

**Plankton sampling by the training vessel *Umitaka-maru* in the Indian sector of
the Southern Ocean in the austral summer of 2018**

Hisae SAKURAI¹, Masato MOTEGI^{1,2*}, Keishi SHIMADA², Yusuke IWAI², Yuri OKUBO²,
Satoshi NIRAZUKA², Junji MATSUSHITA², Mao MORI^{4,5}, Abigail Jessica Rose SMITH⁴,
Shintaro TAKAO^{1,3}, Ryosuke MAKABE^{1,3}, Kunio T. TAKAHASHI^{1,3} and Tsuneo ODATE^{1,3}

¹ National Institute of Polar Research, Research Organization of Information and Systems,
10–3 Midori-cho, Tachikawa, Tokyo 190-8518.

² Tokyo University of Marine Science and Technology, 4–5–7 Konan, Minato-ku, Tokyo 108-8477.

³ Department of Polar Science, School of Multidisciplinary Sciences, SOKENDAI (The Graduate
University for Advanced Studies), 10–3 Midori-cho, Tachikawa, Tokyo 190-8518.

⁴ Institute for Marine and Antarctic Studies, University of Tasmania, Private Bag 129, Hobart,
Tasmania 7001, Australia

⁵ Antarctic Climate & Ecosystems Cooperative Research Centre, Private Bag 80, Hobart,
Tasmania 7001, Australia

*Corresponding author. E-mail: masato@kaiyodai.ac.jp

1. Introduction

The training vessel (T/V) *Umitaka-maru* II of the Tokyo University of Fisheries [currently Tokyo University of Marine Science and Technology (TUMSAT)] participated in the first Japanese Antarctic Research Expedition (JARE-1) in 1956–1957 as the ship associated with the icebreaker *Soya*. Since then, voyages for marine science research in the Southern Ocean have been undertaken intermittently by T/V *Umitaka-maru* III and IV (the present ship). After many years of collaborative relationship, the National Institute of Polar Research (NIPR) and TUMSAT signed a comprehensive cooperation agreement on 9 February 2009.

During the first half of the six-year plan for JARE phase IX (2016–2022) by NIPR, the new three-year (2016–2019) TUMSAT–NIPR joint program on “Studies on Plankton Community Structure and Environment Parameters in the Southern Ocean” was established. This program focuses on an

integrative study of marine ecosystem in the Indian sector of the Southern Ocean as one of the JARE projects (Project no. AP-0923; Associate Prof. Masato Moteki, TUMSAT, principal investigator).

The present report describes the data from the second research cruise conducted by T/V *Umitaka-maru* IV under the mission of project AP-0923. This report contains information about the samples that were collected using two kinds of plankton nets—Vertical Multiple Plankton Sampler (VMPS) net and an Ocean Research Institute (ORI) net—along longitude 110°E off Wilkes Land, Antarctica, during the cruise period between 31 December 2017 and 22 January 2018.

2. Cruise number

Data covered in this report were obtained from the 21st *Kaiyodai* (abbreviated Japanese name for TUMSAT) Antarctic Research Expedition (*KARE-21*) cruise by T/V *Umitaka-maru*, which was conducted as part of the 59th Japanese Antarctic Research Expedition (*JARE-59*) program. This cruise also served as a leg of the long-distance voyage of the Advanced Course of Marine Science and Technology of TUMSAT (voyage number UM-17-09).

3. Sampling protocols

3.1. VMPS

Meso-zooplankton were collected using a VMPS with four nets made of nylon bolting cloth with 100- μ m mesh and a frame opening of 0.25 m² (<http://www.tsk-jp.com/upload/product/pdf/VMPS.pdf>). The samples were collected at three layers from 150 m or 400 m depth with a multiple-net opening-closing system. The wire payout and retrieval speeds were 0.7 and 0.5 m/s, respectively.

VMPS was deployed from the stern of the vessel and towed vertically over predetermined depth intervals. Each of the nets was opened and closed sequentially by commands transmitted from an onboard deck unit through an armored cable to an underwater unit. A deployment consisted of the vertical down-cast from the surface to the maximum depth, and the opening and closing sequences through specific depth strata were undertaken during the up-cast. During operation, flow meter counts, and depth and water temperature data were sent to the onboard deck unit. The flow meter was calibrated by five vertical tows of the VMPS without nets before the UM-17-09 cruise.

Four stations were occupied along the 110°E transect for vertical sampling with the VMPS net (Fig. 1). Detailed sampling information is given in Table 1.

3.2. ORI net

Macro-zooplankton and micro-nekton were collected using an ORI net made of nylon bolting cloth with a 500- μm mesh and a mouth ring diameter of 1.6 m (Omori, 1965). The ORI net-sampling was carried out by oblique tow and the net was launched from the stern of the ship. The wire was paid out until the net reached a depth of about 200 m, keeping the wire angle at approximately 60° and the wire length at 400 m. The net was retrieved at approximately 0.5 m s^{-1} while the ship moved forward at 1 m s^{-1} . The maximum depth reached was measured by a temperature–depth logger (COMPACT-TD; model ATD-HR, JFE Advantech Co., Ltd., Nishinomiya Japan; www.jfe-advantech.co.jp/eng/ocean/compact/compact-td.html) mounted in the mouth of the net. The volume of water filtered was estimated using a digital mechanical flowmeter (#2030R; General Oceanics, Inc., Miami, Florida, USA) mounted at the center of mouth ring of the net.

ORI net samplings were conducted at 13 stations along the 110°E transect (Fig. 2). Detailed sampling information is given in Table 2.

3.3. Zooplankton sample processing

All zooplankton samples were immediately preserved in 5% borate-buffered formalin-seawater on board and stored in a cool, dark place on the ship.

4. Data policy

The purpose of this data report is to provide information about the collection of zooplankton samples for scientists and students conducting research on Antarctic ecosystems and zooplankton. This report should also make interested researchers aware of the opportunity to use these samples to quantitatively describe zooplankton distribution and biomass in the Southern Ocean. All underlying physical data are available for scientific use. We expect the information in this report, in combination with the available samples and environmental data set, to be utilized in various future studies.

Permission to use the data and the preserved samples for publication or presentation should be obtained in writing. Inquiries about details of the data record should be addressed to one of the following:

Tsuneo Odate, Professor	Masato Moteki, Associate Professor
National Institute of Polar Research	Tokyo University of Marine Science and Technology
10–3 Midori-cho, Tachikawa	4–5–7 Konan, Minato-ku
Tokyo 190-8518, Japan	Tokyo 108-8477, Japan
Phone: +81-42-512-0735	Phone: +81-35-463-0527
Facsimile: +81-42-528-3492	Facsimile: +81-35-463-0523
E-mail: odate@nipr.ac.jp	E-mail: masato@kaiyodai.ac.jp

Acknowledgments

We acknowledge Captain Akira Noda and his crew of T/V *Umitaka-maru*, and all cadets on board participating in the Advanced Course for Marine Science and Technology of TUMSAT, for their invaluable assistance during oceanographic observations. We also thank our scientific colleagues and graduate students for their excellent support during the KARE-21 cruise.

References

- Omori, M. (1965): A 160-cm Opening-Closing Plankton Net: I. Description of the Gear. *J. Oceanogr. Soc. Japan.* **21**, 212–220, doi:10.5928/kaiyou1942.21.212.

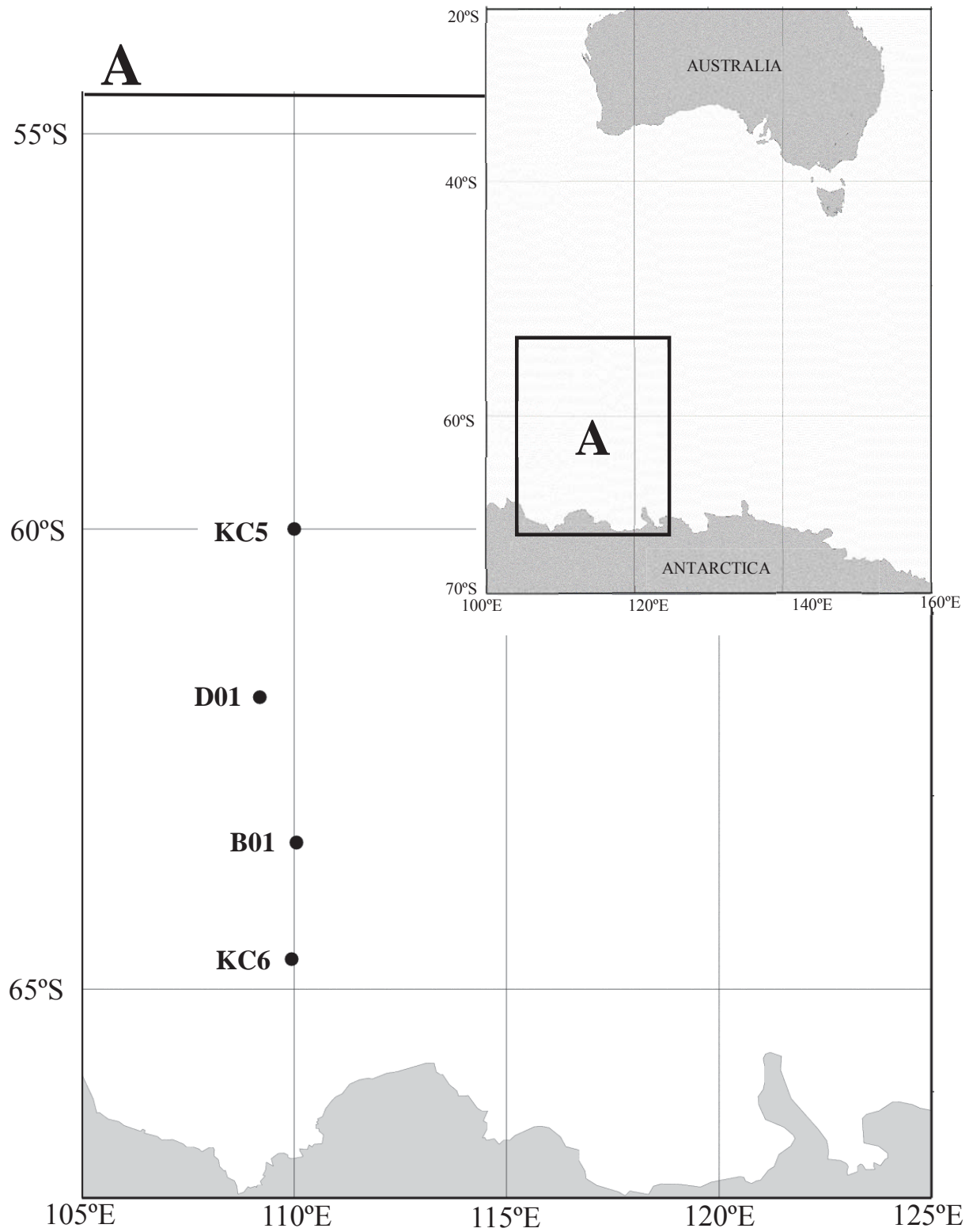


Fig. 1. Stations sampled with a VMPS net on board the training vessel *Umitaka-maru* in the Indian sector of the Southern Ocean, January 2018.

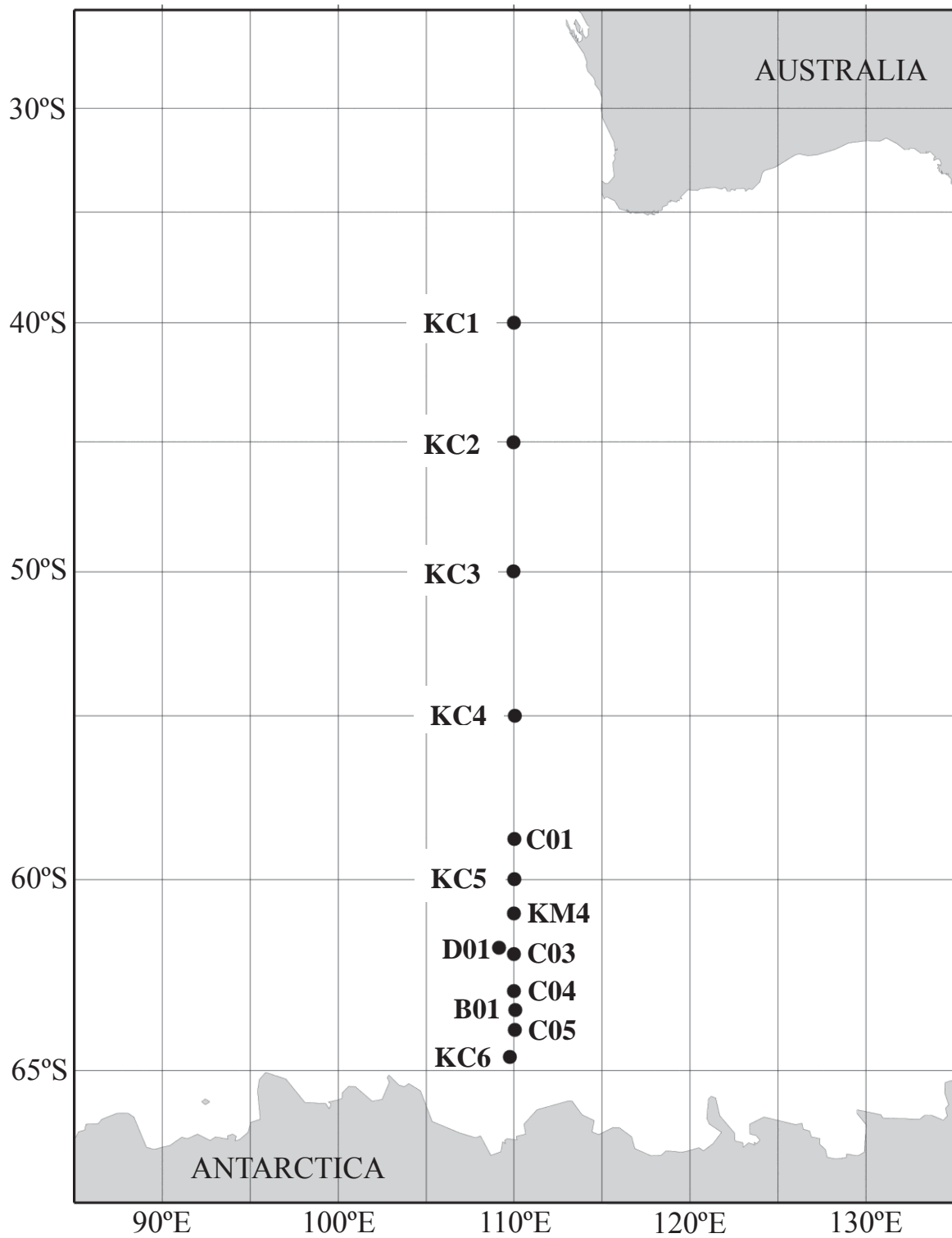


Fig. 2. Stations sampled with an ORI net by oblique tows on board the training vessel *Umitaka-maru* in the Indian sector of the Southern Ocean, January 2018.

Table 1. Sampling data of a VMPS along the 110°E transect in the Southern Ocean in January 2018.

Stn.	Position	Date (yyyy/mm/dd) & Time (UTC) ^a		Bottom depth (m)	Sampling depth interval (m)	Volume filtered (m ³) ^b	Sample No.
		Start	Finish				
KC5	60.0005 °S 109.9989 °E	2018/01/08 02:04	2018/01/08 02:28	4402	0 - 50	12.581	1
					50 - 100	8.328	2
					100 - 150	18.075	3
	60.0005 °S 109.9983 °E	2018/01/08 00:03	2018/01/08 00:37		150 - 200	6.556	4
					200 - 300	19.847	5
					300 - 400	19.847	6
D01	61.9267 °S 109.1837 °E	2018/01/09 07:59	2018/01/09 08:34	4132	0 - 50	12.581	7
					50 - 100	15.417	8
					100 - 150	15.239	9
	61.9268 °S 109.1841 °E	2018/01/09 06:13	2018/01/09 06:48		150 - 200	14.885	10
					200 - 300	17.366	11
					300 - 400	17.897	12
B01	63.4975 °S 110.0467 °E	2018/01/10 12:34	2018/01/10 12:54	3685	0 - 50	*	13
					50 - 100	*	14
					100 - 150	*	15
	63.4976 °S 110.0467 °E	2018/01/10 11:02	2018/01/10 11:37		150 - 200	*	16
					200 - 300	*	17
					300 - 400	*	18
KC6	64.6986 °S 109.9340 °E	2018/01/11 06:41	2018/01/11 07:04	2757	0 - 50	*	19
					50 - 100	*	20
					100 - 150	*	21
	64.6987 °S 109.9341 °E	2018/01/11 05:13	2018/01/11 05:45		150 - 200	*	22
					200 - 300	*	23
					300 - 400	*	24

^aShip mean time = UTC + 8 h

^bMesh size 100 µm

*The flow-meter did not work properly.

Table 2. Sampling data for oblique tows of an ORI net along the 110°E transect in the Southern Ocean in January 2018.

Stn.	Position		Date (yyyy/mm/dd) & Time (UTC) ^a		Maximum depth reached (m) ^b	Volume filtered (m ³) ^c	Sample No.
	Start	Finish	Start	Finish			
KC1	39.9999 °S	39.9862 °S	2018/01/02 01:30	2018/01/02 02:00	163	4002	1
	109.9997 °E	109.9715 °E					
KC2	45.0297 °S	45.0202 °S	2018/01/03 10:13	2018/01/03 10:42	138	4626	2
	109.9751 °E	109.9461 °E					
KC3	49.9883 °S	49.9894 °S	2018/01/05 04:35	2018/01/05 05:06	119	5130	3
	109.9951 °E	109.9553 °E					
KC4	54.9961 °S	54.9902 °S	2018/01/06 11:16	2018/01/06 11:45	135	4853	4
	110.0250 °E	110.0615 °E					
C01	58.9974 °S	58.9768 °S	2018/01/07 14:30	2018/01/07 14:59	128	2775	5
	109.9994 °E	110.0091 °E					
KC5	59.9894 °S	59.9725 °S	2018/01/08 03:00	2018/01/08 03:28	167	3907	6
	110.0129 °E	110.0304 °E					
KM4	60.9343 °S	60.9511 °S	2018/01/08 21:10	2018/01/08 21:40	169	4486	7
	109.9711 °E	109.9944 °E					
D01	61.8778 °S	61.8952 °S	2018/01/09 10:24	2018/01/09 10:52	187	4026	8
	109.1503 °E	109.1567 °E					
C03	62.0393 °S	62.0627 °S	2018/01/09 17:09	2018/01/09 17:40	139	3141	9
	109.9853 °E	109.9772 °E					
C04	63.0085 °S	63.0286 °S	2018/01/10 06:25	2018/01/10 06:55	167	2815	10
	109.9984 °E	109.9911 °E					
B01	63.5023 °S	63.5135 °S	2018/01/10 13:10	2018/01/10 13:38	177	3345	11
	110.0602 °E	110.0899 °E					
C05	63.9976 °S	64.0139 °S	2018/01/10 19:57	2018/01/10 20:25	168	3568	12
	110.0230 °E	110.0418 °E					
KC6	64.6759 °S	64.6815 °S	2018/01/11 11:11	2018/01/11 11:38	142	3888	13
	109.7709 °E	109.7268 °E					

^aShip mean time = UTC + 8 h

^bCOMPACT-TD

^cMesh size, 500 µm