Plankton Sampling in 2004–2009
—Continuous Plankton Recorder survey—

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Introduction

In the Indian Ocean sector of the Antarctic Ocean, the Japanese Antarctic Research Expedition (JARE) has been conducting routine zooplankton observations with a NORPAC standard net every austral summer since 1972 (JARE-14), initially on icebreaker *Fuji* and later *Shirase* (Fukuchi and Tanimura, 1981; Watanabe *et al.*, 1984; Takahashi *et al.*, 1997; Sawabe *et al.*, 2005; Takahashi *et al.*, 2008). The NORPAC net has been invaluable in demonstrating long-term interannual and interdecadal cyclic patterns (Takahashi *et al.*, 1998). However, because of the small size of the net coupled with net avoidance problems, and the large distances between sampling sites, it was noted that the NORPAC net was not ideal for long-term mapping and monitoring of changes in distribution or abundance in relation to the various oceanographic boundaries in the Southern Ocean. As a part of the monitoring programs in Antarctica, the JARE has initiated a Continuous Plankton Recorder (CPR) survey since 1999 (JARE-41), in order to use in improving interpretation of the data collected by NORPAC net (Takahashi *et al.*, 2006). This report presents the sampling information and distance traveled of the CPR tows aboard the icebreaker *Shirase* (JARE-46~49) and RSV *Aurora Australis*, chartered by JARE-50 in 2008/09. Additionally, information on CPR tows aboard the RT/V *Umitaka-Maru* of the Tokyo University of Marine Science and Technology, which collaborated with JARE-46, -47, -49 and -50, is also presented. The voyage of Leg 2 in

the 2007/08 season by *Umitaka-Maru* was carried out under the CEAMARC (Collaborative East Antarctic Marine Census) project which is the Australian, French and Japanese collaboration on the Census for Antarctic Marine Life (IPY Project 53).

Background about CPR

The CPR was designed by Sir Alister Hardy in the mid 1920s, and first used in the Antarctic during the 1925/27 Discovery expedition. The CPR can collect surface plankton continuously for 450 nautical miles (830 km) during a single tow. CPRs have been used successfully in the monitoring of plankton communities in the North Sea and North Atlantic Ocean over the past seventy years, operated by the Sir Alister Hardy Foundation for Ocean Science (SAHFOS) (Reid *et al.*, 2003). The Australian Antarctic program has initiated a long-term CPR survey in 1991 to monitor zooplankton abundances and distribution patterns in the Southern Ocean (Hosie *et al.*, 2003). The Australian CPR survey covers a wide area through much of the year, which reflects broad logistical and research objectives in each season. *Shirase* travels along much the same cruise track at roughly the same time each year. The collection of CPR data on *Shirase* will provide a very important time reference to interpret the data collected by Australia over the rest of the area. Sharing of data and results will greatly benefit both the Australian and Japanese programs.

Sampling protocol

CPR tows on *Shirase* were mainly conducted on three tows south along 110°E from 45°S to the ice edge in December and three or four tows north along 150°E in February to March during each voyage. Four transects by *Umitaka-Maru* were conducted. These transects were from south of Cape Town to the Syowa Station area, from north of the Mawson Station (Australia) area to Fremantle, from south of Fremantle toward Casey Station (Australia) and from north of Dumont d'Urville Station (France) to Melbourne. We used a Type II (Mark V) CPR (Fig. 1), based on the design of the SAHFOS CPRs with minor modifications to the external design, simplification of the internal cassettes, and built using marine grade 316 steel rather than phosphor bronze (Hosie *et al.*, 2003). The CPR was towed horizontally at a ship speed of about 15 knots, from the stern with a wire cable paid out to 100 m. The depth of the CPR tow was about 10 m. The CPR has a

mouth opening of 1.6 cm^2 and was fitted with 270 μm silk gauze. The towing of the CPR through the surface water turns an external propeller, which drives the mesh rolls across the tunnel at a rate of approximately 1 cm per 1 nautical mile of tow. The 6 m long mesh is sufficient to sample 450 nautical miles (830 km) as a normal towing distance. All zooplankton samples were preserved in a 5–10% buffered formaldehyde and seawater solution, and were returned to the laboratory for analysis. The CPR mesh rolls were cut into segments, each representing a 5 nautical mile sample (approximately 9.2 km) along the length of the transect. Complete details of the processing techniques have been described in Hosie *et al.* (2003).

Scientists on board

The samplings during each cruise were carried out by the following members who participated in JARE and acknowledgments are given to these persons listed below;

JARE (Year)	Members	Affiliations *
JARE-46 (2004/05)		
Shirase	A. Otsuki	National Institute of Polar Research
	S. Kudoh	National Institute of Polar Research
Umitaka-Maru	G.W. Hosie	Australian Antarctic Division
JARE-47 (2005/06)		
Shirase	M. Honda	Central Research Institute of Electric Power Industry
	M. Ichinomiya	Tohoku University
Umitaka-Maru	K.T. Takahashi	National Institute of Polar Research
JARE-48 (2006/07)		
Shirase	D-H. Han	Marine Biological Research Institute of Japan Co., LTD
	S. Kudoh	National Institute of Polar Research
JARE-49 (2007/08)		
Shirase	T. Iida	National Institute of Polar Research
	S. Kudoh	National Institute of Polar Research
Umitaka-Maru	A. Tanimura (Leg 1)	Mie University
	R. Makabe (Leg 1)	National Institute of Polar Research
	K.T. Takahashi (Leg 2)	Australian Antarctic Division
	G.W. Hosie (Leg 2)	Australian Antarctic Division

JARE-50 (2008/09)		
Aurora Australis	G.W. Hosie	Australian Antarctic Division
Umitaka-Maru	K.T. Takahashi	National Institute of Polar Research

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

Data policy

Before using the data for publication or presentation, please request permission in writing. Inquiries about details of the data record should be addressed to:

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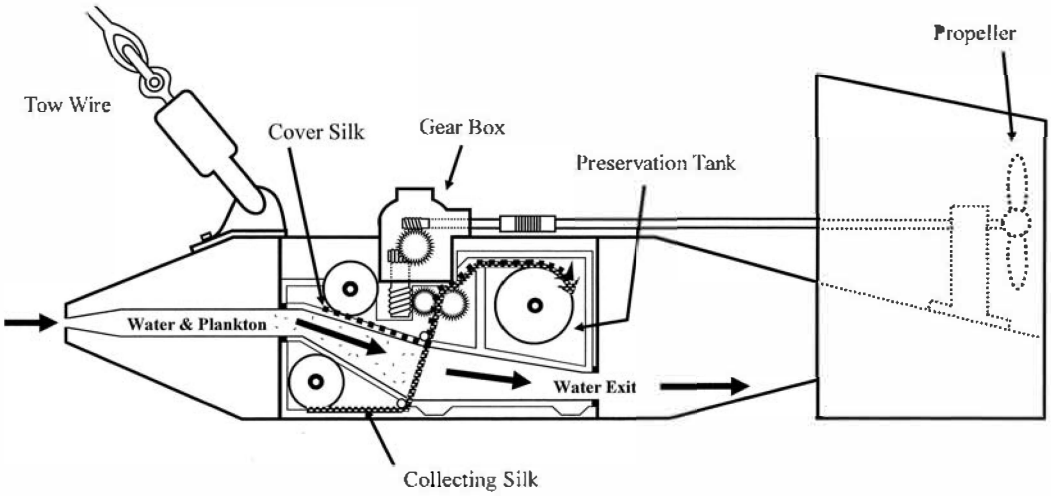

Fig. 1. Cutaway view of the internal mechanism designed by the Australian Antarctic Division CPR, Type II (Mark V) (Hosie *et al*., 2003). Plankton are filtered by the collecting silk (▬▬▬) stretched across the tunnel. This is then met by the cover silk (■ ■ ■) before rolling into the preservation tank.

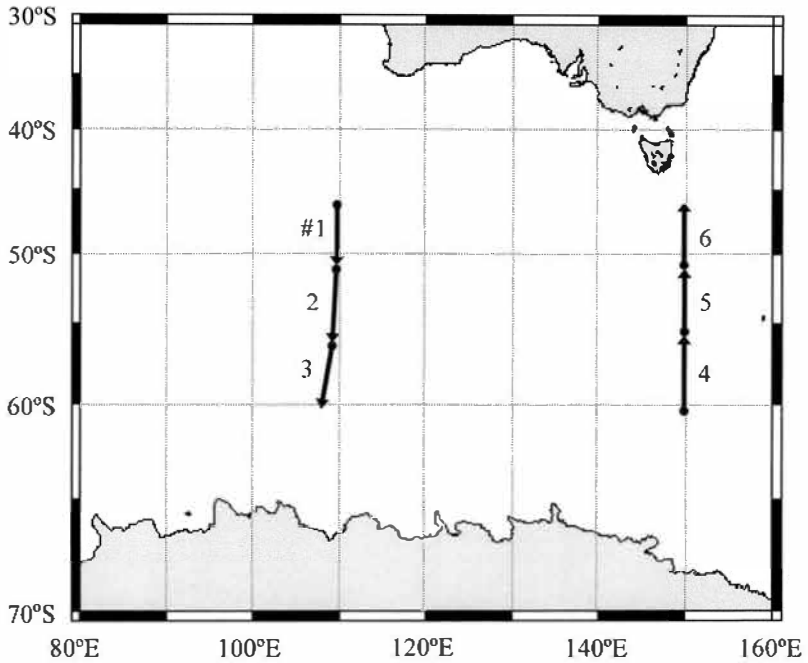

Fig. 2. Transect of the CPR survey during JARE-46 in 2004/2005. Numbers indicate the serial number (#) of the CPR run. ● : Start position, ▼: End position.

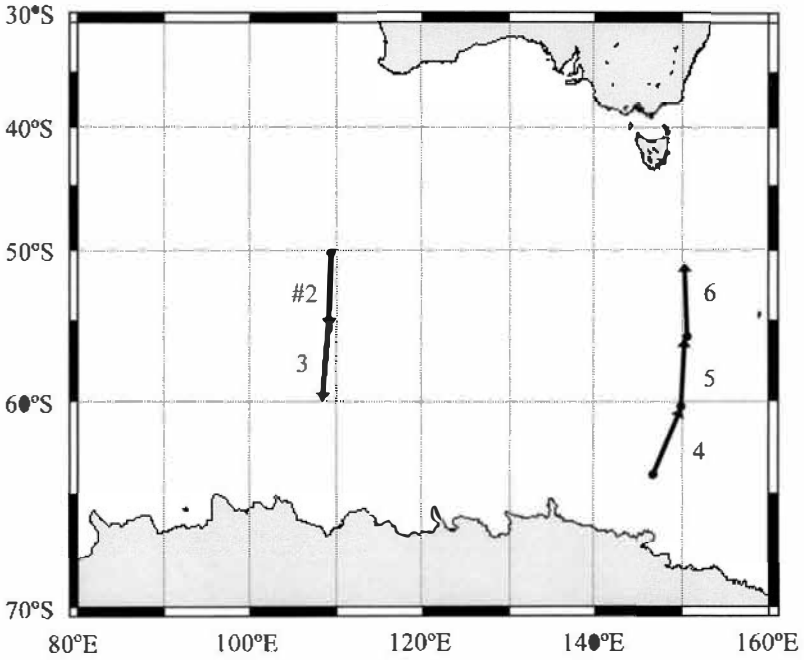

Fig. 3. Transect of the CPR survey during JARE-47 in 2005/2006. Numbers indicate the serial number (#) of the CPR run. ● : Start position, ▼: End position.

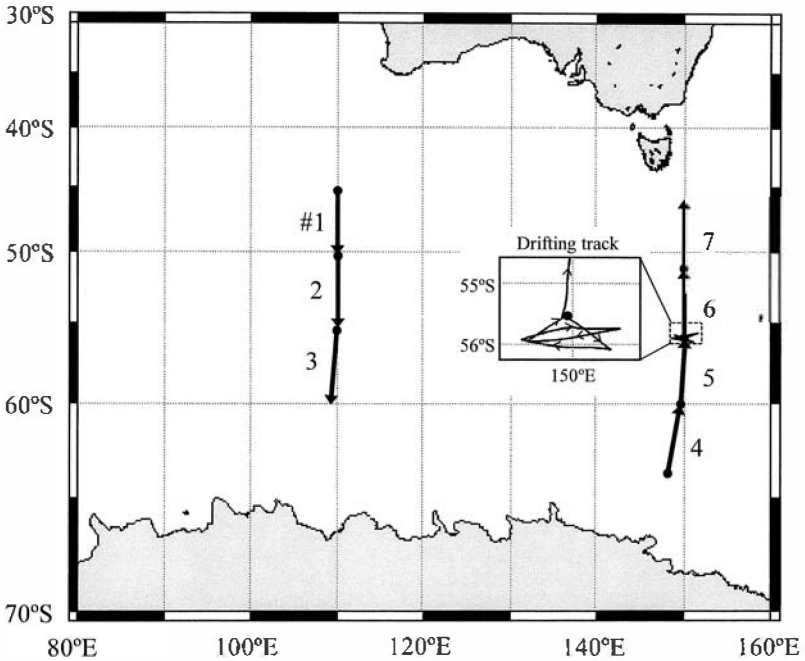

Fig. 4. Transect of the CPR survey during JARE-48 in 2006/2007. Numbers indicate the serial number (#) of the CPR run. ● : Start position, ▼: End position.

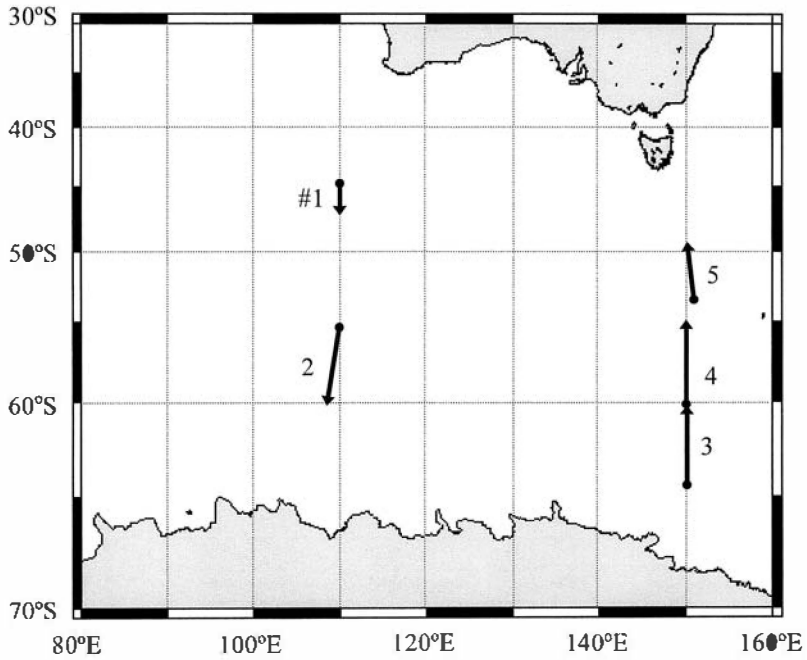

Fig. 5. Transect of the CPR survey during JARE-49 in 2007/2008. Numbers indicate the serial number (#) of the CPR run. ● : Start position, ▼: End position.

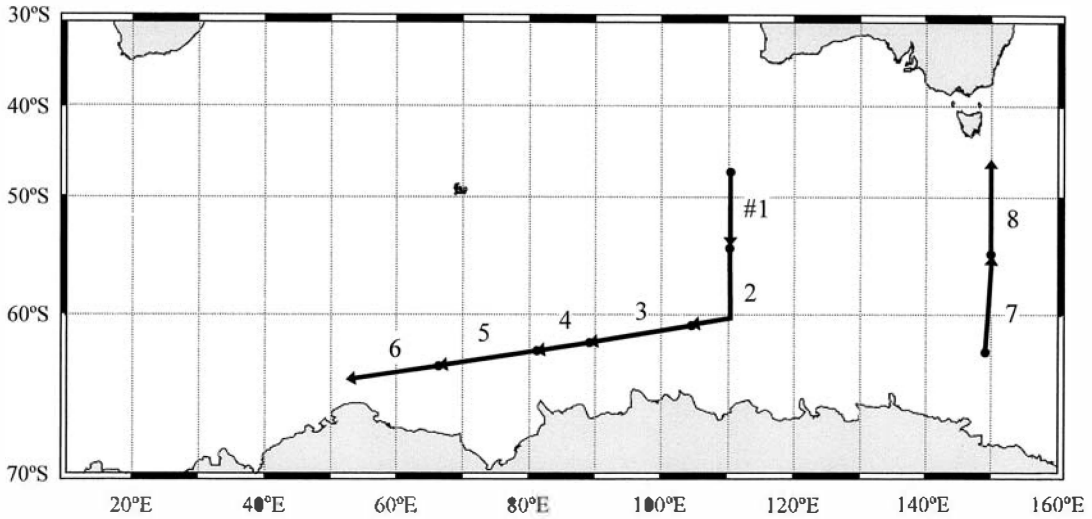

Fig. 6. Transect of the CPR survey during JARE-50 in 2008/2009. Numbers indicate the serial number (#) of the CPR run. ● : Start position, ▼: End position.

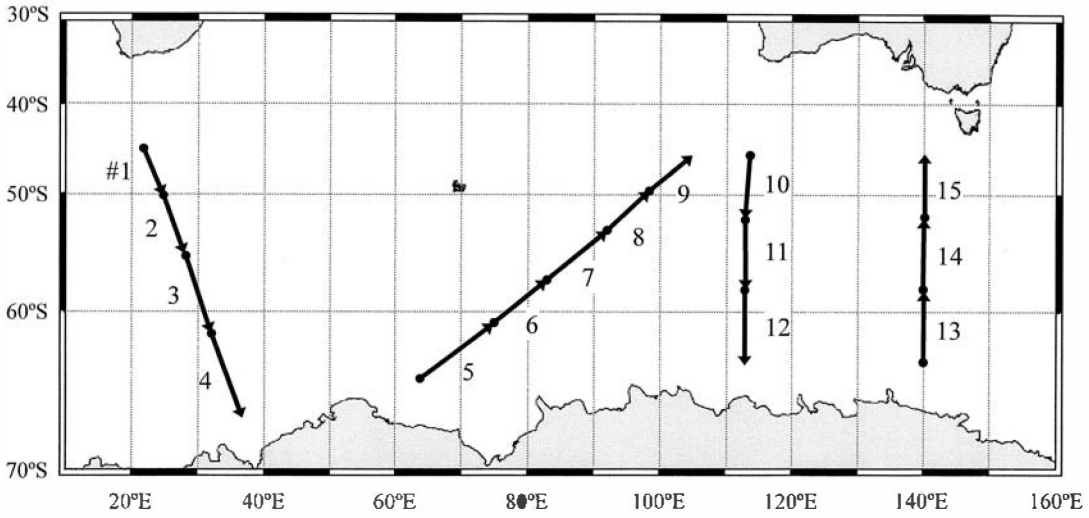

Fig. 7. Map showing the locations of the CPR survey during *Umitaka-Maru* cruise in 2004/2005. Numbers indicate the serial number (#) of the CPR run. ● : Start position, ▼: End position.

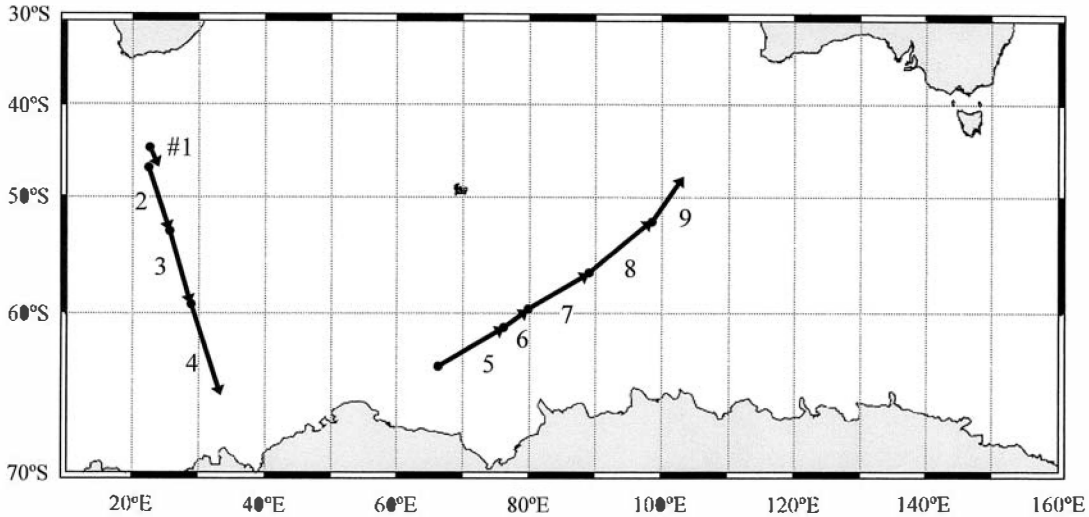

Fig. 8. Map showing the locations of the CPR survey during *Umitaka-Maru* cruise in 2005/2006. Numbers indicate the serial number (#) of the CPR run. ● : Start position, ▼: End position.

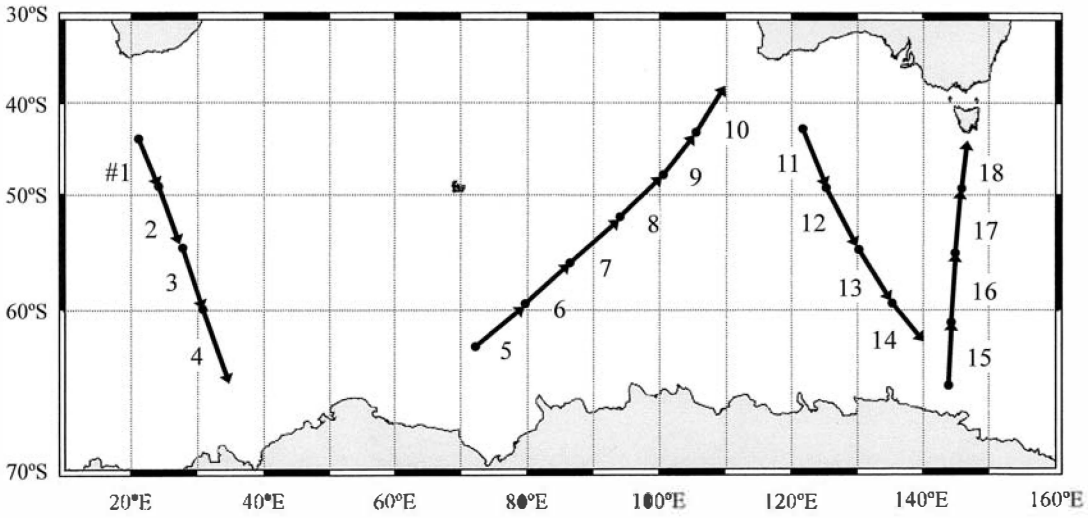

Fig. 9. Map showing the locations of the CPR survey during *Umitaka-Maru* cruise in 2007/2008. Numbers indicate the serial number (#) of the CPR run. ● : Start position, ▼: End position.

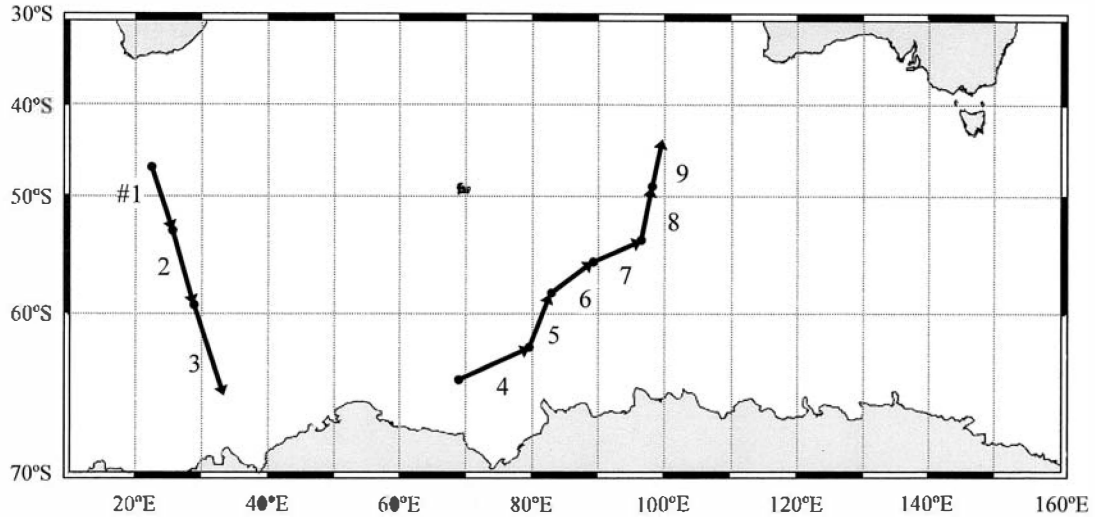

Fig. 10. Map showing the locations of the CPR survey during *Umitaka-Maru* cruise in 2008/2009. Numbers indicate the serial number (#) of the CPR run. ● : Start position, ▼: End position.

Table 1. Data on plankton collected by Continuous Plankton Recorder (CPR) in the JARE-46 cruise of the *Shirase* to the Indian sector of the Southern Ocean, December 2004–March 2005. Samplings were carried out by A. Otsuki and S. Kudoh.

CPR Run #	Start		End		*No. of Segments	Distance towed (km)	Remarks
	Date & Time GMT	Position	Date & Time GMT	Position			
1	Dec. 6, 2005; 09:36	44°34.5'S 109°25.5'E	Dec. 7, 2005; 05:55	49°45.3'S 109°40.9'E	—	—	Failed
2	Dec. 7, 2005; 08:38	49°43.7'S 109°43.7'E	Dec. 8, 2005; 06:00	55°19.8'S 109°35.3'E	69	637	
3	Dec. 8, 2005; 08:56	55°21.1'S 109°34.7'E	Dec. 9, 2005; 06:00	59°53.1'S 108°33.3'E	55	508	
4	Mar. 13, 2006; 07:03	63°56.6'S 146°50.8'E	Mar. 14, 2006; 03:00	60°18.2'S 150°00.2'E	48	444	
5	Mar. 14, 2006; 05:56	60°14.0'S 150°07.9'E	Mar. 15, 2006; 03:00	56°25.3'S 150°30.5'E	49	454	
6	Mar. 15, 2006; 06:31	56°25.5'S 150°52.2'E	Mar. 16, 2006; 03:00	51°36.3'S 150°40.1'E	60	547	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 2. Data on plankton collected by Continuous Plankton Recorder (CPR) in the JARE-47 cruise of the *Shirase* to the Indian sector of the Southern Ocean, December 2005–March 2006. Samplings were carried out by M. Honda and M. Ichinomiya.

CPR Run #	Start		End		*No. of Segments	Distance towed (km)	Remarks
	Date & Time GMT	Position	Date & Time GMT	Position			
1	Dec. 6, 2004; 10:05	45°45.6'S 110°14.4'E	Dec. 7, 2004; 05:50	50°46.2'S 110°00.3'E	63	575	
2	Dec. 7, 2004; 09:30	50°52.1'S 110°14.6'E	Dec. 8, 2004; 05:40	55°52.4'S 109°26.6'E	61	561	
3	Dec. 8, 2004; 09:10	55°54.9'S 109°36.7'E	Dec. 9, 2004; 05:40	60°02.0'S 108°51.7'E	50	461	
4	Mar. 14, 2005; 04:25	60°20.2'S 149°58.9'E	Mar. 15, 2005; 02:35	56°25.0'S 150°02.8'E	48	441	
5	Mar. 15, 2005; 06:25	56°29.7'S 150°13.2'E	Mar. 16, 2005; 02:45	51°29.1'S 149°57.1'E	62	565	
6	Mar. 16, 2005; 06:20	51°27.7'S 150°06.6'E	Mar. 17, 2005; 02:45	46°20.2'S 150°09.4'E	63	578	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 3. Data on plankton collected by Continuous Plankton Recorder (CPR) in the JARE-48 cruise of the *Shirase* to the Indian sector of the Southern Ocean, December 2006–March 2007. Samplings were carried out by D-H. Han and S. Kudoh.

CPR Run #	Start		End		*No. of Segments	Distance towed (km)	Remarks
	Date & Time GMT	Position	Date & Time GMT	Position			
1	Dec. 6, 2006; 09:22	45°03.3'S 109°59.8'E	Dec. 7, 2006; 06:07	50°00.8'S 109°50.4'E	61	558	
2	Dec. 7, 2006; 09:49	49°57.7'S 109°54.1'E	Dec. 8, 2006; 06:07	54°51.3'S 109°53.7'E	60	547	
3	Dec. 8, 2006; 09:37	54°51.2'S 109°59.6'E	Dec. 9, 2006; 06:04	59°49.7'S 108°45.9'E	61	560	
4	Mar. 12, 2007; 07:50	63°36.8'S 148°44.2'E	Mar. 13, 2007; 03:06	59°53.8'S 149°35.4'E	48	436	
5	Mar. 13, 2007; 07:02	59°45.7'S 149°33.7'E	Mar. 14, 2007; 03:07	55°33.7'S 150°03.2'E	52	479	
6	Mar. 14, 2007; 07:21	55°31.4'S 150°09.7'E	Mar. 16, 2007; 03:05	51°36.5'S 149°53.1'E	100	918	Drifting in half a day

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 3. Continued.

CPR Run #	Start		End		*No. of Segments	Distance towed (km)	Remarks
	Date & Time GMT	Position	Date & Time GMT	Position			
7	Mar. 16, 2007; 06:54	51°31.6'S 150°02.4'E	Mar. 17, 2007; 03:03	46°03.5'S 150°57.4'E	68	621	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 4. Data on plankton collected by Continuous Plankton Recorder (CPR) in the JARE-49 cruise of the *Shirase* to the Indian sector of the Southern Ocean, December 2007–March 2008. Samplings were carried out by T. Iida and S. Kudoh.

CPR Run #	Start		End		*No. of Segments	Distance towed (km)	Remarks
	Date & Time GMT	Position	Date & Time GMT	Position			
1	Dec. 6, 2007; 04:34	44°47.3'S 110°10.6'E	Dec. 6, 2007; 11:30	46°31.5'S 110°01.3'E	22	196	
2	Dec. 8, 2007; 10:20	55°39.4'S 110°02.4'E	Dec. 9, 2007; 01:04	59°29.3'S 108°21.8'E	48	438	
3	Mar. 12, 2008; 00:47	64°04.0'S 149°41.9'E	Mar. 12, 2008; 22:00	60°02.0'S 150°00.0'E	50	458	
4	Mar. 13, 2008; 00:58	60°02.0'S 150°10.9'E	Mar. 13, 2008; 22:10	55°13.3'S 150°02.0'E	59	537	
5	Mar. 15, 2008; 07:21	52°46.5'S 151°22.3'E	Mar. 15, 2008; 22:02	49°16.2'S 150°02.3'E	44	404	
6	Mar. 15, 2008; 23:54	49°16.8'S 150°07.3'E	Mar. 16, 2008; 22:04	44°19.3'S 150°07.3'E	—	—	Failed wire trouble

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 5. Data on plankton collected by Continuous Plankton Recorder (CPR) in the JARE-50 cruise of the *Aurora Australis* to the Indian sector of the Southern Ocean, January–February 2009. Samplings were carried out by G.W. Hosie.

CPR Run #	Start		End		*No. of Segments	Distance towed (km)	Remarks
	Date & Time GMT	Position	Date & Time GMT	Position			
1a	Jan. 3, 2009; 04:10	47°34.0'S 109°59.2'E	Jan. 4, 2009; 00:13	51°56.3'S 110°02.0'E	53	485	
1b	Jan. 4, 2009; 03:54	51°58.6'S 110°05.3'E	Jan. 4, 2009; 16:06	54°34.2'S 110°01.9'E	32	291	
2a	Jan. 4, 2009; 16:12	54°35.0'S 110°01.8'E	Jan. 5, 2009; 00:06	56°05.2'S 109°57.2'E	19	166	
2b	Jan. 5, 2009; 03:52	56°05.2'S 109°57.2'E	Jan. 6, 2009; 00:13	59°58.5'S 109°59.3'E	47	434	
2c	Jan. 6, 2009; 04:03	60°00.1'S 109°55.8'E	Jan. 6, 2009; 16:55	60°16.7'S 104°29.6'E	33	299	
3	Jan. 6, 2009; 17:02	60°16.7'S 104°29.6'E	Jan. 8, 2009; 05:59	61°49.4'S 89°27.3'E	90	830	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 5. Continued.

CPR Run #	Start Date & Time GMT	Start Position	End Date & Time GMT	End Position	*No. of Segments	Distance towed (km)	Remarks
4	Jan. 8, 2009; 06:06	61°49.4'S 89°27.3'E	Jan. 8, 2009; 23:40	62°05.0'S 81°18.7'E	48	439	
5	Jan. 9, 2009; 00:20	62°04.3'S 81°19.6'E	Jan. 10, 2009; 11:08	64°16.4'S 65°12.0'E	93	858	
6	Jan. 10, 2009; 11:14	64°16.4'S 65°12.1'E	Jan. 11, 2009; 10:57	64°54.1'S 53°44.9'E	60	553	
7a	Feb. 15, 2009; 01:31	62°04.3'S 149°33.2'E	Feb. 15, 2009; 21:08	58°09.5'S 149°44.2'E	50	459	
7b	Feb. 16, 2009; 00:50	58°07.7'S 149° 45.4'E	Feb. 16, 2009; 21:07	54°06.5'S 149°59.0'E	51	467	
8a	Feb. 17, 2009; 00:50	54°03.8'S 150°10.0'E	Feb. 17, 2009; 20:56	49°49.9'S 150°01.9'E	53	486	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 5. Continued.

CPR Run #	Start Date & Time GMT	Start Position	End Date & Time GMT	End Position	*No. of Segments	Distance towed (km)	Remarks
8b	Feb. 18, 2009; 00:35	49°48.2'S 150°06.3'E	Feb. 18, 2009; 21:01	46°00.1'S 150°00.1'E	48	441	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 6. Data on plankton collected by Continuous Plankton Recorder (CPR) in the the *Umitaka-Maru* cruise to the Indian sector of the Southern Ocean, January–February 2005. Samplings were carried out by G. W. Hosie.

CPR Run #	Start		End		*No. of Segments	Distance towed (km)	Remarks
	Date & Time GMT	Position	Date & Time GMT	Position			
1	Jan. 2, 2005; 10:21	44°58.5'S 22°23.5'E	Jan. 3, 2005; 08:03	50°12.3'S 25°02.5'E	67	618	
2	Jan. 3, 2005; 09:29	50°13.0'S 25°02.2'E	Jan. 4, 2005; 08:05	55°15.0'S 27°56.5'E	65	594	
3	Jan. 4, 2005; 10:28	55°16.0'S 27°54.6'E	Jan. 5, 2005; 08:02	60°37.9'S 31°26.9'E	69	637	
4	Jan. 5, 2005; 09:33	60°38.9'S 31°27.7'E	Jan. 6, 2005; 08:21	66°29.4'S 35°59.7'E	75	686	
5	Jan. 15, 2005; 10:57	63°54.8'S 63°23.8'E	Jan. 16, 2005; 06:01	60°52.2'S 74°07.0'E	72	658	
6	Jan. 16, 2005; 07:30	60°50.9'S 74°09.9'E	Jan. 17, 2005; 05:29	57°07.9'S 81°51.5'E	66	606	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 6. Continued.

CPR Run #	Start Date & Time GMT	Start Position	End Date & Time GMT	End Position	*No. of Segments	Distance towed (km)	Remarks
7	Jan. 17, 2005; 06:43	57°08.2'S 81°53.7'E	Jan. 18, 2005; 12:35	53°20.4'S 91°10.2'E	79	730	
8	Jan. 18, 2005; 12:42	53°20.4'S 91°10.2'E	Jan. 19, 2005; 13:29	49°29.7'S 97°48.7'E	69	632	
9a	Jan. 19, 2005; 13:37	49°29.7'S 97°48.7'E	Jan. 20, 2005; 03:58	46°59.2'S 100°55.9'E	40	364	
9b	Jan. 20, 2005; 05:38	46°55.9'S 100°58.0'E	Jan. 20, 2005; 17:53	44°39.7'S 103°46.0'E	37	337	
10	Feb. 1, 2005; 11:23	44°59.5'S 112°53.5'E	Feb. 2, 2005; 11:31	51°25.0'S 111°58.9'E	78	720	
11a	Feb. 2, 2005; 11:38	51°25.2'S 111°59.0'E	Feb. 3, 2005; 01:53	54°57.4'S 111°55.7'E	43	394	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 6. Continued.

CPR Run #	Start: Date & Time GMT	Start: Position	End: Date & Time GMT	End: Position	*No. of Segments	Distance towed (km)	Remarks
11b	Feb. 3, 2005; 03:23	54°57.9'S 111°54.7'E	Feb. 3, 2005; 11:29	56°59.8'S 111°59.4'E	25	227	
12a	Feb. 3, 2005; 11:36	56°59.5'S 111°59.3'E	Feb. 4, 2005; 01:54	60°32.4'S 111°59.8'E	43	395	
12b	Feb. 4, 2005; 02:56	60°33.6'S 111°59.1'E	Feb. 4, 2005; 11:53	62°59.6'S 111°58.7'E	30	271	
13	Feb. 15, 2005; 03:11	62°58.1'S 140°04.3'E	Feb. 16, 2005; 00:31	57°35.4'S 140°22.7'E	65	598	
14	Feb. 16, 2005; 01:10	57°35.4'S 140°23.2'E	Feb. 16, 2005; 23:58	51°49.9'S 140°55.1'E	70	642	
15a	Feb. 17, 2005; 00:37	51°49.9'S 140°55.2'E	Feb. 17, 2005; 05:02	50°51.5'S 140°56.1'E	12	108	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 6. Continued.

CPR Run #	Start Date & Time GMT	Start Position	End Date & Time GMT	End Position	*No. of Segments	Distance towed (km)	Remarks
15b	Feb. 17, 2005; 07:21	50°53.7'S 140°02.0'E	Feb. 18, 2005; 03:31	46°30.8'S 141°05.9'E	53	488	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 7. Data on plankton collected by Continuous Plankton Recorder (CPR) in the *Umitaka-Maru* cruise to the Indian sector of the Southern Ocean, January 2006. Samplings were carried out by K. T. Takahashi.

CPR Run #	Start		End		*No. of Segments	Distance towed (km)	Remarks
	Date & Time GMT	Position	Date & Time GMT	Position			
1	Jan. 6, 2006; 09:13	44°41.7'S 22°31.8'E	Jan. 6, 2006; 17:41	46°42.0'S 23°15.7'E	26	233	
2	Jan. 7, 2006; 06:39	46°38.7'S 22°33.4'E	Jan. 8, 2006; 13:00	53°07.2'S 26°07.9'E	83	768	
3	Jan. 8, 2006; 13:10	53°07.2'S 26°07.8'E	Jan. 9, 2006; 16:34	59°11.0'S 29°27.6'E	77	711	
4	Jan. 9, 2006; 16:42	59°11.1'S 29°27.5'E	Jan. 10, 2006; 19:58	65°29.6'S 33°23.7'E	82	792	
5a	Jan. 20, 2006; 20:08	63°31.6'S 66°02.4'E	Jan. 21, 2006; 06:00	62°29.6'S 70°49.6'E	30	269	
5b	Jan. 21, 2006; 07:05	62°29.3'S 70°50.4'E	Jan. 21, 2006; 18:25	61°00.9'S 75°57.4'E	35	320	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 7. Continued.

CPR Run #	Start Date & Time GMT	Start Position	End Date & Time GMT	End Position	*No. of Segments	Distance towed (km)	Remarks
6	Jan. 21, 2006; 21:00	61°00.1'S 75°57.1'E	Jan. 22, 2006; 05:22	59°54.0'S 79°36.0'E	27	241	
7a	Jan. 22, 2006; 06:34	59°53.2'S 79°38.3'E	Jan. 22, 2006; 17:54	58°22.8'S 84°19.7'E	36	324	
7b	Jan. 22, 2006; 20:32	58° 22.4'S 84° 21.5'E	Jan. 23, 2006; 08:00	56°25.0'S 88°14.8'E	35	320	
8a	Jan. 23, 2006; 08:06	56°24.9'S 88°15.1'E	Jan. 23, 2006; 13:03	55°37.8'S 89°52.4'E	15	133	
8b	Jan. 23, 2006; 13:18	55°37.3'S 89°53.1'E	Jan. 23, 2006; 16:28	55°05.2'S 90°48.8'E	10	83	
8c	Jan. 23, 2006; 20:03	55°04.0'S 90°51.7'E	Jan. 24, 2006; 06:03	53°25.1'S 93°43.5'E	30	269	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 7. Continued.

CPR Run #	Start Date & Time GMT	Start Position	End Date & Time GMT	End Position	*No. of Segments	Distance towed (km)	Remarks
8d	Jan. 24, 2006; 09:32	53°23.1'S 93°44.9'E	Jan. 24, 2006; 16:00	52°14.6'S 95°28.0'E	19	173	
9a	Jan. 24, 2006; 20:17	52°17.5'S 95°28.8'E	Jan. 25, 2006; 15:23	48°59.7'S 99°41.5'E	52	476	
9b	Jan. 25, 2006; 20:35	49°01.9'S 99°52.1'E	Jan. 26, 2006; 02:37	47°59.7'S 101°15.3'E	17	156	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 8. Data on plankton collected by Continuous Plankton Recorder (CPR) in the JARE-49 cruise of the *Umitaka-Maru* (Leg 1) to the Indian sector of the Southern Ocean, December 2007–January 2008. Samplings were carried out by A. Tanimura and R. Makabe.

CPR Run #	Start		End		*No. of Segments	Distance towed (km)	Remarks
	Date & Time GMT	Position	Date & Time GMT	Position			
1	Dec. 26, 2007; 07:59	43°27.2'S 21°07.1'E	Dec. 27, 2007; 06:59	49°11.2'S 24°09.6'E	74	679	
2	Dec. 27, 2007; 09:20	49°11.2'S 24°11.5'E	Dec. 28, 2007; 07:00	54°28.1'S 27°17.2'E	67	618	
3	Dec. 28, 2007; 09:14	54°29.8'S 27°19.1'E	Dec. 29, 2007; 06:22	59°28.6'S 30°15.9'E	64	583	
4	Dec. 29, 2007; 08:33	59°26.6'S 30°18.0'E	Dec. 30, 2007; 10:55	65°18.6'S 34°56.4'E	77	704	
5a	Jan. 10, 2008; 06:23	63°22.2'S 71°17.7'E	Jan. 10, 2008; 14:48	62°02.2'S 74°50.8'E	26	234	
5b	Jan. 10, 2008; 15:56	62°01.4'S 74°37.9'E	Jan. 11, 2008; 04:02	59°47.9'S 79°37.9'E	39	355	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 8. Continued.

CPR Run #	Start Date & Time GMT	Start Position	End Date & Time GMT	End Position	*No. of Segments	Distance towed (km)	Remarks
6	Jan. 11, 2008; 07:28	59°45.8'S 79°42.1'E	Jan. 12, 2008; 04:30	56°02.3'S 86°33.8'E	63	582	
7	Jan. 12, 2008; 04:40	56°02.0'S 86°34.4'E	Jan. 13, 2008; 04:05	52°17.5'S 93°48.6'E	68	628	
8	Jan. 13, 2008; 04:12	52°17.0'S 93°49.3'E	Jan. 14, 2008; 03:30	48°17.4'S 99°52.9'E	68	624	
9	Jan. 14, 2008; 03:35	48°15.5'S 99°56.0'E	Jan. 15, 2008; 03:20	43°34.9'S 105°07.5'E	72	657	
10	Jan. 15, 2008; 03:27	43°34.6'S 105°07.7'E	Jan. 16, 2008; 07:29	38°46.7'S 110°00.1'E	73	671	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 9. Data on plankton collected by Continuous Plankton Recorder (CPR) in the CEAMARC cruise of the *Umitaka-Maru* (Leg 2) to the Indian sector of the Southern Ocean, January–February 2008. Samplings were carried out by K. T. Takahashi and G. W. Hosie.

CPR Run #	Start		End		*No. of Segments	Distance towed (km)	Remarks
	Date & Time GMT	Position	Date & Time GMT	Position			
11	Jan. 25, 2008; 01:29	42°47.4'S 121°05.3'E	Jan. 25, 2008; 23:56	47°54.4'S 125°22.5'E	72	666	
12	Jan. 26, 2008; 00:02	47°54.4'S 125°22.5'E	Jan. 26, 2008; 23:28	53°08.0'S 130°08.5'E	74	678	
13	Jan. 27, 2008; 00:49	53°08.4'S 130°10.8'E	Jan. 27, 2008; 22:58	57°56.7'S 135°07.6'E	68	621	
14	Jan. 28, 2008; 00:23	57°57.1'S 135°10.3'E	Jan. 28, 2008; 19:48	61°59.3'S 139°59.4'E	57	524	
15a	Feb. 12, 2008; 12:22	65°26.1'S 142°59.4'E	Feb. 12, 2008; 22:59	62°47.4'S 143°33.7'E	32	296	
15b	Feb. 13, 2008; 00:18	62°47.9'S 143°35.0'E	Feb. 13, 2008; 09:32	60°31.2'S 144°14.9'E	28	257	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 9. Continued.

CPR Run #	Start Date & Time GMT	Start Position	End Date & Time GMT	End Position	*No. of Segments	Distance towed (km)	Remarks
16	Feb. 13, 2008; 09:37	60°31.1'S 144°15.1'E	Feb. 14, 2008; 09:31	55°01.7'S 145°18.9'E	67	614	
17a	Feb. 14, 2008; 09:38	55°01.4'S 145°19.1'E	Feb. 15, 2008; 02:36	51°03.1'S 146°10.4'E	49	445	
17b	Feb. 15, 2008; 03:33	51°03.1'S 146°10.5'E	Feb. 15, 2008; 08:59	49°43.9'S 146°29.7'E	17	148	
18	Feb. 15, 2008; 09:06	49°43.5'S 146°30.0'E	Feb. 16, 2008; 08:29	44°44.7'S 147°19.8'E	59	545	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 10. Data on plankton collected by Continuous Plankton Recorder (CPR) in the JARE-50 cruise of the *Umitaka-Maru* to the Indian sector of the Southern Ocean, January–February 2009. Samplings were carried out by K. T. Takahashi.

CPR Run #	Start		End		*No. of Segments	Distance towed (km)	Remarks
	Date & Time GMT	Position	Date & Time GMT	Position			
1	Jan. 9, 2009; 18:00	44°53.7'S 23°49.9'E	Jan. 10, 2009; 14:05	49°36.8'S 27°05.9'E	63	581	
2	Jan. 10, 2009; 14:10	49°36.9'S 27°05.4'E	Jan. 11, 2009; 13:34	54°38.3'S 31°02.3'E	68	622	
3	Jan. 11, 2009; 13:38	54°38.8'S 31° 02.5'E	Jan. 12, 2009; 18:25	60°00.3'S 38°02.5'E	81	745	
4	Jan. 27, 2009; 06:48	64°47.3'S 69°02.8'E	Jan. 28, 2009; 04:34	62°12.1'S 80°07.6'E	68	620	
5	Jan. 28, 2009; 06:13	62°11.9'S 80°08.6'E	Jan. 29, 2009; 03:29	57°38.9'S 83°27.1'E	60	551	
6	Jan. 29, 2009; 04:59	57°39.1'S 83°28.3'E	Jan. 30, 2009; 02:59	55°29.3'S 89°05.7'E	49	446	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.

Table 10. Continued.

CPR Run #	Start Date & Time GMT	Start Position	End Date & Time GMT	End Position	*No. of Segments	Distance towed (km)	Remarks
7	Jan. 30, 2009; 05:42	55°29.3'S 89°07.0'E	Jan. 31, 2009; 09:26	52°39.9'S 96°17.7'E	67	611	
8	Jan. 31, 2009; 09:33	52°39.4'S 96°16.9'E	Feb. 1, 2009; 08:24	48°27.4'S 97°32.9'E	52	477	Failed fouling by the seaweed
9	Feb. 1, 2009; 08:28	48°27.1'S 97°32.5'E	Feb. 2, 2009; 07:59	43°52.2'S 99°57.9'E	62	571	

* Each segment of cut silk corresponds to 5 nautical miles of towing distance.