Oceanographic Data of the 52nd Japanese Antarctic Research Expedition (JARE) acquired on board the training and research vessel, *Umitaka Maru* in the Indian sector of the Southern Ocean during 2010/2011 austral summer

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1. Introduction

Oceanographic observations have been acquired *en route* between Japan and the Japanese Antarctic Station, Syowa (69°00’S, 39°35’E), as part of the annual JARE (Japanese Antarctic Research Expedition) routine observations since JARE-7 in 1965/66, when the JARE research programs were re-started and re-structured in accordance with a Decision of the Japanese Cabinet. The Hydrographic Division of the Japan Maritime Safety Agency (now the “Hydrographic and Oceanographic Department, Japan Coast Guard”) was in charge of maintaining and continuing the oceanographic observations as well as publishing the JARE Data Report series from JARE-7 until JARE-50 in 2008/2009.

Starting from JARE-51 in the 2009/2010 season, the responsibility for maintaining routine oceanographic observations was transferred to the Ministry of Education, Culture, Sports, Science

and Technology (MEXT) as the lead agency, but no new program of oceanographic observations was established. However, through the efforts of the Japanese Antarctic oceanographic community, oceanographic observations continued within the JARE framework, and observations were carried out during JARE-52 in the 2010/2011 season as one of the JARE research projects. The training and research vessel *Umitaka Maru* of the Tokyo University of Marine Science and Technology (TUMSAT) was employed as a platform for *in situ* observations under an agreement between TUMSAT and the National Institute of Polar Research (NIPR).

The present report summarizes the oceanographic data acquired on board the *Umitaka Maru* during cruise UM-10-04 as a part of the JARE-52 research project #AP-25: "Studies on Plankton Community Structure and Environment Parameters" (PI: Takashi Ishimaru, TUMSAT). This project is one of the JARE projects that are authorized and funded by the Headquarters of JARE at MEXT. Oceanographic observations were carried out as part of AP-25, which focused on plankton ecology. Results of the plankton investigations will be published separately.

2. Oceanographic Observations

Figure 1 shows the track of the *Umitaka Maru* in the Southern Ocean during cruise UM-10-04 and the locations of oceanographic stations.

3. CTD and serial observations

Conductivity-Temperature-Depth (CTD) (Seabird SBE911*plus* unit with SBE43, Sea Bird Electronics, Inc., Bellevue, WA, USA) observations were conducted at 10 stations along the 110° and 140°E meridians to obtain continuous data of temperature, salinity, and dissolved oxygen. Serial observations with a Carousel water sampler (2.5 L Niskin bottles × 24) were made to obtain chemical data.

The results are listed in Table 1, including chemical analyses of sampled water and values of temperature, salinity, and dissolved oxygen measured with the CTD.

4. Chemical analysis

The methods used for chemical analysis of seawater samples collected using a bucket for surface observations and collected using Niskin bottles (2.5 L) via the CTD system were as follows.

- Salinity (item (a) below) was calculated from conductivity using the 1978 practical salinity scale (UNESCO, 1981).
- Dissolved oxygen (item (b)) was analyzed by the Winkler method as modified by Carpenter (1965) for greater precision.
- Phosphate (item (c)) was measured using the molybdenum blue method (Murphy and Riley, 1962) as modified by Hansen and Koroleff (1999).
- Silicic acid (item (d)) was measured using the molybdenum blue method (Hansen and Koroleff, 1999).
- Nitrite and nitrate+nitrite (items (e) and (f)) were measured using the Cd–Cu naphthylethylenediamine method of Strickland and Parsons (1972), but using imidazole solution in place of ammonium chloride solution.

(a) Practical salinity: conductive salinometer (Autosal 8400B, Guildline).

(b) Dissolved oxygen: Carpenter method (MET808-DO, Metrohm-Shibata).

(c) Phosphate: molybdenum blue method (AACS-III, Bran+Luebbe).

(d) Silicic acid: molybdenum blue method (AACS-III, Bran+Luebbe).

(e) Nitrite: naphthylethylenediamine method (AACS-III, Bran+Luebbe).

(f) Nitrate+nitrite: cadmium(Cd)–copper(Cu) reduction column, naphthylethylenediamine method (AACS-III, Bran+Luebbe).

5. Digital data archive

All digital data are archived and are available from the online Science Database of the National Institute of Polar Research (http://scidbase.nipr.ac.jp/?ml_lang=en).

Inquiries about details of the data record should be addressed to:

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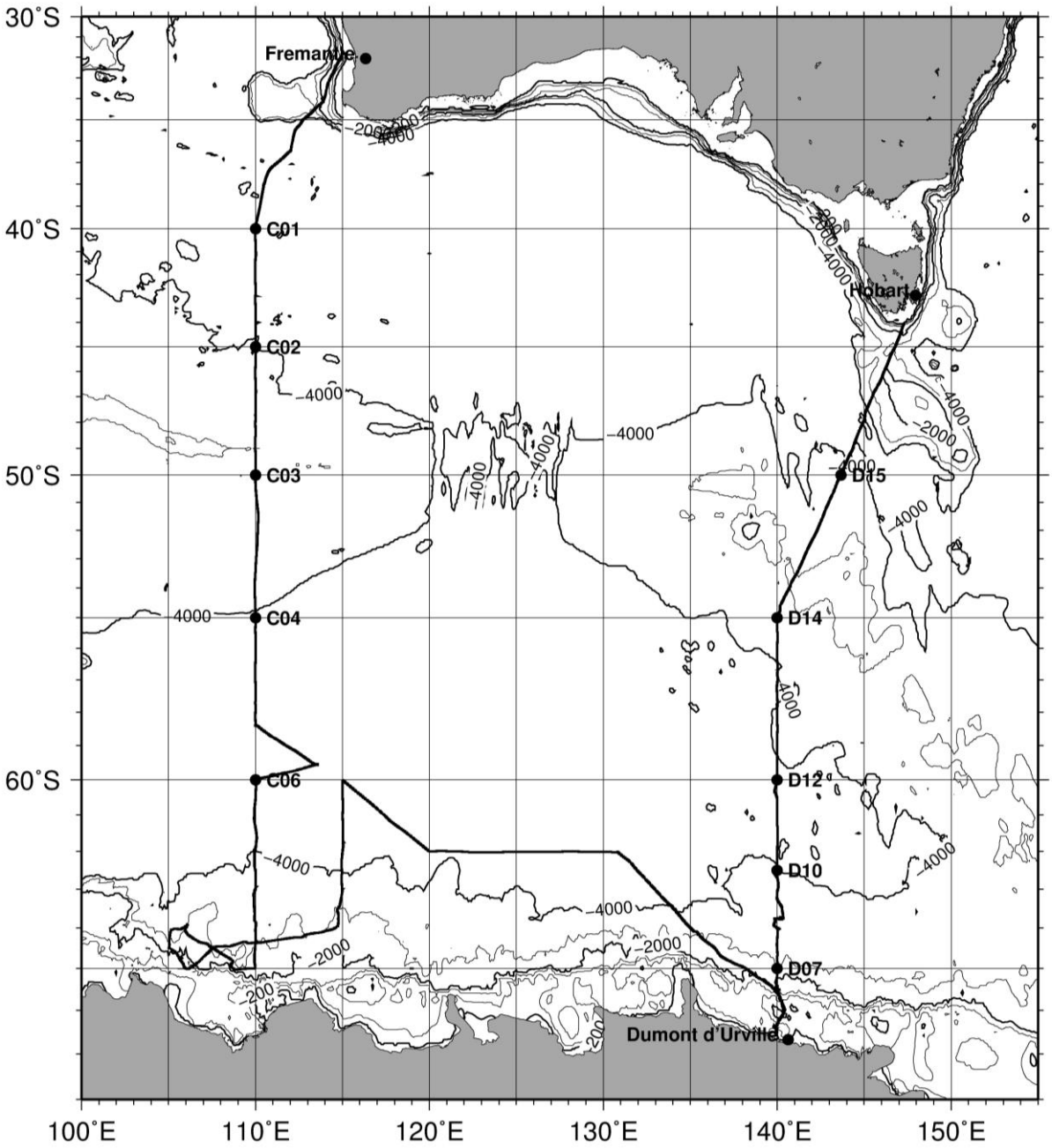

Fig. 1. Cruise track and location of the sampling station in the Southern Ocean in austral summer of 2010–2011 during UM-10-04 cruise.

Table 1. Serial and CTD observation data

Station:	C01	Latitude (°S):	40-00.07	Air temperature (deg C):	13.2
Cast Name:	SBE-A	Longitude (°E):	109-59.81	Sea surface temperature (deg C):	14.8
date (UTC):	25/12/2010	Depth (m):	4611	Atmospheric pressure (hPa):	1027.2
time (UTC):	22:39			Wind speed (m/s):	8.9

No. of Niskin bottle	Pressure	CTD data			Data for sampled water					
		Temperature	Salinity	Oxygen	Salinity	Oxygen	Nitarate	Nitrite	Phosphate	Silicic acid
	(dbar)	(℃)	(PSU)	(mL/L)	(PSU)	(mL/L)	(μM)	(μM)	(μM)	(μM)
#01	4686	0.9141	34.7057	-	34.7066	-	32.2	nd	2.3	124.5
#02	4000	0.9431	34.7105	-	34.7143	-	32.1	nd	2.4	122.1
#03	3498	1.2117	34.7239	-	-	-	31.6	nd	2.4	113.9
#04	2996	1.6457	34.7421	-	34.7459	-	30.7	nd	2.4	99.3
#05	2498	2.1486	34.7394	-	-	-	30.9	nd	2.4	86.7
#06	2000	2.5289	34.6673	-	34.6688	-	32.6	nd	2.6	79.3
#07	1501	3.0412	34.4967	-	-	-	34.0	nd	2.8	64.0
#08	997	5.1956	34.3553	-	-	-	28.7	nd	2.5	24.9
#09	751	7.9789	34.5195	-	34.5231	-	21.2	nd	1.8	9.1
#10	499	9.3223	34.6625	-	-	-	15.6	nd	1.6	3.8
#11	200	10.8697	34.8794	-	-	-	9.7	nd	0.8	1.6
#12	151	11.6350	35.0105	-	-	-	7.8	nd	0.7	1.3
#13	99	12.4419	35.1429	-	-	-	6.0	nd	0.5	0.8
#14	97	12.4776	35.1501	-	-	-	-	-	-	-
#15	76	12.5800	35.1184	-	-	-	5.0	0.5	0.5	0.8
#16	76	12.5330	35.0921	-	-	-	-	-	-	-
#17	76	12.5262	35.0878	-	-	-	4.8	0.5	0.5	0.9
#18	49	14.4788	35.3568	-	-	-	0.2	nd	0.1	nd
#19	48	14.4794	35.3565	-	-	-	-	-	-	-
#20	25	14.5441	35.1954	-	-	-	1.5	0.1	0.2	nd
#21	23	14.5404	35.1919	-	-	-	-	-	-	-
#22	19	14.5402	35.1903	-	-	-	1.4	0.1	0.2	nd
#23	9	14.5490	35.1882	-	-	-	1.5	0.1	0.2	nd
#24	8	14.5460	35.1883	-	-	-	-	-	-	-
Buckets[*1]	0	-	-	-	-	-	1.6	0.1	nd	nd

*1 Surface water was sampled by a plastic buckets. nd: not determined

Table 1. Continued

Station:	C02	Latitude (°S):	44-59.871	Air temperature (deg C):	10.7
Cast Name:	SBE-B	Longitude (°E):	110-00.254	Sea surface temperature (deg C):	11.6
date (UTC):	26/12/2010	Depth (m):	4007	Atmospheric pressure (hPa):	1014.0
time (UTC):	23:14			Wind speed (m/s):	12.7

No. of Niskin bottle	Pressure	CTD data			Data for sampled water					
		Temperature	Salinity	Oxygen	Salinity	Oxygen	Nitarate	Nitrite	Phosphate	Silicate
	(dbar)	(℃)	(PSU)	(mL/L)	(PSU)	(mL/L)	(μM)	(μM)	(μM)	(μM)
#01	4072	1.1338	34.7174	4.52	34.7174	5.07	-	-	-	-
#02	4000	1.1305	34.7181	4.51	34.7181	5.03	-	-	-	-
#03	999	3.8414	34.3132	4.70	34.3132	5.14	-	-	-	-
#04	300	9.3907	34.6265	6.00	34.6265	6.29	-	-	-	-
#05	3500	1.1632	34.7218	4.47	34.7218	4.99	-	-	-	-
#06	2998	1.4275	34.7353	4.41	34.7353	4.97	-	-	-	-
#07	2502	1.9512	34.7526	4.32	34.7526	4.79	-	-	-	-
#08	2003	2.4125	34.7085	4.08	34.7085	4.55	-	-	-	-
#09	1499	2.7872	34.5498	3.89	34.5498	4.27	-	-	-	-
#10	1434	2.8439	34.5211	3.91	34.5211	4.33	-	-	-	-
#11	749	5.8045	34.3566	4.87	34.3566	5.23	-	-	-	-
#12	500	7.8592	34.4409	5.65	34.4409	5.96	-	-	-	-
#13	198	10.0919	34.7399	5.83	34.7399	6.11	-	-	-	-
#14	149	10.357	34.78	5.83	34.7800	6.13	-	-	-	-
#15	100	10.4293	34.7464	6.02	34.7464	6.30	-	-	-	-
#16	97	10.4288	34.7464	6.03	-	-	-	-	-	-
#17	74	10.3759	34.7157	6.14	-	-	-	-	-	-
#18	57	10.191	34.6302	6.41	-	-	-	-	-	-
#19	51	10.6802	34.6848	6.42	34.6896	6.70	-	-	-	-
#20	47	10.8739	34.7023	6.45	-	-	-	-	-	-
#21	24	11.1549	34.5258	6.40	-	-	-	-	-	-
#22	20	11.1588	34.5239	6.39	-	-	-	-	-	-
#23	10	11.1562	34.5239	6.39	-	-	-	-	-	-
#24	4	11.1568	34.524	6.40	-	6.65	-	-	-	-

Table 1. Continued

Station:	C03	Latitude (°S):	50-00.126	Air temperature (deg C):	5.3
Cast Name:	SBE-B	Longitude (°E):	110-00.269	Sea surface temperature (deg C):	7.1
date (UTC):	28/12/2010	Depth (m):	3265	Atmospheric pressure (hPa):	1008.1
time (UTC):	5:35			Wind speed (m/s):	10.5

No. of Niskin bottle	Pressure	CTD data			Data for sampled water					
		Temperature	Salinity	Oxygen	Salinity	Oxygen	Nitarate	Nitrite	Phosphate	Silicate
	(dbar)	(℃)	(PSU)	(mL/L)	(PSU)	(mL/L)	(μM)	(μM)	(μM)	(μM)
#01	3240	0.7449	34.7033	4.66	34.7046	7.30	-	-	-	-
#02	25	5.8072	33.9574	7.05	33.9602	7.33	-	-	-	-
#03	19	5.8083	33.9575	7.05	33.9601	7.31	-	-	-	-
#04	8	5.8400	33.9574	7.05	33.9601	7.33	-	-	-	-
#05	76	5.6754	33.9576	7.04	33.9581	7.30	-	-	-	-
#06	2996	0.7612	34.7051	4.64	34.7059	5.10	-	-	-	-
#07	2501	1.2459	34.7297	4.50	34.7308	4.94	-	-	-	-
#08	2000	1.7772	34.7505	4.39	34.7531	4.82	-	-	-	-
#09	1500	2.2002	34.7298	4.21	34.7309	4.61	-	-	-	-
#10	1000	2.4512	34.5941	3.94	-	4.28	-	-	-	-
#11	750	2.6475	34.4641	4.12	34.4671	4.49	-	-	-	-
#12	499	2.8228	34.2761	4.90	34.2793	5.26	-	-	-	-
#13	197	3.4884	34.0025	6.80	34.0066	7.13	-	-	-	-
#14	148	3.6949	33.9803	6.99	33.9795	7.28	-	-	-	-
#15	101	4.2668	33.967	7.12	33.9704	7.42	-	-	-	-
#16	99	4.2621	33.9668	7.13	-	-	-	-	-	-
#17	77	5.6864	33.9562	7.03	-	-	-	-	-	-
#18	258	3.4083	34.0822	6.17	-	-	-	-	-	-
#19	51	5.7539	33.9574	7.04	-	-	-	-	-	-
#20	49	5.7591	33.9575	7.05	33.9593	7.29	-	-	-	-
#21	24	5.8092	33.9573	7.05	-	-	-	-	-	-
#22	17	5.8102	33.9576	7.06	-	-	-	-	-	-
#23	8	5.8436	33.957	7.05	-	-	-	-	-	-
#24	3	5.8315	33.957	7.05	-	-	-	-	-	-

Table 1. Continued

Station:	C04	Latitude (°S):	54-59.74	Air temperature (deg C):	3.0
Cast Name:	SBE-B	Longitude (°E):	110-00.07	Sea surface temperature (deg C):	3.6
date (UTC):	29/12/2010	Depth (m):	3800	Atmospheric pressure (hPa):	978.0
time (UTC):	7:03			Wind speed (m/s):	10.5

No. of Niskin bottle	Pressure	CTD data			Data for sampled water					
		Temperature	Salinity	Oxygen	Salinity	Oxygen	Nitarate	Nitrite	Phosphate	Silicate
	(dbar)	(℃)	(PSU)	(mL/L)	(PSU)	(mL/L)	(μM)	(μM)	(μM)	(μM)
#01	3651	0.1534	34.6761	4.94	-	5.40	-	-	-	-
#02	4	1.5179	33.9465	7.72	33.9483	-	-	-	-	-
#03	15	1.5174	33.9471	7.73	33.9489	-	-	-	-	-
#04	21	1.5106	33.9476	7.72	-	-	-	-	-	-
#05	3499	0.1918	34.6784	4.90	34.6758	5.37	-	-	-	-
#06	3001	0.3579	34.6863	4.77	-	5.26	-	-	-	-
#07	2495	0.6697	34.7012	4.62	34.7001	5.12	-	-	-	-
#08	2000	1.0776	34.7225	4.51	-	4.96	-	-	-	-
#09	1499	1.5231	34.7415	4.43	34.7401	4.84	-	-	-	-
#10	994	1.9572	34.7301	4.23	34.7287	4.57	-	-	-	-
#11	749	2.0779	34.6962	4.11	-	4.47	-	-	-	-
#12	499	2.2281	34.6029	3.99	34.6017	4.32	-	-	-	-
#13	201	1.3291	34.1955	5.75	34.2097	6.01	-	-	-	-
#14	149	0.2339	34.0035	7.45	34.0012	7.82	-	-	-	-
#15	100	1.0509	33.9618	7.66	33.9661	-	-	-	-	-
#16	100	1.0821	33.9601	7.65	-	-	-	-	-	-
#17	73	1.4933	33.9494	7.71	33.9500	-	-	-	-	-
#18	133	0.267	33.9894	7.60	-	-	-	-	-	-
#19	48	1.5052	33.948	7.71	-	7.98	-	-	-	-
#20	46	1.5066	33.9479	7.72	-	-	-	-	-	-
#21	23	1.5106	33.9476	7.73	-	-	-	-	-	-
#22	18	1.5123	33.9474	7.72	-	-	-	-	-	-
#23	7	1.5147	33.947	7.73	-	-	-	-	-	-
#24	2	1.5299	33.9462	7.73	-	-	-	-	-	-

Table 1. Continued

Station:	C06	Latitude (°S):	60-00.02	Air temperature (deg C):	-0.3
Cast Name:	SBE-B	Longitude (°E):	110-00.16	Sea surface temperature (deg C):	2.3
date (UTC):	31/12/2010	Depth (m):	4402	Atmospheric pressure (hPa):	998.2
time (UTC):	13:31			Wind speed (m/s):	7.1

No. of Niskin bottle	Pressure	CTD data			Data for sampled water					
		Temperature	Salinity	Oxygen	Salinity	Oxygen	Nitarate	Nitrite	Phosphate	Silicate
	(dbar)	(℃)	(PSU)	(mL/L)	(PSU)	(mL/L)	(μM)	(μM)	(μM)	(μM)
#01	4432	-0.1084	34.6565	5.17	-	5.69	-	-	-	-
#02	4390	-0.0825	34.6593	5.14	34.6596	5.65	-	-	-	-
#03	4432	-0.1101	34.6561	5.17	-	-	-	-	-	-
#04	3999	0.0199	34.6699	5.00	-	-	-	-	-	-
#05	3500	0.1264	34.6769	4.88	34.6762	5.41	-	-	-	-
#06	3001	0.2941	34.6843	4.76	-	-	-	-	-	-
#07	2500	0.5257	34.6939	4.63	34.6936	5.12	-	-	-	-
#08	2000	0.8675	34.7118	4.52	-	-	-	-	-	-
#09	1502	1.2633	34.7314	4.46	34.7314	4.88	-	-	-	-
#10	1000	1.6614	34.7388	4.34	-	-	-	-	-	-
#11	749	1.8447	34.7257	4.22	-	-	-	-	-	-
#12	498	1.8809	34.6705	4.09	34.6714	4.46	-	-	-	-
#13	199	1.6254	34.4399	4.41	34.4392	-	-	-	-	-
#14	151	-0.1616	34.1452	6.63	-	-	-	-	-	-
#15	99	-0.3512	33.9929	7.78	-	-	-	-	-	-
#16	99	-0.3482	33.9928	7.78	-	-	-	-	-	-
#17	74	0.2029	33.9737	7.81	-	-	-	-	-	-
#18	138	-0.5322	34.0762	7.19	-	-	-	-	-	-
#19	49	0.3542	33.9226	7.95	-	-	-	-	-	-
#20	49	0.3147	33.9271	7.95	-	-	-	-	-	-
#21	23	0.5976	33.905	7.97	-	-	-	-	-	-
#22	19	0.5978	33.9048	7.97	-	-	-	-	-	-
#23	8	0.5995	33.9048	7.97	-	-	-	-	-	-
#24	3	0.5995	33.9049	7.98	-	-	-	-	-	-

Table 1. Continued

Station:	D07	Latitude (°S):	65-00.00	Air temperature (deg C):	0.6
Cast Name:	SBE-A	Longitude (°E):	140-00.13	Sea surface temperature (deg C):	0.6
date (UTC):	10/1/2011	Depth (m):	2700	Atmospheric pressure (hPa):	1000.4
time (UTC):	19:40			Wind speed (m/s):	13.6

No. of Niskin bottle	Pressure	CTD data			Data for sampled water					
		Temperature	Salinity	Oxygen	Salinity	Oxygen	Nitarate	Nitrite	Phosphate	Silicate
	(dbar)	(℃)	(PSU)	(mL/L)	(PSU)	(mL/L)	(μM)	(μM)	(μM)	(μM)
#01	2675	-0.437	34.6341	5.51	-	-	-	-	-	-
#02	2658	-0.4389	34.634	5.51	-	-	-	-	-	-
#03	2633	-0.4409	34.6342	5.50	-	-	-	-	-	-
#04	2608	-0.4378	34.6343	5.50	-	-	-	-	-	-
#05	2498	-0.3686	34.6385	5.42	-	-	-	-	-	-
#06	2000	0.0454	34.6713	4.96	-	-	-	-	-	-
#07	1498	0.2727	34.6793	4.80	-	-	-	-	-	-
#08	999	0.5692	34.6851	4.67	-	-	-	-	-	-
#09	747	0.876	34.7038	4.59	-	-	-	-	-	-
#10	498	1.0562	34.7055	4.56	-	-	-	-	-	-
#11	197	0.5878	34.6216	4.87	-	-	-	-	-	-
#12	149	-0.0169	34.5477	5.32	-	-	-	-	-	-
#13	101	-1.1208	34.445	5.98	-	-	-	-	-	-
#14	99	-1.2415	34.4352	6.09	-	-	-	-	-	-
#15	77	-1.4183	34.3845	6.37	-	-	-	-	-	-
#16	75	-1.4084	34.374	6.38	-	-	-	-	-	-
#17	61	-1.575	34.2486	6.78	-	-	-	-	-	-
#18	51	-1.5576	34.1352	7.26	-	-	-	-	-	-
#19	50	-1.5504	34.1188	7.26	-	-	-	-	-	-
#20	26	-0.4813	33.7748	7.79	-	-	-	-	-	-
#21	25	-0.4132	33.7579	7.78	-	-	-	-	-	-
#22	21	-0.092	33.6749	7.86	-	-	-	-	-	-
#23	9	-0.0546	33.667	7.88	-	-	-	-	-	-
#24	9	-0.0424	33.6636	7.88	-	-	-	-	-	-

Table 1. Continued

Station:	D10	Latitude (°S):	62-29.905	Air temperature (deg C):	0.7
Cast Name:	SBE-A2	Longitude (°E):	140-00.257	Sea surface temperature (deg C):	1.8
date (UTC):	13/1/2011	Depth (m):	3920	Atmospheric pressure (hPa):	999.5
time (UTC):	16:42			Wind speed (m/s):	10.0

No. of Niskin bottle	Pressure	CTD data			Data for sampled water					
		Temperature	Salinity	Oxygen	Salinity	Oxygen	Nitarate	Nitrite	Phosphate	Silicate
	(dbar)	(℃)	(PSU)	(mL/L)	(PSU)	(mL/L)	(μM)	(μM)	(μM)	(μM)
#01	3964	-0.2692	34.6455	5.30	-	-	-	-	-	-
#02	3923	-0.2231	34.65	5.25	-	-	-	-	-	-
#03	3497	-0.0407	34.6669	5.04	-	-	-	-	-	-
#04	2997	0.1923	34.6815	4.83	-	-	-	-	-	-
#05	2495	0.41	34.6902	4.70	-	-	-	-	-	-
#06	1997	0.7433	34.7071	4.55	-	-	-	-	-	-
#07	1501	1.1229	34.7271	4.47	-	-	-	-	-	-
#08	1000	1.5408	34.742	4.36	-	-	-	-	-	-
#09	749	1.7761	34.7413	4.27	-	-	-	-	-	-
#10	499	1.9093	34.7181	4.11	-	-	-	-	-	-
#11	200	1.9531	34.6274	3.91	-	-	-	-	-	-
#12	148	1.8637	33.8633	2.85	-	-	-	-	-	-
#13	99	0.912	34.4404	4.55	-	-	-	-	-	-
#14	100	0.8008	34.4322	4.71	-	-	-	-	-	-
#15	77	0.041	34.2517	5.96	-	-	-	-	-	-
#16	73	-0.2104	34.2245	6.06	-	-	-	-	-	-
#17	59	-0.8403	34.0363	7.33	-	-	-	-	-	-
#18	51	-0.5763	33.9773	7.61	-	-	-	-	-	-
#19	51	-0.4219	33.9559	7.62	-	-	-	-	-	-
#20	24	0.8659	33.7709	7.89	-	-	-	-	-	-
#21	25	0.8638	33.77	7.90	-	-	-	-	-	-
#22	19	0.8609	33.7695	7.90	-	-	-	-	-	-
#23	11	0.86	33.7694	7.91	-	-	-	-	-	-
#24	2	0.8648	33.77	7.92	-	-	-	-	-	-

Table 1. Continued

Station:	D12	Latitude (°S):	59-59.849	Air temperature (deg C):	2.6
Cast Name:	SBE-A2	Longitude (°E):	140-00.652	Sea surface temperature (deg C):	2.3
date (UTC):	15/1/2011	Depth (m):	4484	Atmospheric pressure (hPa):	1006.1
time (UTC):	5:27			Wind speed (m/s):	5.8

No. of Niskin bottle	Pressure	CTD data			Data for sampled water					
		Temperature	Salinity	Oxygen	Salinity	Oxygen	Nitarate	Nitrite	Phosphate	Silicate
	(dbar)	(℃)	(PSU)	(mL/L)	(PSU)	(mL/L)	(μM)	(μM)	(μM)	(μM)
#01	4491	-0.1002	34.6578	5.15	-	5.66	-	-	-	-
#02	3997	0.1193	34.6763	4.90	-	5.46	-	-	-	-
#03	3499	0.2761	34.6842	4.77	34.6813	-	-	-	-	-
#04	3000	0.4693	34.6925	4.65	-	5.19	-	-	-	-
#05	2498	0.8057	34.7092	4.51	34.7075	-	-	-	-	-
#06	1998	1.1707	34.728	4.43	-	4.91	-	-	-	-
#07	1499	1.589	34.7438	4.34	34.7444	-	-	-	-	-
#08	1000	1.9573	34.7363	4.18	34.7348	-	-	-	-	-
#09	750	2.0885	34.6956	3.99	-	-	-	-	-	-
#10	500	2.2014	34.6238	3.85	-	-	-	-	-	-
#11	199	2.0493	34.4128	4.17	-	-	-	-	-	-
#12	151	1.3645	34.2818	5.01	-	-	-	-	-	-
#13	100	-0.3162	33.9627	7.63	-	-	-	-	-	-
#14	99	-0.3153	33.9628	7.64	-	-	-	-	-	-
#15	75	-0.1565	33.9572	7.75	-	-	-	-	-	-
#16	75	-0.1614	33.9572	7.75	-	-	-	-	-	-
#17	89	-0.2535	33.9601	7.72	-	-	-	-	-	-
#18	51	1.5373	33.9324	7.64	-	-	-	-	-	-
#19	49	1.5439	33.9326	7.64	-	-	-	-	-	-
#20	24	1.6024	33.9345	7.65	-	-	-	-	-	-
#21	24	1.6022	33.9345	7.66	-	-	-	-	-	-
#22	19	1.6054	33.9344	7.66	-	-	-	-	-	-
#23	9	1.6124	33.9343	7.66	-	-	-	-	-	-
#24	2	1.6151	33.9345	7.65	-	-	-	-	-	-

Table 1. Continued

Station:	D14	Latitude (°S):	54-59.948	Air temperature (deg C):	4.7
Cast Name:	SBE-A2	Longitude (°E):	139-59.414	Sea surface temperature (deg C):	5.1
date (UTC):	17/1/2011	Depth (m):	Not Data	Atmospheric pressure (hPa):	1004.9
time (UTC):	0:18			Wind speed (m/s):	8.8

No. of Niskin bottle	Pressure	CTD data			Data for sampled water					
		Temperature	Salinity	Oxygen	Salinity	Oxygen	Nitarate	Nitrite	Phosphate	Silicic acid
	(dbar)	(℃)	(PSU)	(mL/L)	(PSU)	(mL/L)	(μM)	(μM)	(μM)	(μM)
#01	999	2.3684	34.631	3.89	34.6312	-	-	-	-	-
#02	999	2.3676	34.6315	3.89	-	-	-	-	-	-
#03	999	2.3671	34.6316	3.89	-	-	-	-	-	-
#04	999	2.3681	34.6311	3.89	-	-	-	-	-	-
#05	998	2.3682	34.6312	3.89	-	-	-	-	-	-
#06	999	2.3674	34.6315	3.90	-	-	-	-	-	-
#07	999	2.3681	34.6313	3.89	-	-	-	-	-	-
#08	999	2.3673	34.6316	3.89	-	-	-	-	-	-
#09	999	2.3676	34.6313	3.89	-	-	-	-	-	-
#10	999	2.3673	34.6316	3.89	-	-	28.8	nd	2.2	67.1
#11	749	2.4685	34.5299	3.90	-	-	34.3	nd	2.5	66.0
#12	500	2.5271	34.3667	4.37	-	-	-	-	-	-
#13	199	1.7207	33.8793	7.20	-	-	25.2	0.3	1.9	13.5
#14	149	2.1922	33.857	7.25	-	-	24.9	0.4	1.9	10.2
#15	99	2.8881	33.8413	7.29	-	-	25.3	0.3	1.9	4.8
#16	99	2.9165	33.8408	7.29	-	-	-	-	-	-
#17	75	4.1406	33.8227	7.18	-	-	19.0	0.3	1.4	nd
#18	214	1.7389	33.9105	7.00	-	-	26.9	0.2	1.8	15.0
#19	49	4.3925	33.8203	7.19	-	-	-	-	-	-
#20	49	4.3911	33.8201	7.19	-	-	24.0	0.3	1.6	nd
#21	24	4.3985	33.8196	7.20	-	-	22.6	0.3	1.6	nd
#22	19	4.4041	33.8194	7.20	-	-	21.4	0.2	1.5	nd
#23	9	4.3997	33.8192	7.21	-	-	24.1	0.3	1.6	nd
#24	2	4.3988	33.8187	7.21	-	-	23.9	0.3	1.6	nd

nd: not determined

Table 1. Continued

Station:	D15	Latitude (°S):	49-59.794	Air temperature (deg C):	9.6
Cast Name:	SBE-A2	Longitude (°E):	143-40.019	Sea surface temperature (deg C):	10.0
date (UTC):	18/1/2011	Depth (m):	3947	Atmospheric pressure (hPa):	1002.4
time (UTC):	8:45			Wind speed (m/s):	3.9

No. of Niskin bottle	Pressure	CTD data			Data for sampled water					
		Temperature	Salinity	Oxygen	Salinity	Oxygen	Nitarate	Nitrite	Phosphate	Silicic acid
	(dbar)	(℃)	(PSU)	(mL/L)	(PSU)	(mL/L)	(μM)	(μM)	(μM)	(μM)
#01	1001	3.1952	34.4084	4.21	-	-	-	-	-	-
#02	1000	3.1958	34.4077	4.20	-	-	-	-	-	-
#03	1000	3.1959	34.4077	4.19	34.4075	-	-	-	-	-
#04	999	3.196	34.4077	4.20	-	-	-	-	-	-
#05	749	3.4523	34.243	5.03	34.2430	5.42	-	-	-	-
#06	500	5.1428	34.2787	5.09	34.2785	5.42	-	-	-	-
#07	200	6.1845	34.1794	6.44	34.1790	6.77	-	-	-	-
#08	999	3.196	34.4074	4.19	-	-	33.7	nd	2.4	48.1
#09	748	3.4587	34.2431	5.03	-	-	31.6	nd	2.3	31.0
#10	497	5.1544	34.2753	5.10	-	-	27.8	nd	1.9	17.6
#11	197	6.1934	34.1799	6.44	-	-	21.3	nd	1.5	5.1
#12	148	6.4934	34.1964	6.46	-	-	20.7	0.1	1.5	4.4
#13	100	6.5772	34.1247	6.64	-	-	20.4	0.3	1.5	2.5
#14	99	6.4795	34.0859	6.67	-	-	-	-	-	-
#15	74	6.6075	33.9986	6.80	-	7.11	20.3	0.2	1.5	1.9
#16	74	6.5703	34.0002	6.80	-	-	-	-	-	-
#17	73	6.6359	34.0015	6.78	-	-	21.0	0.2	1.5	2.0
#18	49	8.1816	34.092	6.66	-	-	17.7	0.2	1.3	nd
#19	49	8.164	34.095	6.66	-	-	-	-	-	-
#20	21	8.5435	34.0713	6.63	-	-	17.8	0.3	1.2	nd
#21	20	8.5625	34.0713	6.63	-	-	-	-	-	-
#22	21	8.6282	34.0708	6.59	-	-	17.9	0.3	1.2	nd
#23	10	8.6765	34.0605	6.58	-	-	18.1	0.2	1.2	nd
#24	3	8.9241	34.048	6.53	-	-	17.7	0.3	1.2	nd

nd: not determined