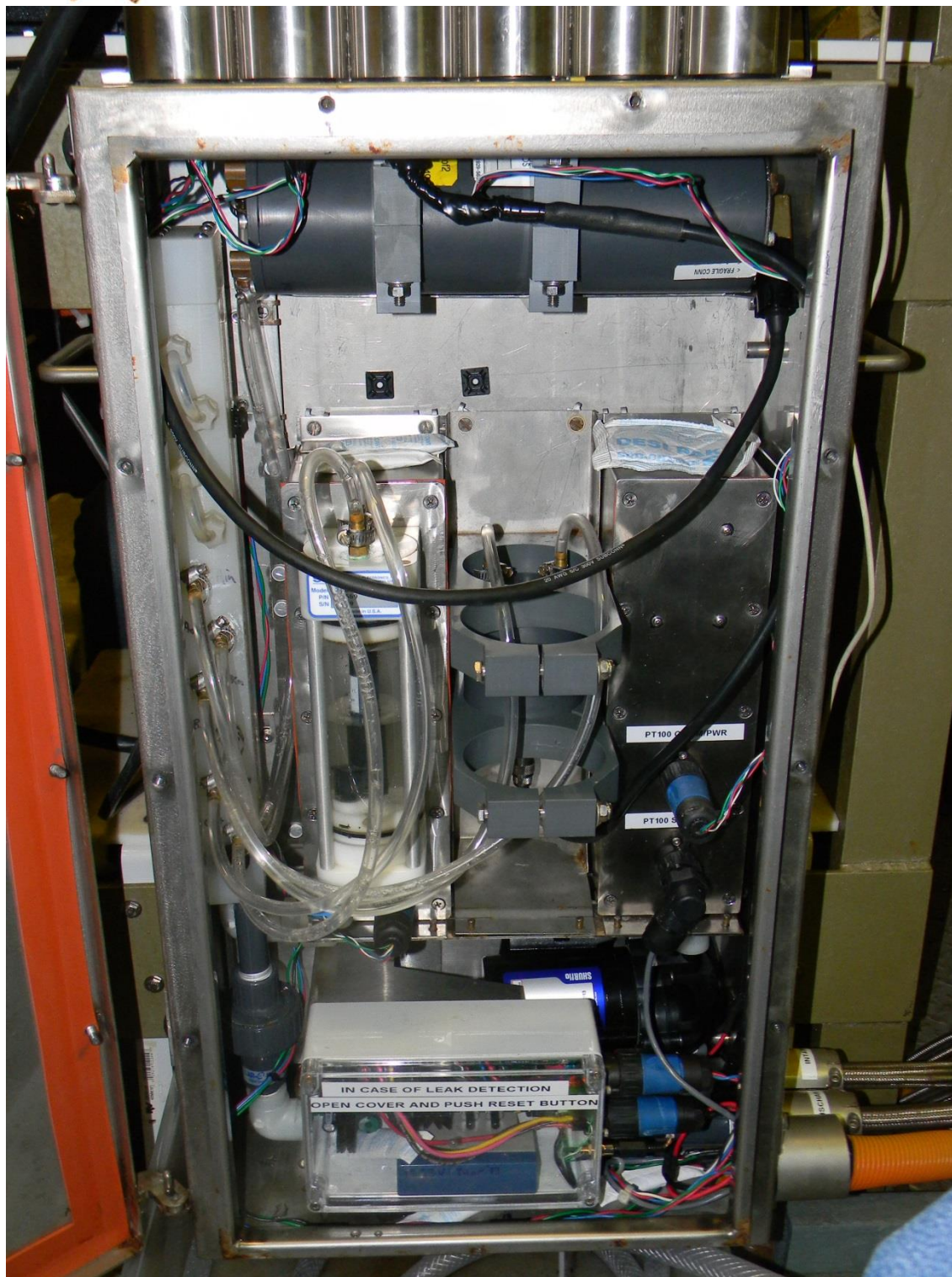


Figure 7: Instrument Box upon departure





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

January 9, 2015

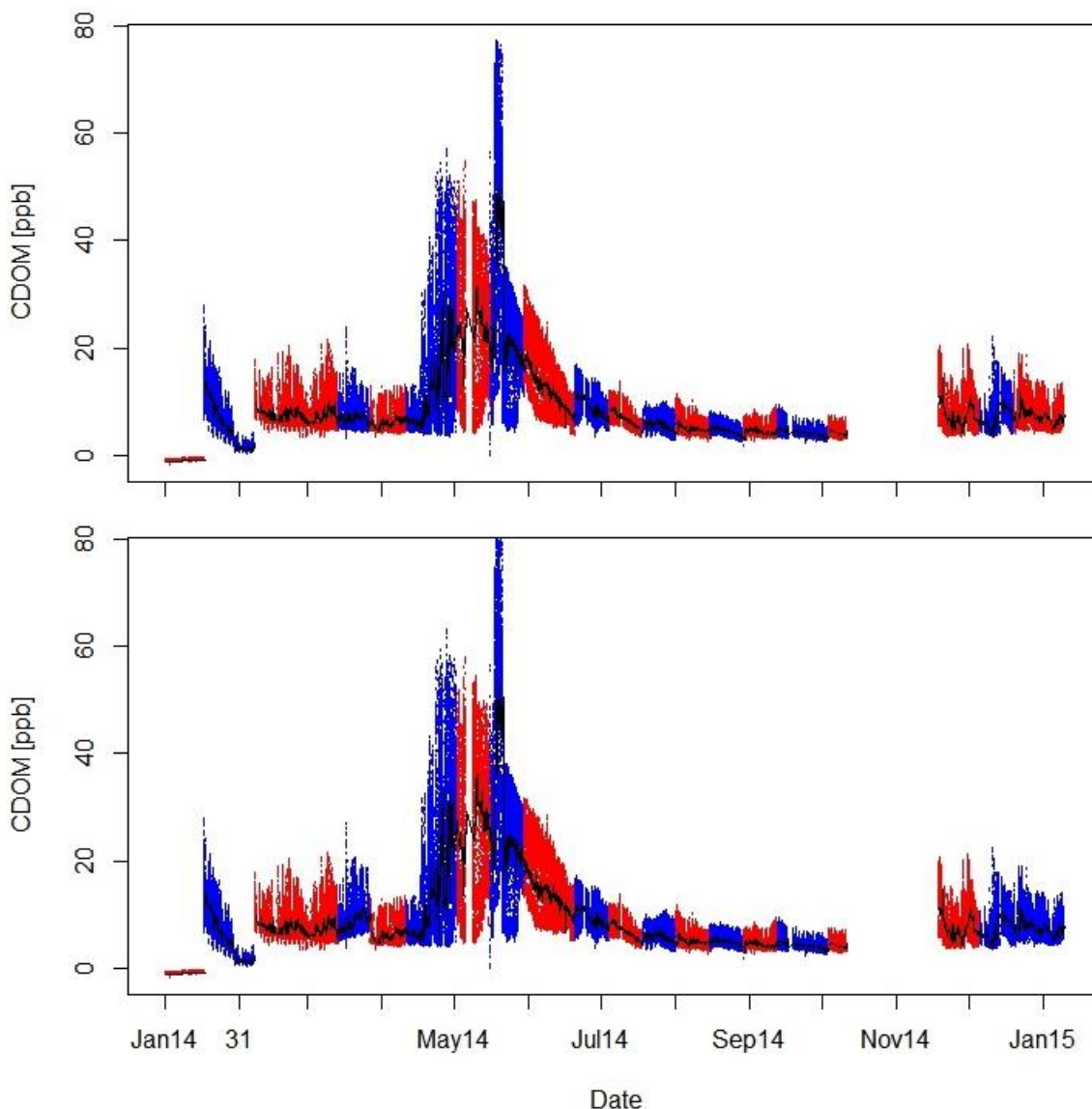


Figure 1. Time series of a) un-corrected; and b) corrected CDOM fluorescence measured en route between Duke Point (Vancouver Island) and Tsawwassen (Mainland, BC) by the BBFL2 unit of the SeaKeeper 1000 instrument suite on board the BC ferry, the Queen of Alberni. Red and blue symbols are used to distinguish 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 19, 2014 and January 9, 2015. The most recent cleaning event took place on January 9, 2015. 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.

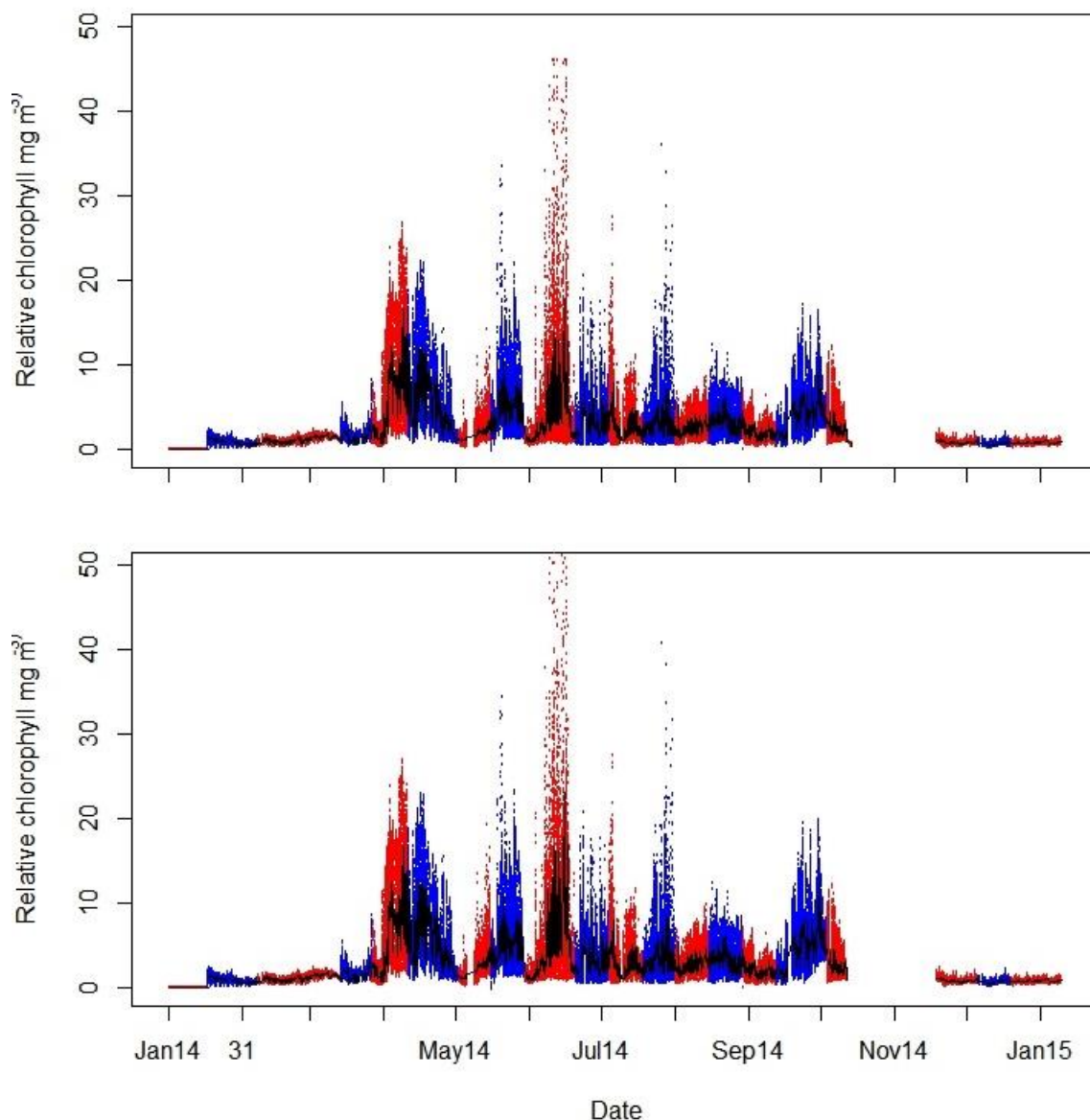


Figure 2. Time series of a) un-corrected; and b) corrected Chl fluorescence measured en route between Duke Point (Vancouver Island) and Tsawwassen (Mainland, BC) by the BBFL2 unit of the SeaKeeper 1000 instrument suite on board the BC ferry, the Queen of Alberni. Red and blue symbols are used to distinguish 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 January 9, 2015. On this date we measured a positive (<1%) response of Diet Coke fluorescence to cleaning (see Table 1). This correction factor was applied retrospectively from December 19, 2014 through January 9, 2015. 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. January 9, 2015. Mean ( $\pm$ standard error) values of pre- and post-cleaning fluorescence for solutions/fluorescent sticks specific to CDOM and Chlorophyll fluorescence. 'Δ 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 19, 2014.

CDOM/Chl Fluorescence	Method	Pre- (mean $\pm$ SEM)	Post- (mean $\pm$ SEM)	Δ fluor (%)
CDOM	Diluted tonic water	128.08 $\pm$ 0.02	133.84 $\pm$ 0.071	0.04
CDOM	Sprite Zero	49.72 $\pm$ 0.02	49.32 $\pm$ 0.02	-0.008
CDOM	Blue fluorescent stick	60.84 $\pm$ 0.05	56.14 $\pm$ 0.02	-0.08
Chl	Diet Coke	6.00 $\pm$ 0.002	6.05 $\pm$ 0.002	0.008
Chl	Pink fluorescent stick	9.70 $\pm$ 0.003	7.39 $\pm$ 0.003	-0.31





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Table 2. Comparison of oxygen saturation values between a lab-calibrated instrument (#418; December 19, 2014 values) and the instrument aboard the Queen of Alberni (#1415; January 9, 2015). 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. Instrument #1415 was removed from service and replaced with instrument #418 on this maintenance trip.

	<b>Optode #418 (mean± SEM)</b>	<b>Optode #1415 (mean± SEM)</b>
100% solution	99.66±0.04	79.63±0.031
0% solution	-0.12±0.003	00.64±0.029