

Cruise: HB2302

Ship: R/V Henry Bigelow

Expo Code: 33HH06092023

Funding Project Title: Ocean acidification measurements from Ships of opportunity, SOOP-OA

Funding Project ID: 20711

Dates: June 06, 2023 to June 27, 2023

Chief Scientist: Jerry Prezioso

Equipment: CTD-Niskin and Flow-Through (FT)

Total number of stations: 78

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 the CTD-Niskin/rosette and Flow-Through system onboard the R/V Henry Bigelow by Chris Taylor. The date and time listed in the data file are UTC when each sample bottle was collected.

DIC:

78 locations, 200 samples each 500-ml, 20 duplicate samples.

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

PI: Dr. Rik Wanninkhof

Analyzed by: Charles Featherstone, Alison Macleod and Patrick Mears

pH:

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78 locations, 200 samples each 500-ml, \duplicate samples.

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

PI: Dr. Rik Wanninkhof

Analyzed by: Alison MacLeod, Patrick Mears

Sample Analysis

DIC:

Instrument ID	Date	Certified CRM ($\mu\text{mol/kg}$)	CRM Value ($\mu\text{mol/kg}$)	CRM Offset ($\mu\text{mol/kg}$)	Blank (Counts)	Avg. Sample Analysis Time
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AOML 5	07/05/2023	2024.96	2027.96	3.00	22.1	9
AOML 5	07/10/2023	2024.96	2027.88	2.92	19.8	9
AOML 5	07/13/2023	2024.96	2026.84	1.88	12.0	9
AOML 5	07/17/2023	2024.96	2026.40	1.44	24.2	8
AOML 5	07/19/2023	2024.96	2026.08	1.12	14.6	9
AOML 6	07/05/2023	2024.96	2023.18	1.78	14.2	9
AOML 6	07/10/2023	2024.96	2019.65	5.31	12.7	9
AOML 6	07/13/2023	2024.96	2018.43	6.53	30.0	9
AOML 6	07/17/2023	2024.96	2019.30	5.66	13.5	9
AOML 6	07/19/2023	2024.96	2021.05	3.91	19.5	11

Analysis date: 07/05/2023

Coulometer used: DICE–CM5017O-AOML 5

Blanks: 22.1 counts/min

CRM # 474 was used and with an assigned value of (includes both DIC and salinity):

Batch 195, c: 2024.96 $\mu\text{mol/kg}$, S: 33.485

CRM values measured: AOML 5: offset 3.00 $\mu\text{mol/kg}$ (2027.96 $\mu\text{mol/kg}$).

Average run time, minimum run time, maximum run time: 12, 8 and 9 min.

Analysis date: 07/10/2023

Coulometer used: DICE–CM5017O-AOML 5

Blanks: 19.8 counts/min

CRM # 508 was used and with an assigned value of (includes both DIC and salinity):

Batch 195, c: 2024.96 $\mu\text{mol/kg}$, S: 33.485

CRM values measured: AOML 5: offset 2.92 $\mu\text{mol/kg}$ (2027.88 $\mu\text{mol/kg}$).

Average run time, minimum run time, maximum run time: 12, 8 and 9 min.

Analysis date: 07/13/2023

Coulometer used: DICE–CM5017O-AOML 5

Blanks: 12.0 counts/min

CRM # 594 was used and with an assigned value of (includes both DIC and salinity):

Batch 195, c: 2024.96 $\mu\text{mol/kg}$, S: 33.485

CRM values measured: AOML 5: offset 1.88 $\mu\text{mol/kg}$ (2026.84 $\mu\text{mol/kg}$).

Average run time, minimum run time, maximum run time: 12, 8 and 9 min.

Analysis date: 07/17/2023

Coulometer used: DICE–CM5017O-AOML 5

Blanks: 24.2 counts/min

CRM # 596 was used and with an assigned value of (includes both DIC and salinity):

Batch 195, c: 2024.96 $\mu\text{mol/kg}$, S: 33.485

CRM values measured: AOML 5: offset 1.44 $\mu\text{mol/kg}$ (2026.40 $\mu\text{mol/kg}$).

Average run time, minimum run time, maximum run time: 10, 8 and 8 min.

Analysis date: 07/19/2023
Coulometer used: DICE–CM5017O-AOML 5
Blanks: 14.6 counts/min
CRM # 561 was used and with an assigned value of (includes both DIC and salinity):
Batch 195, c: 2024.96 $\mu\text{mol/kg}$, S: 33.485
CRM values measured: AOML 5: offset 1.12 $\mu\text{mol/kg}$ (2026.08 $\mu\text{mol/kg}$).
Average run time, minimum run time, maximum run time: 12, 7 and 9 min.

Analysis date: 07/05/2023
Coulometer used: DICE–CM5017O-AOML 6
Blanks: 14.2 counts/min
CRM # 553 was used and with an assigned value of (includes both DIC and salinity):
Batch 195, c: 2024.96 $\mu\text{mol/kg}$, S: 33.485
CRM values measured: AOML 6: offset 1.78 $\mu\text{mol/kg}$ (2023.18 $\mu\text{mol/kg}$).
Average run time, minimum run time, maximum run time: 12, 7 and 9 min.

Analysis date: 07/10/2023
Coulometer used: DICE–CM5017O-AOML 6
Blanks: 12.7 counts/min
CRM # 462 was used and with an assigned value of (includes both DIC and salinity):
Batch 195, c: 2024.96 $\mu\text{mol/kg}$, S: 33.485
CRM values measured: AOML 6: offset 5.31 $\mu\text{mol/kg}$ (2019.65 $\mu\text{mol/kg}$).
Average run time, minimum run time, maximum run time: 12, 7 and 9 min.

Analysis date: 07/13/2023
Coulometer used: DICE–CM5017O-AOML 6
Blanks: 30.0 counts/min
CRM # 612 was used and with an assigned value of (includes both DIC and salinity):
Batch 195, c: 2024.96 $\mu\text{mol/kg}$, S: 33.485
CRM values measured: AOML 6: offset 6.53 $\mu\text{mol/kg}$ (2018.43 $\mu\text{mol/kg}$).
Average run time, minimum run time, maximum run time: 11, 8 and 9 min.

Analysis date: 07/17/2023
Coulometer used: DICE–CM5017O-AOML 6
Blanks: 13.5 counts/min
CRM # 545 was used and with an assigned value of (includes both DIC and salinity):
Batch 195, c: 2024.96 $\mu\text{mol/kg}$, S: 33.485
CRM values measured: AOML 6: offset 5.66 $\mu\text{mol/kg}$ (2019.30 $\mu\text{mol/kg}$).
Average run time, minimum run time, maximum run time: 11, 7 and 9 min.

Analysis date: 07/19/2023
Coulometer used: DICE–CM5017O-AOML 6
Blanks: 19.5 counts/min
CRM # 582 was used and with an assigned value of (includes both DIC and salinity):
Batch 195, c: 2024.96 $\mu\text{mol/kg}$, S: 33.485
CRM values measured: AOML 6: offset 3.91 $\mu\text{mol/kg}$ (2021.05 $\mu\text{mol/kg}$).

Average run time, minimum run time, maximum run time: 13, 9 and 11 min.

Reproducibility: (# samples and average difference): 20 duplicate samples were collected with an average difference of 1.25 (0.21-3.13) and average STDEV of 0.89 (0.18-2.21).

Instrument	Sample ID	Bottle #	DIC	Average	STDEV	Difference
			($\mu\text{mol/kg}$)			
AOML6	100202	5	2171.71			
AOML6	100202	6	2171.45	2171.6	0.18	0.26
AOML6	180412	17	2022.38			
AOML6	180412	18	2024.04	2023.2	1.17	1.66
AOML5	260604	24	2122.32			
AOML5	260604	25	2120.83	2121.6	1.06	1.50
AOML5	300712	31	2041.37			
AOML5	300712	32	2042.85	2042.1	1.05	1.48
AOML5	441101	44	2107.23			
AOML5	441101	45	2108.24	2107.7	0.71	1.01
AOML6	551301	54	2071.23			
AOML6	551301	55	2071.85	2071.5	0.44	0.62
AOML5	681512	64	1874.64			
AOML5	681512	65	1874.86	1874.8	0.15	0.21
AOML5	851701	71	2178.32			
AOML5	851701	72	2176.66	2177.5	1.17	1.66
AOML6	1202301	92	2193.85			
AOML6	1202301	93	2193.44	2193.6	0.29	0.41
AOML5	1332601	102	2203.59			
AOML5	1332601	103	2202.19	2202.9	0.99	1.40
AOML5	1402901	112	2083.91			
AOML5	1402901	113	2087.04	2085.5	2.21	3.13
AOML5	1593112	123	1655.94			
AOML5	1593112	124	1654.23	1655.1	1.21	1.71
AOML5	1623412	133	1680.74			
AOML5	1623412	134	1679.75	1680.2	0.70	0.98
AOML6	1733712	146	2049.98			

AOML6	1733712	147	2050.42	2050.2	0.31	0.44
AOML6	1773901	153	2139.54			
AOML6	1773901	154	2141.81	2140.7	1.60	2.27
AOML5	1794006	158	2000.91			
AOML5	1794006	159	2000.47	2000.7	0.31	0.44
AOML5	1844212	166	2027.97			
AOML5	1844212	167	2028.95	2028.5	0.69	0.98
AOML5	1884401	172	2185.24			
AOML5	1884401	173	2183.82	2184.5	1.00	1.42
AOML6	1964804	186	2173.19			
AOML6	1964804	187	2170.65	2171.9	1.80	2.54
AOML6	2005012	194	2050.98			
AOML6	2005012	195	2049.85	2050.4	0.80	1.13
Average					0.89	1.25

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: 07/05/2023, 07/10/2023, 07/13/2023, 07/17/2023 and 07/19/2023
No CRMs was analyzed before sample analysis.

Spectrophotometer used: HP Agilent 8453

Temperature and salinity of pH samples analyzed.

Sample ID	Sample BTL #	Salinity	Analysis T (°C)
50104	1	32.563	19.923
50108	2	32.542	19.923

70700	3	32.784	19.934
90900	4	35.887	19.935
100202	5	35.421	19.944
100202	6	35.421	19.937
100204	7	35.546	19.940
100212	8	35.903	19.938
110302	9	35.071	19.939
110304	10	35.269	19.945
110312	11	36.049	19.942
141400	12	33.428	19.942
151500	13	32.824	19.937
171700	14	34.291	19.943
180402	15	35.074	19.936
180404	16	35.372	19.941
180412	17	33.664	19.943
180412	18	33.664	19.941
190502	19	35.476	19.945
190504	20	35.615	19.953
371012	41	31.934	19.953
383500	42	30.460	19.949
423900	43	31.076	19.937
441101	44	33.239	19.944
441101	45	33.239	19.947
441107	46	33.567	19.948
441112	47	32.476	19.945
461201	48	32.221	19.948
461206	49	31.432	19.943
461212	50	31.298	19.945
484500	51	31.365	19.931
504700	52	31.033	19.943
535000	53	31.016	19.945
551301	54	31.815	19.938
551301	55	31.815	19.936
625900	61	29.813	19.938
681501	62	32.379	19.940
681505	63	32.346	19.942
681512	64	31.730	19.941
681512	65	31.730	19.942
747100	66	35.135	19.941
777400	67	32.502	19.942
841601	68	35.068	19.944

841604	69	35.335	19.937
841612	70	32.548	19.942
851701	71	35.403	19.938
851701	72	35.403	19.945
851704	73	35.096	19.936
851712	74	32.320	19.945
871801	75	32.868	19.945
871804	76	32.872	19.947
871812	77	32.506	19.943
961901	78	32.738	19.941
961904	79	32.739	19.945
961912	80	32.739	19.948
1092001	81	35.035	19.922
1092004	82	35.393	19.938
1092012	83	31.883	19.936
1122101	84	35.049	19.940
1122105	85	33.735	19.942
1122105	86	33.735	19.949
1122112	87	32.019	19.943
1182201	89	32.577	19.937
1182205	90	32.554	19.945
1182212	91	32.098	19.938
1202301	92	35.046	19.940
1202301	93	35.046	19.942
1202305	94	34.788	19.944
1202312	95	31.975	19.946
1232401	96	33.806	19.932
1232404	97	32.858	19.939
1232412	98	31.952	19.938
1272501	99	32.718	19.954
1272505	100	32.342	19.933
1272512	101	31.963	19.931
1332601	102	34.478	19.921
1332601	103	34.478	19.926
1332604	104	33.502	19.928
1332612	105	32.034	19.930
1362701	106	31.953	19.932
1362705	107	31.946	19.936
1362712	108	31.944	19.936
1372801	109	32.699	19.937
1372805	110	32.295	19.940

1372812	111	32.101	19.942
1402901	112	32.536	19.945
1402901	113	32.536	19.942
1402905	114	32.276	19.943
1402912	115	32.152	19.944
1553001	117	32.187	19.937
1553005	118	31.957	19.935
1553012	119	29.722	19.941
1593101	121	32.219	19.935
1593106	122	31.921	19.927
1593112	123	29.917	19.929
1593112	124	29.917	19.926
1603201	125	32.211	19.935
1603206	126	31.694	19.936
1603212	127	30.582	19.935
1613301	128	31.597	19.938
1613306	129	31.564	19.936
1613312	130	30.624	19.944
1623401	131	33.842	19.938
1623406	132	32.967	19.938
1623412	133	31.789	19.944
1623412	134	31.789	19.947
1693501	138	32.883	19.952
1693506	139	32.933	19.945
1693512	140	32.350	19.943
1713601	141	35.027	19.935
1713606	142	35.110	19.932
1713612	143	32.417	19.932
1733701	144	35.007	19.942
1733704	145	34.986	19.940
1733712	146	35.278	19.945
1733712	147	35.278	19.938
1753801	149	35.009	19.944
1753804	150	35.035	19.951
1753812	151	34.524	19.953
1773901	153	33.648	19.955
1773901	154	33.648	19.953
1773904	155	32.881	19.932
1773912	156	32.496	19.948
1794001	157	32.498	19.939
1794006	158	32.433	19.946

1794006	159	32.433	19.944
1794012	160	32.351	19.944
1824101	161	32.015	19.943
1824106	162	31.981	19.946
1824112	163	31.764	19.946
1844201	164	35.744	19.946
1844204	165	34.690	19.941
1844212	166	34.305	19.920
1844212	167	34.305	19.931
1864301	169	35.033	19.929
1864304	170	35.278	19.935
1864312	171	36.185	19.938
1884401	172	35.004	19.936
1884401	173	35.004	19.938
1884404	174	35.085	19.938
1884412	175	34.127	19.941
1904501	176	32.965	19.945
1904506	177	32.903	19.940
1904512	178	32.393	19.956
1924601	179	31.856	19.955
1924606	180	31.736	19.959
1924612	181	31.629	19.932
1944701	182	32.731	19.936
1944708	183	32.273	19.937
1944712	184	32.379	19.929
1964801	185	35.741	19.933
1964804	186	35.796	19.940
1964804	187	35.796	19.934
1964812	188	34.569	19.940
1984901	189	35.009	19.926
1984904	190	35.110	19.934
1984912	191	34.464	19.950
2005001	192	35.014	19.949
2005004	193	35.082	19.957
2005012	194	35.162	19.947
2005012	195	35.162	19.956
2025101	196	35.242	19.956
2025106	197	33.196	19.948
2025112	198	34.939	19.946
2045201	199	32.748	19.950
2045206	200	32.371	19.945

11410700	88	31.943	19.946
15415400	116	27.474	19.944
15715600	120	29.749	19.944
16516500	135	31.675	19.948
16616600	136	31.060	19.951
16716700	137	31.526	19.949
17417200	148	36.120	19.948
17617400	152	34.035	19.947
18517900	168	34.811	19.929

Reproducibility: pH @ 20⁰C (# samples and average difference): 16 duplicate samples were collected with an average difference of 0.00762 (0.00012 – 0.07845) and an average STDEV of 0.00539 (0.00008 – 0.05547).

Instrument	Sample ID	Bottle #	pH @20 ⁰ C	Average	STDEV	Difference
HP Agilent 8453	100202	5	7.85676			
HP Agilent 8453	100202	6	7.85383	7.85529	0.00208	0.00294
HP Agilent 8453	180412	17	8.03187			
HP Agilent 8453	180412	18	8.03172	8.03180	0.00011	0.00016
HP Agilent 8453	260604	24	7.74728			
HP Agilent 8453	260604	25	7.77238	7.75983	0.01775	0.02510
HP Agilent 8453	300712	31	8.02016			
HP Agilent 8453	300712	32	8.01952	8.01984	0.00045	0.00064
HP Agilent 8453	441101	44	7.78854			
HP Agilent 8453	441101	45	7.78875	7.78865	0.00015	0.00021
HP Agilent 8453	551301	54	7.68159			
HP Agilent 8453	551301	55	7.68180	7.68169	0.00015	0.00021
HP Agilent 8453	681512	64	8.11643			
HP Agilent 8453	681512	65	8.09327	8.10485	0.01638	0.02316
HP Agilent 8453	851701	71	7.83728			
HP Agilent 8453	851701	72	7.83306	7.83517	0.00299	0.00423
HP Agilent 8453	1122105	85	7.72439			

HP Agilent 8453	1122105	86	7.72005	7.72222	0.00306	0.00433
HP Agilent 8453	1202301	92	7.75264			
HP Agilent 8453	1202301	93	7.75201	7.75232	0.00044	0.00062
HP Agilent 8453	1332601	102	7.67066			
HP Agilent 8453	1332601	103	7.67508	7.67287	0.00313	0.00442
HP Agilent 8453	1402901	112	7.78399			
HP Agilent 8453	1402901	113	7.78369	7.78384	0.00021	0.00029
HP Agilent 8453	1593112	123	8.37297			
HP Agilent 8453	1593112	124	8.45142	8.41219	0.05547	0.07845
HP Agilent 8453	1623412	133	8.48046			
HP Agilent 8453	1623412	134	8.48108	8.48077	0.00043	0.00061
HP Agilent 8453	1733712	146	8.08843			
HP Agilent 8453	1733712	147	8.08832	8.08838	0.00008	0.00012
HP Agilent 8453	1773901	153	7.77688			
HP Agilent 8453	1773901	154	7.77131	7.77410	0.00394	0.00557
HP Agilent 8453	1794006	158	7.97354			
HP Agilent 8453	1794006	159	7.97206	7.97280	0.00105	0.00148
HP Agilent 8453	1844212	166	8.05755			
HP Agilent 8453	1844212	167	8.05859	8.05807	0.00074	0.00104
HP Agilent 8453	1884401	172	7.76998			
HP Agilent 8453	1884401	173	7.76757	7.76878	0.00171	0.00242
HP Agilent 8453	1964804	186	7.90959			
HP Agilent 8453	1964804	187	7.90972	7.90966	0.00009	0.00013
HP Agilent 8453	2005012	194	8.08911			
HP Agilent 8453	2005012	195	8.09302	8.09106	0.00277	0.00392
Average					0.00539	0.00762

Reproducibility: pH @ 25⁰C (# samples and average difference): 20 duplicate samples were collected with an average difference of 0.00765 (0.00393 – 0.07896) and an average

STDEV of 0.005411 (0.00009 – 0.05583).

Instrument	Sample ID	Bottle #	pH @25 °C	Average	STDEV	Difference
HP Agilent 8453	100202	5	7.79263			
HP Agilent 8453	100202	6	7.78969	7.79116	0.00208	0.00294
HP Agilent 8453	180412	17	7.96861			
HP Agilent 8453	180412	18	7.96846	7.96853	0.00011	0.00016
HP Agilent 8453	260604	24	7.68350			
HP Agilent 8453	260604	25	7.70864	7.69607	0.01778	0.02514
HP Agilent 8453	300712	31	7.95674			
HP Agilent 8453	300712	32	7.95610	7.95642	0.00045	0.00064
HP Agilent 8453	441101	44	7.72485			
HP Agilent 8453	441101	45	7.72506	7.72496	0.00015	0.00021
HP Agilent 8453	551301	54	7.61811			
HP Agilent 8453	551301	55	7.61832	7.61822	0.00015	0.00021
HP Agilent 8453	681512	64	8.05395			
HP Agilent 8453	681512	65	8.03071	8.04233	0.01643	0.02324
HP Agilent 8453	851701	71	7.77312			
HP Agilent 8453	851701	72	7.76889	7.77100	0.00299	0.00423
HP Agilent 8453	1122105	85	7.66046			
HP Agilent 8453	1122105	86	7.65612	7.65829	0.00307	0.00434
HP Agilent 8453	1202301	92	7.68842			
HP Agilent 8453	1202301	93	7.68779	7.68810	0.00044	0.00063
HP Agilent 8453	1332601	102	7.60646			
HP Agilent 8453	1332601	103	7.61089	7.60867	0.00313	0.00443
HP Agilent 8453	1402901	112	7.72048			
HP Agilent 8453	1402901	113	7.72018	7.72033	0.00021	0.00030
HP Agilent 8453	1593112	123	8.31214			
HP Agilent 8453	1593112	124	8.39110	8.35162	0.05583	0.07896

HP Agilent 8453	1623412	133	8.41986			
HP Agilent 8453	1623412	134	8.42047	8.42016	0.00044	0.00062
HP Agilent 8453	1733712	146	8.02493			
HP Agilent 8453	1733712	147	8.02481	8.02487	0.00008	0.00012
HP Agilent 8453	1773901	153	7.71306			
HP Agilent 8453	1773901	154	7.70749	7.71027	0.00394	0.00558
HP Agilent 8453	1794006	158	7.91045			
HP Agilent 8453	1794006	159	7.90897	7.90971	0.00105	0.00149
HP Agilent 8453	1844212	166	7.99420			
HP Agilent 8453	1844212	167	7.99524	7.99472	0.00074	0.00104
HP Agilent 8453	1884401	172	7.70580			
HP Agilent 8453	1884401	173	7.70338	7.70459	0.00171	0.00242
HP Agilent 8453	1964804	186	7.84548			
HP Agilent 8453	1964804	187	7.84561	7.84555	0.00009	0.00013
HP Agilent 8453	2005012	194	8.02563			
HP Agilent 8453	2005012	195	8.02956	8.02759	0.00278	0.00393
Average					0.00541	0.00765

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). The pH was reported at 20°C and 25°C.

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 automatic syringe before DIC analysis to determine the pH.

Talk:

Analysis date: 07/06/2023, 07/11/2023, 07/14/2023, 07/18/2023 and 07/20/2023

Titration system used: Open cell

Batch 195, CRM #474 Salinity = 33.485, cert. TA = 2213.51 $\mu\text{mol/kg}$.
 Batch 195, CRM #528 Salinity = 33.485, cert. TA = 2213.51 $\mu\text{mol/kg}$.
 Batch 195, CRM #594 Salinity = 33.485, cert. TA = 2213.51 $\mu\text{mol/kg}$.
 Batch 195, CRM #545 Salinity = 33.485, cert. TA = 2213.51 $\mu\text{mol/kg}$.
 Batch 195, CRM #561 Salinity = 33.485, cert. TA = 2213.51 $\mu\text{mol/kg}$.
 Batch 195, CRM #553 Salinity = 33.485, cert. TA = 2213.51 $\mu\text{mol/kg}$.
 Batch 195, CRM #462 Salinity = 33.485, cert. TA = 2213.51 $\mu\text{mol/kg}$.
 Batch 195, CRM #612 Salinity = 33.485, cert. TA = 2213.51 $\mu\text{mol/kg}$.
 Batch 195, CRM #596 Salinity = 33.485, cert. TA = 2213.51 $\mu\text{mol/kg}$.
 Batch 195, CRM #582 Salinity = 33.485, cert. TA = 2213.51 $\mu\text{mol/kg}$.

System 1:

On 07/06/2023 CRM #474 was analyzed before and after sample analysis on System 1.
 On 07/11/2023 CRM #528 was analyzed before and after sample analysis on System 1.
 On 07/14/2023 CRM #594 was analyzed before and after sample analysis on System 1.
 On 07/18/2023 CRM #545 was analyzed before and after sample analysis on System 1.
 On 07/20/2023 CRM #561 was analyzed before and after sample analysis on System 1.

System 2:

On 07/06/2023 CRM #553 was analyzed before and after sample analysis on System 2.
 On 07/11/2023 CRM #462 was analyzed before and after sample analysis on System 2.
 On 07/14/2023 CRM #612 was analyzed before and after sample analysis on System 2.
 On 07/18/2023 CRM #596 was analyzed before and after sample analysis on System 2.
 On 07/20/2023 CRM #582 was analyzed before and after sample analysis on System 2.

The TA for the water samples was corrected using the daily averaged ratios between the certified and measured values of the CRMs run on system 1 and 2 cells. The following table shows the CRM measurements for each day and cell.

Cell System	Date	Time	Bottle #	TA	Difference
1	07/06/2023	08:46:59	474	2211.14	2.37
1	07/06/2023	16:06:25	474	2217.29	3.78
1	07/11/2023	09:03:05	528	2214.15	0.64
1	07/11/2023	17:31:57	528	2215.82	2.31
1	07/14/2023	08:47:44	594	2214.35	0.84
1	07/14/2023	16:52:26	594	2217.52	4.01
1	07/18/2023	09:15:24	545	2219.51	6.00
1	07/18/2023	17:06:20	545	2213.77	0.26
1	07/20/2023	09:16:24	561	2210.89	2.62
1	07/20/2023	16:43:08	561	2214.57	1.06

2	07/06/2023	09:18:19	553	2212.95	0.56
2	07/06/2023	16:01:39	553	2209.12	4.39
2	07/11/2023	09:44:52	462	2211.12	2.39
2	07/11/2023	17:25:26	462	2153.34	60.17
2	07/14/2023	09:02:10	612	2214.81	1.30
2	07/14/2023	17:09:29	612	2213.34	0.17
2	07/18/2023	09:08:31	596	2214.57	1.06
2	07/18/2023	17:21:25	596	2214.10	0.59
2	07/20/2023	09:26:24	582	2214.69	1.18
2	07/20/2023	13:56:39	582	2213.55	0.04

Reproducibility: (# samples and average difference): 20 duplicate samples were collected with an average difference of 2.32 (0.10 – 7.68) and an average STDEV of 1.64(0.07 – 5.43).

System	Sample ID	Station	Salinity	TA (μmol/kg)	Average	STDEV	Difference
System 2	100202	10	35.421	2330.08			
System 2	100202	10	35.421	2330.91	2330.5	0.58	0.83
System 2	180412	18	33.664	2254.83			
System 1	180412	18	33.664	2249.29	2252.1	3.91	5.53
System 1	260604	26	33.301	2233.38			
System 1	260604	26	33.301	2233.93	2233.7	0.39	0.55
System 1	300712	30	34.142	2266.90			
System 1	300712	30	34.142	2268.35	2267.6	1.02	1.45
System 1	441101	44	33.239	2222.58			
System 1	441101	44	33.239	2225.55	2224.1	2.10	2.96
System 1	551301	55	31.815	2141.24			
System 1	551301	55	31.815	2142.20	2141.7	0.68	0.96

System 1	681512	68	31.730	2127.74			
System 1	681512	68	31.730	2124.45	2126.1	2.33	3.29
System 1	851701	85	35.403	2325.37			
System 1	851701	85	35.403	2323.27	2324.3	1.48	2.10
System 2	1122105	112	33.735	2252.31			
System 2	1122105	112	33.735	2252.48	2252.4	0.12	0.17
System 2	1202301	120	35.046	2311.18			
System 2	1202301	120	35.046	2310.94	2311.1	0.17	0.24
System 1	1332601	133	34.478	2281.48			
System 1	1332601	133	34.478	2282.07	2281.8	0.42	0.59
System 1	1402901	140	32.536	2192.63			
System 1	1402901	140	32.536	2194.12	2193.4	1.05	1.49
System 1	1593112	159	29.917	2025.21			
System 1	1593112	159	29.917	2032.89	2029.0	5.43	7.68
System 1	1623412	162	31.789	2155.93			
System 1	1623412	162	31.789	2158.98	2157.5	2.16	3.05
System 2	1733712	173	35.278	2327.54			
System 2	1733712	173	35.278	2326.90	2327.2	0.45	0.64
System 2	1773901	177	33.648	2255.60			
System 2	1773901	177	33.648	2253.68	2254.6	1.36	1.92
System 2	1794006	179	32.433	2193.19			
System 2	1794006	179	32.433	2186.88	2190.0	4.46	6.31
System 1	1844212	184	34.305	2276.54			
System 1	1844212	184	34.305	2276.64	2276.6	0.07	0.10
System 1	1884401	188	35.004	2297.41			
System 1	1884401	188	35.004	2302.28	2299.8	3.44	4.87
System 2	1964804	196	35.796	2351.28			

System 2	1964804	196	35.796	2351.04	2351.2	0.17	0.25
System 2	2005012	200	35.162	2317.64			
System 2	2005012	200	35.162	2321.35	2319.5	2.63	3.72
Average						1.64	2.32

Remarks

CRMs values highlighted in yellow were not used to correct the data.

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 Niskin bottles are approximately one-half meter above the CTD sensors on the rosette. Therefore, Temp and Sal are bin-averaged CTD values representing the next shallower depth from that recorded by the CTD (CTD Depth) at the time the Niskin bottles were fired with the exception of the surface values, which are the same as the CTD Depth values (as per the log sheet).

The Sample ID is the station number, cast number and niskin number.

The Sample ID for Flow Through samples is the station number, 00 if no cast number, and 00 for the niskin number

Sample bottles #86 was lost due to computer freeze during analysis as 5 (Sample ID 1122105)

Sample bottles #87 was lost due to computer freeze during analysis as 5 (Sample ID 1122112)

Sample bottles #88 was lost due to computer freeze during analysis as 5 (Sample ID 11416700)

Sample bottles #197 was lost due to computer freeze during analysis as 5 (Sample ID 20251010)

Flow Through temperature and salinity was taken from the TSG data found in the UW pCO₂ file. The data nearest to the sample collection time was used.

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