

**Plankton sampling by the training vessel *Umitaka-maru* in the Indian sector of
the Southern Ocean in the austral summer of 2019**

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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 a 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 third 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—a 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 2 and 27 January 2019.

2. Cruise number

Data covered in this report were obtained from the 22nd *Kaiyodai* (abbreviated Japanese name for TUMSAT) Antarctic Research Expedition (*KARE-22*) cruise by T/V *Umitaka-maru*, which was conducted as part of the 60th Japanese Antarctic Research Expedition (*JARE-60*) 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-18-08).

3. Sampling protocols

3.1. VMPS

Meso-zooplankton were collected vertically 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>). In one station, the samples were collected by two casts, with a multiple-net opening-closing system, one cast at three layers. Sampling layers were 400 – 0 m, or 600 - 0 m. 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. At several southern stations, the flow-meter did not work properly. The flow meter was calibrated by five vertical tows of the VMPS without nets before the UM-17-09 cruise.

Samples were collected by seven stations 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 keeping the wire angle at approximately 43° to 60° , and the wire length at 500, 1000, 1200 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 calculated by wire length and angle.

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.

Samples were collected by ten stations along the 110°E transect ([Fig. 2](#)). Detailed sampling information is given in [Table 2](#).

3.3. Zooplankton sample processing

Certain aliquots of zooplankton samples after dividing by using a rotating splitter 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 researching 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

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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.

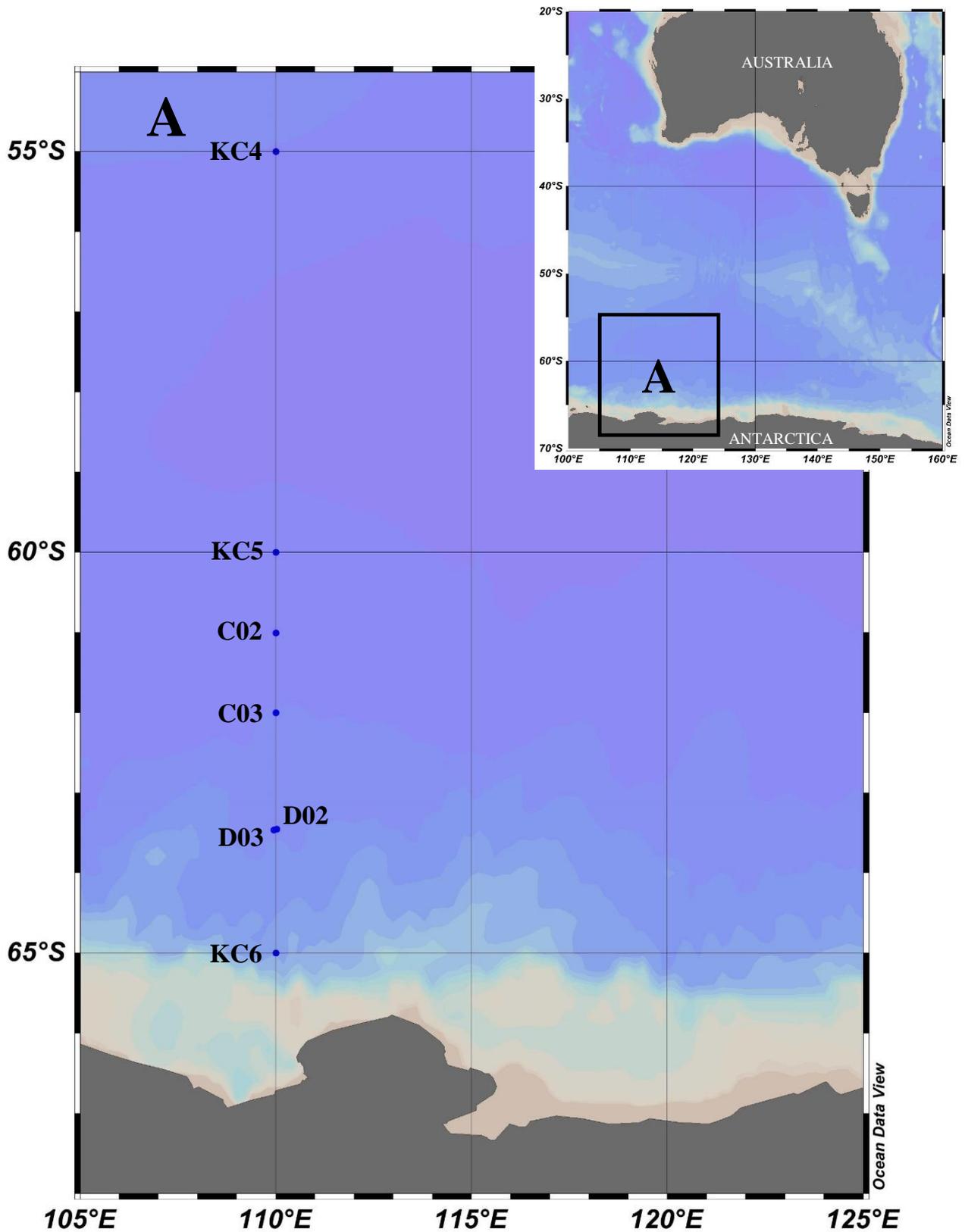


Fig. 1. Stations sampled with a VMPS net on board the training vessel *Umitaka-maru* in the Indian sector of the Southern Ocean, January 2019.

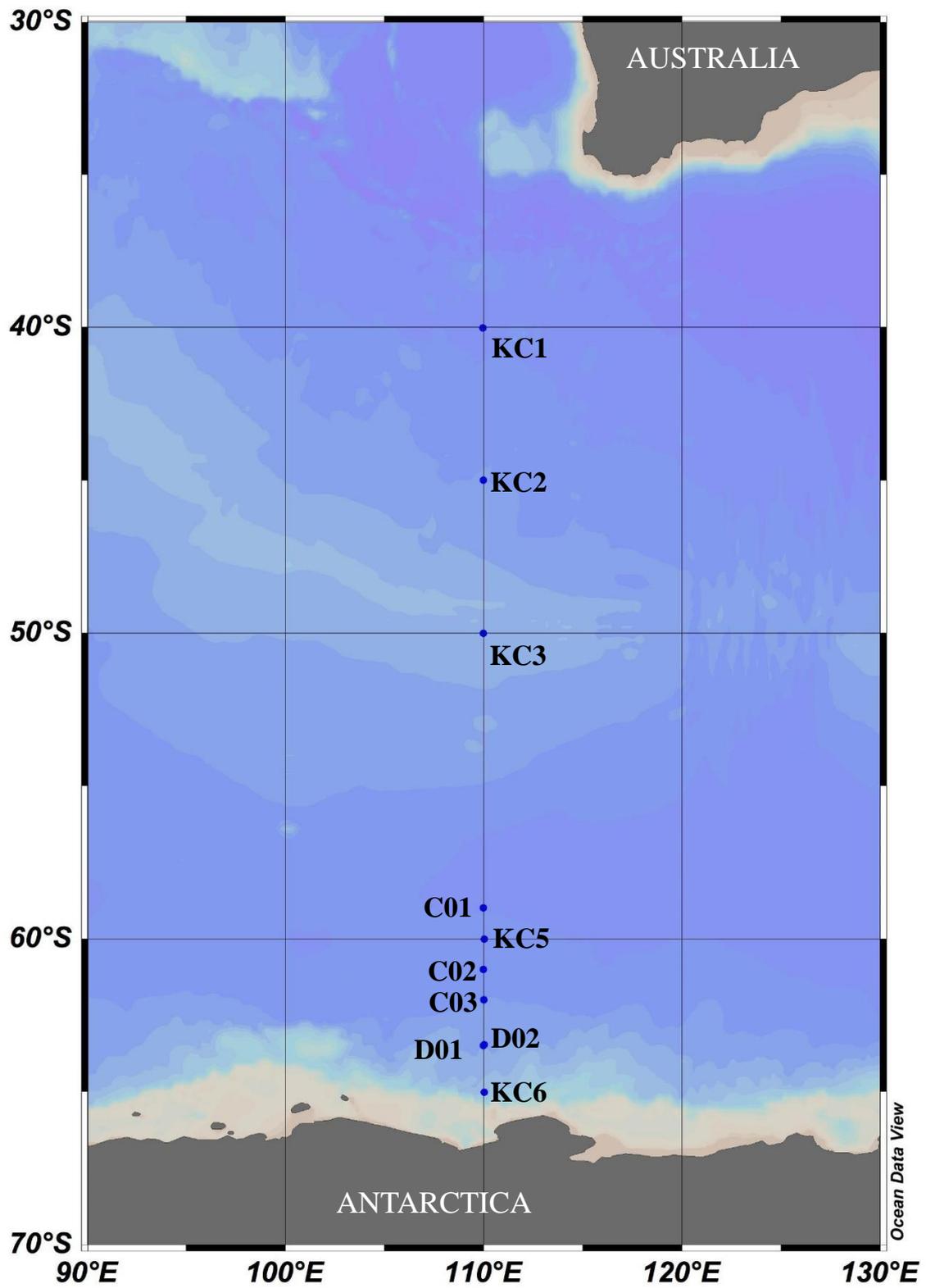


Fig. 2. Stations sampled with an ORI net by oblique tows on board the training vessel *Umitaka-maru* in the Indian sector of the Southern Ocean, January 2019.

Table 1. Sampling data of a VMPS along the 110°E transect in the Southern Ocean in January 2019.

Stn.	Position		Date (yyyy/mm/dd) & Time (UTC) ^a		Bottom depth (m)	Sampling depth interval (m)	Volume filtered (m ³)	Sample No.
	Start	Finish	Start	Finish				
KC4	55.0002 °S	55.0003 °S	2019/01/07 21:50	2019/01/07 22:23	3911	150 - 200	8.860	1
	110.0011 °E	110.0003 °E				200 - 300	30.301	2
						300 - 400	25.694	3
KC5	60.0001 °S	59.9976 °S	2019/01/10 00:01	2019/01/10 00:16	4396	0 - 50	15.771	4
	110.0003 °E	110.0010 °E				50 - 100	9.746	5
						100 - 150	9.746	6
	59.9998 °S	59.9985 °S	2019/01/09 23:05	2019/01/09 23:40	4398	150 - 200	10.455	7
	109.9990 °E	110.0029 °E				200 - 400	41.111	8
C03	62.0004 °S	62.0008 °S	2019/01/11 13:18	2019/01/11 13:36	3998	0 - 50	10.987	9
	110.0010 °E	110.0019 °E				50 - 100	10.455	10
						100 - 150	10.455	11
	62.0000 °S	62.0013 °S	2019/01/11 12:16	2019/01/11 12:52	4000	150 - 200	8.683	12
	109.9979 °E	109.9990 °E				200 - 300	11.341	13
						300 - 400	21.264	14
C02	61.0047 °S	61.0049 °S	2019/01/12 05:50	2019/01/12 06:00	4281	0 - 50	3.367	15
	110.0020 °E	110.0035 °E				50 - 100	8.328	16
						100 - 150	10.278	17
	61.0043 °S	61.0048 °S	2019/01/12 04:57	2019/01/12 05:25	4281	150 - 200	8.151	18
	110.0015 °E	110.0022 °E				200 - 300	8.151	19
						300 - 400	12.227	20
KC6	65.0000 °S	65.0001 °S	2019/01/14 21:22	2019/01/14 21:35	2632	0 - 50	3.721	21
	110.0011 °E	110.0008 °E				50 - 100	5.670	22
						100 - 150	2.658	23
	64.9998 °S	64.9999 °S	2019/01/14 20:31	2019/01/14 21:06	2630	150 - 200	6.556	24
	110.0001 °E	110.0003 °E				200 - 300	6.202	25
						300 - 400	13.467	26
D02-1 day	63.4549 °S	63.4549 °S	2019/01/17 03:48	2019/01/17 04:00	3692	0 - 50	3.190	27
	110.0285 °E	110.0289 °E				50 - 100	2.126	28
						100 - 150	1.595	29
	63.4547 °S	63.4550 °S	2019/01/17 02:50	2019/01/17 03:33	3694	150 - 200	3.898	30
	110.0284 °E	110.0282 °E				200 - 400	3.721	31
						400 - 600	12.581	32
D02-2 night	63.4551 °S	63.4545 °S	2019/01/17 18:42	2019/01/17 18:55	3693	0 - 50	*	33
	110.0237 °E	110.0238 °E				50 - 100	*	34
						100 - 150	6.379	35
	63.4549 °S	63.4549 °S	2019/01/17 17:27	2019/01/17 18:10	3693	0 - 200	11.873	36
	110.0291 °E	110.0287 °E				200 - 400	13.645	37
						400 - 600	9.037	38
D03	63.4638 °S	63.4637 °S	2019/01/19 16:10	2019/01/19 16:34	3675	0 - 50	4.784	39
	109.9532 °E	109.9542 °E				50 - 100	4.784	40
						100 - 150	5.493	41
	63.4635 °S	63.4635 °S	2019/01/19 15:16	2019/01/19 15:47	3675	150 - 200	7.088	42
	109.9530 °E	109.9530 °E				200 - 300	11.873	43
						300 - 400	9.923	44

^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 2019.

Stn.	Position		Date (yyyy/mm/dd) & Time (UTC) ^a		Bottom depth (m)	Wire length (m)	Wire angle (°)	Maximum depth reached (m)	Volume filtered (m ³) ^{de}	Sample No.	Remarks
	Start	Finish	Start	Finish							
KC1	40.0022 °S	40.0170 °S	2019/01/04 11:16	2019/01/04 12:01	4605	500	44	242 ^b	3652	1	
	109.9812 °E	109.9487 °E									
KC2	44.9971 °S	44.9862 °S	2019/01/05 15:12	2019/01/05 15:52	3946	500	46	268 ^b	3000	2	
	109.9971 °E	109.9617 °E									
KC3	49.9998 °S	49.9967 °S	2019/01/05 18:42	2019/01/05 19:25	3261	500	43	266 ^b	3209	3	
	109.9995 °E	109.9500 °E									
C01	58.9947 °S	58.9674 °S	2019/01/09 04:58	2019/01/09 05:35	4480	500	60	250 ^c	3436	4	
	109.9963 °E	109.9805 °E									
KC5	59.9988 °S	59.9978 °S	2019/01/10 01:28	2019/01/10 02:08	4396	500	52	308 ^c	4095	5	
	110.0008 °E	110.0554 °E									
C02	61.0000 °S	61.0000 °S	2019/01/10 07:38	2019/01/10 08:17	4282	500	44	360 ^c	3362	6	
	109.9461 °E	109.9964 °E									
C03	61.9988 °S	61.9700 °S	2019/01/11 15:24	2019/01/11 15:58	4001	500	54	294 ^c	3478	7	
	109.9953 °E	109.9900 °E									
D01	63.4651 °S	63.5013 °S	2019/01/13 19:14	2019/01/13 20:33	3668	1000	43	731 ^c	7342		Not quantitative sample
	109.9305 °E	110.0018 °E									
KC6	65.0017 °S	65.0163 °S	2019/01/15 05:18	2019/01/15 05:55	2627	500	46	347 ^c	3649	8	
	110.0053 °E	110.0460 °E									
D02	63.4464 °S	63.4609 °S	2019/01/17 00:01	2019/01/17 01:19	3685	1200	50	771 ^c	6679		Freezed sample only
	109.9735 °E	110.0742 °E									

^aShip mean time = UTC + 8 h^bCOMPACT - TD ; model ATD-HR, JFE Advantech Co., Ltd., Nishinomiya Japan^cCalculated by wire length and wire angle^dPart Number ; 2030R, General Oceanis Inc.;Miami, Florida, USA^eMesh size, 500 µm