

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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 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 0.26 $\mu\text{mol/kg}$ (0.02 – 0.75) and an average STDEV of 0.18 (0.01 – 0.53).

Instrument	Sample ID	DIC ($\mu\text{mol/kg}$)	Average	STDEV	Difference
AOML5	50101	2063.38			
AOML5	50101	2063.36	2063.37	0.01	0.02
AOML5	110402	2188.61			
AOML5	110402	2189.36	2188.98	0.53	0.75

AOML5	210501	2072.78			
AOML5	210501	2072.93	2072.85	0.10	0.15
AOML6	240611	2050.91			
AOML6	240611	2050.77	2050.84	0.10	0.15
AOML6	591201	2042.96			
AOML6	591201	2042.58	2042.77	0.27	0.38
AOML5	721402	2174.74			
AOML5	721402	2174.41	2174.57	0.23	0.32
AOML5	921703	2143.59			
AOML5	921703	2143.83	2143.71	0.17	0.24
AOML6	991911	2002.31			
AOML6	991911	2002.25	2002.28	0.04	0.06
Average				0.18	0.26

CRM, salinity and HgCl₂ correction applied: Salinity correction was applied using TSG salinity.

Remarks

The volume correction was applied due to added HgCl₂ (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 0.09000 (0.0005 – 0.2166) and an average STDEV of 0.06000 (0.0004 – 0.1532).

Instrument	Sample ID	pH	Average	STDEV	Difference
HP Agilent 8453	50101	7.8326			

HP Agilent 8453	50101	7.8331	7.8328	0.0004	0.0005
HP Agilent 8453	110402	7.7803			
HP Agilent 8453	110402	7.7790	7.7796	0.0009	0.0013
HP Agilent 8453	210501	7.9297			
HP Agilent 8453	210501	7.7952	7.8625	0.0951	0.1345
HP Agilent 8453	240611	7.9640			
HP Agilent 8453	240611	8.0491	8.0065	0.0601	0.0850
HP Agilent 8453	591201	7.9451			
HP Agilent 8453	591201	7.9363	7.9407	0.0062	0.0088
HP Agilent 8453	721402	8.0214			
HP Agilent 8453	721402	7.8048	7.9131	0.1532	0.2166
HP Agilent 8453	921703	7.8006			
HP Agilent 8453	921703	7.8779	7.8393	0.0547	0.0774
HP Agilent 8453	991911	7.7716			
HP Agilent 8453	991911	7.9417	7.8567	0.1203	0.1702
Average				0.06	0.09

pH Sample Temperature

Sample ID	Sample BTL	
	#	Sample Temp. (°C)
CRM173_110	110	20.094
CRM173_478	478	20.028
50100	5	20.029
50101	1	20.020
50101	2	20.033
50105	3	20.022
50109	4	20.029
60201	6	20.028
60209	7	20.035
60211	8	20.039
100301	9	20.032
100304	10	20.044
100312	11	20.042

110401	12	20.040
110402	13	20.032
110402	14	20.042
110412	15	20.040
210500	20	20.048
210501	16	20.039
210501	17	20.041
210507	18	20.034
210511	19	20.054
240601	21	20.023
240603	22	20.028
240611	23	20.025
240611	24	20.035
250701	25	20.024
250703	26	20.031
250711	27	20.027
350801	28	20.044
350803	29	20.032
350805	30	20.035
510900	34	20.047
510901	31	20.035
510907	32	20.034
510911	33	20.034
571001	35	20.046
571002	36	20.037
571011	37	20.033
581101	38	20.049
581105	39	20.039
581111	40	20.044
591201	41	20.050
591201	42	20.054
591206	43	20.042
591211	44	20.040
701300	48	20.041
701301	45	20.052
701302	46	20.041
701311	47	20.038
721402	49	20.034
721402	50	20.031
721405	51	20.030

721412	52	20.023
831501	53	20.037
831506	54	20.044
831511	55	20.041
911601	56	20.054
911605	57	20.056
911611	58	20.041
921700	63	20.051
921701	59	20.060
921703	60	20.043
921703	61	20.047
921711	62	20.055
941801	64	20.031
941805	65	20.034
941811	66	20.036
991901	67	20.030
991905	68	20.037
991911	69	20.058
991911	70	20.058
1012001	71	20.047
1012005	72	20.051
1012011	73	20.061
1072100	77	20.056
1072101	74	20.046
1072105	75	20.055
1072111	76	20.057
1102201	78	20.064
1102207	79	20.050
1102211	80	20.045
1112301	81	20.052
1112306	82	20.046
1112311	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 20⁰C 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.

Station 6, Niskin 9 the sample data was not reported because the sample bottle was not properly numbered and it could not be resolved by the sampler.

Salt and temperature data from the UW pCO₂ files was used for the Flow-thru (FT)

samples collected.

Corresponding UW pCO₂ data can be found at the following website
<http://www.aoml.noaa.gov/ocd/ocdweb/occ.html>