

**Cruise:** HB1803  
**Ship:** R/V Henry Bigelow  
**Expo Code:** 33HH20180523  
**Dates:** May 23, 2018 to June 5, 2018  
**Chief Scientist:** Jerry Prezioso  
**Equipment:** CTD and TSG-Flow thru system  
**Total number of stations:** 23  
**Location:** U.S. Mid-Atlantic and New England coastal region

The samples were run for Chris Melrose of the NEFSC as part of our coastal ocean acidification monitoring project.

### **Sample Collection**

The discrete samples were collected from Niskin bottles attached to a 24 bottle configured rosette and TSG-flow thru system onboard the R/V H. Bigelow by the survey tech Christopher Taylor. The date and time listed in the data file are UTC when each sample bottle was collected.

#### **DIC:**

23 locations, 83 samples each 500-ml, 8 duplicate samples.

Sample\_ID#: 90101, etc.; Station, cast number and Niskin bottle number

PI: Dr. Rik Wanninkhof

Analyzed by: Charles Featherstone and Patrick Mears

#### **pH:**

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#### **TAlk:**

23 locations, 83 samples each 500-ml, 8 duplicate samples.

Sample\_ID#: 90101, etc.; Station, cast number and Niskin bottle number

PI: Dr. Rik Wanninkhof

Analyzed by: Dr. Leticia Barbero, Charles Featherstone and Patrick Mears

### **Sample Analysis**

#### **DIC:**

Instrument ID	Date	Certified CRM (μmol/kg)	CRM Value (μmol/kg)	CRM Offset (μmol/kg)	Blank (Counts)	Avg. Sample Analysis Time
AOML 5	08/08/2018	2042.41	2040.93	1.48	15.0	9

AOML 5	08/09/2018	2042.41	2043.12	0.71	12	9
AOML 6	08/08/2018	2042.41	2045.29	2.88	12	8
AOML 6	08/09/2018	2042.41	2046.69	4.28	15	9

Analysis date: 08/08/2018

Coulometer used: DICE–CM5011- AOML 5

Blanks: 15.0 counts/min

CRM # 230 was used and with an assigned value of (includes both DIC and salinity):

Batch 173, c: 2042.41  $\mu\text{mol/kg}$ , S: 33.414

CRM values measured: AOML 5: offset 1.48  $\mu\text{mol/kg}$  (2040.93  $\mu\text{mol/kg}$ ).

Average run time, minimum run time, maximum run time: 9, 7 and 12 min.

Analysis date: 08/09/2018

Coulometer used: DICE–CM5011- AOML 5

Blanks: 12.0 counts/min

CRM # 355 was used and with an assigned value of (includes both DIC and salinity):

Batch 173, c: 2042.41  $\mu\text{mol/kg}$ , S: 33.414

CRM values measured: AOML 5: offset 0.71  $\mu\text{mol/kg}$  (2043.12  $\mu\text{mol/kg}$ ).

Average run time, minimum run time, maximum run time: 9, 7 and 12 min.

Analysis date: 08/08/2018

Coulometer used: DICE–CM5011- AOML 6

Blanks: 12.0 counts/min

CRM # 166 was used and with an assigned value of (includes both DIC and salinity):

Batch 173, c: 2042.41  $\mu\text{mol/kg}$ , S: 33.414

CRM values measured: AOML 6: offset 2.88  $\mu\text{mol/kg}$  (2045.29  $\mu\text{mol/kg}$ ).

Average run time, minimum run time, maximum run time: 8, 7 and 20 min.

Analysis date: 08/09/2018

Coulometer used: DICE–CM5011- AOML 6

Blanks: 15.0 counts/min

CRM # 416 was used and with an assigned value of (includes both DIC and salinity):

Batch 173, c: 2042.41  $\mu\text{mol/kg}$ , S: 33.414

CRM values measured: AOML 6: offset 4.28  $\mu\text{mol/kg}$  (2046.69  $\mu\text{mol/kg}$ ).

Average run time, minimum run time, maximum run time: 9, 8 and 11 min.

**Reproducibility:** (# samples and average difference): 8 duplicate samples were collected with an average difference 0.52  $\mu\text{mol/kg}$  (0.03 – 1.50) and an average STDEV of 0.36 (0.02 – 1.06).

Instrument	Sample ID	DIC (umol/kg)	Average	STDEV	Difference
AOML5	50101	2064.07			
AOML5	50101	2064.04	2064.06	0.02	0.03
AOML5	110402	2188.58			
AOML5	110402	2190.08	2189.33	1.06	1.50

AOML5	210501	2073.32			
AOML5	210501	2073.61	2073.46	0.21	0.29
AOML6	240611	2051.74			
AOML6	240611	2051.44	2051.59	0.21	0.29
AOML6	591201	2044.02			
AOML6	591201	2043.25	2043.63	0.54	0.76
AOML5	721402	2175.78			
AOML5	721402	2175.13	2175.45	0.46	0.65
AOML5	921703	2144.05			
AOML5	921703	2144.54	2144.29	0.34	0.49
AOML6	991911	2003.03			
AOML6	991911	2002.92	2002.97	0.08	0.11
Average				0.36	0.52

CRM, salinity and HgCl<sub>2</sub> correction applied: Salinity correction was applied using TSG salinity.

### **Remarks**

The volume correction was applied due to added HgCl<sub>2</sub> (Measured DIC\*1.00037).  
The first CRM of each cell was used for a CRM correction.

The DIC instruments were stable: the gas loop and CRM values did not change significantly throughout the life span of each cell.

### **pH:**

Analysis date: 08/08/2018 and 08/09/2018  
Spectrophotometer used: HP Agilent 8453

A CRM was run before pH analysis on each day  
08/08/2018 Batch 173 CRM #110 = 7.8775  
08/09/2018 Batch 173 CRM #478 = 7.8767

**Reproducibility:** (# samples and average difference): 8 duplicate samples were collected with an average difference 0.08000 (0.0005 – 0.1635) and an average STDEV of 0.06000 (0.0003 – 0.1156).

Instrument	Sample ID	pH	Average	STDEV	Difference
HP Agilent 8453	50101	7.8361			

HP Agilent 8454	50101	7.8366	7.8364	0.0003	0.0005
HP Agilent 8453	110402	7.7859			
HP Agilent 8454	110402	7.7847	7.7853	0.0009	0.0012
HP Agilent 8453	210501	7.9296			
HP Agilent 8454	210501	7.8003	7.8650	0.0914	0.1293
HP Agilent 8453	240611	7.9627			
HP Agilent 8454	240611	8.0453	8.0040	0.0584	0.0825
HP Agilent 8453	591201	7.9445			
HP Agilent 8454	591201	7.9360	7.9402	0.0060	0.0085
HP Agilent 8453	721402	8.0184			
HP Agilent 8454	721402	7.8093	7.9139	0.1479	0.2091
HP Agilent 8453	921703	7.8051			
HP Agilent 8454	921703	7.8796	7.8423	0.0527	0.0746
HP Agilent 8453	991911	7.7777			
HP Agilent 8454	991911	7.9413	7.8595	0.1156	0.1635
Average				0.06	0.08

pH Temperature			
Sample ID	Station #	Sample BTL #	Sample Temp. (°C)
CRM173_110	CRM	110	20.094
CRM173_478	CRM	478	20.028
50100	5	1	20.02
50101	5	2	20.033
50101	5	3	20.022
50105	5	4	20.029
50109	5	5	20.029
60201	6	6	20.028
60209	6	7	20.035
60211	6	8	20.039
100301	10	9	20.032
100304	10	10	20.044

100312	10	11	20.042
110401	11	12	20.04
110402	11	13	20.032
110402	11	14	20.042
110412	11	15	20.04
210500	21	16	20.039
210501	21	17	20.041
210501	21	18	20.034
210507	21	19	20.054
210511	21	20	20.048
240601	24	21	20.023
240603	24	22	20.028
240611	24	23	20.025
240611	24	24	20.035
250701	25	25	20.024
250703	25	26	20.031
250711	25	27	20.027
350801	35	28	20.044
350803	35	29	20.032
350805	35	30	20.035
510900	51	31	20.035
510901	51	32	20.034
510907	51	33	20.034
510911	51	34	20.047
571001	57	35	20.046
571002	57	36	20.037
571011	57	37	20.033
581101	58	38	20.049
581105	58	39	20.039
581111	58	40	20.044
591201	59	41	20.05
591201	59	42	20.054
591206	59	43	20.042
591211	59	44	20.04
701300	70	45	20.052
701301	70	46	20.041
701302	70	47	20.038
701311	70	48	20.041
721402	72	49	20.034
721402	72	50	20.031

721405	72	51	20.03
721412	72	52	20.023
831501	83	53	20.037
831506	83	54	20.044
831511	83	55	20.041
911601	91	56	20.054
911605	91	57	20.056
911611	91	58	20.041
921700	92	59	20.06
921701	92	60	20.043
921703	92	61	20.047
921703	92	62	20.055
921711	92	63	20.051
941801	94	64	20.031
941805	94	65	20.034
941811	94	66	20.036
991901	99	67	20.03
991905	99	68	20.037
991911	99	69	20.058
991911	99	70	20.058
1012001	101	71	20.047
1012005	101	72	20.051
1012011	101	73	20.061
1072100	107	74	20.056
1072101	107	75	20.046
1072105	107	76	20.055
1072111	107	77	20.057
1102201	110	78	20.064
1102207	110	79	20.05
1102211	110	80	20.045
1112301	111	81	20.052
1112306	111	82	20.046
1112311	111	83	20.063

### **Remarks**

The equations of Liu et al, 2011 formulated using the purified m-cresol purple indicator was used to determine pH of the samples. pH samples were analyzed at 20°C at Full Scale (pH 0-14).

Temperature for each sample was measured before analysis using a Hart Scientific Fluke

1523 reference thermometer.

Approximately 80 mL of sample was extracted from each DIC sample bottle by syringe before DIC analysis to determine the pH.

Final pH results were reported at 25°C in the data file.

**Talk:**

Analysis date: 08/15/2018 and 08/16/2018

Titration system used: Open cell

CRM Batch 173, Salinity = 33.414, cert. TA = 2210.77 μmol/kg.

On 08/25/2018 and 08/16/2018 one CRM was analyzed before the samples and the same CRM was run at the end of analysis each day for each system. On 08/16/2018 2 different CRMs were run from the same batch on system 1. The TA for the water samples was corrected using the daily averaged ratios between the certified and measured values of the CRMs run on each cell. The following table shows the CRM measurements for each day and cell.

Cell System	Date	Time	Bottle #	TA	ΔCRM
1	08/15/2018	15:25:37	1091	2211.41	
1	08/15/2018	23:42:24	1091	2213.26	1.85
1	08/16/2018	13:10:39	1227	2210.67	
1	08/16/2018	20:27:45	1192	2210.34	0.33
2	08/15/2018	13:50:39	1027	2212.44	
2	08/15/2018	23:38:48	1027	2210.00	2.44
2	08/16/2018	13:28:10	1161	2212.16	
2	08/16/2018	20:21:35	1161	2209.59	2.57

**Reproducibility:** (# samples and average difference): 8 duplicate samples were collected with an average difference μmol/kg 2.22 (0.41- 3.60) and an average STDEV of 1.57 (0.29-2.55).

System	Sample ID	Bottle #	DuplicateTA	AVG TA	Difference	STDEV
System 2	50101	1	2212.41			
System 2	50101	2	2209.04	2210.72	3.37	2.38
System 2	110402	13	2331.71			

System 2	110402	14	2332.13	2331.92	0.41	0.29
System 2	210501	16	2210.67			
System 2	210501	17	2208.75	2209.71	1.91	1.35
System 1	240611	23	2306.75			
System 1	240611	24	2309.05	2307.90	2.30	1.63
System 1	591201	41	2237.13			
System 1	591201	42	2236.75	2236.94	0.38	0.27
System 1	721402	49	2337.27			
System 1	721402	50	2334.83	2336.05	2.44	1.73
System 1	921703	60	2328.63			
System 2	921703	61	2325.30	2326.96	3.33	2.36
System 2	991911	69	2186.95			
System 2	991911	70	2190.56	2188.76	3.60	2.55
Average					2.22	1.57

### **Remarks**

The CRM measurement for each day was used to correct the data for that day only. Both systems worked well.

### **Comments**

The latitude, longitude, date, and time reported with the DIC, pH and TALK measurements were taken from the sample field log. The field log values are provided for reference; no post-cruise assurance of accuracy has been done to this data.

The Sample ID is the sample station, cast number and Niskin bottle number for the discrete samples.

Salt and temperature data from the UW pCO<sub>2</sub> files was used for the Flow-thru (FT) samples collected.

Corresponding UW pCO<sub>2</sub> data can be found at the following website



<http://www.aoml.noaa.gov/ocd/ocdweb/occ.html>