

**Biogeochemical properties of seawater measured from the icebreaker *Shirase*
during the 56th Japanese Antarctic Research Expedition
in the austral summer, 2014–2015**

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1. Introduction

Biogeochemical properties of seawater have been routinely measured between Japan and the Japanese Antarctic Station Syowa (69°00'S, 39°35'E) as part of the monitoring program of the Japanese Antarctic Research Expedition (JARE), which is conducted each austral summer season (December–March) along regular routes across the Indian Ocean sector of the Southern Ocean. During JARE cruises, data have been collected both in the open ocean, and, since the 52nd JARE (2010–2011), in areas of sea ice off Syowa Station in Lützow-Holm Bay.

This report presents biogeochemical data acquired from the JARE-56 cruise (2014–2015). The dataset is composed of two series of data: (1) vertical profile data from samples collected at routine monitoring stations along a meridional transect at 110°E and from samples collected in Lützow-Holm Bay, and (2) data from surface water samples obtained along cruise tracks to confirm spatial variations in biogeochemical properties.

2. Sampling

Biogeochemical data presented in this report include temperature and salinity (measured by a sensor probe) and inorganic nutrients and chlorophyll *a* (Chl *a*) concentrations (measured by water analysis). All seawater samples and auxiliary data were taken from the icebreaker *Shirase* during the JARE-56 cruise. The sampling stations are shown in [Figure 1](#).

2.1. Vertical profile sampling

Seawater samples and auxiliary data for vertical profiles were taken at monitoring stations along 110°E (solid squares along L1–L5 transect, [Fig. 1](#)) in December 2014 and in Lützow-Holm Bay (solid squares along A–BP transect, [Fig. 1](#)) during January–February 2015. Sampling at station D (planned in the pack-ice zone) was canceled because of the extreme narrowness of the pack-ice zone. At the time of sampling, station A was located in the multi-year fast-ice zone, and station B was located in the first-year fast-ice zone. Station C was located in the pack-ice zone ([Fig. 1](#)). Details of sampling in the sea-ice area are given in Takahashi *et al.* (2012, 2014).

Vertical temperature and salinity profiles were measured to a depth of 500 m using a conductivity–temperature–depth (CTD) memory probe (SBE 19 plus; Sea-Bird Electronics, Inc.) attached to a water sampler (SBE 55 ECO; Sea-Bird Electronics, Inc.). The data were downloaded from the CTD to a laptop computer immediately after each cast. The CTD sensor was calibrated by the manufacturer prior to the cruise. Note that the salinity data in this report were not corrected by the bottle salinity data measured by the salinometer. Salinity data at station C are unavailable because of salinity sensor probe difficulties.

Seawater was sampled to a depth of 400 m or to the bottom depth (whichever was less) during the down cast using a standard 4-L Niskin bottle (Sea-Bird Electronics, Inc.). Sampling was conducted at depths of 20, 50, 75, 100, 200, and 400 m at stations L1–L5 and E–BP; at 5, 10, 20, 35, 50, and 70 m at station A; and at 10, 20, 50, 75, 100, and 130 m at station B. Seawater at 0 m was collected from the deck using a 5-L polyethylene bucket. No seawater samples were collected from 50, 100, and 200 m at station C because of Niskin bottle sample difficulties caused by seawater temperatures that were near the freezing point.

Seawater was subsampled into 10-mL polyethylene screw-cap vials and 250-mL high-density polyethylene (HDPE) screw-cap, light-blocking bottles for analysis of concentrations of inorganic nutrients and Chl *a*, respectively. After subsampling, seawater samples for nutrient analysis were immediately stored in an ultra-low-temperature freezer (−85 °C) until analysis on land. Phytoplankton Chl *a* was extracted by N,N-Dimethylformamide (Suzuki and Ishimaru, 1990) just after filtering the seawater through a glass fiber filter (GF/F; Whatman), and the samples were stored in a freezer (−18 °C) until analysis on board the research vessel.

2.2. Underway sampling

Underway surface water sampling was conducted during the cruise. Seawater was continuously pumped from 10 m below the sea surface to an on-board laboratory, and the inlet seawater temperature and salinity were quasi-continuously measured by sensor probes (SBE 38 for temperature and SBE 45 for salinity; Sea-Bird Electronics, Inc.). Inorganic nutrients and Chl *a* were analyzed from samples collected manually 2–3 times per day from the seawater outlet in the laboratory; samples were treated in the same manner as the bottle samples collected in the vertical profiles.

3. Analysis

Concentrations of Chl *a* were determined fluorometrically (Parsons *et al.*, 1984) using an on-board fluorometer (10-AU; Turner Designs, Sunnyvale). The fluorometer was calibrated against a Chl *a* standard (Wako Chemical Co.) at a laboratory on land prior to the cruise with a spectrophotometer and the specific absorption coefficient of Chl *a* (Porra *et al.*, 1989).

The samples for the nutrient concentration analyses were frozen and transported to a laboratory at the Tokyo University of Marine Science and Technology, Japan, via the National Institute of Polar Research, Japan. The frozen samples were thawed to room temperature starting the day before the analyses. Concentrations of the nutrients NO₃ + NO₂, PO₄, SiO₂, and NO₂ were determined using an autoanalyzer (QuAAtro2-HR; BL-TEC K. K.), according to the Joint Global Ocean Flux Study colorimetric analysis methods (JGOFS, 1994). The nutrient concentrations were calibrated against KANSO reference materials (BU, BV, BW, BY, BZ, and CA; KANSO Technos Co., Ltd.).

4. Results

[Table 1](#) lists all information about sampling at the routine monitoring stations. [Figure 2](#) shows vertical profiles of temperature and salinity at each monitoring station, and [Table 2](#) lists bottle analysis data along with CTD data at defined depths. [Table 3](#) shows underway water sampling analysis data and sampling information.

5. Data archive

The data presented in this report are archived and available as a comma-separated values (csv) file from the web site <http://biows.nipr.ac.jp/JARE/>. Permission to use these data for publication or presentation should be obtained in writing. Inquiries about details of the data record should be addressed to:

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References

- JGOFS (1994): Protocols for the Joint Global Ocean Flux Study (JGOFS) core measurements. JGOFS Report, **19**, 43–91.
- Parsons, T.R., Maita, Y. and Lalli, C.M. (1984): A manual of chemical and biological methods for seawater analysis. Oxford, Pergamon Press, 173 p. (Pergamon international library of sciences, technology, engineering and social studies).

- Porra, R.J., Thompson, W.A. and Kriedemann, P.E. (1989): Determination of accurate extinction coefficients and simultaneous equations for assaying chlorophylls *a* and *b* extracted with four different solvents: verification of the concentration of chlorophyll standards by atomic absorption spectroscopy. *BBA-Bioenergetics*, **975**, 384–394.
- Suzuki, R. and Ishimaru, T. (1990): An improved method for the determination of phytoplankton chlorophyll using N, N-dimethylformamide. *J. Oceanogr. Soc. Jpn.* **46**, 190–194.
- Takahashi, K.T., Iida, T., Hashida, G. and Odate, T. (2012): Field test of “ice-fence” for oceanographic observation in the sea-ice zone. *Nankyoku Shiryô (Antarctic Record)*, **56**, 447–455 (in Japanese with English abstract).
- Takahashi, K.T., Takamura, T.R. and Odate, T. (2014): Report on a modified ice-fence for oceanographic observations under heavy sea-ice conditions during JARE-54 and JARE-55. *Nankyoku Shiryô (Antarctic Record)*, **58**, 393–403 (in Japanese with English abstract).

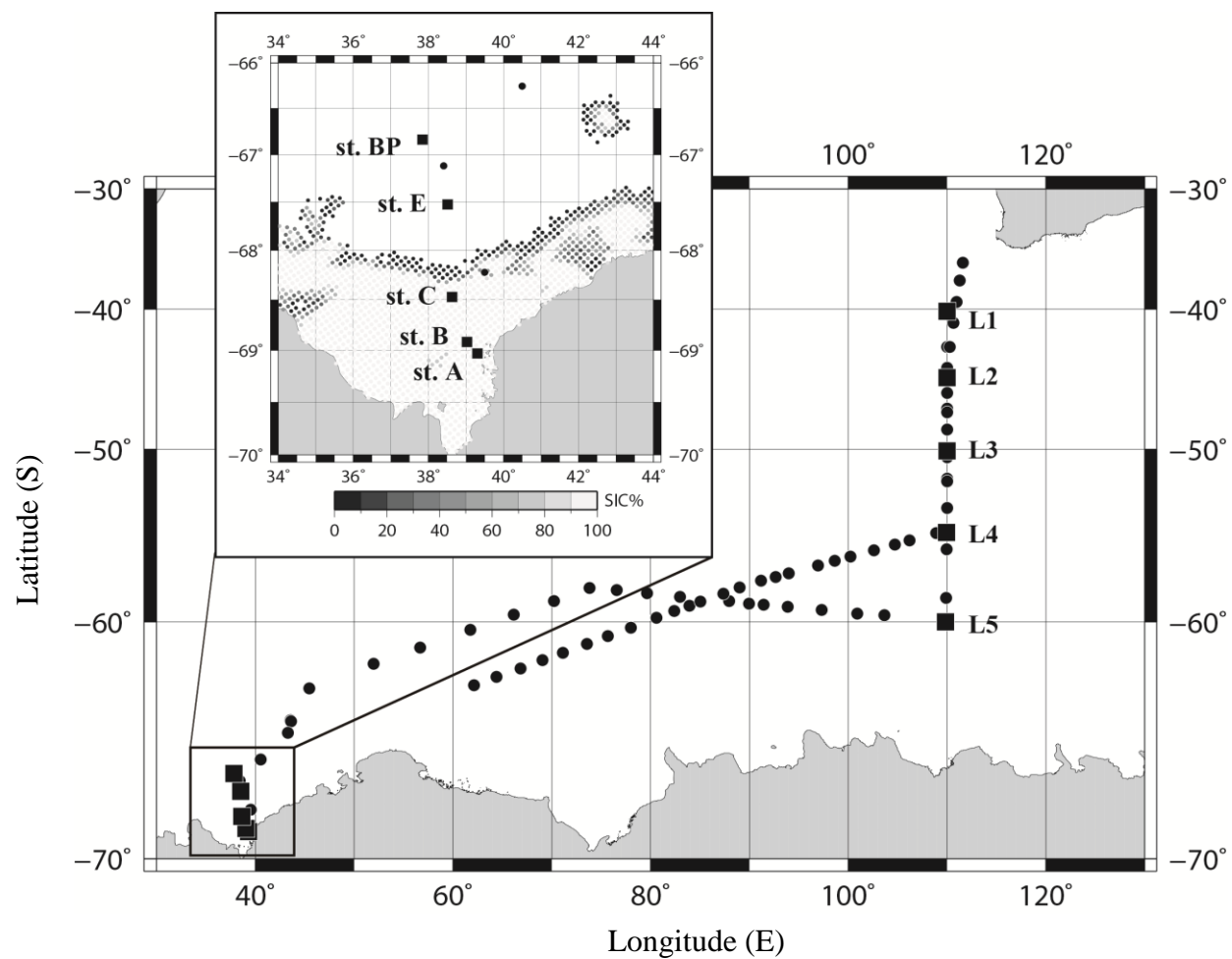


Fig. 1. Locations of sampling stations during the JARE-56 cruise. Solid circles indicate underway surface water sampling points. Solid squares indicate vertical profile sampling stations. SIC indicates the sea ice concentration (%) on 17 February 2015. The SIC data were obtained from Daily AMSR2 sea ice maps (<http://www.iup.uni-bremen.de:8084/amr2/>).

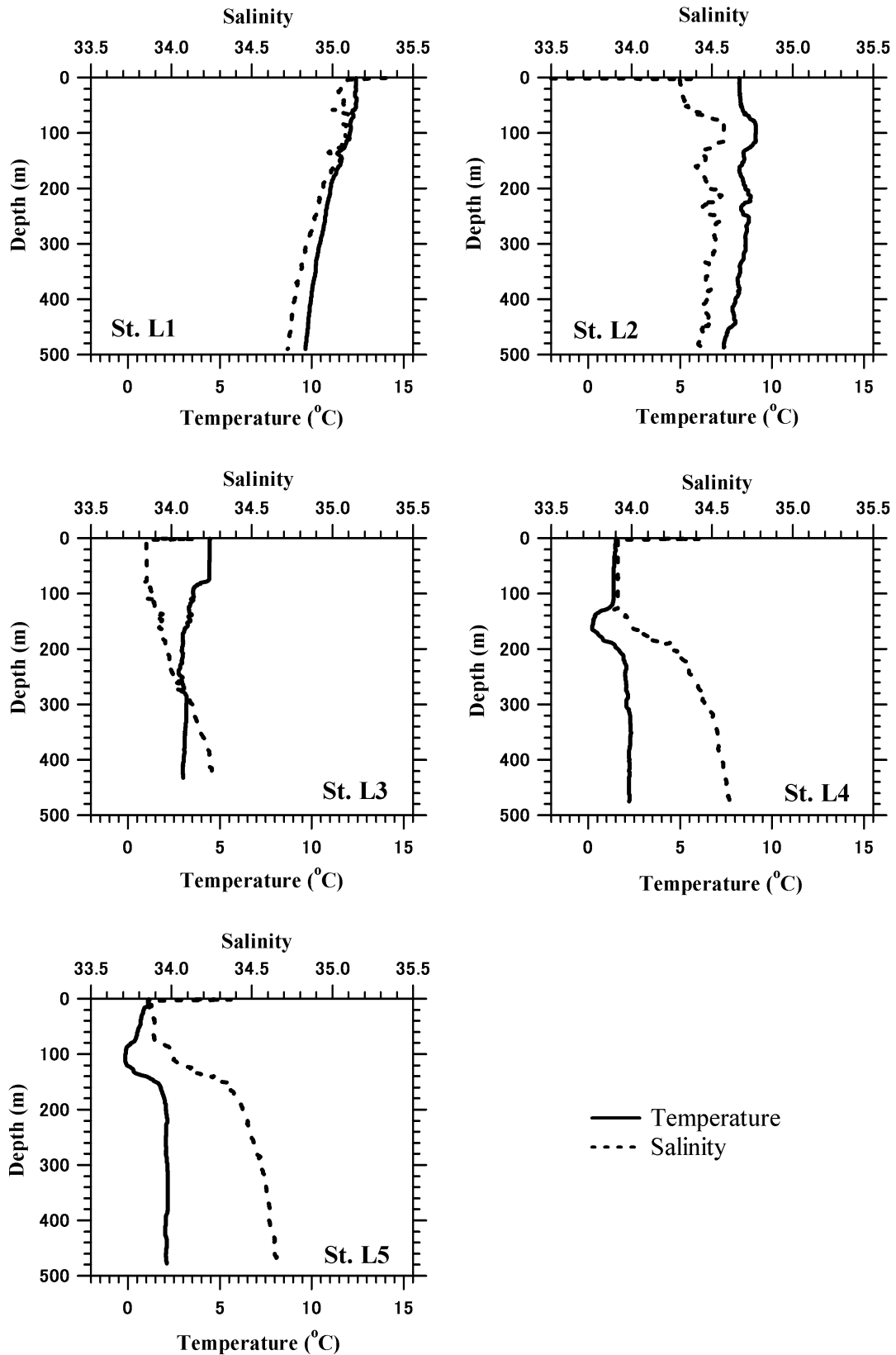


Fig. 2. Vertical profiles of temperature and salinity at each vertical profile monitoring station. Salinity data at station C are unavailable because of salinity sensor probe difficulties.

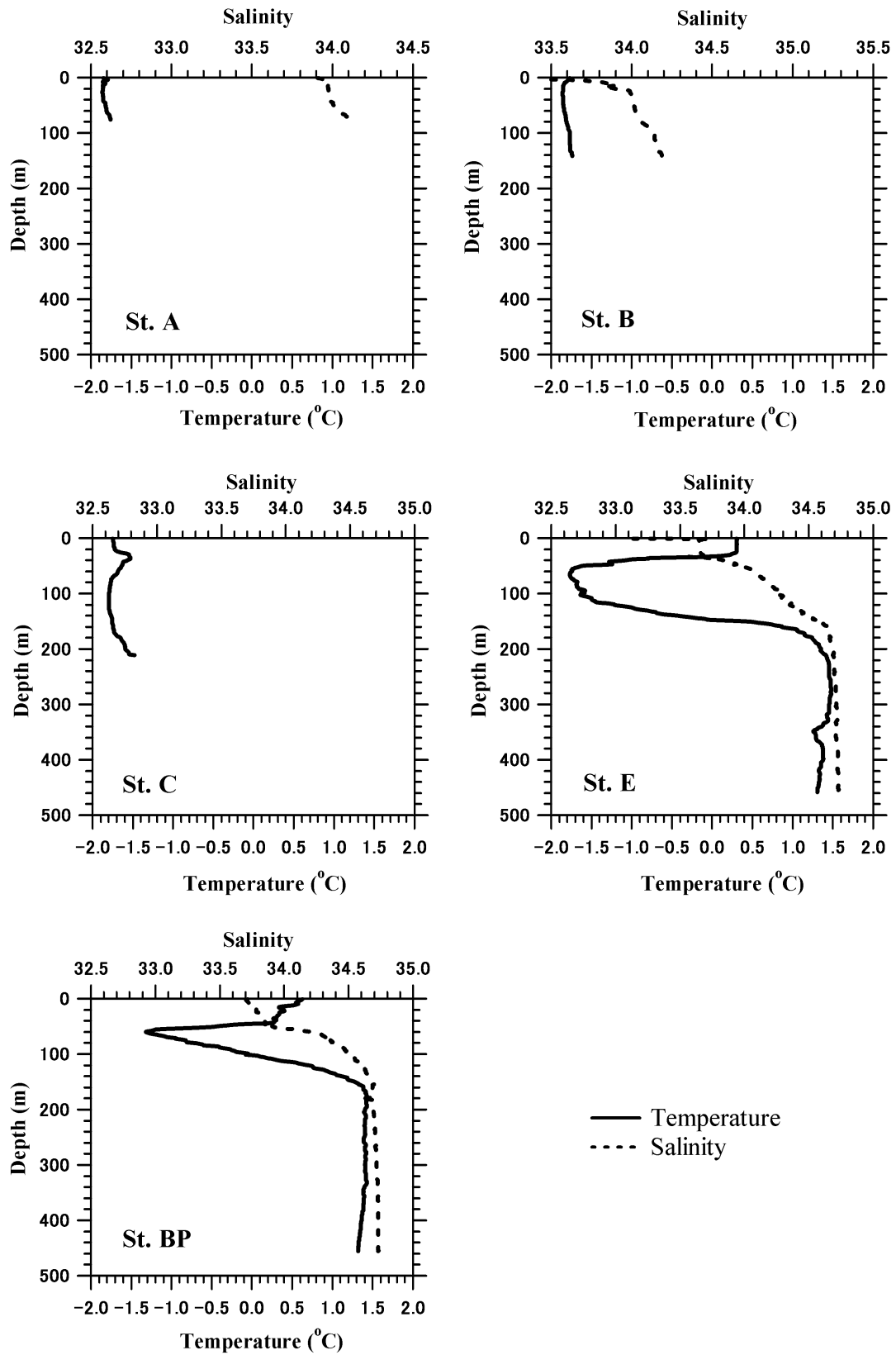


Fig. 2. Continued.

Table 1. Sampling date, time, position, bottom depth, air temperature, wind speed, and atmospheric pressure at each station.

Station	Date (UTC)	Time (UTC)	Latitude (°S)	Longitude (°E)	Air temperature (°C)	Sea surface temperature (°C)	Wind speed (m/s)	Atmospheric pressure (hPa)
L1	2014/12/2	0:58	40-09.70	110-00.21	11.8	12.5	7	1013.3
L2	2014/12/3	0:57	45-07.22	110-00.92	6.8	8.4	9	1004.2
L3	2014/12/4	1:01	50-06.35	109-59.33	5.6	4.5	13	999.2
L4	2014/12/5	6:02	55-07.81	109-57.90	2.8	1.7	10	999.8
L5	2014/12/6	8:03	59-59.21	109-50.26	1.0	1.2	6	984.5
A	2015/1/31	15:44	69-01.85	39-18.71	-1.5	-1.8	1	987.8
B	2015/2/15	16:00	68-55.00	39-01.98	-1.8	-1.8	3	988.8
C	2015/2/16	13:59	68-28.37	38-38.04	-3.4	-1.6	12	979.2
E	2015/2/17	11:29	67-31.53	38-31.02	-0.1	0.4	9	969.6
BP	2015/2/18	5:39	66-50.23	37-50.45	1.3	0.4	1	971.0

Table 2. Conductivity–temperature–depth (CTD) and water analysis data at monitoring stations.

Station	Pressure (dbar)	CTD data		Water analysis data				
		Temperature (°C)	Salinity	Nitrate ($\mu\text{mol/L}$)	Nitrite ($\mu\text{mol/L}$)	Phosphate ($\mu\text{mol/L}$)	Silicate ($\mu\text{mol/L}$)	Chl <i>a</i> ($\mu\text{g/L}$)
L1	0(Bucket)	-	-	6.5	0.34	1.54	0.577	0.292
	20	12.4019	35.0497	6.3	0.15	1.54	0.568	0.300
	49	12.3983	35.0748	5.9	0.16	1.53	0.540	0.372
	74	12.213	35.0719	6.0	0.20	1.63	0.559	0.275
	99	12.0747	35.0791	6.1	0.22	1.62	0.568	0.190
	197	11.037	34.9428	9.5	0.02	2.14	0.751	0.014
	398	9.9693	34.766	12.8	0.02	3.15	0.951	-
L2	0(Bucket)	-	-	14.8	0.29	1.56	1.097	0.816
	19	8.2325	34.3056	14.8	0.28	1.61	1.103	0.759
	49	8.2895	34.3272	14.7	0.30	1.85	1.100	0.714
	74	8.8036	34.5097	13.7	0.31	3.65	1.044	0.606
	99	9.1283	34.5701	13.5	0.33	3.88	1.035	0.432
	198	8.5358	34.4807	14.7	0.40	4.06	1.115	0.132
	396	8.0914	34.4445	19.5	0.03	7.19	1.362	-
L3	0(Bucket)	-	-	22.8	0.24	2.47	1.563	0.486
	20	4.4427	33.8451	22.8	0.23	2.55	1.586	0.456
	49	4.435	33.8451	22.8	0.23	2.58	1.573	0.436
	74	4.4179	33.8452	22.9	0.23	2.79	1.574	0.578
	98	3.5459	33.8808	24.1	0.21	8.26	1.949	0.436
	199	2.9593	33.9625	27.1	0.24	16.62	1.872	0.069
	396	3.0333	34.2373	33.2	0.03	38.27	2.255	-
L4	0(Bucket)	-	-	27.1	0.28	21.38	1.850	0.355
	20	1.4912	33.9179	27.1	0.27	21.40	1.837	0.330
	49	1.427	33.9131	27.1	0.25	21.47	1.858	0.323
	74	1.3987	33.9137	27.2	0.25	21.73	1.848	0.395
	97	1.3971	33.9134	27.1	0.25	21.61	1.849	0.451
	197	1.5089	34.2484	34.2	0.03	50.94	2.337	0.060
	395	2.2352	34.5505	35.4	0.01	73.45	2.422	-
L5	0(Bucket)	-	-	27.6	0.24	28.28	1.868	0.282
	20	0.8592	33.8866	27.6	0.23	28.55	1.892	0.301
	50	0.6389	33.8877	27.7	0.22	30.45	1.884	0.426
	74	0.4007	33.8929	27.9	0.22	32.10	1.902	0.508
	98	-0.1135	34.0002	29.7	0.24	39.60	2.070	0.285
	198	2.0685	34.4431	36.0	0.02	67.77	2.470	0.024
	398	2.0581	34.6049	34.8	0.01	77.83	2.397	-

Table 2. Continued.

Station	Pressure (dbar)	CTD data		Water analysis data				
		Temperature (°C)	Salinity	Nitrate ($\mu\text{mol/L}$)	Nitrite ($\mu\text{mol/L}$)	Phosphate ($\mu\text{mol/L}$)	Silicate ($\mu\text{mol/L}$)	Chl <i>a</i> ($\mu\text{g/L}$)
A	0(Bucket)	-	-	30.1	0.08	60.52	2.049	0.082
	5	-1.7943	33.9589	30.3	0.03	60.21	2.056	0.046
	9	-1.8277	33.9755	30.3	0.02	59.52	2.063	0.036
	19	-1.8507	33.9732	30.4	0.02	60.89	2.072	0.029
	34	-1.852	33.9815	30.4	0.02	60.33	2.066	0.034
	49	-1.8208	34.0052	30.7	0.01	61.60	2.087	0.018
	69	-1.7704	34.0844	31.1	0.02	64.67	2.119	0.011
B	0(Bucket)	-	-	26.8	0.09	55.50	1.934	0.745
	10	-1.8348	33.8461	30.1	0.07	57.97	2.057	0.101
	19	-1.8526	33.9046	30.2	0.04	57.89	2.049	0.061
	49	-1.8471	34.0135	28.4	0.01	55.00	1.974	0.029
	74	-1.8163	34.0553	30.9	0.02	60.83	2.107	0.018
	99	-1.7729	34.1334	31.3	0.01	65.18	2.148	0.017
	128	-1.7631	34.1557	31.3	0.01	65.73	2.154	0.009
C	0(Bucket)	-	-	25.5	0.22	52.16	1.796	0.571
	10	-1.7397	ND	25.8	0.23	52.86	1.822	0.525
	20	-1.7278	ND	27.1	0.18	55.62	1.889	0.492
	50	-1.6348	ND	ND	ND	ND	ND	ND
	74	-1.7697	ND	30.3	0.10	60.45	2.095	0.216
	99	-1.795	ND	ND	ND	ND	ND	ND
	198	-1.5933	ND	ND	ND	ND	ND	-
E	0(Bucket)	-	-	27.0	0.27	51.61	1.869	0.231
	19	0.3027	33.6514	27.1	0.26	51.68	1.872	0.221
	49	-1.4816	33.8742	29.9	0.15	62.66	2.087	0.247
	74	-1.7387	34.1576	31.1	0.16	66.02	2.163	0.205
	97	-1.6356	34.2872	31.7	0.08	67.10	2.181	0.093
	197	1.3341	34.6775	34.1	0.03	89.38	2.333	0.023
	397	1.3779	34.73	32.7	0.01	94.84	2.24	-
BP	0(Bucket)	-	-	27.5	0.25	52.83	1.875	0.377
	19	0.3714	33.8004	27.5	0.24	52.99	1.881	0.453
	49	-0.3933	33.9248	28.2	0.18	55.14	1.927	0.703
	74	-0.88	34.3789	31.7	0.13	72.18	2.199	0.458
	97	-0.129	34.5153	33.0	0.11	78.97	2.276	0.331
	198	1.4169	34.6921	33.6	0.01	91.07	2.294	0.015
	397	1.365	34.7299	32.8	0.01	95.46	2.249	-

ND: No Data

Table 3. Sampling date, time, position, temperature, salinity, nutrient concentrations, and Chl *a* concentrations for underway, surface water samplings.

Station	Date (UTC)	Time (UTC)	Latitude (°S)	Longitude (°E)	Temperature (°C)	Salinity	Nitrate ($\mu\text{mol/L}$)	Nitrite ($\mu\text{mol/L}$)	Phosphate ($\mu\text{mol/L}$)	Silicate ($\mu\text{mol/L}$)	Chl <i>a</i> ($\mu\text{g/L}$)
S001	2014/12/2	13:55	42-51.67	110-00.20	11.0229	34.7345	9.8	0.2	1.8	0.7	0.33
S002	2014/12/3	12:03	47-16.44	110-00.11	8.6370	34.3963	14.3	0.3	2.9	1.0	0.66
S003	2014/12/4	11:56	51-52.29	109-59.99	3.0957	33.8629	24.0	0.3	1.7	1.6	1.07
S004	2014/12/5	11:58	56-05.25	109-57.50	2.0696	33.9095	25.6	0.3	11.1	1.7	1.26
S005	2014/12/6	1:10	58-45.39	109-52.77	1.0906	33.8984	27.8	0.2	27.4	1.9	0.31
S006	2014/12/6	23:36	59-38.91	103-41.00	0.6298	33.8178	26.9	0.3	31.7	1.7	0.70
S007	2014/12/7	6:10	59-33.32	100-55.05	0.3980	33.7785	25.7	0.3	28.7	1.6	0.90
S008	2014/12/7	14:52	59-22.72	97-17.93	0.2277	33.7497	25.4	0.3	24.4	1.6	1.01
S009	2014/12/7	23:45	59-12.34	93-52.87	-0.0190	33.7251	25.5	0.3	25.8	1.6	0.99
S010	2014/12/8	7:30	59-06.79	91-26.02	-0.2399	33.8361	26.1	0.3	34.6	1.7	1.44
S011	2014/12/8	15:16	59-02.43	89-57.17	0.4841	33.8439	26.2	0.3	21.8	1.7	0.63
S012	2014/12/9	1:06	58-55.03	87-56.86	0.2743	33.8930	27.0	0.3	24.5	1.8	0.46
S013	2014/12/9	16:01	58-40.72	82-56.81	-0.3470	34.0724	29.6	0.2	52.7	1.9	1.36
S014	2014/12/10	0:21	58-29.60	79-38.99	-0.3458	34.1515	29.5	0.3	52.2	2.0	1.19
S015	2014/12/10	8:16	58-20.27	76-35.18	-0.4744	34.0940	29.1	0.2	52.0	2.0	1.60
S016	2014/12/10	15:58	58-13.33	73-49.70	-0.7764	33.6429	26.2	0.2	28.6	1.8	0.71
S017	2014/12/11	1:43	58-53.97	70-12.41	-0.8483	33.5843	26.0	0.2	28.7	1.8	0.74
S018	2014/12/11	13:57	59-37.24	66-09.59	-0.8783	33.6310	26.1	0.2	28.3	1.8	0.88
S019	2014/12/12	2:39	60-23.40	61-44.16	-1.0753	33.7142	25.5	0.2	31.5	1.7	1.86
S020	2014/12/12	15:05	61-15.80	56-41.05	-0.6873	33.5976	24.7	0.1	31.0	1.7	1.38
S021	2014/12/13	2:40	62-02.14	51-56.92	-0.7956	33.6599	26.3	0.3	35.4	1.8	0.55
S022	2014/12/13	19:06	63-10.68	45-27.54	-1.0302	33.7268	27.5	0.2	47.3	1.9	0.51
S023	2014/12/14	3:31	64-35.98	43-33.50	-1.2962	33.8583	28.5	0.2	51.6	2.0	0.26
S024	2014/12/14	14:52	64-39.14	43-34.72	-1.3550	33.9140	28.7	0.2	52.3	2.0	0.22
S025	2014/12/15	3:31	65-08.31	43-17.78	-1.6376	33.8556	28.6	0.2	51.5	2.0	0.23
S026	2014/12/15	10:57	66-15.45	40-30.36	-1.5063	33.8415	28.6	0.2	57.6	2.0	0.17

Table 3. Continued.

Station	Date (UTC)	Time (UTC)	Latitude (°S)	Longitude (°E)	Temperature (°C)	Salinity	Nitrate ($\mu\text{mol/L}$)	Nitrite ($\mu\text{mol/L}$)	Phosphate ($\mu\text{mol/L}$)	Silicate ($\mu\text{mol/L}$)	Chl <i>a</i> ($\mu\text{g/L}$)
S027	2014/12/15	19:25	67-07.19	38-24.68	-1.1758	33.8768	30.1	0.2	63.4	2.1	0.16
S028	2014/12/16	4:06	68-13.49	39-30.11	-1.5517	34.0248	31.0	0.1	62.6	2.1	0.22
S029	2015/2/20	10:28	63-03.00	62-07.23	1.0830	33.6611	22.4	0.2	7.5	1.4	1.21
S030	2015/2/20	17:58	62-39.68	64-24.98	0.9786	33.6603	26.4	0.3	30.8	1.7	0.34
S031	2015/2/21	2:19	62-15.27	66-50.02	0.9854	33.6221	25.7	0.3	26.9	1.7	0.21
S032	2015/2/21	10:03	61-51.77	69-04.60	0.8451	33.6185	25.6	0.3	24.6	1.6	0.31
S033	2015/2/21	16:53	61-30.60	71-06.39	0.8977	33.1529	25.9	0.3	29.2	1.6	0.82
S034	2015/2/22	1:10	61-04.49	73-32.20	0.8712	33.3516	25.6	0.3	25.2	1.5	0.25
S035	2015/2/22	8:25	60-41.35	75-41.05	1.0106	33.6038	24.9	0.3	25.6	1.5	1.00
S036	2015/2/22	16:16	60-16.47	77-59.57	1.3352	33.8175	26.2	0.3	22.6	1.7	0.19
S037	2015/2/23	1:19	59-47.03	80-34.02	1.1436	33.8278	24.9	0.3	16.7	1.6	0.41
S038	2015/2/23	7:54	59-25.35	82-22.12	1.4929	33.9527	25.9	0.3	21.8	1.7	0.16
S039	2015/2/23	13:46	59-09.56	83-55.55	0.5008	33.5362	23.3	0.2	27.5	1.5	2.35
S040	2015/2/23	18:06	58-56.57	85-01.17	-0.0479	33.7055	25.4	0.2	41.8	1.7	1.87
S041	2015/2/24	6:22	58-31.68	87-20.90	2.0857	33.9027	26.0	0.3	15.2	1.7	0.23
S042	2015/2/24	14:38	58-11.89	88-59.57	2.0941	33.8884	26.0	0.3	15.4	1.7	0.67
S043	2015/2/25	0:20	57-49.88	91-08.91	2.2791	33.8833	25.7	0.3	11.9	1.7	0.20
S044	2015/2/25	8:07	57-36.82	92-40.18	2.1463	33.8307	25.6	0.3	14.9	1.7	0.20
S045	2015/2/25	14:51	57-25.16	93-59.79	2.0390	33.8189	25.8	0.3	15.3	1.7	0.23
S046	2015/2/26	5:59	56-59.17	96-56.07	2.3456	33.7932	25.7	0.3	14.9	1.7	0.21
S047	2015/2/26	14:46	56-44.27	98-37.55	2.1925	33.7861	25.5	0.3	14.2	1.7	0.22
S048	2015/2/26	23:25	56-29.76	100-14.39	2.2737	33.7858	25.5	0.3	14.4	1.7	0.19
S049	2015/2/27	12:00	56-08.19	102-37.32	2.5672	33.8599	26.3	0.3	16.0	1.7	0.19
S050	2015/2/27	23:45	55-48.95	104-43.21	2.7924	33.8733	26.8	0.3	15.1	1.7	0.20
S051	2015/2/28	5:07	55-35.25	106-11.91	2.9670	33.8114	26.0	0.3	12.9	1.7	0.18

Table 3. Continued.

Station	Date (UTC)	Time (UTC)	Latitude (°S)	Longitude (°E)	Temperature (°C)	Salinity	Nitrate ($\mu\text{mol/L}$)	Nitrite ($\mu\text{mol/L}$)	Phosphate ($\mu\text{mol/L}$)	Silicate ($\mu\text{mol/L}$)	Chl <i>a</i> ($\mu\text{g/L}$)
S052	2015/2/28	13:39	55-10.48	108-53.88	2.7814	33.8166	25.9	0.3	13.5	1.7	0.17
S053	2015/2/28	23:14	53-40.86	110-00.03	3.2002	33.8379	25.9	0.3	10.5	1.7	0.20
S054	2015/3/1	6:28	52-02.99	110-00.00	3.8422	33.8209	24.4	0.3	5.0	1.7	0.13
S055	2015/3/1	14:02	50-30.53	110-00.34	4.4912	33.8123	23.9	0.3	4.0	1.6	0.20
S056	2015/3/1	23:18	48-42.77	110-00.20	5.8283	33.8759	22.1	0.3	1.8	1.5	0.27
S057	2015/3/2	6:13	47-32.44	110-00.02	8.6801	34.0980	16.3	0.3	1.2	1.2	0.33
S058	2015/3/2	14:15	46-10.48	110-00.06	9.6918	34.2398	14.6	0.3	1.1	1.1	0.24
S059	2015/3/2	23:22	44-24.64	110-00.01	9.9651	34.3723	13.9	0.2	1.6	1.0	0.27
S060	2015/3/3	10:10	42-52.12	110-15.03	13.5840	34.9244	5.3	0.1	0.5	0.5	0.59
S061	2015/3/3	23:14	41-02.45	110-38.03	14.1916	34.9450	4.7	0.1	0.4	0.5	0.45
S062	2015/3/4	11:07	39-24.70	110-57.55	15.0081	34.9233	4.2	0.1	0.3	0.4	0.39
S063	2015/3/4	23:23	37-43.41	111-17.55	18.4959	35.5152	0.0	0.0	0.9	0.1	0.18
S064	2015/3/5	9:33	36-17.02	111-34.30	19.2356	35.4782	0.0	0.0	0.7	0.1	0.10