

**Plankton sampling by the training vessel *Umitaka-maru* in the Indian sector of
the Southern Ocean in the austral summer of 2020**

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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 second half of the six-year plan for JARE phase IX (2016–2022) by NIPR, the first year of the second three-year (2019–2022) 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 the marine ecosystem in the Indian sector of the Southern Ocean as one of the JARE projects (Project no. AP-0939; Associate Prof. Masato Moteki, TUMSAT, principal investigator).

The present report describes the data from the fourth research cruise conducted by T/V *Umitaka-maru* IV under the mission of project AP-0939. 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 Vincennes Bay, and off Terre Adélie, Antarctica, during the cruise period between 8 January and 4 February 2020.

2. Cruise number

Data covered in this report were obtained from the 23rd *Kaiyodai* (abbreviated Japanese name for TUMSAT) Antarctic Research Expedition (*KARE-23*) cruise by T/V *Umitaka-maru*, which was conducted as part of the 61st Japanese Antarctic Research Expedition (JARE-61) 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-19-08).

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. The wire payout speeds were maximum 1.0 ms⁻¹, and retrieval speeds were 1.0 ms⁻¹, 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, depth and water temperature data were sent to the onboard deck unit. The flow meter was calibrated by two vertical tows of the VMPS without nets before the UM-19-06 cruise.

Samples were collected by three 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- μ m 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 100, 500 m. The net was retrieved at approximately 0.5 m s⁻¹ while the ship moved forward at 2 knots. The maximum depth reached was measured by a pocket-size temperature-pressure logger (model DEFI2-D2XHG, JFE Advantech Co. Ltd., Nishinomiya Japan; https://www.jfe-advantech.co.jp/ocean/defi2/defi2-d_dhg.html) mounted in the mouth of the net. But in two stations, the maximum depth reached was calculated by wire length and angle because a temperature-pressure logger was not mounted caused by bad sea conditions.

The volume of water filtered was estimated using a digital mechanical flowmeter (#2030R; General Oceanics, Inc., Miami, Florida, USA) mounted at the center of the mouth ring of the net.

Samples were collected by ten stations along the 110°E transect and one station at 137.5°E ([Fig. 2](#)). Detailed sampling information is given in [Table 2](#).

3.3. Zooplankton sample processing

VMPS samples were immediately preserved in 10% neutral Lugol's iodine solution-seawater on board and stored in a refrigeration room on the ship. ORI samples were immediately preserved in 5% borate-buffered formalin-seawater on board after sorting on larval and juvenile fishes, euphausiids, amphipods, salps on deck, 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 following:

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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-23 cruise.

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- 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

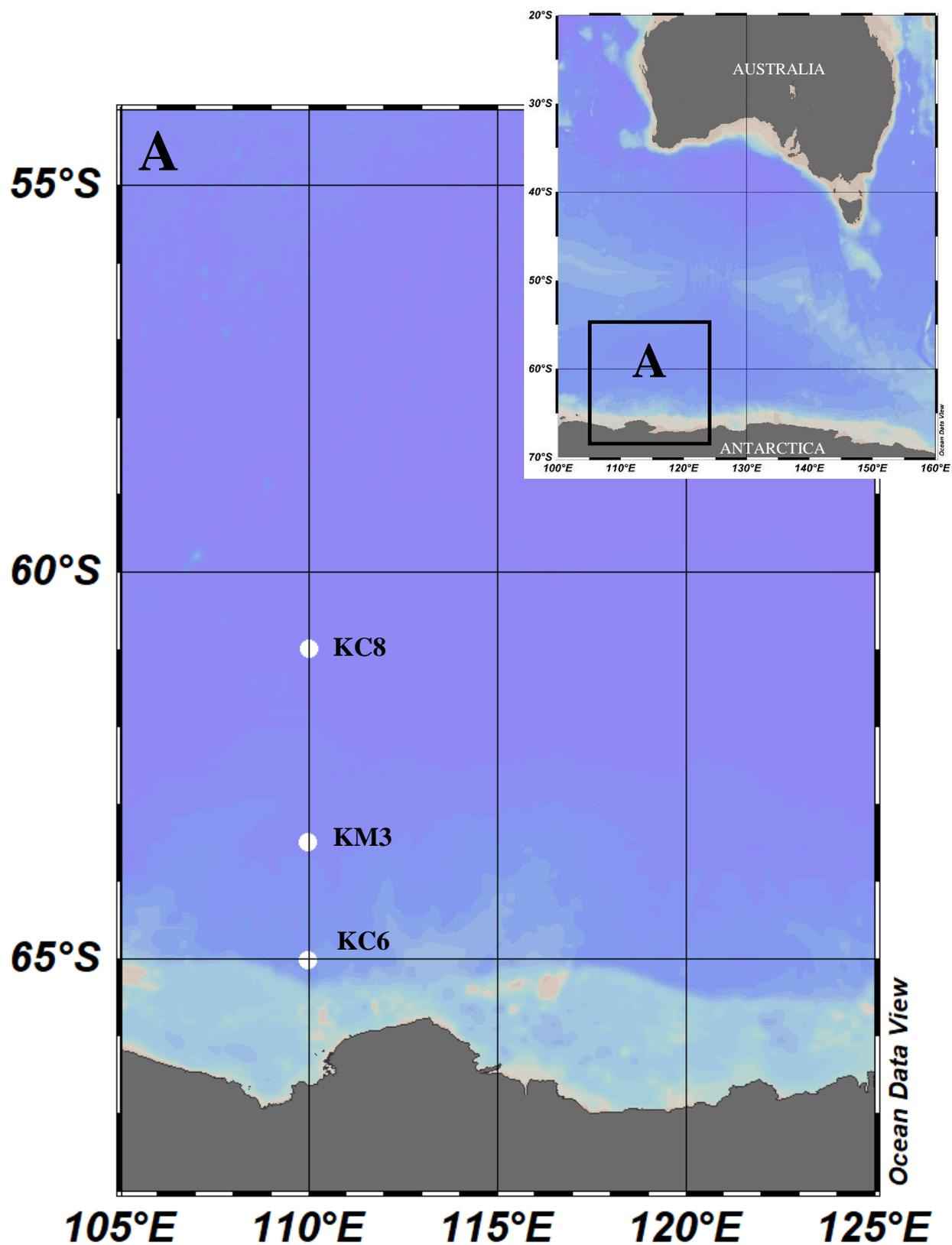


Fig. 1. Stations sampled with a VMPS net on board the training vessel *Umitaka-maru* in the Indian sector of the Southern Ocean, January 2020.

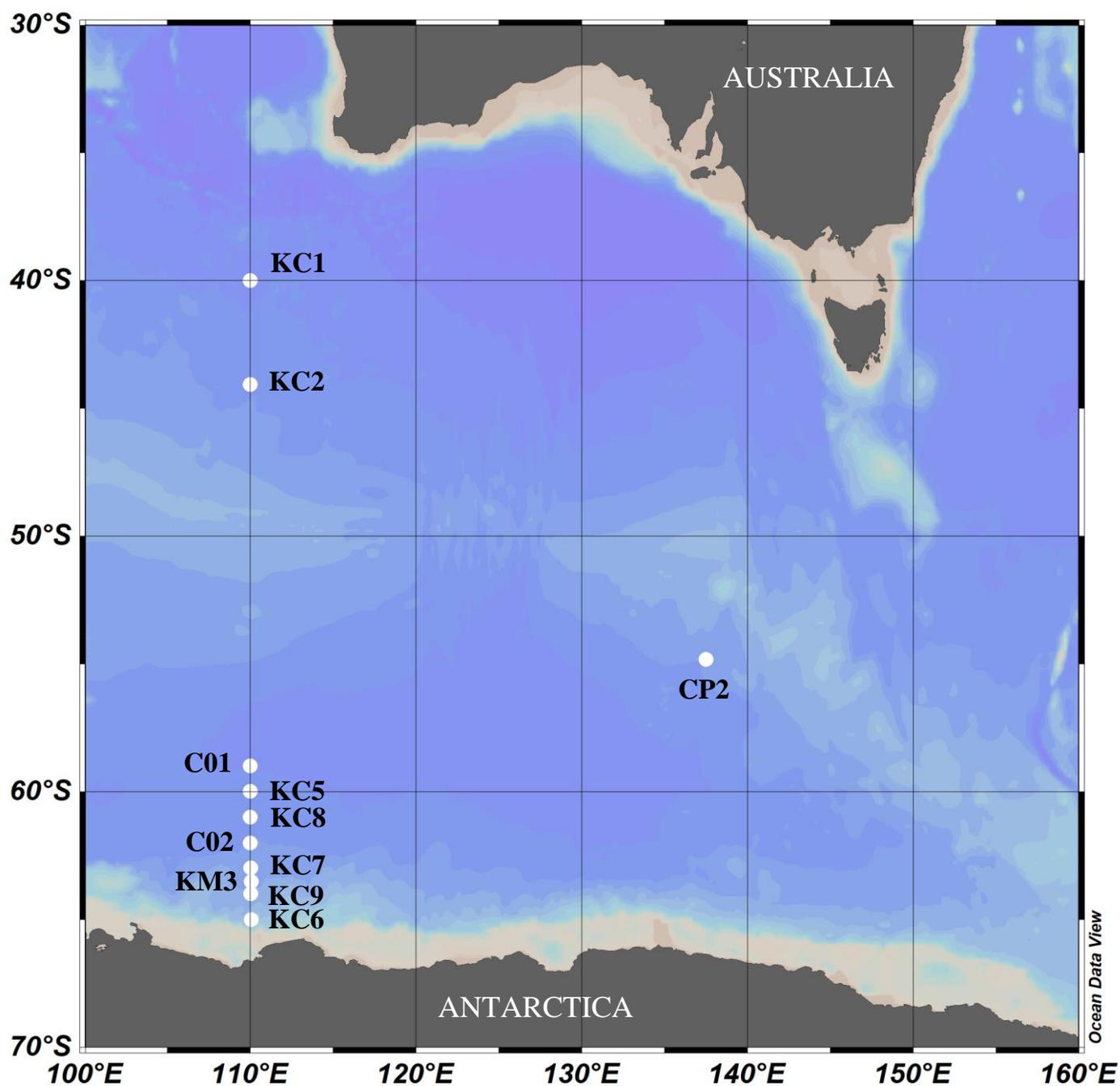


Fig. 2. Stations sampled with an ORI net by oblique tows on board the training vessel *Umitakamaru* in the Indian sector of the Southern Ocean, January 2020.

Table 1. Sampling data of a VMPS along the 110°E transect in the Southern Ocean in January 2020.

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	Start	Finish				
KC8	60.9997 °S	60.9999 °S	2020/01/16 23:01	2020/01/16 23:16	4281	0 - 50	10.175	1
	110.0000 °E	109.9999 °E				50 - 100	7.017	2
						100 - 150	8.421	3
	60.9995 °S	60.9998 °S	2020/01/16 22:17	2020/01/16 22:44	4282	150 - 200	12.631	4
	110.0003 °E	110.0002 °E				200 - 300	19.297	5
						300 - 400	18.946	6
KM3	63.5000 °S	63.5001 °S	2020/01/20 07:45	2020/01/20 07:58	3671	0 - 50	9.298	7
	109.9992 °E	109.9988 °E				50 - 100	10.526	8
						100 - 150	10.526	9
	63.4999 °S	63.5006 °S	2020/01/20 07:04	2020/01/20 07:29	3672	150-200	9.824	10
	109.9986 °E	109.9932 °E				200 - 300	18.420	11
						300 - 400	19.122	12
KC6	65.0149 °S	65.0148 °S	2020/01/23 06:41	2020/01/23 06:56	2617	0 - 50	11.052	13
	109.9761 °E	109.9793 °E				50 - 100	10.526	14
						100 - 150	9.649	15
	65.0150 °S	65.0149 °S	2020/01/23 05:59	2020/01/23 06:24	2614	150 - 200	11.052	16
	109.9782 °E	109.9823 °E				200 - 300	19.824	17
						300 - 400	20.876	18

^aShip mean time = UTC + 8 h^bMesh size 100 µm

Table 2. Sampling data for oblique tows of an ORI net along the 110°E transect in the Southern Ocean in January 2020.

Stn.	Position		Date (yyyy/mm/dd) & Time (UTC) ^d		Bottom depth (m)	Wire length (m)	Wire angle (°)	Maximum depth reached (m) ^{b, c}	Volume filtered (m ³) ^{d, e}	Sample No.	Remarks
	Start	Finish	Start	Finish							
KC1	39.9996 °S	40.0012 °S	2020/01/10 04:34	2020/01/10 05:05	4616	500	55	288 ^b	3624	1	
	109.9949 °E	109.9739 °E									
KC2	44.0875 °S	44.0687 °S	2020/01/11 03:15	2020/01/11 03:55	3945	500	55	287 ^c	4863	2	depth sensor was not carried by bad sea condition
	109.9980 °E	109.9814 °E									
C01	59.0033 °S	59.0064 °S	2020/01/14 20:59	2020/01/14 21:13	4480	100	57	57 ^b	1830	3	
	109.9928 °E	109.9778 °E									
KC5	59.9940 °S	59.9906 °S	2020/01/15 07:17	2020/01/15 07:25	4401	100	48	66 ^b	841	4	
	109.9984 °E	109.9933 °E									
KC8	60.9849 °S	61.0079 °S	2020/01/15 13:59	2020/01/15 14:36	4284	500	53	207 ^b	3224	5	
	109.9955 °E	110.0034 °E									
CO2	62.0025 °S	62.0089 °S	2020/01/17 21:56	2020/01/17 22:13	3997	100	52	43 ^b	1304	6	
	109.9963 °E	109.9816 °E									
KC7	62.9967 °S	62.9920 °S	2020/01/18 11:37	2020/01/18 11:48	3898	100	55	47 ^b	683	7	
	110.0083 °E	110.0022 °E									
KM3	63.5239 °S	63.5257 °S	2020/01/20 10:50	2020/01/20 11:32	3666	500	55	184 ^b	2898	8	
	110.0106 °E	110.0690 °E									
KC9	64.0005 °S	64.0018 °S	2020/01/20 18:08	2020/01/20 18:18	3392	100	54	48 ^b	*	9	a flow meter broken
	110.0034 °E	110.0164 °E									
KC6	65.0127 °S	65.0132 °S	2020/01/23 09:40	2020/01/23 10:24	2612	500	50	321 ^c	4526	10	depth sensor was not carried by bad sea condition
	110.0175 °E	110.0612 °E									
CP2	54.8345 °S	54.8146 °S	2020/01/31 19:52	2020/01/31 20:31	4027	500	55	211 ^b	4648	11	
	137.4989 °E	137.5275 °E									

^aShip mean time=UTC+8 h (110°E), Ship mean time=UTC+9 h (Stn. CP2)

^bPocket-size pressure logger; model DEF12-D2XHG, JFE Advantech Co.Ltd., Nishinomiya Japan

^cCalculated by wire length and wire angle

^dPart Number:2030R, General Oceanic Inc.:Miami, Florida, USA

^eMesh size, 500 µm

*no data