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Plankton Sampling on Board Shirase in 2002-2008
—NORPAC standard net samples—

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Every austral summer (December-March), plankton samplings were carried out in the Indian Ocean sector of the Southern Ocean as a part of routine marine biology surveys of the Japanese Antarctic Research Expeditions (JARE). The samplings were conducted on board the icebreaker *Fuji* during JARE-14~24 (1972-1983) as reported by Fukuchi and Tanimura (1981) and Watanabe *et al.* (1984). Those samplings have been continued on the successor icebreaker *Shirase* which was launched in 1983. Details of sampling information and wet weight data of plankton samples in JARE-25~42 (1983-2001) were previously published (Takahashi *et al.*, 1997; Sawabe *et al.*, 2005). While several kinds of plankton nets were used on board the icebreaker *Shirase*, vertical hauls by NORPAC (North Pacific) standard net were routinely carried out. This report presents the NORPAC standard net data records during JARE-43~49 (March 2002-March 2008).

A twin NORPAC standard net, made of nylon bolting cloth NGG 54 (0.33 mm mesh openings) and NXX 13 (0.11 mm mesh openings), was used at all sampling stations. The net was hauled vertically at a speed *ca.* 1 m/s, from an approximate depth of 150 m. The maximum depth reached was estimated from the wire angle and length of wire paid out. All samples obtained were immediately preserved in 5-10% buffered formalin sea water on board. The volumes of water filtered through each net were estimated using a flow-meter which was mounted at the center of the mouth ring of each net. Sampling stations during March 2002-March 2008 (JARE-43~49) are shown in Figs. 1-7, and the data are listed in Tables 1-7.

As one of the projects under the five year plan Phase VI of JARE (43 to 47), the time-series/multi-ship observations of the Southern Ocean were carried out by the

Research Vessel *Tangaroa* (National Institute of Water and Atmospheric Research, New Zealand) chartered by JARE-43 and -44 (Odate 2002, 2004). NORPAC net (0.33 mm mesh size) samplings were conducted on each cruise, along the south-north transect on *ca.* 140°E between 60 and 66°S. The net was hauled vertically at a speed *ca.* 1 m/s, from an approximate depth of 150 m. The data records of these results are also presented in this report (Fig. 8 and Tables 8, 9).

Samplings during each cruise were carried out by the following members who participated in JARE and acknowledgments are given to these persons.

JARE (Year)	Name of members	Affiliations *
JARE-43 (2001/02)	T. Hirawake	National Institute of Polar Research
	S. Kawaguchi	National Research Institute of Far Seas
	(*Tangaroa*)	Fisheries
	K. T. Takahashi	The Graduate University for Advanced
	(*Tangaroa*)	Studies
JARE-44 (2002/03)	T. Masuzawa	Shizuoka University
	A. Tanimura	Mie University
	(*Tangaroa*)	
	K. T. Takahashi	The Graduate University for Advanced
	(*Tangaroa*)	Studies
JARE-45 (2003/04)	M. Matsuzaki	Hiroshima University
	M. Iida	Hokkaido University
JARE-46 (2004/05)	A. Otsuki	National Institute of Polar Research
	S. Kudoh	National Institute of Polar Research
JARE-47 (2005/06)	M. Honda	Central Research Institute of Electric
		Power Industry
	M. Ichinomiya	Tohoku University
JARE-48 (2006/07)	D-H. Han	Marine Biological Research Institute of
		Japan Co., LTD
	S. Kudoh	National Institute of Polar Research
JARE-49 (2007/08)	T. Iida	National Institute of Polar Research
	S. Kudoh	National Institute of Polar Research

*Affiliations are as of the year they were on board.

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in writing. Inquiries about details of the data records should be addressed to:

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References

Fukuchi, M. and Tanimura, A. (1981): Plankton samplings on board *Fuji* in 1972-1980. JARE Data Rep., **60** (Mar. Biol. 1), 27 p.

Odate, T. (2002): Activities of the summer party of the 43rd Japanese Antarctic Research Expedition, Marine Science Cruise 2002. Nankyoku Shiryô (Antarct. Rec.), **46,** 579-600 (in Japanese with English abstract).

Odate, T. (2004): Activities of the summer party of the 44th Japanese Antarctic Research Expedition, Marine Science Cruise 2003. Nankyoku Shiryô (Antarct. Rec.), **48,** 19-35 (in Japanese with English abstract).

Sawabe, E., Takahashi, K. T., Umeda, H. and Fukuchi, M. (2005) Plankton sampling on board *Shirase* in 1997-2001 –NORPAC standard net samples–. JARE Data Rep., **284** (Mar. Biol. 32), 16 p.

Takahashi, K., Tanimura, A. and Fukuchi, M. (1997): Plankton sampling on board *Shirase* in 1983-1996 –NORPAC standard net samples–. JARE Data Rep., **224** (Mar. Biol. 28), 35 p.

Watanabe, K., Nakajima, Y., Ino, Y., Sasaki, H. and Fukuchi, M. (1984): Plankton samplings on board *Fuji* in 1980-1983. JARE Data Rep., **90** (Mar. Biol. 5), 11 p.

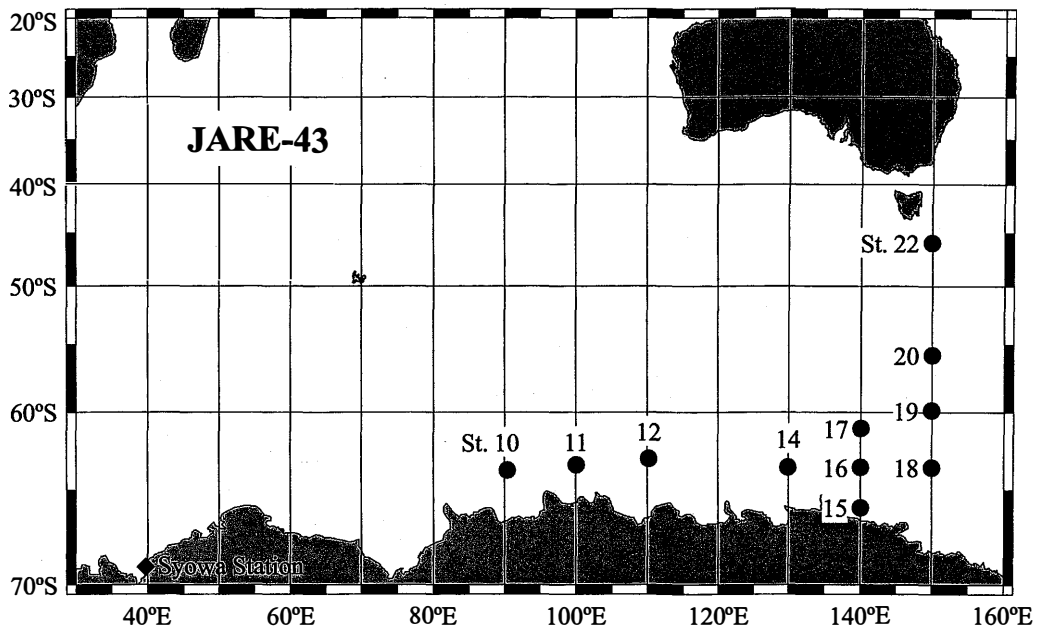

Fig. 1. Sampling stations during JARE-43 in March 2002. ●: March.

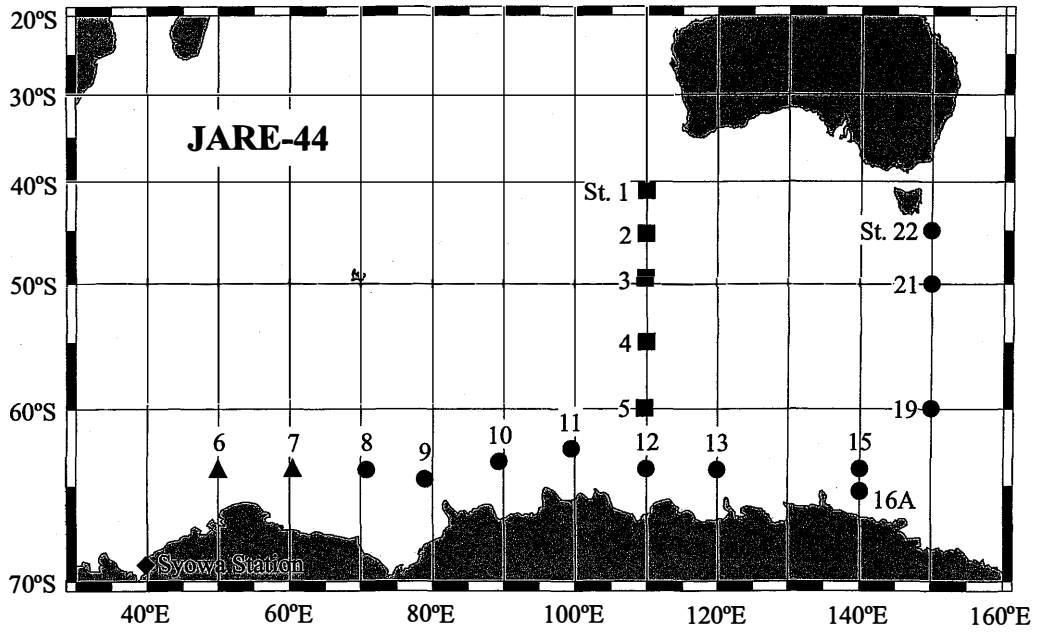

Fig. 2. Sampling stations during JARE-44 in 2002/2003. ■: December, ▲: February, ●: March.

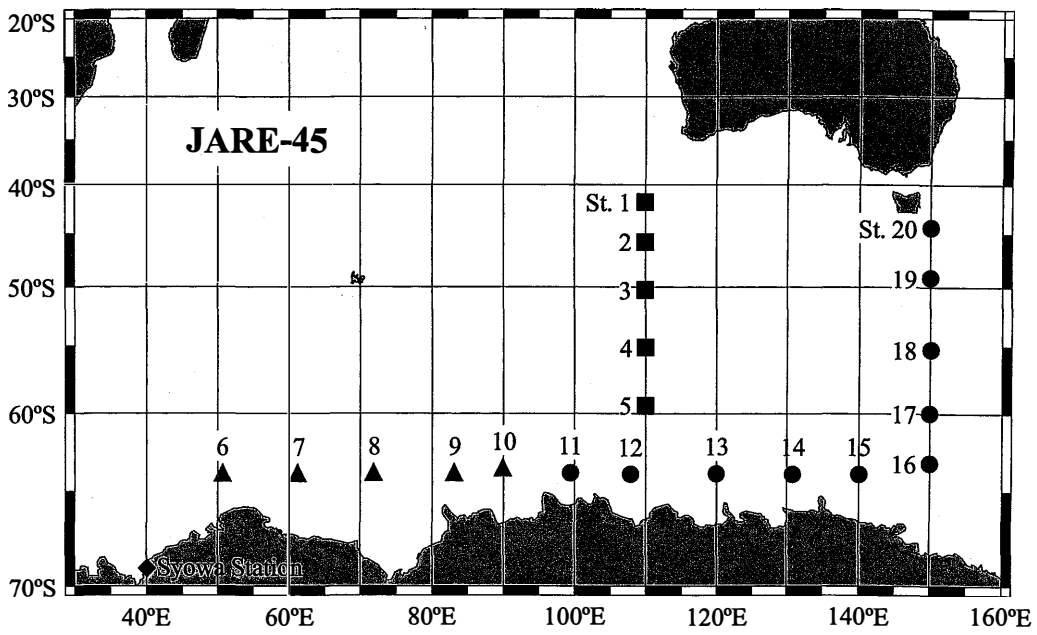

Fig. 3. Sampling stations during JARE-45 in 2003/2004. ■: December, ▲: February, ●: March.

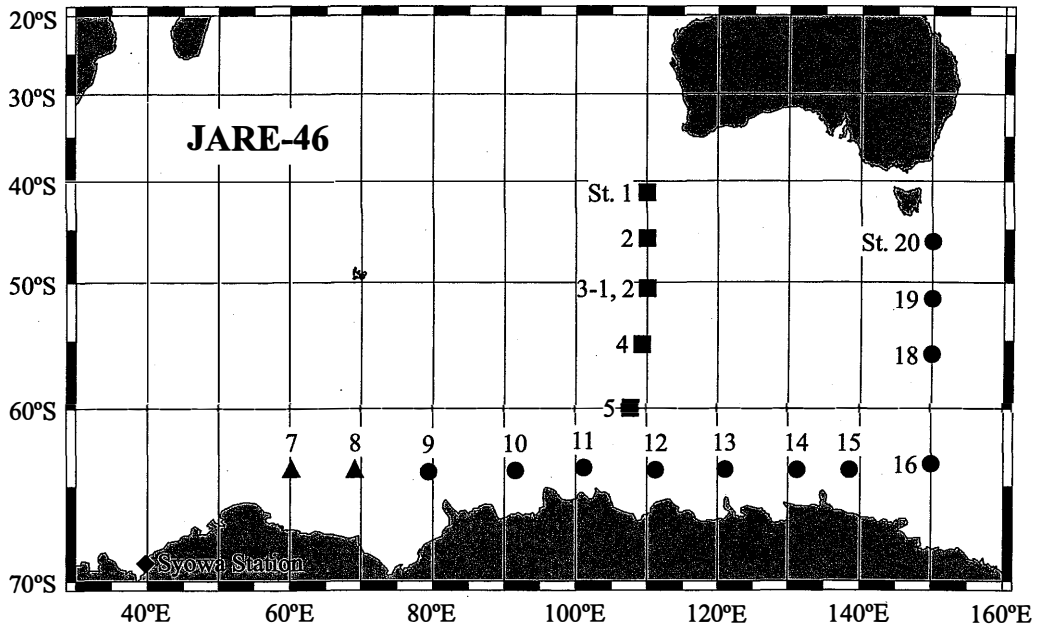

Fig. 4. Sampling stations during JARE-46 in 2004/2005. ■: December, ▲: February, ●: March.

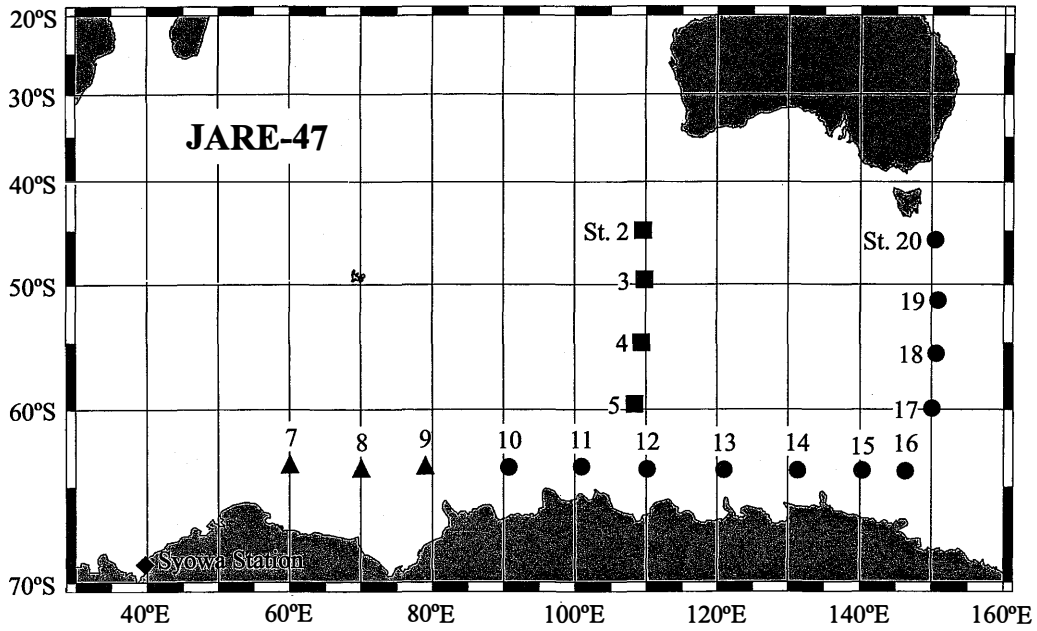

Fig. 5. Sampling stations during JARE-47 in 2005/2006. ■: December, ▲: February, ●: March.

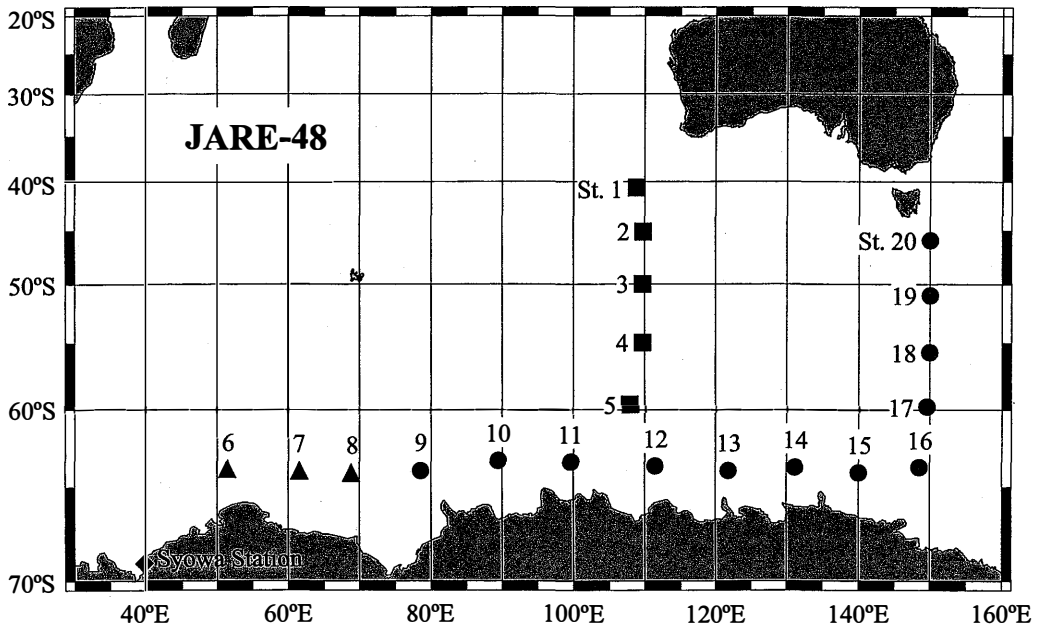

Fig. 6. Sampling stations during JARE-48 in 2006/2007. ■: December, ▲: February, ●: March.

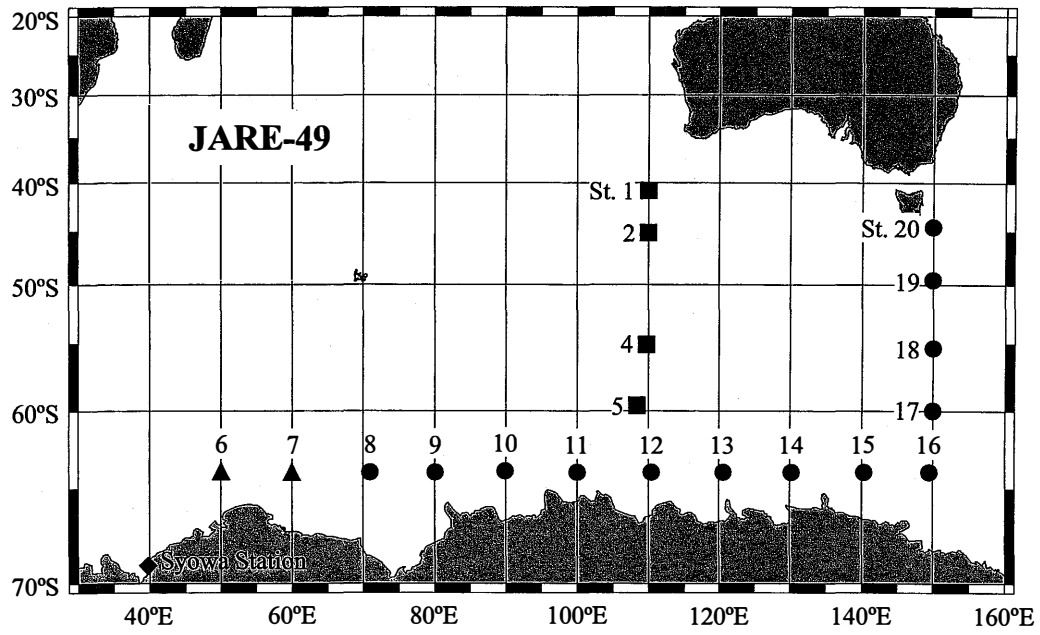

Fig. 7. Sampling stations during JARE-49 in 2007/2008. ■: December, ▲: February, ●: March.

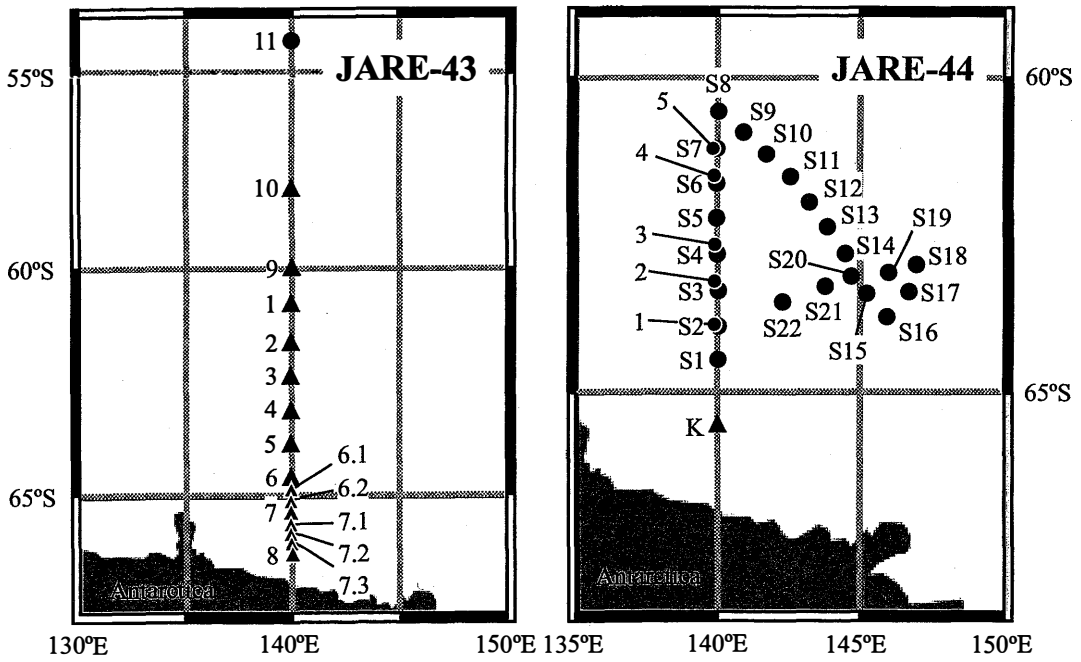

Fig. 8. Sampling stations of *Tangaroa* cruise in JARE-43 (left) and -44 (right). ▲: February, ●: March.

Table 1. Data on plankton collected by vertical hauls with twin NORPAC standard net on the JARE-43 cruise of the *Shirase* to the Indian sector of the Southern Ocean, Mar. 2002. Samplings were carried out by T. Hirawake.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
10	63°58'S	Mar. 4	1412	172	19	150	2473	2750	40.85	495	12.1	330	Stn10GG
	90°17'E						2469	2500	36.53	2352	64.4	110	Stn10XX
11	63°34'S	Mar. 5	1354	159	19	150	2473	1875	27.86	1710	61.4	330	Stn11GG
	100°01'E						2469	1530	22.36	2245	100.4	110	Stn11XX
12	63°15'S	Mar. 6	1358	213	45	150	2473	2898	43.05	6730	156.3	330	Stn12GG
	110°26'E						2469	2600	37.99	16853	443.6	110	Stn12XX
14	64°01'S	Mar. 8	1403	196	40	150	2473	7290	108.30	5778	53.4	330	Stn14GG
	130°36'E						2469	5610	81.98	11462	139.8	110	Stn14XX
15	66°28'S	Mar. 10	0842	151	5	150	2473	1622	24.10	4651	193.0	330	Stn15GG
	140°01'E						2469	1142	16.69	28093	1683.4	110	Stn15XX
16	63°59'S	Mar. 11	0850	165	25	150	2473	3372	50.09	1161	23.2	330	Stn16GG
	140°02'E						2469	3310	48.37	110797	2290.6	110	Stn16XX
17	61°02'S	Mar. 12	0845	164	24	150	2473	2822	41.92	1482	35.3	330	Stn17GG
	139°58'E						2469	2820	41.21	3448	83.7	110	Stn17XX
18	64°01'S	Mar. 13	1355	179	33	150	2473	2387	35.46	4874	137.5	330	Stn18GG
	150°01'E						2469	2979	43.53	6020	138.3	110	Stn18XX
19	59°12'S	Mar. 14	1342	175	31	150	2473	4076	60.55	21905	361.7	330	Stn19GG
	150°03'E						2469	3792	55.41	13640	246.1	110	Stn19XX
20	56°17'S	Mar. 15	1356	190	38	150	2473	4875	72.42	4544	62.7	330	Stn20GG
	150°01'E						2469	5882	85.95	4046	47.1	110	Stn20XX
22	46°44'S	Mar. 17	1402	196	40	150	2473	5668	84.20	2777	33.0	330	Stn22GG
	149°59'E						2469	5820	85.05	653	7.7	110	Stn22XX

Table 2. Data on plankton collected by vertical hauls with twin NORPAC standard net on the JARE-44 cruise of the *Shirase* to the Indian sector of the Southern Ocean, Dec. 2002-Mar. 2003. Samplings were carried out by T. Masuzawa.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
1	40°21'S	Dec. 5	1400	167	26	150	2473	2882	42.81	712	16.6	330	GG54-st1
	110°02'E						2469	2938	42.93	585	13.6	110	XX13-st1
2	44°31'S	Dec. 6	1400	—	—	150	2473	5729	85.11	6092	71.6	330	GG54-st2
	110°01'E						2469	5578	81.51	8637	106.0	110	XX13-st2
3	49°18'S	Dec. 7	1400	—	—	150	2473	3168	47.06	14806	314.6	330	GG54-st3
	109°53'E						2469	3562	52.05	28706	551.5	110	XX13-st3
4	54°59'S	Dec. 8	1400	—	—	150	2473	7364	109.40	14017	128.1	330	GG54-st4
	109°53'E						2469	7555	110.40	22056	199.8	110	XX13-st4
5	60°00'S	Dec. 9	1400	—	—	150	2473	2382	35.39	2034	57.5	330	GG54-st5
	109°43'E						2469	2811	41.08	3967	96.6	110	XX13-st5
6	63°59'S	Feb. 27	0900	—	—	150	2473	2230	33.13	111916	3378.2	330	GG54-st6
	50°02'E						2469	2190	32.00	26468	827.0	110	XX13-st6
7	63°59'S	Feb. 28	0850	—	—	150	2473	3050	45.31	3689	81.4	330	GG54-st7
	60°38'E						2469	3150	46.03	6386	138.7	110	XX13-st7
8	64°01'S	Mar. 1	0450	—	—	150	2473	2425	36.03	1287	35.7	330	GG54-st8
	70°41'E						2469	2520	36.83	1757	47.7	110	XX13-st8
9	64°46'S	Mar. 4	0800	158	18	150	2473	2950	43.83	7341	167.5	330	GG54-st9
	78°15'E						2469	2830	41.36	8952	216.5	110	XX13-st9

Table 2. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
10	63°25'S	Mar. 5	0800	150	5	150	2473	1642	24.39	11555	473.7	330	GG54-st10
	89°13'E						2469	1596	23.32	11865	508.7	110	XX13-st10
11	62°56'S	Mar. 6	0300	177	32	150	2473	2125	31.57	4931	156.2	330	GG54-st11
	99°37'E						2469	2145	31.35	6753	215.4	110	XX13-st11
12	64°04'S	Mar. 7	0830	202	42	150	2473	4590	68.19	15296	224.3	330	GG54-st12
	110°45'E						2469	4080	59.62	19129	320.8	110	XX13-st12
13	64°01'S	Mar. 7	0930	224	48	150	2473	7396	109.87	21503	195.7	330	GG54-st13
	120°04'E						2469	5400	78.91	14789	187.4	110	XX13-st13
15	63°59'S	Mar. 10	0830	188	37	150	2473	2585	38.40	1734	45.2	330	GG54-st15
	140°03'E						2469	2530	36.97	6899	186.6	110	XX13-st15
16A	65°33'S	Mar. 11	0830	162	22	150	2473	3070	45.61	704	15.4	330	GG54-st16
	140°03'E						2469	3050	44.57	1238	27.8	110	XX13-st16
19	59°04'S	Mar. 15	0830	202	42	150	2473	4273	63.48	22490	354.3	330	GG54-st19
	150°03'E						2469	4735	69.19	29216	422.2	110	XX13-st19
21	49°05'S	Mar. 17	0830	200	53	150	2473	—	—	6056	—	330	GG54-st21
	150°03'E						2469	—	—	3025	—	110	XX13-st21
22	44°32'S	Mar. 18	0900	225	49	150	2473	5990	88.99	2008	22.6	330	GG54-s22
	151°06'E						2469	5770	84.32	7428	88.1	110	XX13-st22

Table 3. Data on plankton collected by vertical hauls with twin NORPAC standard net on the JARE-45 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 2003-Mar. 2004. Samplings were carried out by M. Matsuzaki & M. Iida.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
1	41°51'S	Dec. 5	1345	152	10	150	2473	1972	30.43	859	28.2	330	st1.GG
	110°01'E						2469	1990	30.08	834	27.7	110	st1.XX
2	46°09'S	Dec. 6	1317	196	40	150	2473	3890	60.04	8884	148.0	330	st2.GG
	110°02'E						2469	3648	55.15	10002	181.4	110	st2.XX
3	50°35'S	Dec. 7	1343	158	18	150	2473	2037	31.44	21335	678.7	330	st3.GG
	110°01'E						2469	2118	32.02	31071	970.4	110	st3.XX
4	55°28'S	Dec. 8	1255	170	28	150	2473	2477	38.23	19471	509.3	330	st4.GG
	109°21'E						2469	2083	31.49	34721	1102.6	110	st4.XX
5	59°09'S	Dec. 9	1334	173	30	150	2473	3038	46.89	4077	87.0	330	st5.GG
	103°33'E						2469	3012	45.53	6419	141.0	110	st5.XX
6	64°00'S	Feb. 23	0801	170	28	150	2473	1673	25.82	405	15.7	330	st6.GG
	50°48'E						2469	1698	25.67	838	32.6	110	st6.XX
7	64°00'S	Feb. 24	1304	196	40	150	2473	3764	58.09	1194	20.6	330	st7.GG
	60°57'E						2469	3754	56.75	3342	58.9	110	st7.XX
8	64°00'S	Feb. 25	1301	167	26	150	2473	1900	29.32	754	25.7	330	st8.GG
	70°59'E						2469	1893	28.62	1434	50.1	110	st8.XX
9	64°00'S	Feb. 28	1309	151	8	150	2473	1742	26.88	8225	305.9	330	st9.GG
	82°16'E						2469	1611	24.35	12358	507.4	110	st9.XX
10	63°27'S	Feb. 29	1304	156	15	150	2473	1808	27.90	17541	628.6	330	st10.GG
	90°12'E						2469	1430	21.62	10264	474.8	110	st10.XX

Table 3. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
11	63°50'S	Mar. 2	1300	153	12	150	2473	1638	25.28	2725	107.8	330	st11.GG
	99°52'E	.					2469	1612	24.37	3724	152.8	110	st11.XX
12	63°57'S	Mar. 3	1425	202	42	150	2473	3728	57.54	2467	42.9	330	st12.GG
	107°46'E						2469	3677	55.59	2175	39.1	110	st12.XX
13	63°56'S	Mar. 5	1257	156	15	150	2473	2222	34.29	18086	527.4	330	st13.GG
	119°55'E						2469	2234	33.77	5341	158.1	110	st13.XX
14	64°00'S	Mar. 7	1324	160	20	150	2473	2312	35.68	1850	51.9	330	st14.GG
	131°06'E						2469	2360	35.68	529	14.8	110	st14.XX
15	63°59'S	Mar. 8	1250	150	2	150	2473	2282	35.22	715	20.3	330	st15.GG
	140°01'E						2469	2352	35.56	835	23.5	110	st15.XX
16	63°12'S	Mar. 11	1845	167	26	150	2473	4048	62.47	297	4.8	330	st16.GG
	150°06'E						2469	3809	57.58	281	4.9	110	st16.XX
17	60°02'S	Mar. 12	1805	173	20	150	2473	4751	73.32	5625	76.7	330	st17.GG
	149°49'E						2469	4579	69.22	3790	54.8	110	st17.XX
18	55°16'S	Mar. 14	1307	233	50	150	2473	3912	60.37	5674	94.0	330	st18.GG
	149°56'E						2469	3956	59.81	3741	62.6	110	st18.XX
19	48°29'S	Mar. 16	0752	255	54	150	2473	5491	84.74	1229	14.5	330	st19.GG
	149°57'E						2469	5555	83.98	554	6.6	110	st19.XX
20	44°06'S	Mar. 17	0749	209	45	150	2473	3523	54.37	173	3.2	330	st20.GG
	149°46'E						2469	3350	50.64	58	1.1	110	st20.XX

Table 4. Data on plankton collected by vertical hauls with twin NORPAC standard net on the JARE-46 cruise of the *Shirase* to the Indian sector of the Southern Ocean, Dec. 2004-Mar. 2005. Samplings were carried out by A. Otsuki & S. Kudoh.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
1	40°55'S	Dec. 5	1433	175	31	150	2473	4490	55.50	1963.80	35.4	330	st1.GG
	110°01'E						2469	4690	58.63	52	0.9	110	st1.XX
2	45°46'S	Dec. 6	1321	193	39	150	2473	2949	36.45	2352.14	64.5	330	st2.GG
	110°02'E						2469	2682	33.53	2569	76.6	110	st2.XX
3-1	50°47'S	Dec. 7	1317	198	48	150	2473	4966	61.38	49412.06	805.0	330	st3-1.GG
	110°02'E						2469	3318	41.48	51690	1246.1	110	st3-1.XX
3-2	50°48'S	Dec. 7	1420	197	47	150	2473	6168	76.24	26424.38	346.6	330	st3-2.GG
	110°06'E						2469	4130	51.63	46497	900.5	110	st3-2.XX
4	55°52'S	Dec. 8	1315	178	28	150	2473	2360	29.17	2666.9	91.4	330	st4.GG
	109°29'E						2469	2265	28.32	5631	198.8	110	st4.XX
5	60°03'S	Dec. 9	1316	156	6	150	2473	2630	32.51	3100.94	95.4	330	st5.GG
	108°51'E						2469	2558	31.98	3619	113.2	110	st5.XX
7	63°57'S	Feb. 26	1326	197	47	150	2473	4230	52.29	411.82	7.9	330	st7.GG
	60°17'E						2469	4660	58.26	439	7.5	110	st7.XX
8	64°00'S	Feb. 27	1314	188	33	150	2473	3383	41.82	1443.57	34.5	330	st8.GG
	68°54'E						2469	4075	50.95	2271	44.6	110	st8.XX
9	64°20'S	Mar. 2	0815	151	1	150	2473	1740	21.51	2139.77	99.5	330	st9.GG
	79°29'E						2469	1833	22.92	13358	582.9	110	st9.XX

Table 4. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
10	64°01'S	Mar. 6	1313	169	19	150	2473	2050	25.34	3217.09	127.0	330	st10.GG
	91°47'E						2469	2010	25.13	2958	117.7	110	st10.XX
11	63°50'S	Mar. 7	1312	161	11	150	2473	1755	21.69	32409.33	1494.0	330	st11.GG
	101°09'E						2469	1560	19.50	14750	756.3	110	st11.XX
12	64°01'S	Mar. 8	1311	184	34	150	2473	2655	32.82	28585.36	871.0	330	st12.GG
	111°39'E						2469	2672	33.41	17093	511.7	110	st12.XX
13	63°53'S	Mar. 9	1305	176	26	150	2473	2621	32.40	42539.29	1313.0	330	st13.GG
	121°44'E						2469	1778	22.23	25494	1146.9	110	st13.XX
14	64°00'S	Mar. 10	1307	184	34	150	2473	3435	42.46	2490.68	58.7	330	st14.GG
	131°40'E						2469	3177	39.72	2814	70.9	110	st14.XX
15	64°00'S	Mar. 11	1303	174	24	150	2473	2011	24.86	2504.08	100.7	330	st15.GG
	138°09'E						2469	2022	25.28	2967	117.4	110	st15.XX
16	63°31'S	Mar. 13	1303	180	30	150	2473	1980	24.47	9547.73	390.1	330	st16.GG
	149°51'E						2469	2024	25.30	11230	443.8	110	st16.XX
18	56°26'S	Mar. 15	1312	202	52	150	2473	1782	22.03	6687.7	303.6	330	st18.GG
	150°03'E						2469	9870	123.39	20616	167.1	110	st18.XX
19	51°28'S	Mar. 16	1306	187	37	150	2473	2155	26.64	969.88	36.4	330	st19.GG
	149°57'E						2469	2448	30.60	761	24.9	110	st19.XX
20	46°19'S	Mar. 17	1308	169	19	150	2473	2427	30.00	205.66	6.9	330	st20.GG
	150°09'E						2469	2392	29.90	1526	51.0	110	st20.XX

Table 5. Data on plankton collected by vertical hauls with twin NORPAC standard net on the JARE-47 cruise of the *Shirase* to the Indian sector of the Southern Ocean, Dec. 2005-Mar. 2006. Samplings were carried out by M. Honda & M. Ichinomiya.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
2	44°39'S	Dec. 6	1421	183	35	150	2473	4855	72.36	2322.43	32.1	330	St.2 GG
	109°25'E						2469	4930	73.22	8203	112.0	110	St.2 XX
3	49°44'S	Dec. 7	1405	155	15	150	2473	1972	29.39	5531.55	188.2	330	St.3 GG
	109°42'E						2469	1792	26.61	19595	736.3	110	St.3 XX
4	55°20'S	Dec. 8	1420	150	2	150	2473	1890	28.17	1563.16	55.5	330	St.4 GG
	109°35'E						2469	1750	25.99	5943	228.7	110	St.4 XX
5	59°55'S	Dec. 9	1438	173	30	150	2473	2245	33.46	1539.18	46.0	330	St.5 GG
	108°30'E						2469	2490	36.98	6601	178.5	110	St.5 XX
7	63°38'S	Feb. 26	0928	151	8	150	2473	2061	30.72	—	—	330	St.7 GG
	60°09'E						2469	2990	44.40	1062	23.9	110	St.7 XX
8	63°56'S	Feb. 27	1407	156	16	150	2473	1608	23.97	—	—	330	St.8 GG
	69°56'E						2469	1668	24.77	7730	312.1	110	St.8 XX
9	63°31'S	Feb. 28	1455	185	36	150	2473	2573	38.35	1974.88	51.5	330	St.9 GG
	78°58'E						2469	2550	37.87	13435	354.8	110	St.9 XX
ST	61°18'S	Mar. 1	1224	167	26	150	2473	2137	31.85	2003.64	62.9	330	St.trap GG
	80°03'E						2469	1390	20.64	18369	889.8	110	St.trap XX
10	63°27'S	Mar. 7	1410	151	6	150	2473	1682	25.07	7559.39	301.5	330	St.10 GG
	91°34'E						2469	1588	23.58	15163	643.0	110	St.10 XX

Table 5. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
11	63°20'S	Mar. 8	1406	152	10	150	2473	1708	25.46	1132.02	44.5	330	St.11 GG
	101°06'E						2469	1592	23.64	9474	400.7	110	St.11 XX
12	63°53'S	Mar. 9	1401	162	22	150	2473	2240	33.38	897.97	26.9	330	St.12 GG
	111°07'E						2469	2295	34.08	2908	85.3	110	St.12 XX
13	63°58'S	Mar. 10	1409	152	10	150	2473	2411	35.93	1365.53	38.0	330	St.13 GG
	121°11'E						2469	2585	38.39	4907	127.8	110	St.13 XX
14	64°00'S	Mar. 11	1404	151	8	150	2473	1660	24.74	3221.10	130.2	330	St.14 GG
	131°15'E						2469	1600	23.76	6640	279.4	110	St.14 XX
15	63°56'S	Mar. 12	1408	181	34	150	2473	2680	39.94	7685.14	192.4	330	St.15 GG
	140°10'E						2469	2644	39.27	12676	322.8	110	St.15 XX
16	63°58'S	Mar. 13	1414	190	38	150	2473	3005	44.79	7063.08	157.7	330	St.16 GG
	146°45'E						2469	2890	42.92	6611	154.0	110	St.16 XX
17	60°16'S	Mar. 14	1414	196	40	150	2473	3614	53.86	2515.53	46.7	330	St.17 GG
	150°04'E						2469	3559	52.85	4059	76.8	110	St.17 XX
18	56°25'S	Mar. 15	1441	190	38	150	2473	3203	47.74	5691.32	119.2	330	St.18 GG
	150°41'E						2469	3308	49.13	5381	109.5	110	St.18 XX
19	51°36'S	Mar. 16	1410	173	30	150	2473	2538	37.83	16.87	0.4	330	St.19 GG
	150°43'E						2469	2322	34.48	1271	36.9	110	St.19 XX
20	45°43'S	Mar. 17	1408	185	36	150	2473	2062	30.73	11.54	0.4	330	St.20 GG
	150°33'E						2469	2840	42.18	695	16.5	110	St.20 XX

Table 6. Data on plankton collected by vertical hauls with twin NORPAC standard net on the JARE-48 cruise of the *Shirase* to the Indian sector of the Southern Ocean, Dec. 2005-Mar. 2006. Samplings were carried out by D-H. Han & S. Kudoh.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
1	40°54'S	Dec. 6	1300	233	50	150	2473	4008	51.29	271.58	5.3	330	St.1 GG
	109°09'E						2469	2154	27.19	299	11.0	110	St.1 XX
2	45°04'S	Dec. 7	1300	151	8	150	2473	3193	40.86	3214.20	78.7	330	St.2 GG
	109°55'E						2469	3590	45.32	3658	80.7	110	St.2 XX
3	50°00'S	Dec. 8	1300	177	32	150	2473	3560	45.56	9150.06	200.8	330	St.3 GG
	109°50'E						2469	4040	51.00	13336	261.5	110	St.3 XX
4	54°51'S	Dec. 9	1300	173	29	150	2473	2765	35.38	3570.56	100.9	330	St.4 GG
	109°53'E						2469	3030	38.25	5011	131.0	110	St.4 XX
5	59°49'S	Dec. 10	1300	164	24	150	2473	3660	46.84	5142.93	109.8	330	St.5 GG
	108°45'E						2469	3010	38.00	6149	161.8	110	St.5 XX
6	63°59'S	Feb. 24	1455	205	43	150	2473	2790	35.70	373.70	10.5	330	St.6 GG
	51°28'E						2469	2522	31.84	899	28.2	110	St.6 XX
7	63°58'S	Feb. 25	1356	195	39	150	2473	2750	35.19	595.24	16.9	330	St.7 GG
	61°37'E						2469	3800	47.97	1558	32.5	110	St.7 XX
8	64°37'S	Feb. 26	1324	177	32	150	2473	3315	42.42	870.08	20.5	330	St.8 GG
	68°21'E						2469	3320	41.91	12091	288.5	110	St.8 XX
9	63°57'S	Mar. 3	1256	160	20	150	2473	2260	28.92	35286.53	1220.1	330	St.9 GG
	78°26'E						2469	2080	26.26	33338	1269.6	110	St.9 XX
10	63°08'S	Mar. 4	1355	150	0	150	2473	1625	20.79	31817.60	1530.1	330	St.10 GG
	89°30'E						2469	1162	14.67	16777	1143.7	110	St.10 XX

Table 6. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
11	63°18'S	Mar. 5	1255	152	11	150	2473	1644	21.04	24290.40	1154.6	330	St.11 GG
	99°36'E						2469	1110	14.01	35701	2547.8	110	St.11 XX
12	63°31'S	Mar. 7	1245	158	18	150	2473	2732	34.96	35510.08	1015.7	330	St.12 GG
	111°39'E						2469	1499	18.92	29448	1556.2	110	St.12 XX
13	64°01'S	Mar. 8	1155	154	12	150	2473	2075	26.55	18099.56	681.6	330	St.13 GG
	121°23'E						2469	1404	17.72	11103	626.4	110	St.13 XX
14	63°45'S	Mar. 9	1255	153	12	150	2473	1877	24.02	57481.87	2393.1	330	St.14 GG
	130°45'E						2469	1359	17.16	49108	2862.4	110	St.14 XX
15	64°19'S	Mar. 12	1945	216	46	150	2473	5072	64.91	29320.38	451.7	330	St.15 GG
	139°59'E						2469	5072	64.03	42214	659.3	110	St.15 XX
16	63°37'S	Mar. 13	1442	200	37	150	2473	3690	47.22	10947.74	231.8	330	St.16 GG
	148°51'E						2469	3530	44.56	12489	280.3	110	St.16 XX
17	59°50'S	Mar. 14	1450	224	48	150	2473	5368	68.69	1125.70	16.4	330	St.17 GG
	149°35'E						2469	5382	67.94	2148	31.6	110	St.17 XX
18	55°33'S	Mar. 15	1444	185	36	150	2473	2640	33.78	4406.14	130.4	330	St.18 GG
	150°06'E						2469	2380	30.05	10787	359.0	110	St.18 XX
19	51°35'S	Mar. 17	1343	165	24	150	2473	2264	28.97	5154.22	177.9	330	St.19 GG
	149°54'E						2469	2133	26.93	17322	643.3	110	St.19 XX
20	46°02'S	Mar. 18	1348	224	48	150	2473	6580	84.20	519.10	6.2	330	St.20 GG
	150°57'E						2469	8400	106.04	678	6.4	110	St.20 XX

Table 7. Data on plankton collected by vertical hauls with twin NORPAC standard net on the JARE-49 cruise of the *Shirase* to the Indian sector of the Southern Ocean, Dec. 2006-Mar. 2007. Samplings were carried out by T. Iida & S. Kudoh.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
1	40°34'S	Dec. 5	0900	205	43	150	2473	4523	67.38	545	8.1	330	St.1 GG
	110°00'E						2469	4267	63.91	840	13.1	110	St.1 XX
2	44°51'S	Dec. 6	0854	165	25	150	2473	2792	41.60	9914	238.3	330	St.2 GG
	110°02'E						2469	2535	37.97	12332	324.8	110	St.2 XX
4	55°36'S	Dec. 8	1353	188	35	150	2473	2825	42.09	3366	80.0	330	St.4 GG
	109°53'E						2469	2915	43.66	6112	140.0	110	St.4 XX
5	59°29'S	Dec. 9	0930	150	5	150	2473	1658	24.70	2469	100.0	330	St.5 GG
	108°22'E						2469	1573	23.56	3404	144.5	110	St.5 XX
6	64°10'S	Feb. 28	1415	151	9	150	2469	2085	31.23	5018	160.7	330	St.6 GG
	49°58'E						2473	1863	27.75	5766	207.7	110	St.6 XX
7	64°00'S	Feb. 29	1025	220	47	150	2469	6108	91.48	59803	653.7	330	St.7 GG
	60°06'E						2473	4502	67.07	50748	756.6	110	St.7 XX
8	63°58'S	Mar. 4	0917	167	17	150	2469	1790	26.81	24426	911.1	330	St.8 GG
	70°48'E						2473	1360	20.26	16125	795.9	110	St.8 XX
9	64°00'S	Mar. 5	0937	158	18	150	2469	3888	58.23	6002	103.1	330	St.9 GG
	80°00'E						2473	3125	46.56	7977	171.3	110	St.9 XX
10	63°46'S	Mar. 6	0928	113	45	150	2469	4648	69.61	79181	1137.4	330	St.10 GG
	89°36'E						2473	4135	61.60	75493	1225.5	110	St.10 XX

Table 7. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire (m)	Angle of wire (°)	Estimated depth of haul (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time				No.	Revolutions					
11	63°59'S	Mar. 7	0910	165	25	150	2469	2285	34.22	249	7.3	330	St.11 GG
	99°58'E						2473	2336	34.80	2096	60.2	110	St.11 XX
12	63°57'S	Mar. 8	0925	164	24	150	2469	2433	36.44	1834	50.3	330	St.12 GG
	110°21'E						2473	2375	35.38	2455	69.4	110	St.12 XX
13	63°58'S	Mar. 9	0912	166	24	150	2469	2598	38.91	1966	50.5	330	St.13 GG
	120°21'E						2473	2568	38.26	3685	96.3	110	St.13 XX
14	64°01'S	Mar. 10	0900	164	24	150	2469	2225	33.32	954	28.6	330	St.14 GG
	130°13'E						2473	2243	33.42	2361	70.7	110	St.14 XX
15	63°59'S	Mar. 11	0907	190	38	150	2469	3092	46.31	4389	94.8	330	St.15 GG
	140°12'E						2473	2103	31.33	9037	288.4	110	St.15 XX
16	64°01'S	Mar. 12	0910	173	30	150	2469	3143	47.07	1410	30.0	330	St.16 GG
	149°47'E						2473	3107	46.29	1853	40.0	110	St.16 XX
17	60°02'S	Mar. 13	0924	185	33	150	2469	3675	55.04	5346	97.1	330	St.17 GG
	150°03'E						2473	2406	35.84	17843	497.8	110	St.17 XX
18	55°14'S	Mar. 14	0949	244	52	150	2469	5764	86.33	4855	56.2	330	St.18 GG
	150°01'E						2473	5316	79.20	13595	171.7	110	St.18 XX
19	49°16'S	Mar. 16	0910	177	32	150	2469	3062	45.86	6071	132.4	330	St.19 GG
	150°04'E						2473	3079	45.87	5278	115.1	110	St.19 XX
20	44°19'S	Mar. 17	0913	150	5	150	2469	2021	30.27	309	10.2	330	St.20 GG
	150°08'E						2473	1992	29.68	621	20.9	110	St.20 XX

Table 8. Data on plankton collected by vertical hauls with twin NORPAC standard net on the JARE-43 cruise of the *Tangaroa* to the Indian sector of the Southern Ocean, Feb.-Mar. 2002. Samplings were carried out by S. Kawaguchi & K. T. Takahashi.

Stn. No.	Position	Ship's time (LMT)		Length of wire paid out (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time		No.	Revolutions					
8	66°26'S 140°00'E	Feb. 13	0940	150	2993	1970	18.65	15520	832.1	330	Tan43-8
5	64°00'S 140°00'E	Feb. 15	0103	150	2993	1705	16.14	4600	285.0	330	Tan43-5
7	65°26'S 139°51'E	Feb. 18	0144	150	2993	2085	19.74	19826	1004.3	330	Tan43-7
7.1	65°32'S 139°51'E	Feb. 18	0932	150	2891	2370	23.96	10560	440.8	330	Tan43-7.1
7.2	65°34'S 139°50'E	Feb. 18	1202	150	2891	2005	20.27	3340	164.8	330	Tan43-7.2
7.3	65°44'S 139°50'E	Feb. 18	1444	150	2891	2010	20.32	2960	145.7	330	Tan43-7.3
6.2	65°22'S 139°53'E	Feb. 18	2006	150	2891	1977	19.99	4100	205.2	330	Tan43-6.2
6.1	65°07'S 139°51'E	Feb. 19	0134	150	2891	2044	20.66	23025	1114.3	330	Tan43-6.1
6	64°45'S 139°51'E	Feb. 19	1521	150	2891	1760	17.79	3800	213.6	330	Tan43-6

Table 8. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire paid out (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time		No.	Revolutions					
4	63°13'S 140°01'E	Feb. 20	2059	150	2891	2080	21.03	7742	368.2	330	Tan43-4
3	62°29'S 140°00'E	Feb. 21	0502	150	2891	2395	24.21	19485	804.8	330	Tan43-3
2	61°44'S 139°59'E	Feb. 22	0500	150	2891	2080	21.03	12070	574.0	330	Tan43-2
1	61°00'S 139°59'E	Feb. 23	2100	150	2891	2450	24.77	3661	147.8	330	Tan43-1
9	60°00'S 140°01'E	Feb. 27	0808	150	2891	2075	20.98	890	42.4	330	Tan43-9
10	57°01'S 140°01'E	Feb. 28	0854	150	2891	2160	21.84	9850	451.1	330	Tan43-10
11	54°00'S 140°00'E	Mar. 2	0730	150	2891	2130	21.53	—	—	330	Tan43-11

Table 9. Data on plankton collected by vertical hauls with twin NORPAC standard net on the JARE-44 cruise of the *Tangaroa* to the Indian sector of the Southern Ocean, Feb.-Mar. 2002. Samplings were carried out by A. Tanimura & K. T. Takahashi.

Stn. No.	Position	Ship's time (LMT)		Length of wire paid out (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time		No.	Revolutions					
K	65°36'S 140°01'E	Feb. 26	0633	150	2891	2050	20.72	1200	57.9	330	Tan44-K
S1	64°30'S 140°00'E	Mar. 1	1102	150	2891	1665	16.83	799	47.5	330	Salp 1F
S2	63°57'S 139°59'E	Mar. 1	1359	150	2891	1667	16.85	2969	176.2	330	Salp 2F
S3	63°24'S 140°01'E	Mar. 1	1703	150	2891	1662	16.80	661	39.3	330	Salp 3F
S4-1	62°49'S 139°59'E	Mar. 1	2003	150	2891	1610	16.28	1045	64.2	330	Salp 4F-1
S4-2	62°49'S 139°59'E	Mar. 1	2015	200	2891	2218	22.42	1412	63.0	330	Salp 4F-2
S5-1	62°17'S 140°00'E	Mar. 1	2300	150	2891	1630	16.48	1446	87.8	330	Salp 5F-1
S5-2	62°17'S 140°00'E	Mar. 1	2312	200	2891	2160	21.84	2349	107.6	330	Salp 5F-2
S6	61°44'S 139°59'E	Mar. 2	0200	150	2891	1582	15.99	3985	249.2	330	Salp 6F

Table 9. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire paid out (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time		No.	Revolutions					
S7	61°11'S 139°59'E	Mar. 2	0501	150	2891	1615	16.33	13119	803.6	330	Salp 7F
S8	60°38'S 140°00'E	Mar. 2	0803	150	2891	1926	19.47	15558	799.1	330	Salp 8F
S9	60°53'S 141°05'E	Mar. 2	1107	150	2891	1812	18.32	22266	1215.6	330	Salp 9F
S10	61°14'S 141°49'E	Mar. 2	1358	150	2891	1891	19.12	2684	140.4	330	Salp 10F
S11	61°41'S 142°27'E	Mar. 2	1700	150	2891	1460	14.76	4501	305.0	330	Salp 11F
S12	62°09'S 143°07'E	Mar. 2	2001	150	2891	1579	15.96	6721	421.1	330	Salp 12F
S13-1	62°37'S 143°50'E	Mar. 2	2300	150	2891	1664	16.82	1204	71.6	330	Salp 13F-1
S13-2	62°37'S 143°50'E	Mar. 2	2308	200	2891	1989	20.11	1830	91.0	330	Salp 13F-2
S14-1	63°03'S 144°31'E	Mar. 3	0200	150	2891	2100	21.23	734	34.6	330	Salp 14F-1
S14-2	63°03'S 144°31'E	Mar. 3	0213	250	2891	2415	24.41	—	—	330	—

Table 9. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire paid out (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time		No.	Revolutions					
S15	63°28'S 145°10'E	Mar. 3	0406	150	2891	1700	17.19	1660	96.6	330	Salp 15F
S16	63°56'S 145°53'E	Mar. 3	0800	150	2891	2110	21.33	1256	58.9	330	Salp 16F
S17	63°31'S 146°43'E	Mar. 3	1104	150	2891	1655	16.73	1119	66.9	330	Salp 17F
S18	63°15'S 146°55'E	Mar. 3	1359	150	2891	1658	16.76	6938	413.9	330	Salp 18F
S19	63°20'S 146°01'E	Mar. 3	1710	150	2891	1860	18.80	710	37.8	330	Salp 19F
S20	63°27'S 144°46'E	Mar. 3	2001	150	2891	2101	21.24	342	16.1	330	Salp 20F
S21	63°36'S 143°32'E	Mar. 3	2301	150	2891	1743	17.62	5887	334.1	330	Salp 21F
S22	63°44'S 142°19'E	Mar. 4	0200	150	2891	2187	22.11	6865	310.5	330	Salp 22F
5	64°00'S 140°00'E	Mar. 4	0811	150	2891	1850	18.70	665	35.6	330	Tan44-5
4	63°13'S 140°02'E	Mar. 5	1912	150	2891	1680	16.98	1920	113.1	330	Tan44-4

Table 9. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire paid out (m)	Flow-meter		Estimated volume of water filtered (m^3)	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)	Mesh size (μm)	Sample No.
		Date	time		No.	Revolutions					
3	62°30'S 140°00'E	Mar. 5	2321	150	2891	1765	17.84	4395	246.3	330	Tan44-3
2	61°45'S 140°00'E	Mar. 6	1054	150	2891	1595	16.12	795	49.3	330	Tan44-2
1	61°00'S 139°59'E	Mar. 6	1600	150	2891	1700	17.19	16170	940.9	330	Tan44-1