Plankton Sampling on Board Shirase in 1983–1996
—NORPAC standard net samples—

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During every austral summer season (December–March), plankton sampling has been carried out in the Indian Ocean sector of the Southern Ocean as part of the routine marine biology observations of the Japanese Antarctic Research Expedition (JARE). The sampling was done on board the icebreaker Fuji during 1972–1983 as described by Fukuchi and Tanimura (1981) and Watanabe *et al.* (1984). The icebreaker Shirase was launched in 1983 and the sampling has been done since then. Several kinds of plankton nets were employed on board the icebreaker Shirase and vertical hauls by NORPAC standard net (North Pacific standard net) have been routinely and frequently carried out. This report presents the data records of the NORPAC standard net vertical hauls during JARE-25~37 (1983–1996). Additionally, data of wet weight of plankton samples during JARE-23 and -24, which were not dealt with by Watanabe *et al.* (1984), are also presented.

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 employed at all sampling stations. The net was hauled vertically at a speed of *ca.* 1 m/s, mostly from a depth of 150 m. All samples obtained were preserved in 5–10 % buffered formalin sea water immediately on board. The volumes of water filtered through each net were estimated from a flow-meter which was mounted at the center of the mouth ring of each net. However, it was estimated by assuming 100 % efficiency of the net when the flow-meter data were not available, *i.e.* when a flow-meter did not work properly because of

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some trouble, or flow-meter calibration data were not available. Stations in 1983–1996 (JARE-25~37) are shown in Figs. 1 and 2. During JARE-25~28, samplings were mainly conducted in the western part of the Indian sector of the Southern Ocean (Fig. 1); thereafter sampling stations were changed to the eastern area of the Indian sector of the Southern Ocean (Fig. 2) because the cruise tracks of the Shirase were changed from JARE-29. Data on the NORPAC standard net hauls in JARE-25~37 are listed in Tables 1–13 and data of wet weights of samples during JARE-23~24 are additionally listed in Tables 14 –15.

The 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-25 (1983/84)	A. Taniguchi	Tohoku University
	Y. Hamada	Tokyo University of Fisheries
JARE-26 (1984/85)	Y. Fukuda	Kumamoto University
	M. Ohno	Kochi University
JARE-27 (1985/86)	H. Hattori	Tohoku University
	M. Fukuchi	National Institute of Polar Research
JARE-28 (1986/87)	T. Kubodera	National Science Museum
JARE-29 (1987/88)	Y. Ino	Waseda University
JARE-30 (1988/89)	Y. Watanuki	National Institute of Polar Research
JARE-31 (1989/90)	T. Konno	Tokyo University of Fisheries
JARE-32 (1990/91)	T. Kuramochi	Gifu University
JARE-33 (1991/92)	T. Odate	Mie University
JARE-34 (1992/93)	M. Ishii	Meteorological Research Institute
JARE-35 (1993/94)	M. Kawachi	Tsukuba University
JARE-36 (1994/95)	K. Nomura	Hokkaido University
JARE-37 (1995/96)	Y. Miyamoto	Tokyo University of Fisheries

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

Measurements of biomass and primary sorting of the samples are being undertaken. This report presents preliminary data on plankton samples stored at the National Institute of Polar Research. Inquiries about details of the data record should be addressed to:

Department of Biological Data
Division of Data Collection and Processing
National Institute of Polar Research
9–10, Kaga 1-chome, Itabashi-ku, Tokyo 173.

References

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

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), 11p.

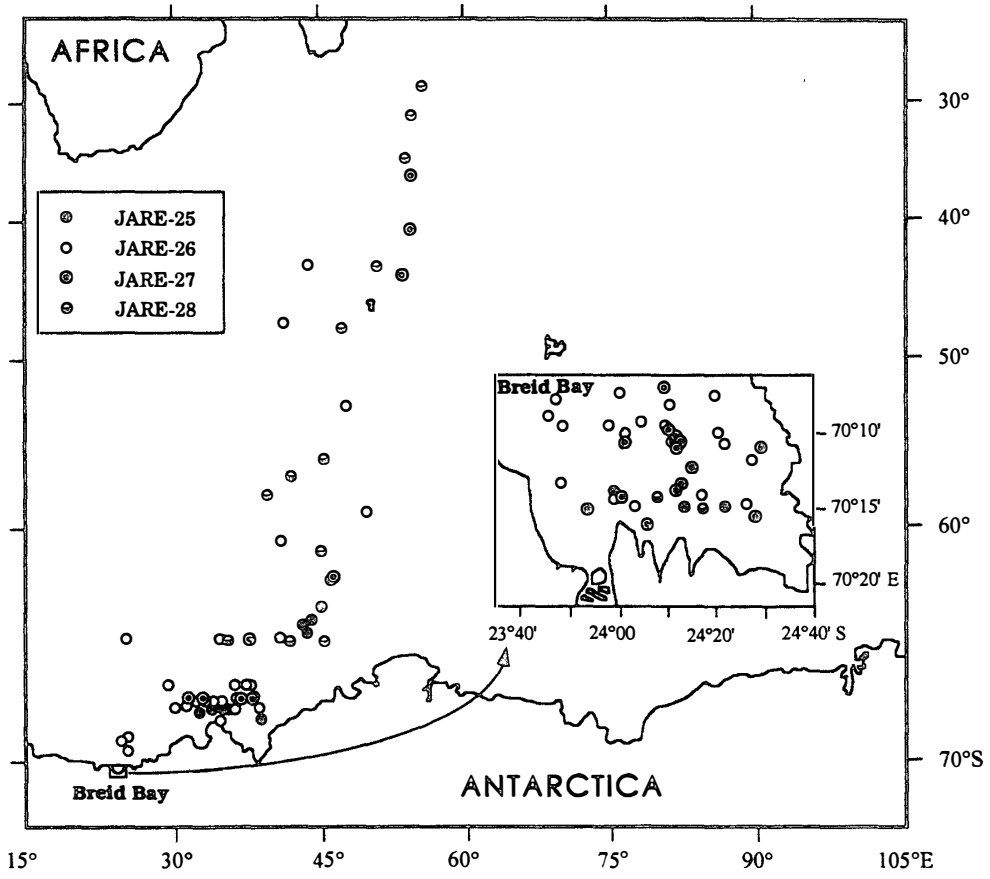

Fig. 1. Stations of NORPAC standard net samplings on board the icebreaker Shirase in the Indian sector of the Southern Ocean in 1983-1987.

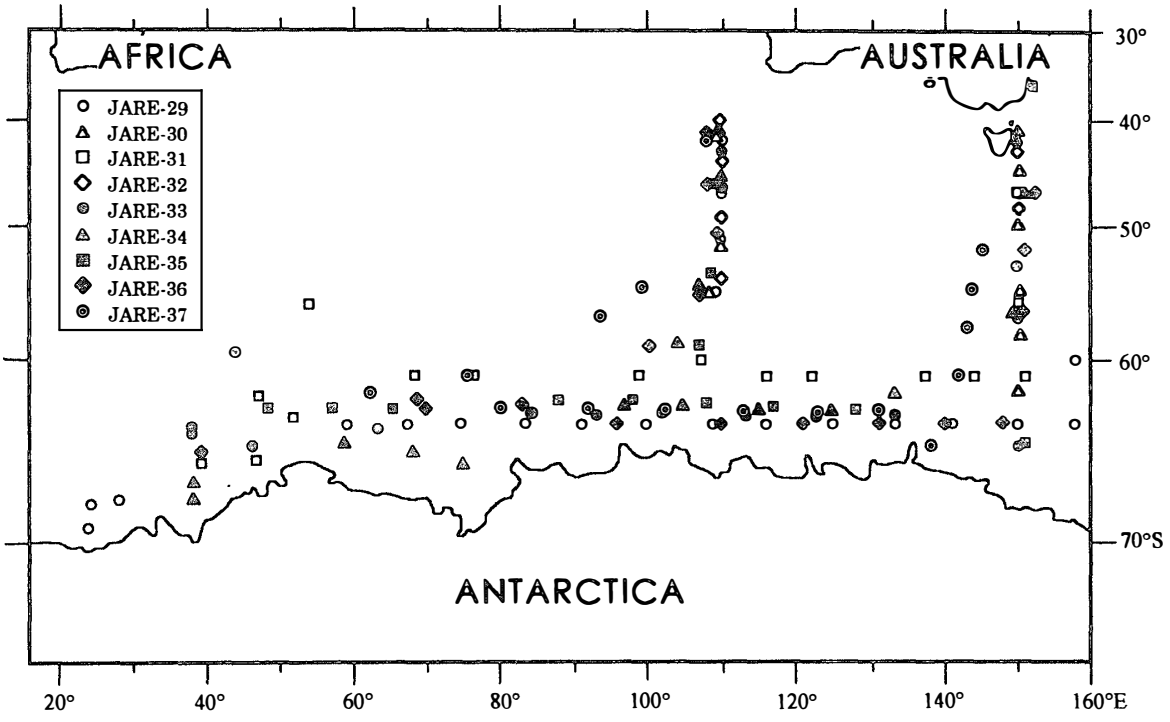

Fig. 2. Stations of NORPAC standard net samplings on board the icebreaker Shirase in the Indian sector of the Southern Ocean in 1987-1996.

Table 1. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-25 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1983- Mar. 1984. Samplings were carried out by A. Taniguchi & Y. Hamada.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
1	63°42'S	Dec. 14	1001	161	21	150	61	1805	22.44	680	30.3	330	1
	44°54'E						51	1750	20.56	1980	96.3	110	2
2	64°02'S	Dec. 14	1902	173	32	147	61	2258	28.07	1660	59.1	330	17
	43°59'E						51	2140	24.96	2820	113.0	110	18
3	64°13'S	Dec. 15	0930	155	14	150	61	1617	20.10	1760	87.6	330	19
	43°53'E						51	1425	16.74	2690	160.7	110	20
4	64°25'S	Dec. 15	1828	150	2	150	61	1446	17.97	550	30.6	330	36
	43°34'E						51	1381	16.23	1860	114.6	110	35
5	64°37'S	Dec. 16	0916	153	12	150	61	1754	21.80	380	17.4	330	37
	43°22'E						51	1592	17.97	180	10.0	110	38
6	68°23'S	Dec. 27	0900	160	0	160	61	1784	22.18	660	29.8	330	39
	38°40'E						51	1648	19.36	440	22.7	110	40
7	68°23'S	Dec. 30	1000	—	—	—	61	1673	20.80	260	12.5	330	41
	38°40'E						51	1546	18.16	580	31.9	110	42
8	70°15'S	Feb. 11	1154	210	45	148	61	3158	39.25	213	5.4	330	43
	24°21'E						51	2822	33.16	3143	94.8	110	44
9	70°15'S	Feb. 12	0902	180	38	142	51	2025	23.79	3430	144.2	110	55
	24°14'E						61	2250	27.97	180	6.4	330	56
11	68°00'S	Feb. 16	1028	200	40	153	51	3700	43.48	2120	48.8	110	67
	34°59'E						61	3531	43.89	590	13.4	330	68

Table 1. 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					
12	68°00'S	Feb. 16	1338	210	45	148	51	4700	55.23	970	17.6	110	69
	34°25'E						61	4380	54.44	700	12.9	330	70
13	68°00'S	Feb. 16	1543	180	35	147	51	3451	40.55	490	12.1	110	71
	33°49'E						61	3430	42.63	418	9.8	330	72
14	67°59'S	Feb. 16	1740	173	32	147	51	3881	45.60	470	10.3	110	73
	33°12'E						61	2734	33.98	31	0.9	330	74
15	70°14'S	Feb. 19	0935	210	45	148	51	2087	24.52	3310	135.0	110	75
	23°55'E						61	2934	36.47	320	8.8	330	76

Table 2. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-26 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1984- Mar. 1985. Samplings were carried out by Y. Fukuda & M. Ohno.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
Breid Bay													
5	70°09'S	Dec. 27	1039	248	8	246	1298	2667	40.89	1846	45.2	110	26N001
	23°58'E						1301	2867	44.47	1244	28.0	330	26N002
6	70°09'S	Dec. 27	1237	290	12	284	1298	2907	44.56	2812	63.1	110	26N003
	23°48'E						1301	2268	35.18	1182	33.6	330	26N004
7	70°09'S	Dec. 27	1558	270	23	249	1298	2785	42.69	2400	56.2	110	26N005
	24°09'E						1301	2065	32.03	1210	37.8	330	26N006
2	70°04'S	Dec. 29	1026	1000	25	906	1301	8843	135.56	332	2.4	110	26N007
	24°00'E						1298	11063	171.59	1926	11.2	330	26N008
1	70°05'S	Dec. 29	1220	900	10	886	1301	6465	99.11	214	2.2	110	26N009
	23°48'E						1298	9228	143.13	1726	12.1	330	26N010
8	70°10'S	Dec. 29	1453	250	2	250	1301	1980	30.35	3580	117.9	110	26N011
	24°20'E						1298	2442	37.88	72	1.9	330	26N012
3	70°05'S	Dec. 30	1156	1000	15	966	1298	10801	165.58	3768	22.8	110	26N013
	24°10'E						1301	8850	137.26	1810	13.2	330	26N014
4	70°04'S	Dec. 30	1345	800	10	788	1298	8150	124.94	1880	15.0	110	26N015
	24°20'E						1301	6252	96.97	1018	10.5	330	26N016
9	70°12'S	Dec. 30	1538	250	10	246	1298	2472	37.90	2320	61.2	110	26N017
	24°27'E						1301	2049	31.78	436	13.7	330	26N018

Table 2. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
off Syowa St.													
1	67°59'S	Feb. 3	1018	1000	15	966	1298	10278	157.56	9548	60.6	110	26N019
	38°02'E						1301	12712	197.16	860	4.4	330	26N020
2	67°30'S	Feb. 3	1421	1000	27	891	1298	9350	143.34	10880	75.9	110	26N021
	37°58'E						1301	11082	171.88	4464	26.0	330	26N022
3	66°59'S	Feb. 4	0852	1000	5	996	1298	7990	122.49	9474	77.3	110	26N023
	37°58'E						1301	10590	164.25	8082	49.2	330	26N024
4	66°59'S	Feb. 4	1157	1000	17	956	1298	10157	155.71	5896	37.9	110	26N025
	37°01'E						1301	18623	288.84	4538	15.7	330	26N026
5	67°00'S	Feb. 4	1717	1000	22	927	1298	7875	120.72	260	2.2	110	26N027
	35°59'E						1301	10423	161.66	6442	39.8	330	26N028
6	67°30'S	Feb. 5	0943	1000	8	990	1298	9843	150.89	2426	16.1	110	26N029
	36°00'E						1301	8645	134.08	1434	10.7	330	26N030
7	67°59'S	Feb. 5	1311	1000	5	996	1298	10848	166.30	1484	8.9	110	26N031
	35°58'E						1301	8045	124.78	1356	10.9	330	26N032
Breid Bay													
6	70°09'S	Feb. 8	0848	260	15	251	1298	2274	34.86	10182	292.1	110	26N033
	24°01'E						1301	3157	48.97	2406	49.1	330	26N034
5	70°08'S	Feb. 8	1037	280	8	277	1298	2024	31.03	10326	332.8	110	26N035
	23°46'E						1301	2772	42.99	3024	70.3	330	26N036

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					
7	70°10'S	Feb. 9	0936	250	48	167	1298	2304	35.32	418	11.8	110	26N037
	24°09'E						1301	3510	54.44	104	1.9	330	26N038
8	70°11'S	Feb. 9	1135	300	50	193	1298	2203	33.77	860	25.5	110	26N039
	24°21'E						1301	4803	74.49	410	5.5	330	26N040
4	70°14'S	Feb. 10	1509	270	38	213	1298	2230	34.19	4840	141.6	110	26N045
	24°16'E						1301	3340	51.80	210	4.1	330	26N046
1	70°13'S	Feb. 10	1813	250	36	202	1298	2220	34.03	2826	83.0	110	26N041
	23°48'E						1301	3109	48.22	240	5.0	330	26N042
2	70°14'S	Feb. 11	0847	190	28	168	1298	1620	24.83	3110	125.2	110	26N047
	23°59'E						1301	2375	36.84	552	15.0	330	26N048
3	70°15'S	Feb. 11	1027	200	30	173	1298	1690	25.91	6306	243.4	110	26N043
	24°04'E						1301	2438	37.81	2748	72.7	330	26N044
9	70°15'S	Feb. 11	1406	260	14	252	1298	1795	27.52	3644	132.4	110	26N049
	24°27'E						1301	2715	42.11	3878	92.1	330	26N050
other area													
1	69°00'S	Feb. 12	1006	500	25	453	1298	4582	70.24	7576	107.9	110	26N051
	25°02'E						1301	5384	83.51	12436	148.9	330	26N052
2	69°03'S	Feb. 15	1153	500	35	410	1298	4686	71.84	30072	418.6	110	26N053
	24°58'E						1301	6254	97.00	17812	183.6	330	26N054
3	69°33'S	Feb. 16	1005	500	13	487	1298	—	79.48	4272	53.7	110	26N055
	25°02'E						1301	5388	83.57	1732	20.7	330	26N056

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					
Güunnerus Bank													
1	67°57'S	Feb. 23	0906	2000	62	939	1298	21455	328.91	49160	149.5	110	26N057
	30°00'E						1301	23330	361.85	26454	73.1	330	26N058
2	67°59'S	Feb. 23	1321	2000	57	1089	1298	—	317.93	39604	124.6	110	26N059
	31°02'E						1301	26140	405.43	96	0.2	330	26N060
6	67°59'S	Feb. 24	0901	400	27	356	1308	6672	86.07	2304	26.8	110	26N061
	34°57'E						1291	5803	71.38	908	12.7	330	26N062
5	67°59'S	Feb. 24	1200	400	38	315	1308	7008	90.40	2866	31.7	110	26N063
	33°58'E						1291	5412	66.57	1026	15.4	330	26N064
4	67°59'S	Feb. 24	1509	400	30	346	1308	5409	69.78	1156	16.6	110	26N065
	32°58'E						1291	4827	59.37	554	9.3	330	26N066
3	67°58'S	Feb. 24	1858	324	22	300	1308	5055	65.21	5356	82.1	110	26N067
	32°00'E						1291	4588	56.43	6480	114.8	330	26N068
7	68°22'S	Feb. 25	0908	290	25	263	1308	3453	44.54	868	19.5	110	26N069
	34°14'E						1291	3205	39.42	580	14.7	330	26N070
other area													
4	66°59'S	Feb. 26	1052	150	2	150	1308	1730	22.32	16498	739.3	110	26N071
	29°50'E						1291	1710	21.03	7492	356.2	330	26N072
5	64°58'S	Feb. 27	1134	150	25	136	1308	1904	24.56	566	23.0	110	26N073
	25°02'E						1291	1867	22.96	1524	66.4	330	26N074

Table 2. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
6	65°02'S	Feb. 28	1043	164	30	142	1308	2472	31.89	6828	214.1	110	26N075
	34°13'E						1291	2600	31.98	16288	509.3	330	26N076
7	65°00'S	Mar. 2	—	183	35	150	1308	2818	36.35	8312	228.7	110	26N077
	40°19'E						1291	3490	42.93	2072	48.3	330	26N078
8	60°39'S	Mar. 3	1700	200	39	155	1308	4522	58.33	14192	243.3	110	26N079
	40°51'E						1291	3590	44.16	16168	366.1	330	26N080
9	58°54'S	Mar. 4	1150	160	30	139	1308	2585	33.35	10400	311.9	110	26N081
	39°51'E						1291	2589	31.84	5244	164.7	330	26N082
10	52°56'S	Mar. 6	1140	164	25	149	1308	2535	32.70	244	7.5	110	26N083
	37°40'E						1291	2424	29.82	2744	92.0	330	26N084
11	47°31'S	Mar. 7	—	167	30	145	1308	—	26.55	31340	1180.6	110	26N085
	40°08'E						1291	—	26.55	23860	898.8	330	26N086
12	43°26'S	Mar. 8	—	173	26	155	1308	2508	32.35	24	0.7	110	26N087
	40°54'E						1291	2354	28.95	474	16.4	330	26N088

Table 3. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-27 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1985- Mar. 1986. Samplings were carried out by H. Hattori & M. Fukuchi.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
4	70°14'S	Dec. 25	1202	168	28	148	51	2252	29.91	2054	68.7	330	27N001
	24°11'E						1249	1240	17.17	3922	228.4	110	27N002
5	70°10'S	Dec. 25	1610	150	0	150	51	1530	20.32	1666	82.0	330	27N003
	24°28'E						1249	755	10.46	1910	182.6	110	27N004
1—1	70°14'S	Dec. 26	0959	160	20	150	51	1935	25.70	2112	82.2	330	27N005
	24°10'E						1249	825	11.43	2432	212.8	110	27N006
1—2	70°10'S	Dec. 26	1707	152	10	150	51	1702	22.60	3136	138.8	330	27N007
	24°11'E						1249	843	11.68	3224	276.0	110	27N008
1—3	70°10'S	Dec. 26	2207	150	6	149	51	1600	21.25	2328	109.6	330	27N009
	23°10'E						1249	734	10.17	1872	184.1	110	27N010
1—4	70°09'S	Dec. 27	0311	153	12	147	51	—	24.32	2154	88.6	330	27N011
	24°10'E						1249	—	24.32	1912	78.6	110	27N012
1—5	70°10'S	Dec. 27	1000	150	2	150	51	1548	20.56	1240	60.3	330	27N013
	24°11'E						1249	735	10.18	3696	363.1	110	27N014
2	70°06'S	Dec. 29	1020	152	10	150	51	1682	22.34	2026	90.7	330	27N015
	24°08'E						1249	700	9.70	4076	420.2	110	27N016
3	70°15'S	Dec. 29	1352	165	25	150	51	2000	26.56	3202	120.6	330	27N017
	24°27'E						1249	848	11.74	1432	122.0	110	27N018
4—1	70°13'S	Feb. 14	1119	196	40	150	51	4918	65.31	1480	22.7	330	27N019
	24°12'E						1249	1513	20.96	10720	511.5	110	27N020

Table 3. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
4—2	70°15'S	Feb. 14	2124	162	22	150	51	1925	25.43	6796	267.2	330	27N021
	24°02'E						1249	1102	15.26	12480	817.8	110	27N022
4—3	70°14'S	Feb. 14	2350	160	20	150	51	1969	26.15	4376	167.3	330	27N023
	24°00'E						1249	933	12.92	14452	1118.6	110	27N024
4—4	70°10'S	Feb. 15	0350	173	30	150	51	2410	32.01	2704	84.5	330	27N025
	24°00'E						1249	1208	16.73	9904	592.0	110	27N026
4—5	70°15'S	Feb. 15	1128	212	45	150	51	3620	48.07	1872	38.9	330	27N027
	23°53'E						1249	1660	22.99	5920	257.5	110	27N028
6	67°30'S	Feb. 18	1057	177	32	150	51	2776	36.87	1168	31.7	330	27N029
	31°02'E						1249	2182	30.22	916	30.3	110	27N030
7	67°30'S	Feb. 19	0941	150	0	150	51	1794	23.82	6968	292.5	330	27N031
	32°59'E						1249	1427	19.76	944	47.8	110	27N032
8	67°29'S	Feb. 20	1050	156	16	150	51	1862	24.73	3272	132.3	330	27N033
	36°01'E						1249	1608	22.27	1680	75.4	110	27N034
10	67°30'S	Feb. 21	1049	196	40	150	51	2836	37.66	1676	44.5	330	27N035
	37°40'E						1249	2360	32.69	6980	213.5	110	27N036
11—1	64°59'S	Feb. 25	1110	196	40	150	51	3189	42.35	2340	55.3	330	27N037
	37°40'E						1249	2468	34.18	8720	255.1	110	27N038
11—2	65°00'S	Feb. 25	1802	155	15	150	51	2061	27.37	1690	61.7	330	27N039
	37°40'E						1249	1770	24.51	2750	112.2	110	27N040

Table 3. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
11—3	64°59'S	Feb. 25	2341	170	28	150	51	2783	36.96	1942	52.5	330	27N041
	37°40'E						1249	2120	29.36	5440	185.3	110	27N042
11—4	65°01'S	Feb. 26	0403	150	6	149	51	1950	25.90	2370	91.5	330	27N043
	37°39'E						1249	1540	21.33	4850	227.4	110	27N044
11—5	65°00'S	Feb. 26	1106	150	0	150	51	1833	24.34	1756	72.1	330	27N045
	37°39'E						1249	1470	20.36	92	4.5	110	27N046
12	62°11'S	Mar. 2	1202	300	60	150	51	7257	96.37	5764	59.8	330	27N047
	46°04'E						1249	4458	61.74	13642	221.0	110	27N048
17	43°52'S	Mar. 8	1155	233	50	150	51	5600	74.37	2848	38.3	330	27N049
	53°05'E						1249	4670	64.68	1666	25.8	110	27N050
18	40°35'S	Mar. 9	0756	270	55	155	51	5402	71.74	986	13.7	330	27N051
	53°56'E						1249	3184	44.10	1262	28.6	110	27N052
19	36°07'S	Mar. 10	0751	173	30	150	51	1848	24.54	54	2.2	330	27N053
	54°30'E						1249	1550	21.47	112	5.2	110	27N054

Table 4. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-28 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1986- Mar. 1987. Samplings were carried out by T. Kubodera.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
1	70°14'S	Feb. 13	1855	178	33	149	51	1885	22.43	1276	56.9	330	28N001
	24°09'E						1249	1378	18.47	7302	395.3	110	28N002
2	70°15'S	Feb. 14	1530	170	28	150	51	1519	18.08	368	20.4	330	28N003
	24°17'E						1249	1203	16.12	10786	669.1	110	28N004
3	65°03'S	Feb. 24	0908	183	35	150	51	3987	47.45	746	15.7	330	28N005
	34°43'E						1249	3220	43.15	6142	142.3	110	28N006
4	64°59'S	Feb. 25	1430	183	35	150	51	4040	48.08	3576	74.4	330	28N007
	41°48'E						1249	3022	40.49	10386	256.5	110	28N008
5	64°57'S	Feb. 26	0748	190	38	150	51	3119	37.12	6492	174.9	330	28N009
	45°04'E						1249	2524	33.82	11216	331.6	110	28N010
6	61°10'S	Feb. 27	1015	212	45	150	51	3784	45.03	1048	23.3	330	28N011
	44°46'E						1249	3490	46.77	2110	45.1	110	28N012
7	58°08'S	Mar. 1	0910	224	48	150	51	5120	60.93	130	2.1	330	28N013
	39°34'E						1249	4238	56.79	4188	73.7	110	28N014
8	56°58'S	Mar. 3	0815	268	56	150	51	7530	89.61	2716	30.3	330	28N015
	41°43'E						1249	6000	80.40	11518	143.3	110	28N016
9	56°14'S	Mar. 4	1415	173	30	150	51	3136	37.32	776	20.8	330	28N017
	45°04'E						1249	3095	41.47	2954	71.2	110	28N018
10	47°45'S	Mar. 7	0615	185	36	150	51	3195	38.02	5314	139.8	330	28N019
	46°55'E						1249	3000	40.20	4466	111.1	110	28N020

Table 4. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
11	43°11'S	Mar. 8	0758	216	46	150	51	3792	45.12	2400	53.2	330	28N021
	50°17'E						1249	2522	33.79	1724	51.0	110	28N022
12	34°55'S	Mar. 10	1145	179	33	150	51	2703	32.17	242	7.5	330	28N023
	53°27'E						1249	2318	31.06	1180	38.0	110	28N024
13	30°57'S	Mar. 11	1140	177	32	150	51	2570	30.58	266	8.7	330	28N025
	54°12'E						1249	2360	31.62	2152	68.1	110	28N026
14	25°54'S	Mar. 12	1408	202	42	150	51	3070	36.53	742	20.3	330	28N027
	55°02'E			185	36	150	1249	2250	30.15	1592	52.8	110	28N028

Table 5. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-29 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1987- Mar. 1988. Samplings were carried out by Y. Ino.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
1	42°04'S	Dec. 5	—	150	5	149	—	2475	29.70	98	3.3	330	29N001
	109°58'E						—	3020	32.31	248	7.7	110	29N002
2	46°40'S	Dec. 6	—	150	7	149	—	2072	24.86	6496	261.3	330	29N003
	110°05'E						—	2074	22.19	55396	2496.2	110	29N004
3	51°22'S	Dec. 7	—	150	—	—	—	—	23.84	8878	372.3	330	29N005
	109°56'E						—	—	23.84	99754	4183.5	110	29N006
4	55°35'S	Dec. 8	—	150	30	130	—	3130	37.56	6766	180.1	330	29N007
	108°53'E						—	3182	34.05	39392	1157.0	110	29N008
5	69°27'S	Feb. 8	1458	150	8	149	—	3352	40.22	11316	281.3	330	29N009
	23°39'E						—	2333	24.96	10244	410.4	110	29N010
6	68°25'S	Feb. 10	1212	176	47	120	—	4660	55.92	42340	757.2	330	29N011
	24°12'E						—	3671	39.28	10284	261.8	110	29N012
7	68°03'S	Feb. 11	1440	150	31	129	—	2660	31.92	1068	33.5	330	29N013
	27°55'E						—	3231	34.57	4472	129.4	110	29N014
8	63°59'S	Feb. 29	1222	150	21	140	—	3402	40.82	5652	138.4	330	29N015
	59°14'E						—	3552	38.01	4250	111.8	110	29N016
9	63°57'S	Mar. 1	1201	150	40	115	—	3030	36.36	96	2.6	330	29N017
	67°07'E						—	3720	39.80	60	1.5	110	29N018
10	64°00'S	Mar. 2	1417	150	23	138	—	2320	27.84	72	2.6	330	29N019
	74°47'E						—	2582	27.63	310	11.2	110	29N020

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°52'S	Mar. 3	1433	150	14	146	—	2200	26.40	174	6.6	330	29N021
	83°48'E						—	2216	23.71	216	9.1	110	29N022
12	63°53'S	Mar. 4	1359	150	21	140	—	1700	20.40	374	18.3	330	29N023
	91°50'E						—	1878	20.09	1382	68.8	110	29N024
13	63°55'S	Mar. 5	1305	150	35	123	—	2430	29.16	778	26.7	330	29N025
	99°51'E						—	2850	30.50	1056	34.6	110	29N026
14	64°00'S	Mar. 6	1335	150	23	138	—	1803	21.64	302	14.0	330	29N027
	108°27'E						—	2088	22.34	1174	52.5	110	29N028
15	64°02'S	Mar. 7	1331	150	25	136	—	1692	20.30	66530	3276.7	330	29N029
	116°26'E						—	1770	18.94	125000	6600.1	110	29N030
16	63°59'S	Mar. 8	1348	150	0	150	—	1292	15.50	8694	560.8	330	29N031
	125°01'E						—	1638	17.53	14524	828.7	110	29N032
17	63°56'S	Mar. 9	1340	150	24	137	—	1879	22.55	554	24.6	330	29N033
	133°14'E						—	2142	22.92	1024	44.7	110	29N034
18	64°01'S	Mar. 10	1314	150	33	126	—	2351	28.21	208	7.4	330	29N035
	141°46'E						—	2710	29.00	866	29.9	110	29N036
19	64°00'S	Mar. 11	1154	150	50	96	—	4090	49.08	564	11.5	330	29N037
	149°56'E						—	4690	50.18	732	14.6	110	29N038
20	64°00'S	Mar. 12	1151	150	38	118	—	3213	38.56	318	8.2	330	29N039
	158°00'E						—	3336	35.70	392	11.0	110	29N040

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					
21	60°17'S	Mar. 13	1152	150	46	104	—	2783	33.40	3012	90.2	330	29N041
	157°57'E						—	3160	33.81	57660	1705.3	110	29N042

Table 6. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-30 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1988- Mar. 1989. Samplings were carried out by Y. Watanuki.

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°48'S	Dec. 5	—	200	—	—	—	—	31.79	734	23.1	110	30N001
	110°01'E						—	—	31.79	392	12.3	330	30N002
2	45°36'S	Dec. 6	—	200	—	—	—	—	31.79	4628	145.6	110	30N003
	110°01'E						—	—	31.79	4018	126.4	330	30N004
3	50°44'S	Dec. 7	—	200	—	—	—	—	31.79	14330	450.7	110	30N005
	110°00'E						—	—	31.79	7686	241.8	330	30N006
4	55°13'S	Dec. 8	—	200	—	—	—	—	31.79	5338	167.9	110	30N007
	109°07'E						—	—	31.79	3258	102.5	330	30N008
5	63°00'S	Mar. 13	—	200	—	—	—	—	31.79	14722	463.1	110	30N009
	150°00'E						—	—	31.79	826	26.0	330	30N010
6	59°40'S	Mar. 14	—	200	—	—	—	—	31.79	13362	420.3	330	30N011
	150°00'E						—	—	31.79	574	18.1	110	30N012
7	52°02'S	Mar. 15	—	200	—	—	—	—	31.79	920	28.9	330	30N013
	150°14'E						—	—	31.79	1222	38.4	110	30N014
8	47°07'S	Mar. 16	—	200	—	—	—	—	31.79	280	8.8	330	30N015
	150°09'E							—	31.79	546	17.2	110	30N016

Table 7. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-31 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1994- Mar. 1995. Samplings were carried out by T. Konno.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
7	66°34'S	Feb. 11	1550	183	35	150	—	—	29.09	756	26.0	110	31N001
	39°00'E												
8	66°03'S	Feb. 24	1445	209	44	150	—	—	33.22	18984	571.4	110	31N003
	46°49'E						—	—	33.22	664	20.0	330	31N004
9	62°40S	Feb. 25	1320	152	10	150	—	—	24.16	628	26.0	110	31N005
	47°03'S						—	—	24.16	36	1.5	330	31N006
10'	56°03'S	Feb. 28	1510	283	58	150	—	—	44.99	19752	439.1	110	31N007
	54°24'E						—	—	44.99	6050	134.5	330	31N008
13	60°58'S	Mar. 3	1245	205	43	150	—	—	32.59	164	5.0	110	31N009
	67°43'E						—	—	32.59	84	2.6	330	31N010
14	61°02'S	Mar. 4	1425	173	30	150	—	—	27.50	270	9.8	110	31N011
	76°41'E						—	—	27.50	78	2.8	330	31N012
17	61°02'S	Mar. 7	1515	190	38	150	—	—	30.20	4332	143.4	110	31N013
	99°18'E						—	—	30.20	3388	112.2	330	31N014
18	60°58'S	Mar. 8	1500	185	36	150	—	—	29.41	2860	97.3	110	31N015
	107°05'E						—	—	29.41	2072	70.5	330	31N016
19	61°02'S	Mar. 9	1455	160	20	150	—	—	25.43	2032	79.9	110	31N017
	114°27'E						—	—	25.43	1626	63.9	330	31N018
20	61°00'S	Mar. 10	1415	151	8	150	—	—	24.00	3296	137.3	110	31N019
	122°09'E						—	—	24.00	2512	104.7	330	31N020

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					
22	61°05'S	Mar. 12	1435	216	46	150	—	—	34.34	16744	487.7	110	31N021
	137°18'E						—	—	34.34	9512	277.0	330	31N022
23	61°00'S	Mar. 13	1455	173	30	150	—	—	27.50	11388	414.1	110	31N023
	144°54'E						—	—	27.50	7084	257.6	330	31N024
24	60°31'S	Mar. 14	1535	212	45	150	—	—	33.70	17476	518.6	110	31N025
	150°08'E												
25	56°36'S	Mar. 15	1455	209	44	150	—	—	33.22	4752	143.0	110	31N027
	149°56'E						—	—	33.22	5878	176.9	330	31N028
27	47°55'S	Mar. 17	1410	196	40	150	—	—	31.16	282	9.1	110	31N029
	150°03'E						—	—	31.16	312	10.0	330	31N030

Table 8. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-32 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1990- Mar. 1991. Samplings were carried out by T. Kuramochi.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
1	39°47'S	Dec. 5	1540	156	17	149	1838	1880	24.10	672	27.9	110	32N001
	110°03'E						1835	1873	24.12	562	23.3	330	32N002
2	44°38'S	Dec. 6	1515	173	23	159	1838	2256	28.92	9968	344.7	110	32N003
	110°03'E						1835	2290	29.47	1914	64.9	330	32N004
3	49°37'S	Dec. 7	1529	190	39	148	1838	2356	30.20	19456	644.2	110	32N005
	109°56'E						1835	3090	39.77	7404	186.2	330	32N006
4	54°29'S	Dec. 8	610	220	50	141	1838	2669	34.22	8134	237.7	110	32N007
	109°56'E						1835	5320	68.47	4582	66.9	330	32N008
27	47°44'S	Mar. 17	1250	220	46	153	1835	3760	48.39	7166	148.1	110	32N009
	150°3'E						1838	4077	52.27	4880	93.4	330	32N010
28	42°57'S	Mar. 18	1505	167	25	151	1838	1515	19.42	1400	72.1	330	32N011
	150°21'E						1835	1455	18.73	2494	133.2	110	32N012

Table 9. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-33 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1991- Mar. 1992. Samplings were carried out by T. Odate.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
1	41°21'S	Dec. 5	1200	216	55	124	1855	5965	85.30	300	3.5	330	33N001
	110°01'E						1852	4765	63.76	400	6.3	110	33N002
5	64°08'S	Dec. 21	1606	262	55	150	1855	9270	132.56	4300	32.4	330	33N003
	37°51'E						1852	8953	119.79	4300	35.9	110	33N004
5	64°09'S	Feb. 29	1342	185	36	150	1852	2139	28.62	4700	164.2	330	33N005
	37°50'E						1855	3727	53.30	13900	260.8	110	33N006
12	65°04'S	Mar. 1	1612	209	44	150	1855	3330	47.62	2300	48.3	330	33N007
	46°44'E						1852	3278	43.86	4200	95.8	110	33N008
13	64°21'S	Mar. 3	1543	202	42	150	1855	3096	44.27	600	13.6	330	33N009
	63°33'E						1852	2742	36.69	500	13.6	110	33N010
15	63°31'S	Mar. 5	1523	216	46	150	1852	3492	46.72	7700	164.8	330	33N011
	84°22'E						1855	3770	53.91	12400	230.0	110	33N012
16	63°30'S	Mar. 6	1515	167	26	150	1852	3298	44.13	26600	602.8	330	33N013
	93°33'E						1855	2264	32.38	43200	1334.4	110	33N014
17	63°25'S	Mar. 7	1428	190	38	150	1852	3128	41.85	27400	654.7	330	33N015
	102°00'E						1855	2714	38.81	24600	633.9	110	33N016
18	63°25'S	Mar. 8	1458	164	24	150	1855	2218	31.72	400	12.6	330	33N017
	113°03'E						1852	2863	38.31	1600	41.8	110	33N018
19	63°29'S	Mar. 9	1448	154	14	149	1855	1840	26.31	800	30.4	330	33N019
	123°39'E						1852	1522	20.36	12000	589.3	110	33N020

Table 9 .Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
20	63°57'S	Mar. 10	1452	185	36	150	1852	3720	49.77	900	18.1	330	33N021
	133°17'E						1855	2182	31.20	8500	272.4	110	33N022
21	64°47'S	Mar. 12	1035	152	10	150	1852	—	24.16	500	20.7	330	33N023
	150°08'E						1855	1658	23.71	2600	109.7	110	33N024
23	56°31'S	Mar. 14	1155	216	46	150	1852	5007	71.60	1900	26.5	330	33N025
	150°13'E						1855	3819	51.10	1500	29.4	110	33N026
24	52°47'S	Mar. 15	1200	196	40	150	1855	3228	46.16	2500	54.2	330	33N027
	150°17'E						1852	3919	52.44	3100	59.1	110	33N028
26	42°14'S	Mar. 17	0947	202	42	150	1852	4990	66.77	100	1.5	330	33N029
	150°36'E						1855	3592	51.37	300	5.8	110	33N030

Table 10. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-34 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1992- Mar. 1993. Samplings were carried out by M. Ishii.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
1	41°03'S	Dec. 5	1535	152	12	149	51	2025	24.10	840	34.9	330	34N001
	109°56'E						1249	1936	22.84	1126	49.3	110	34N002
2	45°42'S	Dec. 6	1501	170	28	150	51	2628	31.27	1226	39.2	330	34N003
	110°01'E						1249	2184	25.77	1768	68.6	110	34N004
4	55°00'S	Dec. 8	1524	175	31	150	51	2825	33.62	43718	1300.5	330	34N005
	107°30'E						1249	2309	27.25	49904	1831.6	110	34N006
5	59°28'S	Dec. 9	—	—	—	—	51	2245	26.72	3226	120.8	330	34N007
	104°37'E						1249	2958	34.90	3730	106.9	110	34N008
L1-A	63°28'S	Dec. 14	—	185	36	150	51	2817	33.52	5616	167.5	330	34N009
	51°24'E						1249	2242	26.46	13728	518.9	110	34N010
L2	68°21'S	Feb. 11	0854	150	4	150	51	—	23.84	1404	58.9	330	34N011
	38°38'E						1249	1190	14.04	1676	119.4	110	34N012
L1-B	67°16'S	Feb. 13	1331	179	33	150	51	2924	34.80	1458	41.9	330	34N013
	38°13'E						1249	2485	29.32	2854	97.3	110	34N014
7	64°56'S	Feb. 27	1430	175	31	150	51	2425	28.86	1018	35.3	330	34N015
	59°12'E						1249	2215	26.14	2438	93.3	110	34N016
8	65°47'S	Feb. 28	1345	167	26	150	51	2581	30.71	1362	44.3	330	34N017
	68°27'E						1249	2250	26.55	1280	48.2	110	34N018
P3	66°01'S	Mar. 4	1235	163	23	150	51	2255	26.83	962	35.8	330	34N019
	75°10'E						1249	2128	25.11	1484	59.1	110	34N020

Table 10. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
9	63°06'S	Mar. 7	1333	199	41	150	51	3294	39.20	14692	374.8	330	34N021
	97°02'E						1249	2249	26.54	9922	373.9	110	34N022
10	62°54'S	Mar. 8	1456	185	36	150	51	2890	34.39	11624	338.0	330	34N023
	105°37'E						1249	2178	25.70	36044	1402.5	110	34N024
11	63°07'S	Mar. 9	1426	150	5	149	51	—	23.84	3014	126.4	330	34N025
	115°49'E						1249	1686	19.89	13618	684.5	110	34N026
12	63°01'S	Mar. 10	1438	156	16	150	1858	1900	25.27	3958	156.6	330	34N027
	125°20'E						1249	1788	21.10	7486	354.8	110	34N028
13	63°32'S	Mar. 11	1450	212	45	150	1858	3628	48.25	2614	54.2	330	34N029
	133°52'E						1249	2656	31.34	8952	285.6	110	34N030
16	56°07'S	Mar. 15	1400	183	35	150	1858	2660	35.38	4242	119.9	330	34N031
	148°47'E						1249	2630	31.03	7510	242.0	110	34N032
18	46°56'S	Mar. 17	1502	199	41	150	1858	3168	42.13	4442	105.4	330	34N033
	151°05'E						1249	2748	32.43	8122	250.5	110	34N034
19	42°09'S	Mar. 18	1148	164	24	150	1858	1926	25.62	1010	39.4	330	34N035
	150°33'E						1249	2035	24.01	2030	84.5	110	34N036

Table 11. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-35 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1993- Mar. 1994. Samplings were carried out by M. Kawachi.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
3	49°45'S	Dec. 7	1300	150	0	150	1479	4718	41.27	8656	209.7	330	35N001
	109°24'E						1249	4508	41.95	14808	353.0	110	35N002
4	54°40'S	Dec. 8	1200	202	42	150	1479	3572	31.25	6306	201.8	330	35N003
	109°50'E						1249	2180	20.29	16814	828.7	110	35N004
5	58°58'S	Dec. 9	1230	180	34	149	1479	2605	22.79	5784	253.8	330	35N005
	107°30'E						1249	1671	15.55	9320	599.4	110	35N006
6	63°06'S	Feb. 25	1150	244	52	150	1479	5623	49.19	2392	48.6	330	35N007
	48°19'E						1249	5212	48.51	4676	96.4	110	35N008
7	63°01'S	Feb. 26	0900	157	17	150	1479	2495	21.82	2016	92.4	330	35N009
	57°26'E						1249	2520	23.45	2320	98.9	110	35N010
8	63°01'S	Feb. 27	1200	220	47	150	1479	2550	22.31	1786	80.1	330	35N011
	65°44'E						1249	2248	20.92	1054	50.4	110	35N012
9	62°31'S	Mar. 5	1200	160	20	150	1479	2638	23.08	1812	78.5	330	35N013
	88°42'E						1249	2400	22.33	3102	138.9	110	35N014
10	62°32'S	Mar. 6	1200	151	8	150	1479	1752	15.32	12496	815.7	330	35N015
	98°42'E						1249	1553	14.45	11056	765.1	110	35N016
11	62°31'S	Mar. 7	1300	180	34	149	1479	2920	25.54	3488	136.6	330	35N017
	108°51'E						1249	2550	23.73	3316	139.7	110	35N018
12	62°34'S	Mar. 8	1430	155	15	150	1479	1882	16.46	3174	192.8	330	35N019
	117°36'E						1249	1779	16.55	3416	206.4	110	35N020

Table 11. 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					
13	62°30'S	Mar. 9	—	164	24	150	1479	5072	44.37	4336	97.7	330	35N021
	128°18'E						1249	3740	34.81	6556	188.3	110	35N022
14	65°01'S	Mar. 12	—	172	29	151	1479	2879	25.18	13698	544.0	330	35N023
	150°18'E						1249	2695	25.18	17028	676.3	110	35N024
17	65°00'S	Mar. 15	—	215	46	149	1479	4100	35.87	88732	2473.7	330	35N025
	150°18'E						1249	3665	34.11	58536	1716.1	110	35N026
19	36°44'S	Mar. 19	1130	255	54	150	1479	6107	53.43	2202	41.2	330	35N027
	151°29'E						1249	5548	51.63	2366	45.8	110	35N028

Table 12. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-36 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1994- Mar. 1995. Samplings were carried out by K. Nomura.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
1	41°43'S	Dec. 5	1200	173	30	150	1	3340	54.46	5086	93.4	330	36N001
	109°55'E						2	3220	52.41	1826	34.8	110	36N002
2	45°27'S	Dec. 6	1205	173	30	150	1	3660	59.67	4306	72.2	330	36N003
	109°54'E						2	3350	54.52	3484	63.9	110	36N004
3	50°23'S	Dec. 7	1200	233	50	150	1	4070	66.36	52410	789.8	330	36N005
	109°54'E						2	3130	50.94	25044	491.6	110	36N006
4	55°23'S	Dec. 8	1520	152	10	150	1	2062	33.62	6074	180.7	330	36N007
	106°33'E						2	1638	26.66	44944	1685.9	110	36N008
5	59°11'S	Dec. 9	1155	216	46	150	1	4660	75.98	22062	290.4	330	36N009
	100°40'E						2	3170	51.59	60456	1171.8	110	36N010
B1	62°33'S	Dec. 12	1615	152	10	150	1	2862	46.66	30126	645.6	330	36N011
	70°14'E						2	1460	23.76	41016	1726.2	110	36N012
B2	66°44'S	Feb. 20	1200	160	20	150	1	1750	28.53	1432	50.2	330	36N013
	38°57'E						2	1194	19.43	3924	201.9	110	36N014
8	62°59'S	Mar. 4	0800	164	24	150	1	2360	38.48	488	12.7	330	36N015
	70°11'E						2	1203	19.58	10104	516.1	110	36N016
9	63°23'S	Mar. 5	1150	154	10	152	1	2218	36.16	512	14.2	330	36N017
	83°51'E						2	2007	32.66	17004	520.6	110	36N018
10	64°07'S	Mar. 6	1125	150	—	—	1	—	23.84	656	27.5	330	36N019
	95°56'E						2	1928	31.38	950	30.3	110	36N020

Table 12. Continued.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
11	64°13'S	Mar. 7	1150	183	34	152	1	2949	48.08	628	13.1	330	36N021
	108°55'E						2	3005	48.91	896	18.3	110	36N022
12	64°07'S	Mar. 8	1150	213	45	151	1	3140	51.20	328	6.4	330	36N023
	120°53'E												
13	64°03'S	Mar. 9	1150	181	34	150	1	2668	43.50	512	11.8	330	36N024
	131°40'E						2	2535	41.26	1106	26.8	110	36N025
14	64°41'S	Mar. 10	1405	181	34	150	1	3276	53.41	644	12.1	330	36N026
	140°19'E						2	3352	54.55	1418	26.0	110	36N027
15	64°07'S	Mar. 11	1210	177	32	150	1	6380	104.02	892	8.6	330	36N028
	148°45'E						2	6182	100.61	61226	608.5	110	36N029
17	57°31'S	Mar. 14	1150	167	26	150	1	3118	50.84	4614	90.8	330	36N030
	150°06'E						2	3074	50.03	6850	136.9	110	36N031
19	52°08'S	Mar. 16	1150	202	42	150	—	—	32.11	2830	88.1	330	36N032
	150°58'E						—	—	32.11	4856	151.2	110	36N033
20	47°06'S	Mar. 17	1150	213	45	151	—	—	33.86	816	24.1	330	36N034
	151°22'E						—	—	33.86	814	24.0	110	36N035

Table 13. Data on plankton collected by vertical hauls with NORPAC twin standard net in the JARE-37 cruise of the Shirase to the Indian sector of the Southern Ocean, Dec. 1995- Mar. 1996. Samplings were carried out by Y. Miyamoto.

Stn. No.	Position	Ship's time (LMT)		Length of wire	Angle of wire	Estimated depth of	Flow-meter		Estimated volume of water	Wet weight of sample in	Wet weight of sample per	Mesh size	Sample No.
		Date	time	(m)	(°)	haul (m)	No.	Revolutions	filtered (m^3)	a haul (mg)	m^3 (mg)	(μm)	
1	42°02'S	Dec. 5	1153	196	40	150	2471	3090	46.02	840	18.3	330	37N001
	108°51'E						2470	3550	55.06	1366	24.8	110	37N002
4	55°23'S	Dec. 8	1500	173	30	150	2471	2240	33.36	5858	175.6	330	37N003
	99°38'E						2470	1710	26.52	27576	1039.8	110	37N004
5	57°33'S	Dec. 9	1200	196	40	150	2471	4560	67.91	6164	90.8	330	37N005
	94°34'E						2470	2800	43.42	24300	559.6	110	37N006
B1	61°28'S	Dec. 12	1230	196	40	150	2471	2471	36.80	5876	159.7	330	37N007
	76°10'E						2470	—	31.16	14168	454.7	110	37N008
7	62°54'S	Feb. 28	1215	173	30	150	2470	—	27.50	1246	45.3	330	37N009
	62°21'E						2471	2590	38.57	1942	50.3	110	37N010
9	63°03'S	Mar. 1	1210	181	34	150	2470	3500	54.28	12678	233.6	330	37N011
	80°38'E						2471	3560	53.02	12592	237.5	110	37N012
10	63°27'S	Mar. 2	1215	164	24	150	2470	2078	32.23	9610	298.2	330	37N013
	92°10'E						2471	2435	36.26	20088	553.9	110	37N014
11	63°27'S	Mar. 3	1200	152	10	150	2470	1864	28.91	1234	42.7	330	37N015
	103°22'E						2471	2492	37.11	3880	104.5	110	37N016
12	63°32'S	Mar. 4	1200	150	0	150	2470	1575	24.43	3850	157.6	330	37N017
	113°52'E						2471	1778	26.48	7748	292.6	110	37N018
13	63°27'S	Mar. 5	1252	152	0	150	2470	1559	24.18	10312	426.5	330	37N019
	123°57'E						2471	1572	23.41	14538	621.0	110	37N020

Table 13 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					
14	63°44'S	Mar. 6	1200	177	32	150	2470	1508	23.39	4844	207.1	330	37N021
	131°27'E						2471	2020	30.08	12214	406.0	110	37N022
15	64°55'S	Mar. 7	1230	152	10	150	2470	1460	22.64	450	19.9	330	37N023
	138°55'E						2471	1460	21.74	22122	1017.4	110	37N024
17	61°58'S	Mar. 12	1215	160	20	150	2470	2340	36.29	1058	29.2	330	37N025
	142°02'E						2471	2886	42.98	1078	25.1	110	37N026
18	58°13'S	Mar. 13	1205	173	30	150	2470	1348	20.91	1088	52.0	330	37N027
	143°36'E						2471	1678	24.99	1180	47.2	110	37N028
19	55°60'S	Mar. 14	1245	181	34	150	2470	2400	37.22	208600	5604.3	330	37N029
	144°30'E						2471	5900	87.87	163472	1860.4	110	37N030
20	52°47'S	Mar. 15	900	177	30	153	2470	3070	47.61	846	17.8	330	37N031
	145°29'E						2471	2434	36.25	428	11.8	110	37N032

Table 14. Wet weight data of plankton collected by vertical hauls with NORPAC twin standard net in the JARE-23 cruise of the Fuji. Other details of the sampling were described in Watanabe *et al* . (1984).

Stn. No.	Position	Sample No.	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)
1	63°02'S	23N001	116	4.5
	48°00'E	23N002	1174	45.6
2	63°00'S	23N003	1308	43.8
	53°00'E	23N004	2376	79.5
3	63°00'S	23N005	620	21.8
	60°06'E	23N006	2720	95.6
4	59°26'S	23N007	1092	41.1
	53°27'E	23N008	1512	57.0
5	55°17'S	23N009	1908	64.9
	49°28'E	23N010	3986	135.5
6	51°04'S	23N011	2732	110.9
	48°06'E	23N012	3492	141.7
7	46°40'S	23N013	5646	161.4
	48°16'E	23N014	4650	133.0

Table 15. Wet weight data of plankton collected by vertical hauls with NORPAC twin standard net in the JARE-24 cruise of the Fuji. Other details of the sampling were described in Watanabe *et al* . (1984).

Stn. No.	Position	Sample No.	Wet weight of sample in a haul (mg)	Wet weight of sample per m^3 (mg)
1	68°59'S	24N001	1284	53.1
	24°48'E	24N002	3836	158.8
2	66°50'S	24N003	936	39.0
	33°40'E	24N004	1698	70.7
3	64°37'S	24N005	84	3.4
	38°41'E	24N006	692	28.1
4	62°35'S	24N007	222	8.8
	42°05'E	24N008	514	20.3
5	59°01'S	24N009	1830	76.2
	42°00'E	24N010	5668	236.1
6	58°17'S	24N011	1646	54.5
	41°26'E	24N012	5378	178.1
7	53°39'S	24N013	1352	48.1
	42°04'E	24N014	4802	170.7
8	48°51'S	24N015	1370	57.1
	42°09'E	24N016	4988	207.8
9	44°14'S	24N017	4074	132.1
	42°09'E	24N018	6414	208.0
10	40°22'S	24N019	434	16.6
	42°24'E	24N020	250	9.6