

Preliminary Report
of
The Hakuho Maru Cruise KH-81-4

July 6-August 4, 1981

Japan Trench

(WESTPAC)

Ocean Research Institute

University of Tokyo

1988

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by

The Scientific Members of the Cruise

Edited by

Masuoki HORIKOSHI

and

Suguru OHTA

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I. INTRODUCTORY REMARKS

The Pacific coast of northeastern Honshu, Japanese main island, is an interesting locality for the deep-sea research. A deep-sea terrace of around 2,000m deep spreads extensively along Sanriku Region, northern part of the northeastern coast of Honshu. From the edge of the deep-sea terrace at depths of 2,500-3,000m, steep slopes drop down directly to the axis of the Japan Trench, and beyond the trench there spreads a vast level terrain of ocean floor of the North Pacific Basin.

Among the cruises of JEDS (Japanese Expeditions of Deep Seas), which were conducted as the activity of the Deep-sea Research Committee of the Japan Society of Promotion of Science, three cruises (JEDS-2, 4, 6) were carried out in this region, and six trawling stations were established by the senior writer (M.H.) and his collaborators (Suyehiro *et al.*, 1960, 1962; Horikoshi, 1962, 1971a; Harada and Narita, 1964) including one in the trench. Since the launch of our research vessel Hakuho Maru, deep-sea trawlings in this region were conducted at two occasions (KH-67-2, KH-69-2), and seven stations were established also by the senior writer and his colleagues (Horikoshi *et al.*, 1971; Horikoshi, 1971a). Collecting efforts in these cruises, however, were concentrated on the trawling in bathyal depths of the deep-sea terrace due to the limited ship time. In one of these cruises (KH-69-2), deep-sea photography was attempted for the first time, and several bottom photographs of good quality were obtained on an amphipods association associated with *Radicipes* and also on a stalkless crinoid association (Horikoshi, 1971b; Nakai *et al.*, 1971).

In the present cruise of Hakuho Maru (KH-81-4), which was declared as WEST-PAC cruise, together with the pelagic studies, a more extensive survey of the deep-sea, benthic domains in this region was attempted, covering all of the three different zones of the deep-sea system, *i.e.*, bathyal, abyssal and hadal. The stations were arranged in two transects, among nine trawlings in the present cruise, two were carried out in the trench. During the previous trawling operation in the trench in one of the cruises of JEDS (JEDS-4), it was so windy that the research vessel Ryofu Maru was drifted to north-east obliquely away from the axis of the trench, and the trawling was conducted on a gentle slope within the trench. This time, we were fortunate, and we had quite flat seas in both of the two trawlings in the trench. We trawled right along the very axis of the trench. The assemble of organisms obtained by these two trawlings were almost identical. A small and white globular species of a bivalve of the genus *Kelliella* was found abundantly as the dominant species, and a hadal fish, *Careproctus amblystomopsis*, was observed to be associated. On the other hand, these results were quite dissimilar to that of the previous JEDS trawling, in which a hadal isopod species, *Storthyngula*, was dominant, and associated with a hadal species of protobranchiate bivalve, *Spinura vitjazi*. From the results of these trawlings in the trench, it has been known that there are at least two distinct benthic communities, or associations, within the trench (Horikoshi, 1984, 1987: pp. 163-164).

The abyssal fauna on the landward slope of the trench was also found to be clearly distinct both from the bathyal fauna on the deep-sea terrace shallower than 3,000m, and from the hadal fauna deeper than 6,000m. This abyssal fauna is devoid of red-coloured arthropods such as crustaceans and pycnogonids, and it is mainly characterized by the wide occurrences of an abyssal asteroid, *Eremicaster crassus*.

In spite of these new findings on hadal and abyssal faunae, we still feel that our knowledge on the deep-sea benthic communities are rather fragmental and not sufficient to draw up general schema of their distributions in the bathyal, abyssal and hadal depths in this region of interesting topography. Several cruises of Hakuho Maru should be made until we accomplish such a project.

On behalf of the scientists aboard, we wish to express our sincere gratitude to Captain I. Tadama, the officers and the crew of the R.V. Hakuho Maru for their cooperation throughout the cruise. As indicated above, the present cruise was one of the WESTPAC cruises, and three foreign marine biologists from three Southeast Asian countries joined to the present cruise: Mrs. Widiarsih Kastoro, National Institute of Oceanology, Indonesia, Dr. Paul K. Shin, Environmental Protection Agency, Hong Kong and Miss Mai D. G. Lopez, Marine Sciences Center, University of the Philippines. We are most grateful to the IOC Office, UNESCO in Paris for financial support, as well as the ROSTERA Office, UNESCO in Jakarta and the Ministry of Education, Science and Culture, Japan, for kind arrangement.

Masuoki HORIKOSHI

Chief Scientist,
R.V. Hakuho Maru KH-81-4 Cruise
Ocean Research Institute, University of Tokyo

Present affiliation:
Department of Biology, Faculty of Science,
Chiba University

Suguru OHTA

Editor
Ocean Research Institute, University of Tokyo

REFERENCE

- Harada, E. and T. Narita (1964): Ecological aspects of the research of bottom animals of the deep-sea with reference to the collections of JEDS-6. *La Mer*, 1(2): 62-66.
- Horikoshi, M. (1962): Bird's eye view of the studies of the benthos in Japan. *Jour. Oceanogr. Soc. Japan*, 20 th Anniv. vol., 707-723. (in Japanese)
- Horikoshi, M. (1971a): Bathyal fauna on the deep-sea shelf and on the top of the rise and seamount. *La Mer*, 9(1): 46-53.
- Horikoshi, M. (1971b): Biological notes on the bottom photographs. *Prelim. Rep. Hakuho Maru Cruise KH-69-2*: 167-168.
- Horikoshi, M. (1984): Two distinct hadal benthic community and their physical environments within the Japan Trench. *Abstr. Pap. Biannual Meeting Oceanogr. Soc. Japan*, 1984 (Spring): 265.
- Horikoshi, M., S. Gamo., M. Imajima and S. Kosuge (1971): Studies on the deepsea benthos in the bathyal zone on the Japanese Pacific Sea-shelf. *Prelim. Rep. Hakuho Maru Cruise KH-69-2*: 171-172.
- Horikoshi, M. (1987): Deep-sea faunae and their bathymetrical zonation. *In* Horikoshi, M., Nagata, Y. and T. Sato: *The Sea around the Japanese Islands. Nature in Japan*. vol. 7, viii+299 pp., Iwanami Publ. Co., Tokyo: 146-168.
- Nakai, T., H. Hasumoto, H. Otobe, C. Igarashi and S. Tanaka (1971): Deep-sea photography. *Prelim. Rep. Hakuho Maru Cruise KH-69-2*: 147-155, 9 pls.
- Suyehiro, Y., E. Iwai, M. Ishino and M. Horikoshi (1960): Benthic animals (in Suyehiro and others, 1960): Notes on the sampling gears and the animals collected on the second cruise of the Japanese Expedition of Deep-Seas (JEDS-2). *Oceanogr. Mag.*, 11(2): 187-200 (188-192).
- Suyehiro, Y., Y. Okada, M. Horikoshi and E. Iwai (1962): A brief note on the benthic animals on the fourth cruise of the Japanese Expedition of Deep-Seas (JEDS-4). *Oceanogr. Mag.*, 13(2): 149-153.

II. SCIENTISTS ABOARD

Name	Institution Address of Institution and business phone Home Address and phone	
Masuoki HORIKOSHI* (chief scientist)	Marine Ecology Division Ocean Research Institute, University of Tokyo Minamidai 1-15-1, Nakano-ku, Tokyo 164	03-376-1251
	Pabiyon Meguro 302, Meguro 1-3-31, Meguro-ku, Tokyo 153	03-492-5070
Shozaburo NAGUMO** (vice scientist)	Earthquake Research Institute, University of Tokyo Yayoi 1-1-1, Bunkyo-ku, Tokyo 113	03-812-2111
	Nakane 1-17-23, Meguro-ku, Tokyo 152	03-724-6780
Sigeo GAMO	Faculty of Education, Yokohama National University Tokiwadai 156, Hodogaya-ku, Yokohama-shi, Kanagawa 240	045-335-1451
	Kohinata 2-10-26-303, Bunkyo-ku, Tokyo 112	03-941-6301
Yasuo SUGIURA	Faculty of Liberal Arts, Dokkyo University Sakae-cho 600, Soka-shi, Saitama 340	0489-42-1111
	Park Town 2-803, Sengendai nishi 3-2, Koshigaya-shi, Saitama 343	
Muneo OKIYAMA	Ocean Research Institute, University of Tokyo Minamidai 1-15-1, Nakano-ku, Tokyo 164	03-376-1251
	RC 101, Naka 2-1, Kunitachi-shi, Tokyo 186	0425-77-2086
Widiarsih KASTORO	Lembaga Oseanologi Nasional-LIPI*** Jl. Pasir Putih 1, Ancol Timur. P.O. Box 580 Dak, Jakarta 11001, Indonesia	683850
	Komplek Lipi F3, Jalan Gatot Subroto, Jakarta Selatan, Indonesia	514248
* retired in March 1985: present affiliation;	Ecology Division, Department of Zoology, Faculty of Science, Chiba University Yayoi-cho 1-33, Chiba-shi, Chiba 260	0472-51-1111
** retired in March 1988: present affiliation;	Seismology Division, Hawaii Institution of Geophysics, University of Hawaii 2525 Correa Rd., Honolulu, HI 96822, U.S.A.	001-1-808-948- 7846
*** owing to change in organization, LON-LIPI should be read as;	Pusat Penelitian dan Pengembangan Oseanologi-LIPI (Center for Oceanological Research and Development-LIPI) Jl. Pasir Putih No. 1, Ancol Timur, Kotak Pos 580 Dak, Jakarta 11001, Indonesia Cable: LONAS; Telex: 45875 PDIN-IA	683850

Akira TANIGUCHI	Faculty of Agriculture, Tohoku University Amamiya-cho 1-1, Tsutsumidori, Sendai-shi, Miyagi 980	0222-72-4321
	Kamo 4-11-5, Izumi-shi, Miyagi 981-31	0223-78-2418
Yoshihiko MACHIDA	Department of Biology, Faculty of Science, Kochi University Akebono-cho 2-5-1, Kochi-shi, Kochi 780	0888-44-0111
	Akebono-cho 2-5-2, Kochi-shi, Kochi 780	0888-43-7816
Hiroshi MUKAI	Ocean Research Institute, University of Tokyo Minamidai 1-15-1, Nakano-ku, Tokyo 164	03-376-1251
	Koyagami 6083-7-M1-212, Kawagoe-shi, Saitama 350	0492-35-5598
Suguru OHTA (editor)	Marine Ecology Division Ocean Research Institute, University of Tokyo Minamidai 1-15-1, Nakano-ku, Tokyo 164	03-376-1251
	Suwahara Danchi 1-8-401, Wako-shi, Saitama 351-01	0484-65-4346
Seiichi IRIMURA	Yokohama Municipal Totsuka High School Kumisawa-cho 2-27-1, Totsuka-ku, Yokohama-shi, Kanagawa 245	045-871-0301
	Okusawa 1-49-1, Setagaya-ku, Tokyo 158	03-727-4153
Hideo MINEGISHI	Attached High School of Nihon Women's University Nishiikuta 1-1-1, Tama-ku, Kawasaki-shi, Kanagawa 214	044-966-2120
	Ozenji 747-46, Aso-ku, Kawasaki-shi, Kanagawa 215	044-955-0055
Hiroshi HASUMOTO	Ocean Research Institute, University of Tokyo Minamidai 1-15-1, Nakano-ku, Tokyo 164	03-376-1251
	Sakashita 3-7-10-206, Itabashi-ku, Tokyo 174	03-965-7666
Sadayuki KORESAWA	Earthquake Research Institute, University of Tokyo Yayoi 1-1-1, Bunkyo-ku, Tokyo 113	03-812-2111
	Kosugaya-cho 2000-10-1-706, Totsuka-ku, Yokohama-shi, Kanagawa 247	045-893-3216
Yasue NAKAMURA	Faculty of Agriculture, Tohoku University Amamiya-cho 1-1, Tsutsumidori, Sendai-shi, Miyagi 980	0222-72-4321
	Kashiwagi 1-2-34-567, Sendai-shi, Miyagi	0222-33-4376
Eiji TSUCHIDA	Ocean Research Institute, University of Tokyo Minamidai 1-15-1, Nakano-ku, Tokyo 164	03-376-1251
	Asamizodai 2572-6, Sagami-hara-shi, Kanagawa 228	0427-45-1372

Paul SHIN	Hong Kong Fisheries Research Station 100 A, Shek Pai Wan Road, Aberdeen, Hong Kong 1020, Block 13, Chai Wan Estate, Chai Wan, Hong Kong	
Mai Davide G. LOPEZ	Marine Sciences Center, University of Philippines Diliman, Quezon City, Philippines 1 University Valley, Old Balava, Diliman, Quezon City, Philippines	
David D. SWINBANKS*	Ocean Research Institute, University of Tokyo Minamidai 1-15-1, Nakano-ku, Tokyo 164 Mezon Fujimigaoka 401, Takaidonishi 2-10-13, Suginami-ku, Tokyo 166	03-376-1251 03-335-5466
Toru YAMAMOTO**	Faculty of Agriculture, Tohoku University Amamiya-cho 1-1, Tsutsumidori, Sendai-shi, Miyagi 980 Takamatsu 3-5-3, Sendai-shi, Miyagi 983	0222-72-4321
Tamiji YAMAMOTO***	Faculty of Agriculture, Tohoku University Amamiya-cho 1-1, Tsutsumidori, Sendai-shi, Miyagi 980 Komatsushima 2-15-26, Sendai-shi, Miyagi 983	0222-72-4321 0222-33-8324
Hiroshi HATTORI	Faculty of Agriculture, Tohoku University Amamiya-cho 1-1, Tsutsumidori, Sendai-shi, Miyagi 980 Komatsushima 1-1-24, Sendai-shi, Miyagi 983	0222-72-4321 0222-33-0390
Chung-Zen SHYU****	Ocean Research Institute, University of Tokyo Minamidai 1-15-1, Nakano-ku, Tokyo 164 Shimorenjaku 2-21-6, Mitaka-shi, Tokyo 181	03-376-1251

Present Affiliation

- * Macmillan Shuppan K. K.
Hongo 1-10-9, Bunkyo-ku, Tokyo 113
- ** Century Research Center Co. Ltd.
Nihonbashi Honcho 3-2, Chuo-ku, Tokyo 103
Sugiura-so, Ichikawa 3-24-21, Ichikawa-shi, Chiba 272
- *** Aichi Prefectural Fisheries Laboratory, Owari Division
Toyoura 3-36, Toyohama, Minami Chita-cho, Chita-gun, Aichi 470-34
Yukimi-cho 3-3, Showa-ku, Nagoya-shi, Nagoya 466
- **** Department of Fishery Biology, Taiwan Fisheries Research Institute,
199, Hou 1st Road, Keelung, 200 Taiwan, R. O. C.

Takashi OHWADA	Ocean Research Institute, University of Tokyo Minamidai 1-15-1, Nakano-ku, Tokyo 164	03-376-1251
	SK Haimu 103, Minamidai 1-7-14, Nakano-ku, Tokyo 164	03-299-4755
Tomoko SHOJI	Faculty of Agriculture, Tohoku University Amamiya-cho 1-1, Tsutsumidori, Sendai-shi, Miyagi 980	0222-72-4321
	Itsuwa 1-12-3, Sendai-shi, Miyagi 983	0222-56-
Nozomu IWASAKI*	Ocean Research Institute, University of Tokyo Minamidai 1-15-1, Nakano-ku, Tokyo 164	03-376-1251
	Wakaba Danchi 27-306, Wakaba-cho 4-25-1, Tachikawa-shi, Tokyo 170	0425-36-9413
Ryuta YAMAMOTO**	Ocean Research Institute, University of Tokyo Minamidai 1-15-1, Nakano-ku, Tokyo 164	03-376-1251
	Chitosedai 1-27-8, Setagaya-ku, Tokyo 157	03-484-2517

Present affiliation

* Inojiri Marine Biological Laboratory, Kochi University Inojiri 194, Usa-cho, Tosa-shi, Kochi 781-04	0888-56-3311
Inojiri 217-3, Usa-cho, Tosa-shi, Kochi 781-11	0888-56-3127
** Doris Marine Development Chitosedai 1-27-8, Setagaya-ku, Tokyo 157	03-484-2517

III. TRACK CHARTS OF THE HAKUHO MARU CRUISE KH-81-4

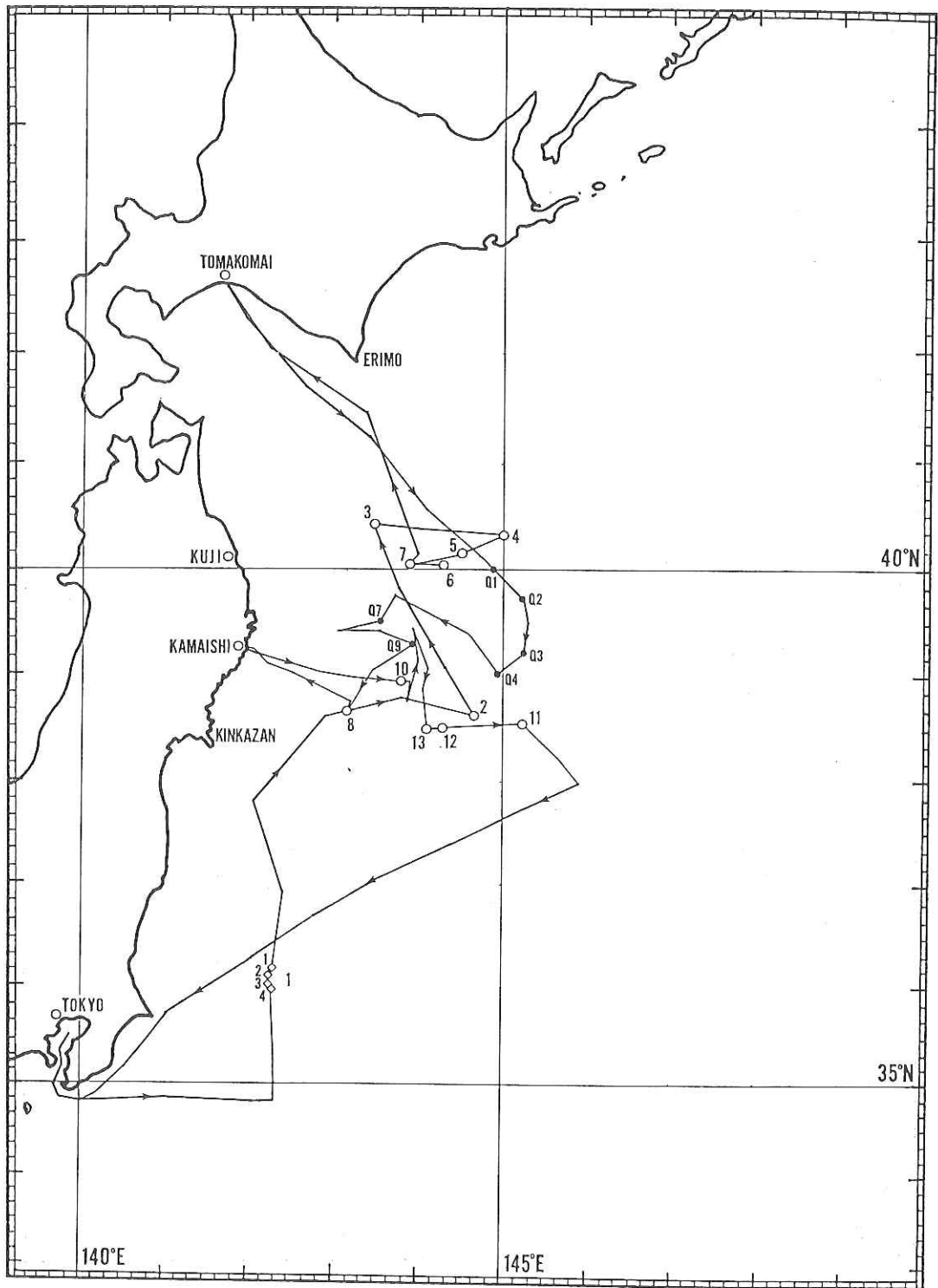


Fig. 1. Tracks and location of stations of the cruise KH-81-4.

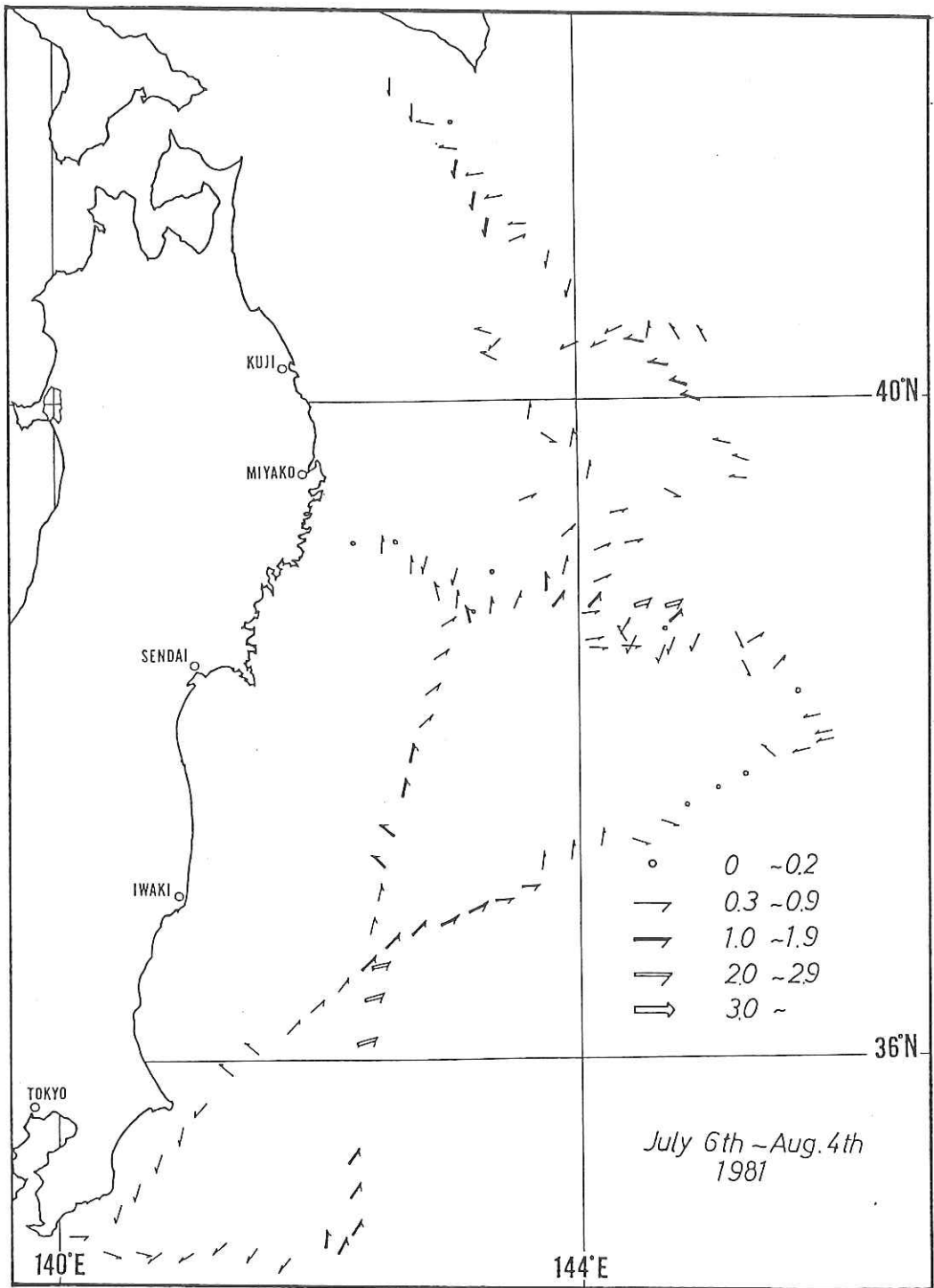


Fig. 2. Surface currents observed during the cruise KH-81-4.

IV. STATION LISTS

4-1. Station lists of benthic studies

Beam trawl	[Table 1]
Epibenthic sledge	[Table 2]
Box (Spade) corer	[Table 3]
Underwater photography	[Table 4]

4-2. Station lists of plankton and micronekton studies

Plankton studies of the Tohoku Region	[Table 5]
NORPAC twin net hauls (Leg 1)	[Table 6]
MTD (Motoda's Multiple Horizontal Tow Net) hauls	[Table 7]
LHPR (Longhurst-Hardy Plankton Recorder) observations	[Table 8]
SFTD (Scatter-Fluorescence-Temperature-Depth Recorder) observations	[Table 9]
Indian Ocean Standard net (IIOE) hauls	[Table 10]
Bongo net hauls	[Table 11]
10-foot IKMT (Isaacs-Kidd Midwater Trawl) hauls	[Table 12]
NORPAC twin net hauls (Leg 2)	[Table 13]

4-3. Station list of hydrographic observations

CTD observations	[Table 14]
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Table 1. Station list of beam trawl operations.

St. No.	Area	Date	Time of operation	Time on bottom	Ship Position	Depth range (corrected)	Type of gear	Remarks
3	off Kuji	'81.7.10	12:35-15:19	13:18-14:40	40°22.1'N; 143°22.8'E - 40°21.7'N; 143°25.2'E	1970-2000 m (1997-2027 m)	4 m ORE beam trawl	2500m wire out
6	off Kuji	'81.7.13-14	19:00-07:04	22:15-03:11	40°02.3'N; 144°19.4'E - 40°07.3'N; 144°21.4'E	7420-7440 m (7347-7366 m)	4 m ORE beam trawl	9500m wire out
7 - I	off Kuji	'81.7.15	08:20-13:34	09:54-11:47	40°06.8'N; 143°58.2'E - 40°04.5'N; 143°57.2'E	4200-4220 m (4221-4241 m)	4 m ORE beam trawl	5300m wire out
7 - II	off Kuji	'81.7.16	06:35-11:35	07:56-09:57	40°07.2'N; 143°58.1'E - 40°05.0'N; 143°57.6'E	4170-4210 m (4192-4231 m)	3 m ORE beam trawl	5800m wire out
8	off Kinkazan	'81.7.25	12:22-16:00	13:44-15:15	38°44.0'N; 143°11.1'E - 38°46.3'N; 143°12.0'E	1950-1960 m (1976-1987 m)	4 m ORE beam trawl	3300m wire out
10	off Kinkazan	'81.7.27	10:10-15:02	11:59-13:52	39°11.3'N; 143°54.4'E - 39°13.3'N; 143°56.3'E	5010-5100 m (5017-5105 m)	3 m ORE beam trawl	6300m wire out
11	off Kinkazan	'81.8.01	10:25-15:55	12:22-14:41	38°33.9'N; 145°15.7'E - 38°35.5'N; 145°15.1'E	5350-5370 m (5349-5368 m)	4 m ORE beam trawl	7300m wire out
12	off Kinkazan	'81.7.31	09:52-15:07	11:17-13:31	38°33.3'N; 144°19.4'E - 38°35.4'N; 144°20.3'E	6380-6450 m (6348-6416 m)	4 m ORE beam trawl	8100m wire out
13	off Kinkazan	'81.7.29	11:42-17:00	14:00-17:15	38°30.2'N; 144°06.6'E - 38°31.6'N; 144°06.4'E	7420-7450 m (7347-7375 m)	4 m ORE beam trawl	9700m wire out

Table 2. Station list of epibenthic sledge operations.

St. No.	Area	Date	Time of operation	Time on bottom	Ship Position	Depth range (corrected)	Wire out
3	off Kuji	'81.7.10	15:40-17:27	16:19-16:50	40°21.4'N; 143°23.5'E - 40°21.4'N; 143°22.8'E	1948-1980 m (1975-2007 m)	2300m
7	off Kuji	'81.7.15	14:15-17:45	15:54-16:22	40°05.3'N; 143°07.6'E - 40°05.7'N; 143°57.4'E	4170-4170 m (4192-4192 m)	4400m
8	off Kinkazan	'81.7.26	00:20-02:52	01:07-02:11	38°03.9'N; 143°09.3'E - 38°44.9'N; 143°09.6'E	1890-1900 m (1916-1926 m)	2300m

Table 3. Station list of spade corer (1/4m² USNEL type) operations.

St. No.	Date	Time of operation	Time on bottom	Ship Position	Depth range (corrected)	Wire out	Core depth	Sediment temperature	Sediment	Remarks
3	'81.7.10	10:10-11:50	11:10	40°11.0'N; 144°26.6'E	1956m (1983m)	1967m	25cm	5.0°C	Gravelly, sandy mud	
6	'81.7.14	08:10-13:24	10:50	40°04.7'N; 144°21.0'E	7440m (7366m)	7569m	—	—	—	Trigger failed
6'	'81.7.14	14:34-18:47	17:00	40°03.2'N; 144°19.2'E	7440m (7366m)	7651m	40cm	3.7°C	Soft mud with sand Laminae at depth (-20cm)	
7	'81.7.16	12:49-15:37	14:20	40°05.7'N; 143°57.5'E	4170m (4920m)	4235m	35cm	2.3°C	Mud with very thin sand Laminae	
8	'81.7.25	17:00-18:16	17:44	38°44.3'N; 143°11.7'E	1965m (1992m)	1980m	—	—	—	Failed to trigger, but entered sediment
10	'81.7.27	15:54-18:42	17:32	39°11.9'N; 143°55.8'E	5150m (5154m)	5248m	—	—	—	Crane wire mistake, sample dropped overboard
10'	'81.7.28	08:30-10:45	09:34	39°12.0'N; 143°54.9'E	5120m (5125m)	5209m	ca. 5cm	—	Mudstone	Sedimentary rock
11	'81.8.1	06:30-09:30	08:17	38°35.3'N; 145°14.8'E	5370m (5369m)	5472m	30cm	2.0°C	Mud	Water sampler failed
12	'81.7.30	11:29-15:00	13:32	38°32.2'N; 144°19.9'E	6380m (6348m)	6524m	25cm	4.0°C*	Gravelly, sandy mud	One water sampler broken
13	'81.7.29	06:36-10:56	09:08	38°31.0'N; 144°06.5'E	7460m (7386m)	7676m	40cm	2.4°C	Soft mud, with sandy, shelly Laminae at depth (21-23cm)	Water samplers failed

* after one hour in the sun

Table 4. Station list of underwater camera operations.

St. No.	Area	Date	Time of operation	Time on bottom	Ship Position	Depth range (corrected)	Remarks
3	off Hachinohe	'81.7.10	06:58-09:50	07:52'00"- 09:32'28"	40°22.2'N; 143°24.2'E - 40°22.2'N; 143°24.2'E	1974-2007m (2001-2034m)	OK 1.89°C;
6	off Hachinohe	'81.7.14-15	19:25-01:45	-	40°03.0'N; 144°19.1'E - 40°03.0'N; 144°18.8'E	7420-7440m (7347-7366m)	both cameras failed
7	off Hachinohe	'81.7.15-16	23:27-03:33	00:54'07"- 02:34'23"	40°05.3'N; 143°57.4'E - 40°05.2'N; 143°57.1'E	4175-4180m (4197-4202m)	OK 1.44°C; 34.685%
8	off Kinkazan	'81.7.25	20:38-23:40	21:17'16"- 22:57'41"	38°44.5'N; 143°10.7'E - 38°44.7'N; 143°11.1'E	1950-1960m (1977-1987m)	OK 1.87°C;
10	off Kinkazan	'81.7.27-28	23:55-04:40	01:37'59"- 03:17'36"	39°11.8'N; 143°55.3'E - 39°12.0'N; 143°55.8'E	5080-5140m (5085-5144m)	OK
11	off Kinkazan	'81.8.1	16:50-21:47	18:37'24"- 20:15'35"	38°35.0'N; 145°14.2'E - 38°35.3'N; 145°13.2'E	5380-5380m (5378-5378m)	OK 1.59°C;
12	off Kinkazan	'81.7.30-31	20:15-01:42	22:23'35"- 00:03'47"	38°32.4'N; 144°20.7'E - 38°32.4'N; 144°19.5'E	6300-6300m (6271-6271m)	A camera failed 1.73°C;
13(I)	off Kinkazan	'81.7.28-29	23:35-05:00	02:01'27"- 03:40'45"	38°30.9'N; 144°06.2'E - 38°30.5'N; 144°06.1'E	7440-7460m (7366-7386m)	A camera failed 1.92°C;
13(II)	off Kinkazan	'81.7.29-30	21:20-03:21	23:47'42"- 01:28'22"	38°30.2'N; 144°06.2'E - 38°29.9'N; 144°06.2'E	7440-7480m (7366-7399m)	OK 1.92°C;

Table 5. Station list of plankton studies in the subarctic waters off Tohoku.

St. No.	Date	Time of operation	Ship Position	CTD cast	Water samplings	Net samplings
1-1	'81.7.7	19:18-20:54	36°11.1'N; 142°16.4'E	0-1000m	0-100m; 7 layers	150-0m; Vertical haul 100-0m; Vertical haul
1-2	'81.7.7	21:51-23:22	36°08.3'N; 142°17.5'E	0-300m	0-125m; 7 layers	150-0m; Vertical 60-0m; Vertical
1-3	'81.7.8	00:21-02:06	36°05.9'N; 142°18.7'E	0-300m	0-100m; 7 layers	150-0m; Vertical 65-0m; Vertical
1-4	'81.7.8	04:16-07:00	35°58.8'N; 142°18.8'E	0-1000m	0-100m; 7 layers	150-0m; Vertical 50-0m; Vertical

Table 6. Station list of NORPAC twin net hauls (Leg. 1).

St. No.	Date	Time of operation	Ship Position	Wire length (m)	Wire angle (degree)	Sampling depth (m)	Type of netting	Flowmeter No.	Flowmeter revolution
1-1	'81.7.7	20:32	36°11.1'N; 142°16.4'E	154	10	150-0	XX13 GG54	639 491	2000 1990
		20:46	36°11.1'N; 142°16.4'E	154	15	100-0	XX13 GG54	639 491	1130 1268
1-2	'81.7.7	22:58	36°08.3'N; 142°17.5'E	65	22	60-0	XX13 GG54	639 491	940 1124
		23:10	36°08.3'N; 142°17.5'E	167	25	150-0	XX13 GG54	639 491	2234 2308
1-3	'81.7.8	01:49	36°05.9'N; 142°18.7'E	85	40	65-0	XX13 GG54	639 491	1500 1715
		01:54	36°05.9'N; 142°18.7'E	224	48	150-0	XX13 GG54	639 491	4238 5438
1-4	'81.7.8	06:40	35°58.8'N; 142°18.8'E	50	0	50-0	XX13 GG54	639 491	516 578
		06:55	35°58.8'N; 142°18.8'E	170	28	150-0	XX13 GG54	639 491	1775 2209
2	'81.7.9	07:50	38°38.1'N; 144°40.1'E	152	10	150-0	XX13 GG54	639 491	1523 1950
3	'81.7.10	11:55	40°22.4'N; 143°21.5'E	156	15	150-0	XX13 GG54	639 491	1632 1678
5	'81.7.12	19:00	40°21.5'N; 144°28.6'E			150-0	XX13 GG54	639 491	1605 1723
6	'81.7.14	13:27	40°05.9'N; 144°21.3'E	154	13	150-0	XX13 GG54	639 491	1525 1798
7	'81.7.15	18:38	40°05.7'N; 143°57.7'E	190	38	150-0	XX13 GG54	639 491	3528 3738

Table 7. Station list of MTD (Motoda's Multiple Horizontal Towing Net) hauls.

St. No.	Date	Time of operation	Ship Position
2	'81.7.9	13:17-14:57	38°38.5'N; 144°41.8'E - 38°38.3'N; 144°42.3'E
5	'81.7.12	21:04-22:44	40°22.8'N; 144°29.7'E - 40°24.4'N; 144°31.1'E
5	'81.7.13	06:02-07:35	40°25.5'N; 144°34.2'E - 40°25.5'N; 144°33.5'E

Table 8. Station list of LHPR (Longhurst-Hardy Plankton Recorder) towing.

St. No.	Date	Time of operation	Ship Position	Towing method
1-5	'81.7.8	10:33-11:25	36°05.5'N; 142°17.7'E - 36°05.3'N; 142°18.1'E	Horizontal tow
2	'81.7.9	15:35-16:36	38°37.8'N; 144°43.7'E - 38°37.2'N; 144°46.4'E	Oblique tow (0-500m)
5	'81.7.12	10:44-11:40	40°16.9'N; 144°28.3'E - 40°19.9'N; 144°28.6'E	Oblique tow (0-500m)
5	'81.7.12	22:57-24:00	40°25.2'N; 144°31.4'E - 40°28.0'N; 144°31.3'E	Oblique tow (0-500m)

Table 9. Station list of SFTD (Scatter-Fluorescence-Temperature-Depth Recorder) tows.

St. No.	Date	Time of operation	Ship Position	Towing method
1-5	'81.7.8	09:22-11:30	36°06.9'N; 142°17.2'E - 36°05.2'N; 142°18.1'E	Horizontal tow
2	'81.7.9	15:27-16:46	38°38.0'N; 144°43.2'E - 38°37.2'N; 144°46.5'E	Horizontal + Vertical
5	'81.7.12	10:38-11:53	40°16.6'N; 144°28.2'E - 40°19.9'N; 144°28.6'E	Horizontal + Vertical
5	'81.7.12-13	22:51-00:12	40°24.9'N; 144°31.4'E - 40°28.2'N; 144°31.1'E	Horizontal + Vertical

Table 10. Station list of Indian ocean standard net hauls.

St. No.	Date	Time of operation	Wire out (m)	Wire angle (degree)	Towing method	Sampling depth (m)	Water volume filtered (m ³)	Remarks
5-8	'81.7.11-12	20:31-01:20	7000	2	Ver.	0-7000	5741.7	failed *
5-9	'81.7.12	02:02-07:26	7000	3	Ver.	0-7000	—	failed **
12	'81.7.31	03:31-08:20	6300	3	Ver.	4979-6300	844.0	
13	'81.7.30	03:57-09:23	7400	6	Ver.	5053-7400	861.3	

* The net didn't close due to miss tripping of messenger weight.

** The net didn't close due to miss working of the releasing bridle plus flow meter trouble.

Table 11. Station list of Bongo Net hauls.

St. No.	Date	Time of operation	Wire out (m)	Wire angle (degree)	Towing method	Sampling depth (m)	Water volume filtered (m ³)	Remarks
5-1	'81.7.11	10:32-11:53	1000	60	Obl.	0-500	—	failed
5-2	'81.7.11	12:20-13:10	500	60	Obl.	0-250	—	failed *
5-3	'81.7.11	13:35-14:20	500	60	Obl.	0-250	—	failed *
5-4	'81.7.11	14:21-15:14	500	60	Obl.	0-250	—	failed *
5-5	'81.7.11	15:48-16:27	360	45	Obl.	0-250	27.0	
5-6	'81.7.11	16:52-17:30	360	45	Obl.	0-250	36.2	
5-7 (1)	'81.7.11	18:17-19:12			Obl.	0-500	55.2	
5-7 (2)		17:51-19:50	1413	45	Obl.	500-1000	—	duplex operation failed **
5-10 (1)	'81.7.12	08:31-			Obl.	0-250	—	failed *
5-10 (2)		08:50-09:55	1000	60	Obl.	250-500	—	duplex operation failed ***

* The net door didn't open.

** The net door didn't open, and the net was occluded.

*** Release trouble

Table 12. Station list of 10-foot IKMT hauls.

St. No.	Date	Time of operation	Wire out (m)	Towing method	Water volume filtered (m ³)
3-1	'81.7.10	03:15-04:42	2000	Obl.	23266.5
3-2	'81.7.10	05:02-06:37	2000	Obl.	23129.1
4-1	'81.7.11	00:06-01:32	2000	Obl.	27846.6
4-2	'81.7.11	01:42-03:03	2000	Obl.	26871.9
6-1	'81.7.15	01:58-03:30	2000	Obl.	20192.8
6-2	'81.7.15	03:39-05:12	2000	Obl.	23507.9
8	'81.7.26	03:12-04:46	2000	Obl.	19689.4
10	'81.7.26	22:24-23:54	2000	Obl.	19937.8
11	'81.8.01	22:16-23:45	2000	Obl.	17982.0
12	'81.7.31	02:14-03:31	2000	Obl.	16148.8
13	'81.7.29	19:32-20:55	2000	Obl.	24753.0
14	'81.8.02	03:40-05:02	2000	Obl.	16118.0

* Depth recorder didn't work.

Table 13. Station list of NORPAC twin net hauls (Leg 2).

St. No.	Date	Time of operation	Wire out (m)	Wire angle (degree)	Towing method	Sampling depth (m)	Type of netting	Water volume filtered (m ³)
8	'81.7.25	11:56-12:07	158	18	Ver.	0-150	XX13 GG54	22.84 39.26
10	'81.7.27	19:17-19:28	170	27	Ver.	0-150	XX13 GG54	26.60 31.97
11	'81.7.31	21:53-22:03	150	2	Ver.	0-150	XX13 GG54	18.31 21.72
12	'81.7.30	15:11-15:20	173	30	Ver.	0-150	XX13 GG54	26.99 29.03
13	'81.7.28	18:32-18:42	160	20	Ver.	0-150	XX13 GG54	24.10 28.58

Table 14. Station list of CTD observations.

St. No.	Date	Time of oper.	Ship Position	Bottom depth (m)	Obs. depth (db)	Wire out (m)
1-1	'81.7.07	19:18-20:27	36° 11.1'N; 142° 16.7'E	3,860	990	1,000
1-2	'81.7.07	21:51-22:02	36° 08.3'N; 142° 17.8'E	4,000	300	300
1-3	'81.7.08	00:21-22:58	36° 05.8'N; 142° 18.3'E	4,240	290	300
1-4	'81.7.08	04:16-05:04	35° 159.0N; 142° 20.1'E	4,520	1,010	1,000
2	'81.7.09	08:06-11:12	38° 38.1'N; 144° 40.3'E	5,560	3,320	4,000
5	'81.7.12	12:06-16:12	40° 20.6'N; 144° 28.7'E	7,160	5,660	5,500
7	'81.7.15	19:16-22:34	40° 06.9'N; 143° 58.0'E	4,260	4,250	4,240
8	'81.7.25	17:44-19:30	38° 44.1'N; 143° 11.5'E	1,965	1,940	1,940
10	'81.7.27	19:39-23:25	39° 11.7'N; 143° 55.2'E	5,050		5,180
11	'81.7.31	22:09-02:16	38° 34.8'N; 145° 14.8'E	7,440	5,480	5,935
12	'81.7.30	15:39-19:43	38° 32.1'N; 144° 19.3'E	6,430	6,000	5,850
13	'81.7.28	18:52-22:58	38° 30.8'N; 144° 06.7'E	5,370	6,000	5,370

V. STUDY ITEMS AND PRELIMINARY REPORTS

5-1. Studies of megabenthos

5-1-1. Collection of megabenthos and macrobenthos, mainly based on beam trawls and an epibenthic sledge

M. Horikoshi, M. Okiyama, H. Mukai, S. Ohta, H. Hasumoto, E. Tsuchida, D. D. Swinbanks, C. Z. Shyu (ORI, Univ. Tokyo), S. Gamō (Yokohama Nat. Univ.), Y. Sugiura (Dokkyo Univ.), W. Kastoro (LON-LIPI), Y. Machida (Kochi Univ.), S. Irimura (Totsuka High School), H. Minegishi (Att. High School, Nihon Women's Univ.), P. Shin (Hong Kong Fish. Res. Sta.) and M. D. G. Lopez (Mar. Sci. Cent., Univ. Phil.)

Nine hauls of beam trawls (ORE-type semi-balloon shrimp nets of 3m and 4m spans) and 3 hauls of an epibenthic sledge (Sanders-Hessler type of 0.8m span) were carried out at eight stations traversing the axis of the Japan Trench, east off the Sanriku District, northeastern part of the Japanese main island (Tables 1 and 2).

The bathymetry ranged from about 2000m (Stations 3 and 7) on the landward wall of the Japan Trench to the depth of about 7400m (Stations 6 and 13) in the axis of the Japan Trench, including the Pacific Ocean floor of 5350m deep (Station 11). Thus, collection of megabenthos and macrobenthos embraces the lower bathyal, the hadal zones and oceanic basin.

Catches were washed on 1.0mm mesh screen in case of the trawl and on 0.5mm mesh screen in case of the epibenthic sledge, sorted out on board, identified preliminarily, counted and preserved in 10% seawater formalin buffered with borax (later transferred to 70% ethanol) or in 70% ethanol directly. "Gamo's net" is a small conical plankton nets attached to the inside of the trawl nets in order to retain smaller organisms.

Many scientists collaborated in the preparation of gears, trawling operation and sorting of the specimens. In the preparations of the lists of trawl catch (Table 5-1-1-1) and epibenthic catch (Table 5-1-1-2) by S. Ohta and M. Lopez, the following groups of scientists were mainly responsible for the identification of each taxon. However, any of the identification and counting were done only provisionally, so that the lists remain to be rather tentative ones, and should be confirmed by further studies.

A part of the box core (USNEL type) samples and supernatant water were also washed on 0.5mm mesh screen for the study of dominant macrobenthos. The preliminary catch list was included in the *section 5-1-2* (Table 5-1-2-1). Scientists responsible for the identification of each taxon are the same group.

Pisces and cephalopoda: M. Okiyama and Y. Machida
Ophiuroidea: S. Irimura
Mollusca: M. Horikoshi, W. Kastoro and E. Tsuchida
Smaller crustaceans: S. Gamō
Polychaeta: P. Shin, I. Hayashi
Turbellaria: H. Minegishi
Coelenterata: Y. Sugiura
other taxa: S. Ohta and M. Lopez

Table 5-1-1-1-1. Catch list of mega- and macrobenthos collected by beam trawl.

Station 3

Depth Range: 1997-2027m

Date: July 10, 1981

Gear: 4m ORE Beam Trawl

POLYCHAETA	
? Hesionidae	x 1
? Flabelligeridae	x 1
Maldanidae	x 1
Nereidae	x 1
<i>Lumbrineris</i> sp.	x 1
Sabellidae	x 4
Ampharetidae	x 1 (anterior portion only)
? Orbinidae	x 1 (anterior portion only)
<i>Lagis (Pechinaris)</i> sp.	x 3 (with sand tubes)
Terebellidae	x 1
Aphroditidae (<i>Laetmonice</i> sp. ?)	x 13 (two specimens — Shin, others — ORI)
SIPUNCULIDA	
<i>Golfingia</i> sp.	x 6 (in dead sand tubes occupied by <i>Lagis</i> sp.)
NEMERTINEA	
? nemertian worm gen. sp.	x 1
MOLLUSCA	
<i>Lunatia (Pallida) groenlandica</i> Moller	x 2
<i>Lunatia</i> sp.	x 2
<i>Natica (Tectonatica)</i> sp.	x 1
<i>Aforia</i> sp.	x 1
<i>Rectiplanes</i> sp.	x 1
<i>Neadmete</i> sp. a	x 1
<i>Cylichna</i> sp.	x 2
<i>Machaeroplax</i> sp.	x 1
<i>Hazuregyra</i> sp.	x 1
<i>Buccinum</i> (aff. <i>B. pemphigum</i> Dall)	x 3 + 5
<i>Neptunea</i> sp.	x 3 + fragments
<i>Philine</i> sp.	x 4
Scaphopoda	x 2
<i>Portlandia (Portlandiella)</i> cf. <i>beringii</i> (Dall, 1916)	x 6
<i>Yoldiella</i> sp. a	x 2
<i>Limopsis</i> sp.	x fragments
<i>Malletia</i> sp.	x ½
<i>Neilonella</i> sp.	x 1
PYCNOGONIDA	
<i>Colossendeis</i> sp. (<i>C. ? colossea</i> Wilson, 1881)	x
<i>Nymphon</i> sp. a	x
<i>Nymphon</i> sp. b	x
ISOPODA	
<i>Ilyarachna</i> (?) sp.	x 1
<i>Cryptoniscina</i> (sp.)	x 3 (externally parasitizing to <i>Scalpellum</i> sp.)
AMPHIPODA	
<i>Metaphoxus</i> (?) habitus	x 1
CIRRIPEDIA	
<i>Scalpellum</i> sp.	x 1

[to be continued]

((Station 3 continued))

MYSIDACEA

mysid gen. sp. a x 7
mysid gen. sp. b x 11

ANOMURA

Parapagurus pilosimanus scaber Henderson, 1888 x

MACRURA

* *Gennadas* sp. x 1
Nematocarcinus sp. x 1
Crangon sp. (cf. *C. abyssorum* Rathbun, 1912) x 1
damaged, unidentifiable shrimp x 1

CRINOIDEA

Antedon - type 10-armed sea fern x 2

ASTEROIDEA

Eremicaster crassus (Sladen, 1883) x 3
Ctenodiscus crispatus (Retzius, 1805) x 8
Benthopecten spinosus Verrill, 1884 x 1
Hymenaster glaucus Sladen, 1889 x 1

OPHIUROIDEA

Ophiacantha bathybia H.L. Clark, 1911 x 1
Ophiophthalmus normani (Lyman, 1879) x 13
Amphiura koreae Duncan, 1879 x 4
Ophiocten hastatum Lyman, 1878 x 40

PISCES

Coryphaenoides acrolepis (Bean, 1883) x 2
Antimora microlepis Bean, 1891 x 1
* Melamphasidae gen sp. x 1
* *Chauliodus* sp. x 1
* Myctophidae gen. sp. a x 1
* Myctophidae gen. sp. b x 1
* *Cyclothone* sp. x 1
* Ceratioidea gen. sp. x 1

Table 5-1-1-1-2. Catch list of mega- and macrobenthos collected by beam trawl.

Station 6	Depth Range: 7347-7366m
	Date: July 13-14, 1981
	Gear: 4m ORE Beam Trawl
ANTHOZOA	
grey, rugose sea anemone	x 7
POLYCHAETA	
? <i>Macellicephala</i> / <i>Macellicephaloides</i> sp.	x 27 (some badly smashed 2-Shin; others-ORI)
Opheliidae (<i>Travisia</i> sp. ?)	x 123 (6-Shin; others-ORI)
Phyllodocidae	x 1
<i>Lumbrineris</i> sp.	x 4
Nereidae	x 3
Capitellidae (<i>Notomastus</i> sp. ?)	x 64 (6-Shin; others-ORI)
Terebellidae	x 3
Cirratulidae	x 22 (with fragments)
Cirratulidae	x 358 (in 0.5 mm fraction with fragments, etc)
ECHIUROIDEA	
Bonellidae gen. sp.	x 2
PRIAPULOIDA	
<i>Priapulid</i> (<i>P. tubereolatospinosus abyssorum</i>)	x 3
MOLLUSCA	
<i>Scaphander</i> sp.	x 1
<i>Dentalium</i> (<i>Striodentalium</i>) sp.	x 1
<i>Kelliella</i> sp. a	x 1426
<i>Axinulus</i> sp. a	x 279
<i>Yoldiella</i> sp. b	x 125
<i>Neilonella</i> sp.	x 308
[in Gamo's net]	
<i>Admete</i> sp. b	x 1
<i>Yoldiella</i> sp. b	x 12
<i>Kelliella</i> sp. a	x 476
<i>Neilonella</i> sp. a	x 37
<i>Axinulus</i> sp. a	x 1
ISOPODA	
<i>Storothyngura</i> sp.	x ca. 20 (with fragments)
<i>Storothyngura</i> ? sp. a	x 1
NEBALIACEA	
<i>Nebalia</i> sp.	x 1
CUMACEA	
<i>Leptostylis</i> ? <i>spinescens</i> Gamø, 1987	x 1
AMPHIPODA	
<i>Metaphaxus</i> ? habitus	x 12
HOLOTHURIOIDEA	
<i>Mesothuria</i> ? <i>murrayi</i> (Theel, 1886)	x 306
? <i>Hadalothuria wolffi</i> Hansen, 1956	x 29
<i>Peniagone</i> sp. (cf. <i>P. wyvilli</i> Theel, 1882)	x 306
<i>Elpidia glacialis kurilensis</i> Baranova et Belyaev, 1971	x 638
PISCES	
<i>Careproctus amblystomopsis</i> Andriashev, 1955	x 8
* <i>Chauliodus</i> sp.	x 1

* indicates mesopelagic component

Table 5-1-1-1-3. Catch list of mega- and macrobenthos collected by beam trawl.

Station 7-I

Depth Range: 4221-4241m

Date: July 15, 1981

Gear: 4m ORE Beam Trawl

SCYPHOSTOMA	
<i>Periphylla hiacynthina</i> Steenstrup	x 1
ANTHOZOA	
Gorgonian with hollow chocolate stem	x 20
<i>Calibelemnon</i> sp.	x 9
<i>Umbellula thomsoni</i> Kolliker, 1874	x 4
sea anemone (red, soft)	x 38
sea anemone (yellow, rugose)	x 18
sea anemone (white, small)	x 5
sea anemone (white, large)	x 5
madreporalian coral	x 1
POLYCHAETA	
Lumbrineridae	x 13 (perhaps more than 1 species)
? <i>Sthenelais</i> sp.	x 54 (head with pale red color when alive)
Glyceridae	x 6
Ampharetidae	x 1
Maldanidae A	x 2
Maldanidae B	x 1
Sabellidae	x 2 (in mud tubes)
ECHIUROIDA	
Bonellidae gen. sp.	x 9
grey, long echiuran worm	x 1
SIPUNCUROIDA	
sipunculid worm gen. sp.	x 1
MOLLUSCA	
<i>Ancistrolepis</i> sp. a	x 5 + 2
<i>Ancistrolepis</i> sp. b	x 1
<i>Buccinum</i> sp.	x 1
<i>Seguenzia</i> sp.	x 11
<i>Lunatia</i> sp. a	x 4
<i>Lunatia</i> sp. b	x 5
<i>Lunatia</i> sp. c	x 2
<i>Lunatia</i> sp. d	x 1
<i>Trophonopsis</i> sp. a	x 1
<i>Pleurotomella</i> sp.	x 1
<i>Oenopota (Funitoma)</i> sp. c	x 1
<i>Oenopota (Funitoma)</i> sp. d	x 1
<i>Nematoma</i> sp.	x 13
<i>Admete (Admete)</i> sp.	x 4
<i>Hazuregyra</i> sp.	x 1
Pteropoda	x 1
<i>Cadulus (Polyschides)</i> sp.	x 25
<i>Dentalium (Laevidentalium) sominium</i> Okutani, 1964	x 10
Naticidae	x 1
<i>Cardiomya</i> sp.	x 3
<i>Kelliella</i> sp. a	x 279
<i>Lyonsiella</i> sp. a	x 4
<i>Cyclopecten</i> sp. a	x 6
<i>Axinulus</i> sp. a	x 4
<i>Axinulus</i> sp. b	x 1
<i>Xylophaga</i> sp.	x 3
<i>Neilonella</i> sp. b	x 1

[to be continued]

((Station 7-I continued))

<i>Neilonella</i> sp. c	x 9
<i>Neilonella</i> sp. d	x 1
Mallettiidae	x 1
[in Gamo's net]	
<i>Cyclopecten</i> sp. a	x 2
<i>Kelliella</i> sp. a	x 1
<i>Neilonella</i> sp.	x 1
Pelecypoda	x 1
PYCNOGONIDA	
<i>Nymphon</i> sp. c	x 1
CUMACEA	
<i>Leucon</i> sp. b	x 1
<i>Makrokyllindrus</i> (<i>Coalescuma</i>) sp. a	x 1
<i>Makrokyllindrus</i> (<i>Coalescuma</i>) sp. c	x 1
<i>Makrokyllindrus</i> (<i>Makrokyllindrus</i>) sp. b	x 1
TANAIDACEA	
<i>Apseudes</i> (?) sp.	x 4
aff. <i>Neotanais</i> sp.	x 1
ISOPODA	
<i>Eurycope</i> sp.	x 1
AMPHIPODA	
<i>Melita</i> sp. (St. 7-BT)	x 3
<i>Ampelisca</i> habitus sp. (St. 7-BT)	x 42
<i>Metaphoxus</i> habitus sp.	x 12
Lysianassidae sp. (St. 7-BT)	x 1
gen. ? sp. ?	x 2
MACRURA	
<i>Plesiopenaeus armatus</i> Bate, 1881	x 1
<i>Sclerocrangon zenkevitchi</i> Birstein et Vinogradov, 1953	x 37
ASTEROIDA	
<i>Eremicaster crassus</i> (Sladen, 1883)	x 1
<i>Luidiaster</i> sp. a	x 22
<i>Dytaster</i> sp.	x 1
OPHIUROIDEA	
<i>Amphiura patens</i> Lyman	x 1
<i>Ophiura bathybia</i> H.L. Clark, 1911	x 201
ECHINOIDEA	
<i>Pourtalesia</i> sp. a (small, brown)	x 4
<i>Aceste</i> sp. (small, not constricted)	x 10
<i>Echinocrepis</i> sp. (large, purple, triangular spatangoid)	x many fragments (ca. 10?)
<i>Pourtalesia</i> sp. (medium-sized, bottle-shaped, purple spatangoid)	x ca. 5?
HOLOTHURIOIDEA	
<i>Peniagone wyvilli</i> Theel, 1882	x 2
<i>Ypsilothuria bitentaculata</i> (Ludwig, 1894)	x 134
<i>Molpadia musculus</i> Risso, 1826	x 17
PISCES	
<i>Synaphobranchus</i> sp.	x 1
<i>Coryphaenoides armatus</i> Hector, 1875	x 3
<i>Coryphaenoides yaquinae</i> Iwamoto et Stein, 1974	x 5
Zoarcidae gen. sp.	x 1
* Melamphasidae gen. sp.	x 1
* <i>Cyclothone</i> sp.	x 1
* Myctophidae gen. sp.	x 1

* indicates mesopelagic components

Table 5-1-1-1-4. Catch list of mega- and macrobenthos collected by beam trawl.

Station 7-II	Depth Range: 4192-4231 m
	Date: July 16, 1981
	Gear: 3 m ORE Beam Trawl
<hr/>	
ANTHOZOA	
sea anemone (red, soft)	x 14
sea anemone (yellow, rugose)	x 1
sea anemone (white)	x 3
POLYCHAETA	
Terebellidae	x 2 (smashed)
Sabellidae	x 2
Maldanidae	x 2
Ampharetidae	x 1
Opheliidae (<i>Travisia</i> sp.)	x 2
? <i>Sthenelais</i> sp.	x 6
Lumbrineridae (<i>Lumbrineris</i> sp.)	x 7 (fragments)
ECHIUROIDA	
Bonellidae gen. sp.	x 3 (= St. 7-I)
MOLLUSCA	
<i>Cocculina</i> sp.	x 14
<i>Ancistrolepis</i> sp. a	x 3
<i>Ancistrolepis</i> sp. b	x 2
<i>Neptunea</i> sp.	x 1
<i>Lunatia</i> sp. a	x 3
<i>Lunatia</i> sp. e	x 5
<i>Lunatia</i> sp. b	x 2
<i>Seguenzia</i> sp.	x 4
<i>Oenopota</i> (<i>Funitoma</i>) sp. a	x 1
<i>Nematoma</i> sp.	x 4
<i>Daphnella</i> sp. a	x 1
<i>Daphnella</i> sp. b	x 1
<i>Margarites</i> sp.	x 1
Trochidae	x 1
<i>Admete</i> sp.	x 2
<i>Admete</i> sp. 1	x 1 (young)
<i>Admete</i> sp. 2	x 1
<i>Cavolinia</i> sp.	x 1
Gastropoda 1	x 3
Gastropoda 2	x 7
Gastropoda 3	x 1
Gastropoda 4	x 1
<i>Dentalium</i> (<i>Laevidentalium</i>) <i>sominium</i> Okutani, 1964	x 8
<i>Cadulus</i> (<i>Polyschides</i>) sp.	x 20
Scaphopoda	x 20
<i>Kelliella</i> sp. a	x 94
<i>Cyclopecten</i> sp. a	x 4
<i>Cardiomya</i> sp. a	x 3
<i>Lyonsiella</i> sp. b	x 1
<i>Axinulus</i> sp. a	x 100
<i>Axinulus</i> sp. b	x 78
<i>Axinulus</i> sp. c	x 161
<i>Neilonella</i> sp. d	x 31
<i>Xylophaga</i> sp.	x 2

[to be continued]

((Station 7-II continued))	
[from Gamo's net]	
<i>Axinulus</i> sp. b	x 5
<i>Kelliella</i> sp. a	x 1
Gastropoda	x 1
ECHIUROIDA	
Bonellidae gen. sp.	x 3 (= St. 7-I)
CUMACEA	
<i>Leucon</i> sp. c	x 1
TANAIDACEA	
<i>Apseudes</i> (?) sp.	x 2
ISOPODA	
<i>Haploniscus</i> sp. (? <i>pseudounicornis</i>)	x 4
AMPHIPODA	
<i>Melita</i> sp. (= St. 7-BT)	x 2
<i>Ampelisca</i> habitus sp. (= St. 7-BT)	x 5
Lysianassidae sp. (= St. 7-BT)	x 1
MYSIDACEA	
mysid gen. sp. a	x 1
mysid gen. sp. b	x 1
mysid gen. sp. c	x 3
MACRURA	
* <i>Gennadas</i> sp.	x 1
<i>Hemipenaeus spinidorsalis</i> Bate, 1881	x 3
<i>Benthesicymus</i> cf. <i>crenatus</i> Bate, 1881	x 2
<i>Sclerocrangon zenkevitchi</i> Birstein et Vinogradov, 1953	x 7 (= St. 7-I)
ASTEROIDEA	
<i>Eremicaster crassus</i> (Sladen, 1883)	x 6
<i>Luidiaster</i> sp. a	x 5
OPHIUROIDEA	
<i>Ophiura bathybia</i> H.L. Clark, 1911	x 73
ECHINOIDEA	
<i>Pourtalesia</i> sp. a	x 88
<i>Aceste</i> sp.	x 7
<i>Echinocrepis</i> sp. (large, purple, triangular spatangoid)	x 1
<i>Pourtalesia</i> sp. (medium, bottle-shaped, purple spatangoid)	x 6
HOLOTHURIOIDEA	
<i>Elpidia theeli</i> Hansen, 1956	x 3
<i>Ypsilothuria bitentaculata</i> (Ludwig, 1894)	x
<i>Molpadia musculus</i> Risso, 1826	x 12
PISCES	
* Myctophidae gen. sp.	x 1
* Melanostomiidae gen. sp.	x 1

* indicates mesopelagic components

Table 5-1-1-1-5. Catch list of mega- and macrobenthos collected by beam trawl.

Station 8

Depth Range: 1976-1987m

Date: July 25, 1981

Gear: 4m ORE Beam Trawl

POLIFERA	
<i>Farrea</i> sp.	x 1
COELENTERATA	
white sea anemone	x 2
orange-red sea anemone	x 2
slender sea anemone with sand grain	x 4
POLYCHAETA	
Nephtyidae	x 3
Maldanidae A	x 13 (counted only anterior portions)
Maldanidae B (smaller than A; anal cone different)	x 3
Sabellidae A	x 36 (11-Shin; others-ORI)
Sabellidae B	x 6 (in mud tubes)
Sabellidae C	x 2
Serpulidae	x 7 (on rocks; more than 7)
? Aphrodita sp.	x 3 (1-Shin; others-ORI)
Aphroditidae (<i>Laetmonice</i> sp.)	x 16 (2-Shin; others-ORI)
Glyceridae	x 1
Opheliidae (<i>Travisia</i> sp.)	x 9 (3-Shin; others-ORI)
? Polychaeta	x 2 (further check required)
BRACHIOPODA	
Brachyopoda gen. sp.	x 12
MOLLUSCA	
<i>Buccinum</i> sp. (aff. <i>B. pemphigum</i> Dall)	x 25 + 6
<i>Neptunea</i> sp. b	x 2
<i>Neptunea</i> sp. (aff. <i>N. leticostata</i> Golikov)	x 1
<i>Ancistrolepis trochoides</i> (Dall)	x 1 + 1
<i>Buccinum</i> sp. 1	x 1
<i>Buccinum</i> sp. 2	x 3
<i>Buccinum</i> sp.	x 3
<i>Trophonopsis</i> sp. b	x 4
<i>Taranis corneus</i> Okutani, 1966	x 20
<i>Aforia</i> sp. 1	x 1
<i>Aforia</i> sp.	x 3
Turrid shell	x 3
<i>Oenopota (Funitoma)</i> sp. e	x 9
Turrid shell	x 1
<i>Antiplanes (Rectaplanes)</i> sp.	x 16
<i>Bathytoma (Riuguhdrillia)</i> sp.	x 1
Turrid shell	x 1
<i>Lunatia</i> sp. 1	x 27
<i>Lunatia</i> sp. 2	x 26
<i>Lunatia</i> sp. 3	x 2
<i>Margarites</i> sp. 2	x 1
<i>Seguenzia</i> sp. b	x 36
<i>Cylichna</i> sp.	x 8
<i>Lepeta</i> sp.	x 1
Fissurellidae	x 4
* Pteropoda gen. sp.	x 2

[to be continued]

((Station 8 continued))

Chiton 1	x 1
Chiton 2	x 4
Scaphopoda 1	x 11
Scaphopoda 2	x 11
Scaphopoda 3	x 4
<i>Portlandia (Portlandiella) cf. beringii</i> Dall	x 7
<i>Musculus</i> sp. a	x 6
<i>Neilonella</i> sp.	x 20
<i>Cuspidaria</i> sp.	x 1
<i>Pecten</i> sp.	x 1
<i>Lyonsiella</i> sp.	x 4
[from Gamo's net]	
<i>Lunatia</i> sp. 1	x 1
<i>Lunatia</i> sp. 4	x 1
<i>Aforia</i> sp. 1	x 1
<i>Aforia</i> sp. 2	x 1
<i>Acteon</i> sp.	x 4
<i>Seguenzia</i> sp. b	x 5
<i>Cylichna</i> sp. 2	x 1
<i>Scaphander</i> sp.	x 3
Gastropoda 1 & 2	x 1 (each)
Scaphopoda a	x 3
Scaphopoda b	x 8
Scaphopoda c	x 16
<i>Neilonella</i> sp.	x 1
<i>Neilonella</i> sp.	x 11
<i>Musculus</i> sp. b	x 1
<i>Musculus</i> sp.	x 6
<i>Axinulus</i> sp. c	x 3
PYCNOGONIDA	
<i>Colossendeis colossea</i> Wilson, 1881	x 43
<i>Colossendeis</i> sp.	x 6
<i>Nymphon</i> sp.	x 2
<i>Achelia</i> -type	x 4
<i>Ascorhynchus japonicum</i> Ives, 1892	x 117
CIRRIPEDIA	
<i>Scalpellum</i> sp.	x 4
CUMACEA	
<i>Diastylis</i> sp. d	x 9
<i>Campylaspis</i> sp.	x 1
TANAIDACEA	
aff. <i>Neotanais</i> 2 spp.	x 6
gen. ? sp. ?	x 1
ISOPODA	
<i>Antarcturus</i> sp. a?	x 3
<i>Antarcturus</i> sp. b?	x 1
<i>Antarcturus</i> sp. d	x 3
<i>Synidothea</i> (?) sp.	x 3
gen. sp. a (Sphaeromatidae)	x 90
gen. sp. b (Sphaeromatidae)	x 1
aff. <i>Ioella</i>	x 2
<i>Munnopsis</i> sp.	x 2
AMPHIPODA	
<i>Uschakoviella echinophora</i> ?	x 1
<i>Epimeria</i> sp.	x 2
aff. <i>Acanthogoma</i> ? sp.	x 3

[to be continued]

((Station 8 continued))	
<i>Rhachotropis habitus</i> sp.	x 6
<i>Melita</i> ? sp.	x 1
aff. <i>Orchonaene</i> (?) sp.	x 23
MACRURA	
* <i>Sergia</i> sp.	x 1
* <i>Gennadas</i> sp.	x 1
<i>Nematocarcinus</i> sp.	x 1
<i>Crangon</i> sp. (cf. <i>C. abyssorum</i> Rathbun, 1912)	x 1
BRACHYURA	
<i>Chinoecetes angulatus</i> Rathbun, 1924	x 10
<i>Ethusa</i> sp.	x 1
ANOMURA	
<i>Parapagurus pilosimanus scaber</i> Henderson, 1888	x 6
CRINOIDEA	
<i>Antedon</i> -type sea fern (10-armed)	x 15
ASTEROIDEA	
<i>Eremicaster crassus</i> (Sladen, 1883)	x 42
<i>Ctenodiscus crispatus</i> (Retzius, 1805)	x 26
<i>Benthopecten spinosus</i> Verrill, 1884	x 1
<i>Hymenaster glaucus</i> Sladen, 1889	
<i>Pteraster</i> sp. (red brim)	x 1
<i>Solaster</i> sp. a (with spiny comb)	x 5
<i>Solaster</i> sp. b (yellow, 9-11 armed)	x 26
<i>Henricia</i> sp.	x 1
<i>Hippasteria</i> sp.	x 1
<i>Aseudarchaster</i> -type	x 1
ECHINOIDEA	
<i>Brisaster latifrons</i> A. Agassiz, 1898	x 2
OPHIUROIDEA	
<i>Ophiacantha bathybia</i> H.L. Clark, 1911	x 26
<i>Ophiophthalmus normani</i> (Lyman, 1879)	x 63
<i>Amphiura koreae</i> Duncan, 1879	x 1754
<i>Ophiocten hastatum</i> Lyman, 1878	x 1883
<i>Asteronyx loveni</i> Muller et Troschel, 1842	x 3
Ophiomyxidae gen. sp.	x 1
HOLOTHURIOIDEA	
<i>Pseudostichopus</i> sp. b	x 745
<i>Pseudostichopus</i> sp. c	x 11
<i>Pseudostichopus</i> sp. d	x 1
<i>Paelopatides</i> sp.	x 6
Dendrochirota gen. sp.	x 1
<i>Psolus</i> sp. a	x 2
PISCES	
<i>Synaphobranchus</i> sp.	x 2
<i>Rouleina</i> sp.	x 1
<i>Coryphaenoides acrolepis</i> (Bean, 1883)	x 11
<i>Coryphaenoides cinereus</i> (Gilbert, 1893)	x 16
<i>Coryphaenoides longifilis</i> Günther, 1877	x 9
<i>Antimora microlepis</i> Bean, 1891	x 2
<i>Spectrunculus grandis</i> Günther, 1877	x 1
<i>Porogadus</i> sp.	x 1
Zoarcidae gen. sp.	x 1
* <i>Chauliodus</i> sp.	x 1
* Myctophidae gen. sp.	x 1

* indicates mesopelagic elements

Table 5-1-1-1-6. Catch list of mega- and macrobenthos collected by beam trawl.

Station 10	Depth Range: 5017-5105m
	Date: July 27, 1981
	Gear: 3m ORE Beam Trawl
COELENTERATA	
<i>Umbellula thomsoni</i> Kolliker, 1874	x 1
white sea anemone on a twig	x 2
POLYCHAETA	
Opheliidae (<i>Travisia</i> sp. ?)	x 3
Opheliidae (<i>Travisia</i> sp. ?)	x 16 (small; Gamo's net)
Aphroditidae (<i>Laetmonice</i> sp. ?)	x 2 (badly smashed)
Cirratulidae	x 4 (from Gamo's net)
Maldanidae	x 2 (from Gamo's net)
ECHIUROIDA	
echiurid worm in a mud tube	x 10 (= St. 11)
MOLLUSCA	
<i>Neptunea</i> sp. c	x 4
<i>Buccinum</i> sp. 3	x 1
<i>Ancistrolepis</i> sp. 2	x 2
<i>Ancistrolepis</i> sp. 3	x 1
<i>Lunatia</i> sp. 4	x 6
<i>Seguenzia</i> sp. c	x 1
<i>Cylichna</i> sp. 3	x 1
Gastropoda	x 1
<i>Kelliella</i> sp. a	x 1
Pelecypoda	x 10
[from Gamo's net]	
<i>Admete</i> sp. 1	x 9
<i>Admete</i> sp. 2	x 1
<i>Seguenzia</i> sp. d	x 2
<i>Lunatia</i> sp.	x 1
<i>Scaphander</i> sp. 1	x 1
<i>Scaphander</i> sp. 2	x 10
Gastropoda	x 1
Gastropoda	x 4
Gastropoda	x 1
Pteropoda	x 2
<i>Axinulus</i> sp. b	x 1
<i>Axinulus</i> sp. c	x 2
<i>Kelliella</i> sp. a	x 1
Pelecypoda	x 3
Scaphopoda	x 1
PYCNOGONIDA	
<i>Nymphon</i> sp.	x 1
LOWER CRUSTACEA	
aff. <i>Protomina</i> sp.	x 1
MYSIDACEA	
mysid gen. sp.	x 1
MACRURA	
* <i>Sergia</i> sp.	x 4
* <i>Gennadas</i> sp.	x 2
<i>Plesionika</i> sp.	x 1
ASTEROIDEA	

[to be continued]

((Station 10 continued))

<i>Eremicaster crassus</i> (Sladen, 1883)	x 2
<i>Dytaster</i> sp.	x 13
OPHIUROIDEA	
<i>Ophiacantha bathybia</i> H.L. Clark, 1911	x 3
<i>Ophiura bathybia</i> H.L. Clark, 1911	x 108
ECHINOIDEA	
<i>Kamptosoma asterias</i> A. Agassiz, 1881	x 5
HOLOTHURIOIDEA	
<i>Psychropotes raripes</i> Ludwig, 1893	x 1
<i>Peniagone azorica</i> von Marenzeller, 1894	x 19
<i>Peniagone</i> sp. b	x 1
<i>Molpadia</i> sp. a	x 6
<i>Molpadia</i> sp. b	x 4
PISCES	
<i>Coryphaenoides yaquinae</i> Iwamoto et Stein, 1974	x 1
Zoarcidae gen. sp.	x 1
* Myctophidae gen. sp.	x 1
* <i>Gonostoma gracile</i> Günther, 1878	x 1

* indicates mesopelagic elements

Table 5-1-1-1-7. Catch list of mega- and macrobenthos collected by beam trawl.

Station 11

Depth Range: 5349-5368m

Date: August 1, 1981

Gear: 4m ORE Beam Trawl

COELENTERATA

white, giant, rugose sea anemone	x 2
sea anemone attached flat to pumice	x 24
<i>Bathypathes</i> sp. (Anthipatharian coral)	x 2 colonies
<i>Umbellula durissima</i> Kolliker, 1880	x 3
<i>Umbellula thomsoni</i> Kolliker, 1874	x 128
solitary coral (? <i>Fungiacyathus</i>)	x 40

POLYCHAETA

Aphroditidae (<i>Laetmonice</i> sp. ?)	x 11 (2-Shin; others-ORI)
Opheliidae (<i>Travisia</i> sp. ?)	x 2 (all - ORI)
? Ampharetidae	x 2 (fragments only)
? Other Polychaete fragments	x 4
Maldanidae	x 3 (all are fragments)

ECHIUROIDA

echiurid worm in a mud tube	x 30 (= St. 10)
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MOLLUSCA

<i>Trophonopsis</i> sp.	x 1
<i>Admete</i> sp.	x 3
<i>Aforia</i> sp.	x 1
<i>Oenopota (Funitoma)</i> sp.	x 7
Turrid shell	x 2
Turrid shell	x 1
Turrid shell	x 3
Turrid shell	x 3
<i>Ancistrolepis</i> sp.	x 2
<i>Buccinum</i> sp.	x 1
<i>Lunatia</i> sp. 4	x 4 + 2
<i>Lunatia</i> sp. 5	x 1
<i>Lunatia</i> sp. 6	x 1
Trochidae	x 1
<i>Turritella</i> sp.	x 1
<i>Platyschides</i> sp.	x 1
Scaphopoda	x 2
Scaphopoda	x 2
Scaphopoda	x 2
<i>Kelliella</i> sp. a	x 15
<i>Neilonella</i> sp.	x 2
<i>Cuspidaria</i> sp.	x 1
Pelecypoda	x 4
<i>Spinula oceanica</i> Filatova	x 14
[from Gamo's net]	
Turrid shell	x 4
Turrid shell	x 2
<i>Scaphander</i> sp.	x 3
Scaphopoda	x 2
Gastropoda	x 1
Gastropoda	x 1
<i>Cavolinia</i> sp.	x 1
<i>Kelliella</i> sp. a	x 26

[to be continued]

((Station 11 continued))	
<i>Neilonella</i> sp.	x 2
Pelecypoda	x 4
Pelecypoda	x 1
PYCNOGONIDA	
<i>Colossendeis</i> sp. (white, giant-sized)	x 1
MACRURA	
* <i>Gennadas</i> sp.	x 3
? <i>Aristeus</i> sp.	x 1
<i>Benthesicymus</i> cf. <i>crenatus</i> Bate, 1881	x 2
ANOMURA	
<i>Munidopsis</i> sp.	x 1
OPHIUROIDEA	
<i>Amphiophiura convexa</i> (Lyman, 1878)	x 114
<i>Ophiacantha bathybia</i> H.L. Clark, 1911	x 4
<i>Ophiophthalmus normani</i> (Lyman, 1879)	x 1
<i>Dougaloplus amphacantha</i> (McClendon, 1909)	x 2
<i>Amthophiura</i> sp.	x 1
ASTEROIDEA	
<i>Eremicaster crassus</i> (Sladen, 1883)	x 21
<i>Styracaster</i> sp. (nov.?)	x 13
ECHINOIDEA	
<i>Aceste ?ovata</i> A. Agassiz et H.L. Clark	x many fragments
giant, triangular spatangoid (= St. 7?)	x many fragments
<i>Kamptosoma asterias</i> A. Agassiz, 1881	x 35
HOLOTHURIOIDEA	
<i>Pseudostichopus</i> sp.	x 3
<i>Bentholdytes typica</i> Theel, 1882	x 12
<i>Psychropotes raripes</i> Ludwig, 1893	x 2
<i>Molpadia</i> [? <i>granulata</i> (Ludwig, 1894)]	x 15
PISCES	
<i>Coryphaenoides yaquinae</i> Iwamoto et Stein, 1974	x 7
* <i>Chauliodus</i> sp.	x 1

* indicates mesopelagic elements

Table 5-1-1-1-8. Catch list of mega- and macrobenthos collected by beam trawl.

Station 12

Depth Range: 6348-6416m

Date: July 31, 1981

Gear: 4m ORE Beam Trawl

PORIFERA	
Demospongia gen. sp.	x 4 fragments
COELENTERATA	
<i>Galatheanthemum</i> sp.	x 3
white, rugose sea anemone	x 2
cone-shaped white sea anemone	x 2
POLYCHAETA	
Maldanidae	x 19 (6-Shin; others-ORI)
Opheliidae (<i>Travisia</i> sp.)	x 2 (all - ORI)
Polychaeta fragments	x 4
Nephtyidae	x 1 (from Gamo's net)
ECHIUROIDEA	
echiurid worms	x 20
SIPUNCULOIDA	
bulbous sipunculid worm	x 1
MOLLUSCA	
<i>Buccinum</i> sp.	x 1
<i>Ancistrolepis</i> sp.	x 1
<i>Buccinum</i> sp. 2	x 1
<i>Aforia</i> sp.	x 1
<i>Lunatia</i> sp.	x 1
<i>Admete</i> sp.	x 2
Gastropoda 1 to 23	x 1 (each)
<i>Buccinum</i> sp.	x 13
<i>Spinula oceanica</i> Filatova	x 2
<i>Neilonella</i> sp. 1a	x 35
<i>Neilonella</i> sp. 1b	x 13
<i>Lyonsiella</i> sp.	x 1
<i>Neilonella</i> sp. 1c	x 7
<i>Pecten</i> sp.	x 2
<i>Kelliella</i> sp. a	x 7
<i>Cuspidaria</i> sp.	x 1
Pelecypoda 1	x 2
Pelecypoda 2	x 2
Pelecypoda 3	x 2
[from Gamo's net]	
<i>Acteon</i> sp.	x 5
Cancellariidae	x 1
<i>Scaphander</i> sp. 1	x 2
<i>Scaphander</i> sp. 2	x 2
Gastropoda	x 4
<i>Neilonella</i> sp. 1d	x 2
<i>Neilonella</i> sp. d	x 2
<i>Kelliella</i> sp. a	x 1
<i>Pecten</i> sp.	x ½
Pelecypoda 1	x 4
Pelecypoda 2	x 2
Pelecypoda 3	x 4
Pelecypoda 4	x 1

[to be continued]

((Station 12 continued))

CEPHALOPODA

Cirrothauma-type cephalopod x 1

CUMACEA

Bathycuma (?) sp. x 1 (heavily injured)

Makrokyllindrus (*Makrokyllindrus*) sp. x 1

ISOPODA

Ianiella sp. a x 4

Ianiella sp. b x 3

Storthyngura sp. x 1

Eurycope sp. x 1

TANAIDACEA

Neotanais sp. x 4

AMPHIPODA

Epimeria sp. x 1

species cf. *Lysianassidae* x 1

MACRURA

Benthesicymus cf. *crenatus* Bate, 1881 x 3

* *Acanthephyra quadrispinosa* Kemp, 1939 x 1

* *Gennadas* sp. x 1

CRINOIDEA

Bathycrinus sp. x 12

OPHIUROIDEA

Ophiacantha bathybia H.L. Clark, 1911 x 75

Amphiophiura convexa (Lyman, 1878) x 16

ASTEROIDEA

Freyella cf. *oligobrachia* (H.L. Clark, 1920) x 4

Dytaster sp. x 4

? *Asterina* sp. (broader arm) x 4

? *Asterina* sp. (slender arm) x 1

HOLOTHURIOIDEA

Synallactes sp. x 6

Benthodytes sp. x 1

? *Hadalothuria* sp. b x 1

Peniagone azorica von Marenzeller, 1894 x 246

Peniagone sp. x 4

Scotoplanes globosa Theel, 1879 x 3

PISCES

Coryphaenoides yaquinae Iwamoto et Stein, 1974 x 6

* *Melamphasidae* gen. sp. x 2

* indicates mesopelagic elements

Table 5-1-1-1-9. Catch list of mega- and macrobenthos collected by beam trawl.

Station 13

Depth Range: 7347-7375m

Date: July 29, 1981

Gear: 4m ORE Beam Trawl

POLYCHAETA	
<i>Macellicephalo</i> / <i>Macellicephaloides</i> sp.	x 3 (all-ORI)
Opheliidae (<i>Travisia</i> sp.)	x 47
Opheliidae (<i>Travisia</i> sp.)	x 8 (from Gamo's net)
<i>Lumbrineris</i> sp.	x 2 (1 from Gamo's net)
Nereidae	x 1
PRIAPULOIDA	
<i>Priapulus</i> sp. (? <i>P. tubereolatospinosus abyssorum</i>)	x 3
ECHIUROIDA	
Bonellidae gen. sp.	x 1
MOLLUSCA	
<i>Kelliella</i> sp. a	x 1826
<i>Kelliella</i> sp. b	x 1775
<i>Kelliella</i> sp. c	x 5
<i>Axinulus</i> sp. a	x 42
<i>Cardiomya</i> sp.	x 4
<i>Spinula vitiazi</i> Filatova	x 2
<i>Yoldiella</i> sp.	x 28
Pelecypoda	x 3
[from Gamo's net]	
<i>Scaphander</i> sp.	x 1
<i>Kelliella</i> sp. a	x 58
<i>Cardiomya</i> sp.	x 1
<i>Axinulus</i> sp. a	x 1
<i>Neilonella</i> sp.	x 12
Pelecypoda	x 15
ISOPODA	
<i>Storothyngura</i> sp.	x ca. 18
AMPHIPODA	
aff. <i>Cyphocaris</i> sp.	x 1
gen. sp. (? <i>Lysianassidae</i>)	x 1
MACRURA	
<i>Benthesicymus</i> cf. <i>crenatus</i> Bate, 1881	x 1
* <i>Gennadas</i> sp.	x 1
* ? <i>Notostomus</i> sp.	x 1
HOLOTHURIOIDEA	
<i>Elpidia glacialis kurilensis</i> Baranova et Belyaev, 1971	x 324
? <i>Mesothuria</i> sp.	x 73
<i>Peniagone azorica</i> von Marenzeller, 1894	x 27
PISCES	
<i>Careproctus amblystomopsis</i> Andriashev, 1955	x 1
* <i>Gonostoma gracile</i> Günther, 1878	x 2

* indicates mesopelagic components

Table 5-1-1-2-1. Catch list of mega- and macrobenthos collected by epibenthic sledge.

Station 3

Depth Range: 1975-2007m

Date: July 10, 1981

Gear: Sanders-Hessler type Epibenthic Sledge

HARPACTICOIDA	
gen. spp.	x 45 (incl. 3 spp. ?)
CUMACEA	
<i>Leucon</i> sp. a	x 3
<i>Leucon</i> sp. b	x 5
TANAIDACEA	
gen. sp. a	x 18
gen. sp. b	x 2
ISOPODA	
<i>Desmonosoma</i> ? sp.	x 18
AMPHIPODA	
<i>Metaphoxus</i> habitus sp.	x 1
MOLLUSCA	
Scaphopoda gen. sp.	x 2
<i>Limacina</i> sp.	x 2
<i>Yoldiella</i> sp. b	x 3

Table 5-1-1-2-2. Catch list of mega- and macrobenthos collected by epibenthic sledge.

Station 7

Depth Range: 4192-4192m

Date: July 15, 1981

Gear: Sanders-Hessler type Epibenthic Sledge

POLYCHAETA	
Lumbrinereidae	x 3 (small)
? <i>Sthenelais</i> sp.	x 6
MOLLUSCA	
<i>Margarites</i> sp.	x 1
<i>Seguenzia</i> sp.	x 1
<i>Admete</i> sp.	x 1 + 1
Pteropoda 1	x 1
Pteropoda 2	x 2
Scaphopoda	x 4
<i>Cadulus (Polyschides)</i> sp.	x 1
<i>Axinulus</i> sp. b	x 4
<i>Axinulus</i> sp. c	x 18
<i>Cyclopecten</i> sp.	x 2
<i>Kelliella</i> sp. a	x 9
<i>Neilonella</i> sp.	x 1
Pelecypoda 1	x 1
Pelecypoda 2	x 5
OSTRACODA	
aff. <i>Cythereis</i>	x 10 (incl. 3 spp.)
CUMACEA	
<i>Leuconidae</i>	x 4 (incl. 3 spp.?) heavily injured
<i>Campylaspis</i> sp. a	x 1
TANAIDACEA	
aff. <i>Neotanais</i> sp.	x 2
ISOPODA	
<i>Haploniscus</i> sp. (? <i>pseudounicornis</i>)	x 5
AMPHIPODA	
<i>Cyphocaris</i> sp.	x 1
OPHIUROIDEA	
<i>Amphiura patens</i> Lyman	x 1
<i>Ophiura bathybia</i> H.L. Clark, 1911	x 352

Table 5-1-1-2-3. Catch list of mega- and macrobenthos collected by epibenthic sledge.

Station 8

Depth Range: 1916-1926m

Date: July 26, 1981

Gear: Sanders-Hessler type Epibenthic Sledge

Sediment; Sandy bottom + rock fragments

POLYCHAETA	
Aphroditidae (<i>Laetmonice</i> sp. ?)	x 1
MOLLUSCA	
<i>Lunatia</i> sp. a	x 1
<i>Seguenzia</i> sp. a	x 8
<i>Admete</i> sp.	x 1
Turrid shell	x 1
<i>Cuspidaria</i> sp.	x 1
<i>Axinulus</i> sp. c	x 6
Scaphopoda 1	x 56
Scaphopoda 2	x 3
HARPACTICOIDA	
gen. spp.	x 3 (3 spp.)
OSTRACODA	
Myodocopa	x 2
CUMACEA	
<i>Leucon</i> sp.	x 24 (manca larval stage and juveniles)
<i>Hemilamprops</i> (??)	x 3 (fragments)
<i>Campylaspis</i> sp. c?	x 1
<i>Campylaspis</i> sp. e	x 2 (juveniles)
<i>Campylaspis</i> sp. f	x 2
<i>Campylaspis</i> sp. g	x 3 (incl. 1 manca larva)
<i>Diastylis</i> sp. d	x 12 (manca larval stage)
<i>Diastylis</i> sp.	x 2 (manca larval stage)
<i>Makrokyllindrus</i> sp.	x 2 (manca)
<i>Leptostylis</i> sp.	x 10 (manca)
TANAIDACEA	
aff. <i>Neotanais</i> sp.	x 3
ISOPODA	
<i>Antarcturus</i> sp.	x 5 (juveniles)
<i>Neastacilla</i> sp.	x 10
<i>Janirallata</i> sp.	x 5
<i>Desmosoma</i> sp.	x 11
<i>Haploneiscus</i> sp.	x 2
<i>Ilyarachna</i> sp.	x 2
<i>Munnopsis</i> sp.	x 1
AMPHIPODA	
<i>Lepechinella</i> sp. a	x 4
aff. <i>Metaphoxus</i> ?	x 6
<i>Cyphocaris</i>	x 3 (2 spp.?)
<i>Rhachotropis</i> ??	x 30
Lysianassidae sp.	x 3
PYCNOGONIDA	
<i>Ascorhynchus japonicum</i> Ives, 1892	x 1
OPHIUROIDEA	
<i>Amphiura koreae</i> Duncan, 1879	x 7
<i>Ophiocten hastatum</i> Lyman, 1878	x 9

[to be continued]

((Station 8 continued))

<i>Ophiophthalmus normani</i> (Lyman, 1879)	x 1
ECHINOIDEA	
<i>Brisaster latifrons</i> A. Agassiz, 1898	x 9
HOLOTHURIOIDEA	
<i>Pseudostichopus</i> sp. b	x 1
<i>Psolus</i> sp. a	x 2
PISCES	
<i>Synaphobranchus</i> sp.	x 1

5 - 1 - 2. Deep-sea fishes collected in the area of the Japan Trench off Sanriku district

Muneo OKIYAMA (ORI, Univ. Tokyo)
and
Yoshihiko MACHIDA (Kochi Univ.)

A Total of nine tows using 3 m or 4 m beam trawls (BT) were conducted at the lower bathyal to hadal depths ranging from 1,950 to 7,420m. All tows but one with 3m-BT (St. 7-2) yielded 79 specimens referable to more than 13 species as follows:

- Synaphobranchus* sp. (3 specimens: St. 7-1, 8)
- Rouleina* sp. (1 specimen: St. 8)
- Coryphaenoides acrolepis* (Bean, 1883) (14 specimens: St. 3, 8)
- Coryphaenoides cinereus* (Gilbert, 1893) (16 specimens: St. 8)
- Coryphaenoides longifilis* Günther, 1877 (9 specimens: St. 8)
- Coryphaenoides armatus* Hector, 1875 (3 specimens: St. 7-1)
- Coryphaenoides yaquinae* Iwamoto & Stein, 1974 (17 specimens: St. 7-1, 10, 11, 12)
- Antimora microlepis* Bean, 1891 (2 specimens: St. 3, 8)
- Spectrunculus grandis* Günther, 1877 (1 specimen: St. 8)
- Porogadus* sp. (1 specimen: St. 8)
- Careproctus amblystomopsis* Andriashev, 1955 (9 specimens: St. 6, 13)
- Zoarcidae gen. spp. (3 specimens: St. 7-1, 8, 10)

Macrourids comprising five species of the genus *Coryphaenoides* predominated, accounting for about 75 percent of the demersal fish catches, i.e., 59 out of 79 specimens. According to bathymetrical ranges of their occurrences, they fall into two groups; former three species are referred to the lower bathyal members while the latter two are the abyssal ones. The geographic range of the dominant species, *C. yaquinae*, extended from the central Pacific to the westernmost area of this ocean by this collection.

Occurrences of nine specimens of the hadal liparid, *Careproctus amblystomopsis*, in both tows at hadal depths of 7,420-7,530m are worth mentioning, because (1) this is the first capture of this rare species by Japanese vessel, and (2) a tow at St. 6 produced as many as eight specimens. Despite limited data, this fish seems to live ubiquitously and densely in this trench area. Stomach contents of the four specimens were composed of small crustaceans such as Amphipoda, Isopoda, and Copepoda. All of them took significant amounts of food materials, suggesting the richness of food resources in this hadal bottoms.

5-1-3. Systematic study on the benthic small crustaceans in the Japan Trench and its vicinity

Sigeo GAMŌ (Dept. Biol., Fac. Ed., Yokohama Natl. Univ.)

The works are essentially taxonomical, morphological and biogeographical studies on the bathyal, abyssal and ultra-abyssal benthic small crustaceans from the Japan Trench and its vicinity during the cruise KH-81-4. The samples were taken at 8 stations (1976-7386m deep) using beam trawls (BT), an epibenthic sledge (ES) and a USNEL box corer (BC). The specimens were fixed in 10 or 5% buffered formalin made up with seawater, and transferred to 80% ethanol for preservation. The specimens were preliminarily identified during the cruise, and listed in Table 5-1-3-1 for the catch of plankton nets ("Gamo's net") attached to inside of the beam trawls, in section 5-1-1 for the epibenthic catch (Table 5-1-1-2), and in section 5-2 for the box corer catch (Table 5-2-1).

While working on the specimens, the following characteristic species were found in the collection and illustrated herewith. Some of them have already been studied and described as new to science.

COPEPODA

Harpacticoida

1. *Aegisthus mucronatus* Giesbrecht, 1891 (Fig. 1, A) (Aegisthidae), St. 13-BT; bathypelagic species, cosmopolitan; see Giesbrecht, 1982.
2. *Cervinia* ? sp. (Fig. 1, B) (Cervinidae) St. 13-BC.
3. *Mesoclatodes* ? sp. (Fig. 3, I) (Clatodidae) St. 13-BC.

MALACOSTRACA

Cumacea

4. *Paralamprops corollifera* Gamō, 1984 (Fig. 2, A) (Lampropidae) St. 11-BT.
5. *Paraleucon? ultraabyssalis* Gamō, 1987 (Fig. 1, C) (Leuconidae) St. 13-BT.
6. *Makrokylindrus (Makrokylindrus) hystrix* Gamō, 1985 (Fig. 1, D); (Diastylidae); St. 12-BT.
7. *Leptostylis quadridentata* Gamō, 1985 (Fig. 1, E) (Diastylidae) St. 11-BT.
8. *Leptostylis ? spinescens* Gamō, 1987 (Fig. 1, F) (Diastylidae) St. 6-BT.

9. *Janirella (Janirella) tuberculata* Birstein, 1963 (Fig. 2, B) (Janirellidae), St. 11-BT, St. 12-BT: see Gamō, 1983.
10. *Janirella (J.) aculeata* Gamō, 1983 (Fig. 2, C) (Janirellidae) St. 11-BT.
11. *Janirella (J.) rotundifrons* Gamō, 1982 (Janirellidae) St. 11-BT; previously described from Sagami Bay, 1678m deep.
12. *Janirella (Parajanirella) sedecimtuberculata* Gamō, 1983 (Fig. 2, D) (Janirellidae); St. 11-BT, St. 12-BT.
13. *Janirella (P.) verrucosa* Birstein, 1971 (Fig. 2, E) (Janirellidae); St. 11-BT: see Gamō, 1983.
14. *Janiralata* sp. (Fig. 2, F) (Thambematidae) St. 8-ES.
15. *Haplomesus* sp. (Fig. 2, G) (Ischinomesidae) St. 12-BT.
16. *Macrostylis* sp. a (Fig. 3, A) (Macrostylidae) St. 12-BT.
17. *Macrostylis* sp. b (Fig. 3, B) (Macrostylidae) St. 12-BT.
18. *Mesosignum latum* Birstein, 1970 (Fig. 3, C) (Munnidae) St. 12-BT: see Gamō, 1983.
19. *Aryballurops japonica* Gamō, 1983 (Fig. 3, D) (Munnidae) St. 12-BT.

Amphipoda

20. *Lepechinella* sp. a (Fig. 3, E) (Dexaminidae (=Lepechinellidae)); St. 8-BT, ES.
21. *Lepechinella* sp. b (Fig. 3, F) (Dexaminidae) St. 10-BT.
22. *Lepechinella* sp. c (Fig. 3, G) (Dexaminidae) St. 11-BT.
23. *Lepechinella* sp. d (Fig. 3, H) (Dexaminidae) St. 11-BT.

Literature cited

- Birstein, Y. A., 1963. Deep-sea isopods of the north western Pacific. Akad. Nauk USSR, Moscow, pp. 1-214, 3 pls. (In Russian, with English summary).
- Birstein, Y. A., 1970 (1972). New Crustacea Isopoda from the Kurile-Kamchatka Trench. In: Bogorov, V. G. ed., Fauna of the Kurile-Kamchatka Trench and its environment. Trudy Inst. Okeanol., 86: 308-356 (1-573). Israel Program for Scientific Translation, Jersalem, 1972. (Translated from Russian).
- Birstein, Y. A., 1971. Additions to the fauna of isopods (Crustacea: Isopoda) of Kurile-Kamchatka Trench, Part 2, Asselota-2. Trudy Inst. Okeanol., 92: 162-238. (in Russian, with English summary).
- Giesbrecht, W., 1892. Systematik und Faunistik der pelagischer

- Copepoden des Golfes von Neapel und der angrenzenden Meeresabschnitt. Fauna und Flora des Golfes von Neapel, 19: i-ix, 1-831, pls. 1-54.
- Gamō, S., 1982. Two new deep-sea species of *Janirella* Bonnier, 1896 (Crustacea Isopoda: Asellota) from Sagami Bay. Sci. Repts. Yokohama Natl. Univ., sec. II, (29): 1-8.
- Gamō, S., 1983a. Some species of abyssal asellote isopods (Crustacea) from east of the Japan Trench, with the descriptions of *Janirella* (*Janirella*) *aculeata* sp. nov., *J.* (*Parajanirella*) *sedecimtuberculata* sp. nov., and *Aryballurops japonica* gen. sp. nov. Sci. Repts. Yokohama Natl. Univ., sec. II, (30): 1-18.
- Gamō, S., 1983b. Occurrence of a bathypelagic harpacticoid copepods, *Aegisthus mucronatus* Giesbrecht (Crustacea) in the northwestern Pacific Ocean. Bull. Biogeogr. Soc. Japan, 38(7): 45-50.
- Gamō, S., 1984. A new abyssal cumacean, *Paralamprops corollifera* sp. nov. (Crustacea) from east of the Japan Trench. Bull. Biogeogr. Soc. Japan, 39(4): 21-25.
- Gamō, S., 1985. *Makrokylindrus* (*Makrokylindrus*) *hystrix* sp. nov. and *Leptostylis quadridentata* sp. nov., two new abyssal cumaceans from the Japan Trench (Crustacea). Sci. Repts. Yokohama Natl. Univ., sec II, (32): 1-10.
- Gamō, S., 1987. Two new cumacean crustaceans, *Paraleucon* ? *ultraabyssalis* sp. nov. and *Leptostylis* ? *spinescens* sp. nov. from the Japan Trench. Biogeogr. Soc. Japan, 42(7): 43-48.

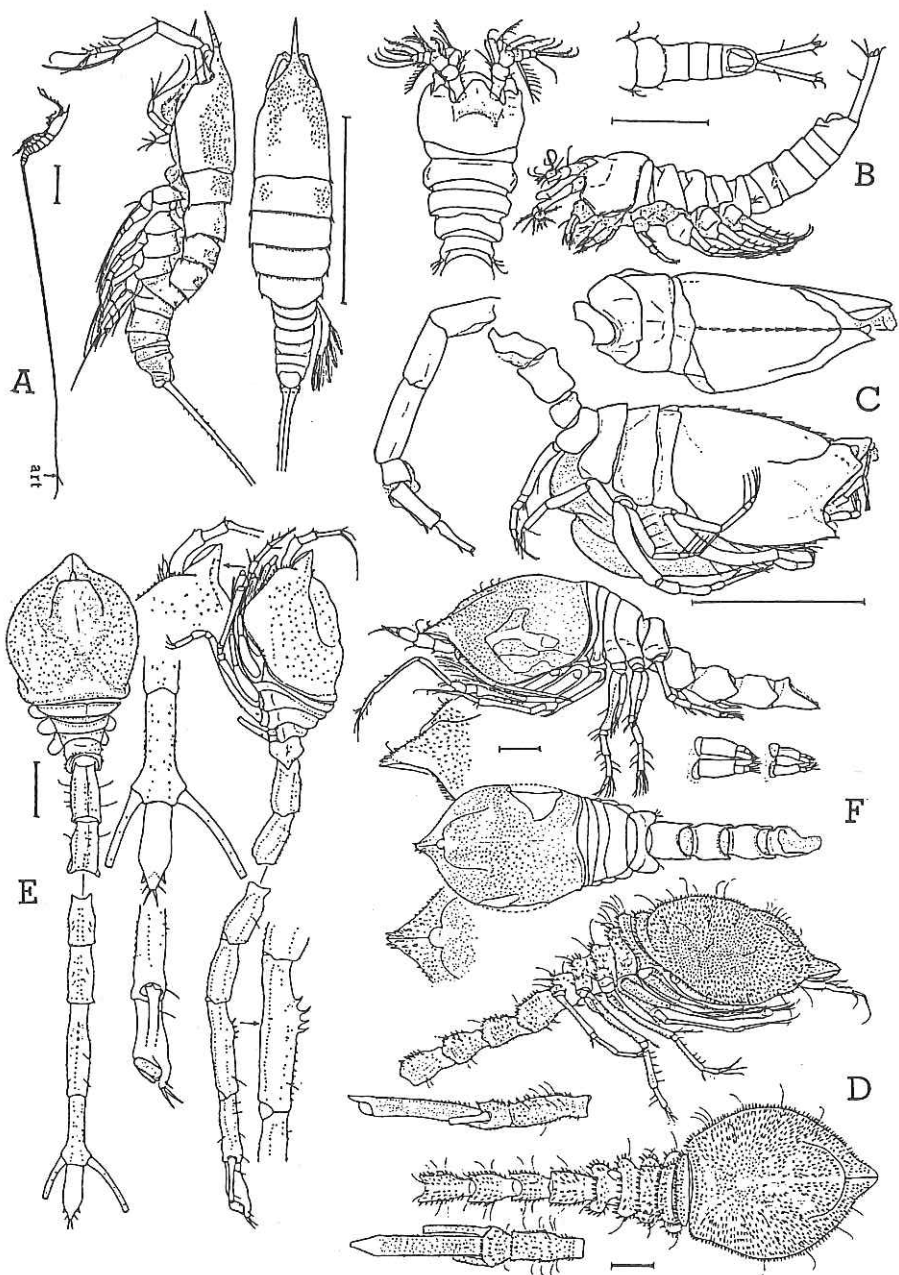


Fig. 1. Benthic small crustaceans from the Japan Trench. Harpacticoid copepoda: a, *Aegisthus mucronatus* Giesbrecht; b, *Cervinia* ? sp., Cumacea: C, *Paraleucon* ? *ultraabyssalis* Gamō; D, *Makrokylindrus* (*Makrokylindrus*) *hystrix* Gamō; E, *Leptostylis quadridentata* Gamō; F, *Leptostylis* ? *spinescens* Gamō. Scale bars represent 1mm.

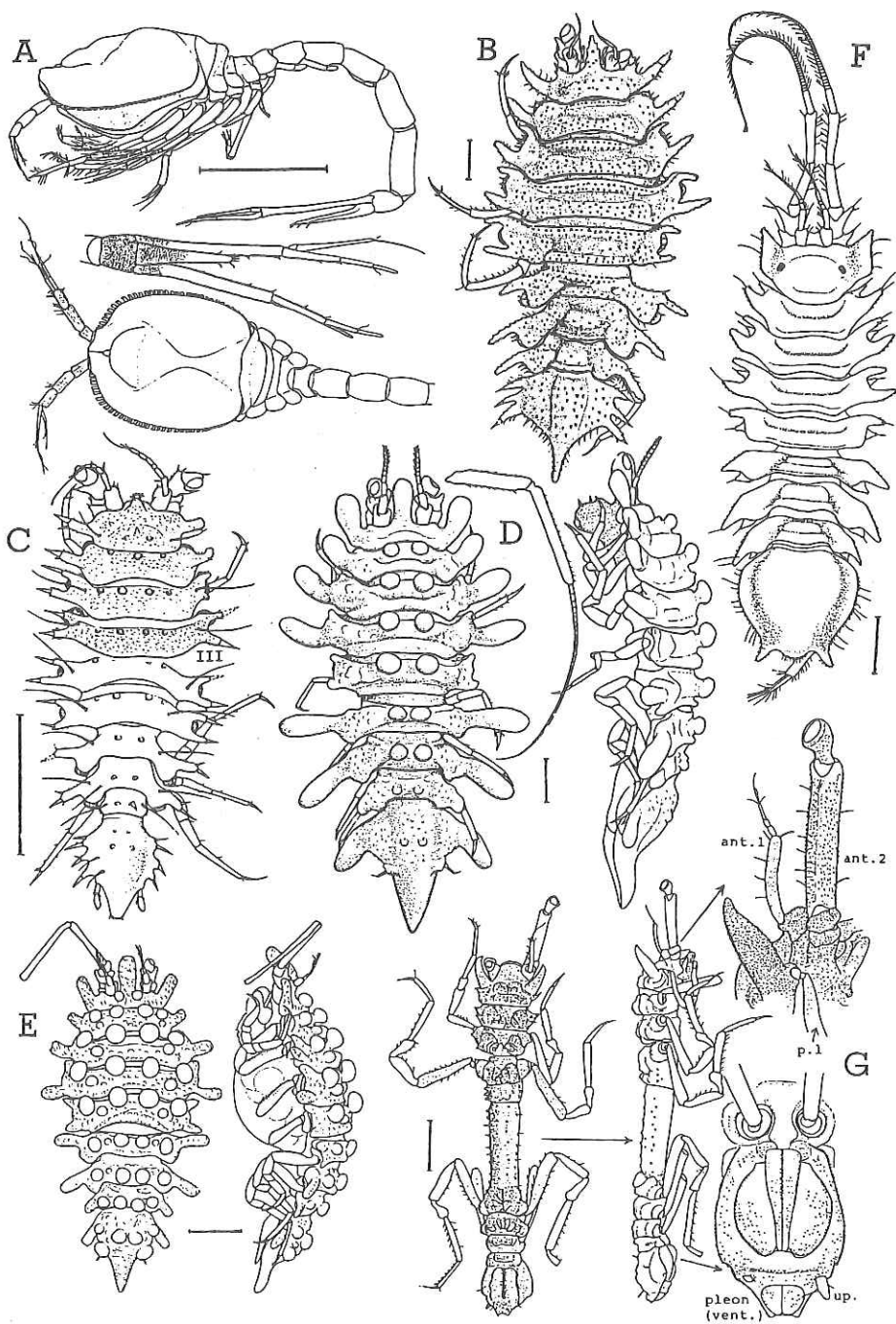


Fig. 2. Benthic small crustaceans from the Japan Trench. Cumacea: A, *Paralamprops corollifera* Gamō, Isopoda: B, *Janirella (Janirella) tuberculata* Birstein; C, *J. (J.) aculeata* Gamō; D, *J. (Parajanirella) sedecimtuberculata* Gamō; E, *J. (P.) verrucosa* Birstein; F, *Janirellata* sp.; G, *Haplomesus* sp. Scale bars represent 1 mm.

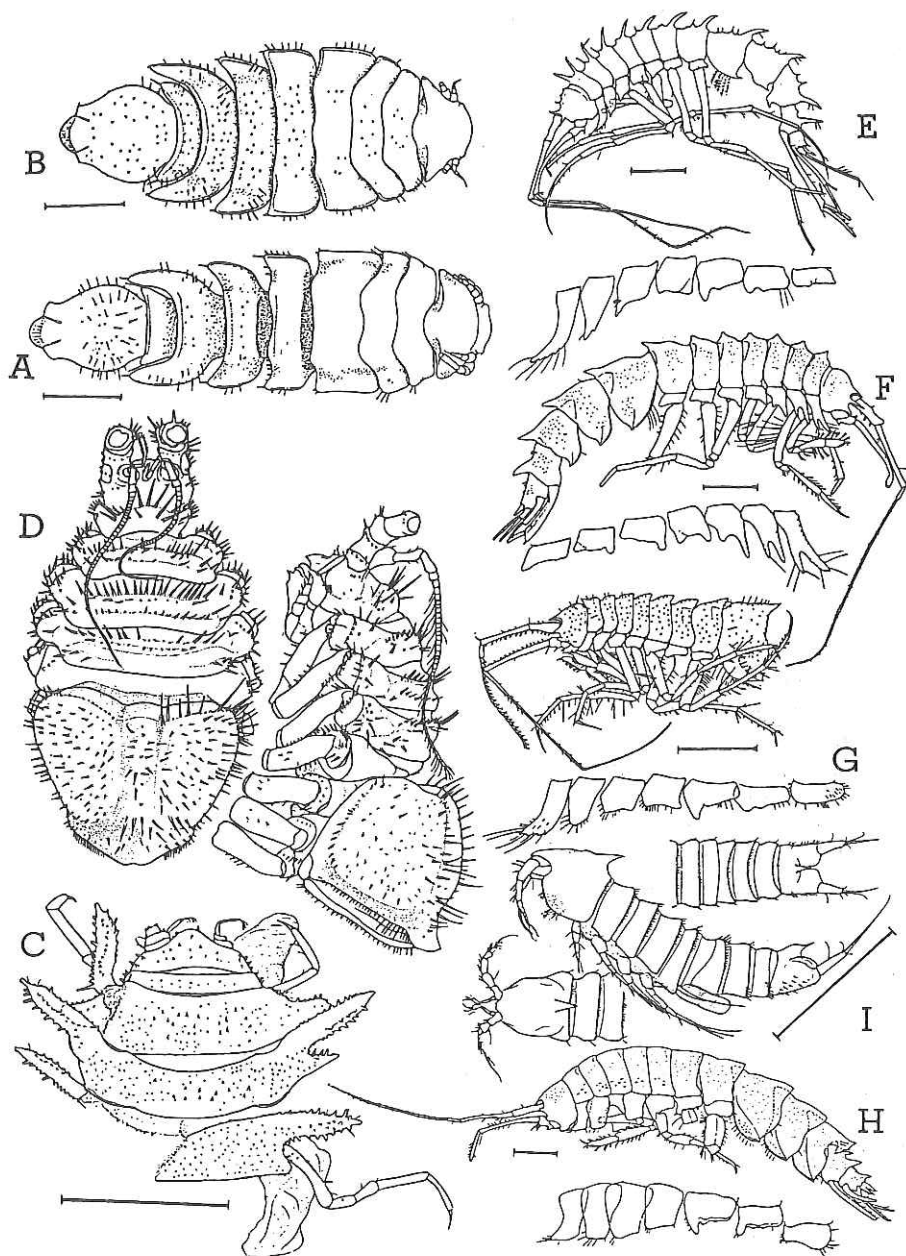


Fig. 3. Benthic small crustaceans from the Japan Trench. Isopoda: A, *Macrostylis* sp. a; B, *M.* sp. b; C, *Aryballurops japonica* Gamō; D, *Mesosignum latum* Birstein, Amphipoda: E, *Lepechinella* sp. a; F, *L.* sp. b; G, *L.* sp. c; H, *L.* sp. d, Harpacticoid copepoda: I, *Mesoclatodes* ? sp. Scale bars represent 1 mm.

Table 5-1-3-1. Preliminary catch list of benthic small crustaceans collected by "Gamo's plankton nets" attached inside of the beam trawls.

<< Station 6 >>

TANAIDACEA	
gen. sp.	x 1
ISOPODA	
<i>Storthyngura</i> sp.	x 1 (juvenile)
AMPHIPODA	
<i>Metaphoxus</i> ? habitus	x 4

<< Station 7-I >>

HARPACTICOIDA	
gen. ? sp. ?	x 8 (1 sp.)
CUMACEA	
<i>Leucon</i> sp. a	x 6
<i>Leucon</i> sp. b	x 1
<i>Leucon</i> sp. c	x 1
<i>Eudorella</i> sp.	x 1
<i>Campylaspis</i> sp. a	x 1
<i>Campylaspis</i> sp. b	x 1
<i>Paralamprops</i> ? sp.	x 1
<i>Makrokylindrus</i> (<i>Coalescuma</i>) sp.	x 1
<i>Leptostylis</i> sp.	x 5
ISOPODA	
<i>Mesosignum</i> ? sp.	x 1
<i>Ilyarachna</i> ? sp.	x 1
<i>Haploniscus</i> sp. (" <i>pseudounicornis</i> ")	x 6
AMPHIPODA	
<i>Cyphocaris</i> sp.	x 1
gen. ? sp. ?	x 3

<< Station 7-II >>

CUMACEA	
<i>Leptostylis</i> sp.	x 1
ISOPODA	
<i>Haploniscus</i> sp. (" <i>pseudounicornis</i> ")	x 1
AMPHIPODA	
<i>Cyphocaris</i> sp.	x 1
<i>Ampelisca</i> habitus (=St. 7 BT)	x 1
gen. ? sp. ?	x 1

<< Station 8 >>

HARPACTICOIDA	
gen. sp.	x 1
CUMACEA	

<i>Leucon</i> sp. (serrated carapace)	x 1
<i>Leucon</i> sp. (carapace with unicorn)	x 1
<i>Eudorella</i> sp.	x 8
<i>Platysympus</i> sp.	x 1
<i>Lamprops</i> ? sp.	x 1
<i>Campylaspis</i> sp. a	x 22
<i>Campylaspis</i> sp. b	x 14
<i>Campylaspis</i> sp. c	x 3
<i>Campylaspis</i> sp. d	x 3
<i>Diastylis</i> sp. a	x 16
<i>Diastylis</i> sp. b	x 11
<i>Diastylis</i> sp. c	x 12
<i>Makrokylindrus</i> (<i>M.</i>) sp.	x 3
<i>Makrokylindrus</i> (<i>Coalescuma</i>) sp.	x 4
TANAIDACEA	
aff. <i>Neotanais</i> sp.	x 4
gen. ? sp. ?	x 2
ISOPODA	
<i>Antarcturus</i> sp. a	x 3
<i>Antarcturus</i> sp. b	x 4
<i>Antarcturus glaber</i> habitus	x 5
<i>Haploniscus</i> sp.	x 2
Sphaeromatidae sp.	x 15
aff. <i>Ioella</i> sp.	x 3
<i>Munnopsis</i> sp.	x 23
aff. <i>Ilyarachna</i> sp.	x 2
AMPHIPODA	
<i>Uschakoviella echinophora</i> ?	x 1

<< Station 10 >>	
OSTRACODA	
<i>Cythereis</i> spp.	x 2 (2 spp.)
CUMACEA	
<i>Leucon</i> ? sp.	x 1 (fragments)
<i>Diastylis</i> ? sp.	x 1 (fragments)
TANAIDACEA	
aff. <i>Neotanais</i> sp.	x 3
gen. ? sp. ?	x 1
ISOPODA	
<i>Haploniscus</i> sp.	x 1
<i>Eurycope</i> ? sp.	x 1
AMPHIPODA	
<i>Cyphocaris</i> sp.	x 4
aff. <i>Metaphoxus</i> ? sp.	x 1 (fragments)
<i>Lepechinella</i> sp. b	x 1

<< Station 11 >>	
HARPACTICOIDA	
gen. spp.	x 16 (2 spp.)
OSTRACODA	
<i>Cythereis</i> sp.	x 2

CUMACEA

<i>Leucon</i> sp. (serrated carapace)	x 3
<i>Hemilamprops</i> sp.	x 1 (manca)
<i>Paralamprops corollifera</i> Gamō, 1984	x 1 (juvenile, male)
<i>Campylaspis</i> sp. (c ?)	x 2
<i>Leptostylis quadridentata</i> Gamō, 1985	x 1 (manca, female)
<i>Makrokylindrus</i> (M.) sp.	x 7
<i>Leptostylis</i> sp.	x 2
<i>Bathycuma</i> sp.	x 1

TANAIDACEA

aff. <i>Neotanais</i> sp.	x 3
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ISOPODA

<i>Janirella</i> (J.) <i>tuberculata</i> Birstein	x 3
<i>J.</i> (J.) <i>aculeata</i> Gamo, 1983	x 1
<i>J.</i> (J.) <i>rotundifrons</i> Gamō, 1982	x 1
<i>J.</i> (Parajanirella) <i>verrucosa</i> Birstein	x 1
<i>J.</i> (P.) <i>sedecimtuberculata</i> Gamō, 1983	x 1
<i>Haploniscus</i> spp.	x 2 (2 spp.)
<i>Haplomesus</i> sp.	x 4
<i>Eurycope</i>	x 5 (2 spp.?)

AMPHIPODA

<i>Lepechinella</i> sp. c	x 1
<i>Lepechinella</i> sp. d	x 3
aff. <i>Metaphoxus</i> ? sp.	x 1
<i>Lilyeborgia habitus</i>	x 2

 << Station 12 >>

HARPACTICOIDA

gen. sp.	x 3 (2 spp.)
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OSTRACODA

aff. <i>Cythereis</i> sp.	x 1
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CUMACEA

<i>Bathycuma</i> (?) sp.	x 12
<i>Makrokylindrus</i> ? sp.	x 1
<i>Leptostylis</i> ?? sp.	x 1

TANAIDACEA

aff. <i>Neotanais</i> spp.	x 5 (2 spp.)
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ISOPODA

<i>Janirella</i> (J.) <i>rotundifrons</i> Gamō, 1982	x 1
<i>J.</i> (J.) <i>tuberculata</i> Birstein	x 11
<i>Mesosignum latum</i> Birstein, 1970	x 1
<i>Janirella</i> (Parajanirella) <i>sedecimtuberculata</i> Gamō, 1983	x 10
<i>Haplomesus</i> sp.	x 6
<i>Haploniscus</i> sp.	x 1
<i>Aryballurops japonica</i> Gamō, 1983	x 11
<i>Macrostylis</i> sp. a	x 1
<i>Macrostylis</i> sp. b	x 1
<i>Storothyngura</i> sp.	x 2
<i>Eurycope</i> sp.	x ca. 2 (fragments)
<i>Ilyarachna</i> sp.	x ca. 2 (fragments)

AMPHIPODA

aff. <i>Paradiscus</i> sp.	x 3
<i>Rhachotropis</i> ?? sp.	x 2
gen.? sp.? (Lysianassidae)	x 15

<< Station 13 >>

HARPACTICOIDA

<i>Aegisthus mucronatus</i> Giesbrecht, 1892	x 1
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CUMACEA

<i>Paraleucon</i> ? <i>ultraabyssalis</i> Gamō, 1987	x 1
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ISOPODA

<i>Storthyngura</i> sp.	x 2
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AMPHIPODA

aff. <i>Metaphoxus</i> ? sp.	x 2
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5-1-4. Studies of Turbellaria

H. Minegishi (Attached High School of Nihon Women's University)

1. Turbellarians were found only at St. 11 and St. 12 from the trawl and box core samples of each station.

(1) The surface of stones collected by the beam trawls and the Gamo's net set within the trawls were looked carefully for turbellarians under a binocular microscope.

(2) The surface of the sediment obtained by a box corer was directly scrutinized for the turbellarians, and a part of the sediment thus obtained were sieved, and then examined under a binocular microscope.

2. White leaf-shaped turbellarian-like individuals were collected from the samples of the Gamo's net at St. 11 (1 individual) and St. 12 (3 inds.). These specimens have many rhabdites on the dorsal side, and this is the first finding of such a form from deep-sea trawling samples.

3. During the cruise, 3 forms of turbellarians were collected from floating seaweed.

(1) Among the samples collected in the first leg of the cruise, many mature individuals of *Notoplana* sp. were found.

(2) Specimens collected in Kamaishi Bay (baymouth) were immature *Planocera* sp., and this species was a common surface planktons of this area.

(3) Immature specimens of *Notoplana* sp. (3 inds.) and *Vorticeros ijimai* (2 inds.) [Allocoela] were collected from floating seaweed near St. 11.

(4) *Vorticeros ijimai* is a common species upon *Sargassum* on the Pacific coast in Japan (e.g., Miura Peninsula), but in this case, it was found on seaweed floating at St. 11 in an offshore region. The seaweed masses were supposed to have drifted on the surface of the ocean for so long period of time, and a special community of animals was found among and/or upon the seaweed mass. This is thought to be very interesting from the stand point of the dispersal of coastal species such as *Notoplana ijimai*.

"NEMERTINEA"

All the specimens which appeared to be nemertine-like organisms collected in the present cruise (fixed or non-fixed) were examined, but were found to be either Nematoda or Annelida.

5 - 1 - 5. Survey on the distribution of medusae

Yasuo SUGIURA (Dokkyo Univ.)

For the study of the distribution of medusae, the present author collected medusa specimens during the survey. The collection was carried out from July 21st to August 4th, 1981, the latter half of the cruise. For the collection of materials, two methods were used in each station; (1) Collection of surface plankton by 20-minute towing of Norpac Net, GG 54 or Kitahara-type Net, GG 34, 30cm in diameter. (2) Collection of midwater plankton or nekton by Isaacs-Kidd Midwater Trawl (IKMT). From the materials obtained by these methods, only medusae were sorted out and identified. The following results are mainly based on qualitative analysis rather than quantitative one.

(I) For the surface-water medusae obtained by plankton net, species names and the number of specimens for each species are listed below for each sampling station (Table 5-1-1-1). Enormous numbers of mature *Chrysaora helvola* medusae of 10-20cm diameter were found around the Hakuho-Maru in the inner part of Tomakomai Harbour. Most of the medusae obtained from each station were very common species widely distributing around the Japan coast.

(II) For the deep-water medusae obtained by the Isaacs-Kidd Midwater Trawl, species names and the number of specimens for each species are listed in Table 5-1-1-2. These deep-sea medusae, especially *Periphylla hiacinthina* and *Atolla wyvillei* were widely distributed. The former were 10-100mm in diameter, and the latter were 10-90mm in diameter and the mature gonads were found in individuals larger than 22mm. Coronatae scyphomedusae were found not only in coastal regions but also oceanic deep sea generally. On the other hand, also in this survey, numerous *Stephanoscyphus* spp. were observed on the crushed rock collected from the deep-sea bottom.

These facts suggest that the detailed analysis of the relation between the conditions of deep sea and the life history of Coronatae would be important subject for future research.

Table 5-1-5-1. Surface water meduase obtained by plankton net.

Locality	Date	Time	Species	Number	Net
Tomakomai	7.22	08:00	<i>Chrysaora helvola</i>	—	—
St. 8	7.25	13:00	<i>Phialidium pentata</i>	2	K
			<i>Euceilota paradoxica</i>	20	
			<i>Aglaura hemistoma</i>	4	
			<i>Liriope tetraphylla</i>	2	
Kamaishi	7.26	10:30	<i>Obelia</i> sp.	2	
St. 10	7.27	12:00	<i>Aglaura hemistoma</i>	4	
St. 10	7.27	20:10	<i>Aglaura hemistoma</i>	3	N
			<i>Liriope tetraphylla</i>	10	
St. 10	7.28	08:00	<i>Euceilota paradoxica</i>	1	
		&	<i>Aglaura hemistoma</i>	2	
		10:00	<i>Liriope tetraphylla</i>	1	
St. 13	7.29	04:30	<i>Aglaura hemistoma</i>	3	
			<i>Liriope tetraphylla</i>	1	
St. 12	7.31	13:50	<i>Aglaura hemistoma</i>	1	
			<i>Liriope tetraphylla</i>	1	
St. 11	8.1	18:50	<i>Euceilota paradoxica</i>	5	
			<i>Aglaura hemistoma</i>	5	
			<i>Liriope tetraphylla</i>	2	
			<i>Solmundella bitentaculata</i>	2	

K: Kitahara-type Net

N: Norpac Net

Tomakomai: Inner part of Tomakomai Harbour

Kamaishi: Entrance of Kamaishi Harbour

Table 5-1-5-2. Deep-water medusae obtained by the IKMT hauls.

Species	Locality (St. No.)								
	3	4	6	8	10	13	12	11	14
<i>Crossota brunnea</i>	30	0	x	x	0	0	0	4	7
<i>Colobonema typicum</i>	0	9	0	1	3	4	1	3	1
<i>Periphylla hiacinthina</i>	6	9	2	1	3	6	1	6	3
<i>Atolla wyvillei</i>	2	14	11	8	14	3	3	3	8

x: uncertain in number, though it was not null

5-2. Studies of Macrobenthos, Meiobenthos, Trace Fossils and Chemistry
using Box Corer

Isao HAYASHI (Kyoto Univ.), Paul K. SHIN (Hong Kong Fisheries Research Station)
and

David D. SWINBANKS (ORI, Univ. Tokyo)

Sampling Procedure for Box Corer

Subcores A to Q will be used for the following studies: —

A to D : vertical subcores for analysis of macrofauna by Mr. Y. Shirayama
(Ocean Research Institute)

E to H : horizontal subcores (5 cm thick slabs) for analysis of macrofauna
by Dr. P. Shin (Hong Kong Fisheries Research Station)

I & J : 2.5 cm (I) & 10 cm (J) thick, vertical subcores for analysis of
the effects of thickness on X-ray radiograph quality by D. D.
Swinbanks (Ocean Research Institute)

Subcores A to J inclusive were all X-rayed on board ship for the study of
biogenic structures and trace fossils by D. D. Swinbanks (Ocean Research
Institute)

K : Radioisotope analysis of sedimentation rates and bioturbation
by Mr. Yamada (Hokkaido University)

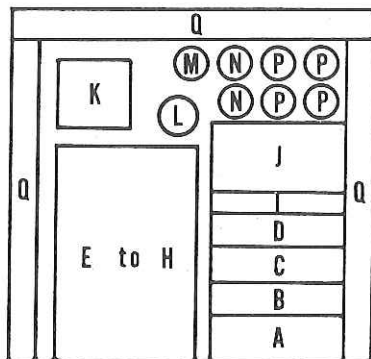
L : Analysis of water content and solid phase chemistry (Fe & Mn
oxides) by D. D. Swinbanks (Ocean Research Institute)

M : Chemical analysis by Dr. I. Koike (Ocean Research Institute)

N : Grain size and chemical analysis (CaCO₃ content, org. C, N)
by Mr. Y. Shirayama (Ocean Research Institute)

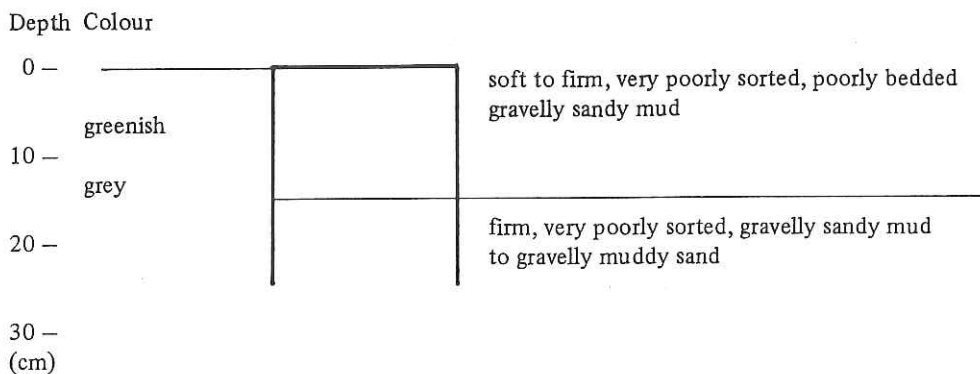
P : Meiofaunal analysis by Mr. Shirayama (Ocean Research Institute)

Q : vertical slabs of sediment washed for analysis of trace fossils and
sedimentary layering by D. Swinbanks (Ocean Research Institute)

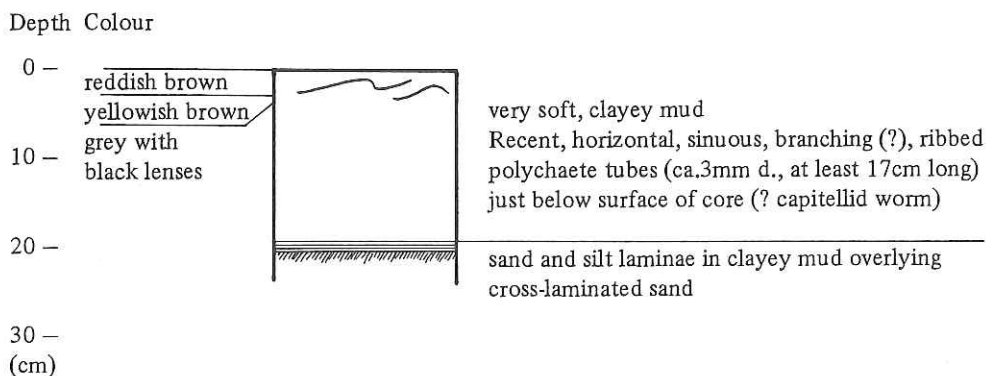


Lithology and Sedimentary Structures of Box Corer Samples

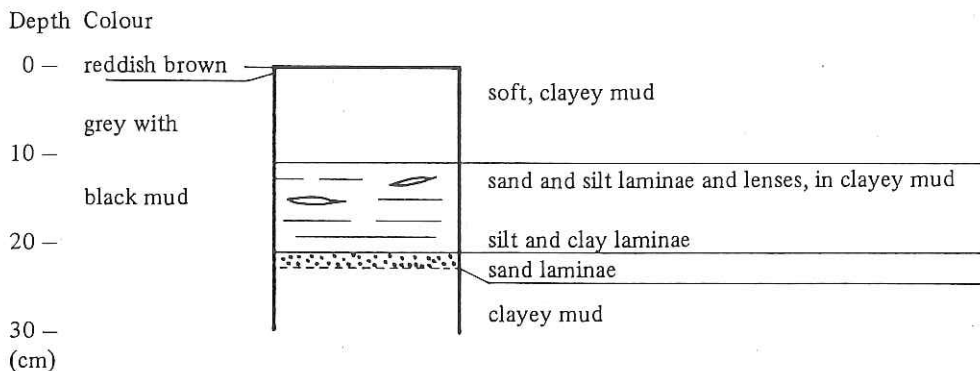
STATION 3



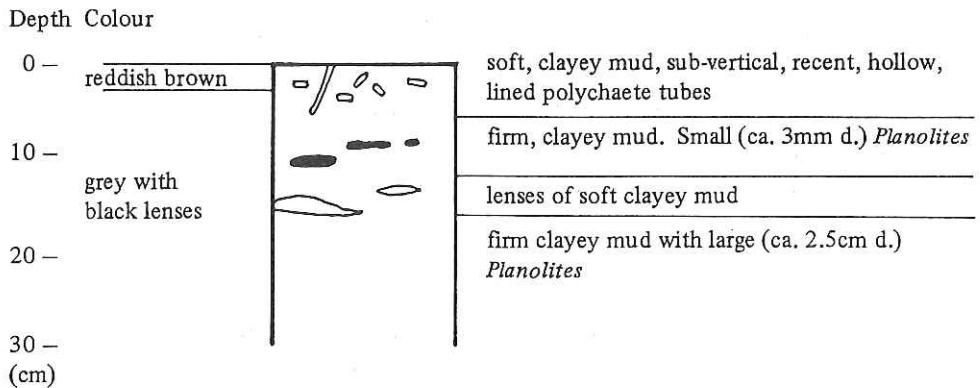
STATION 6



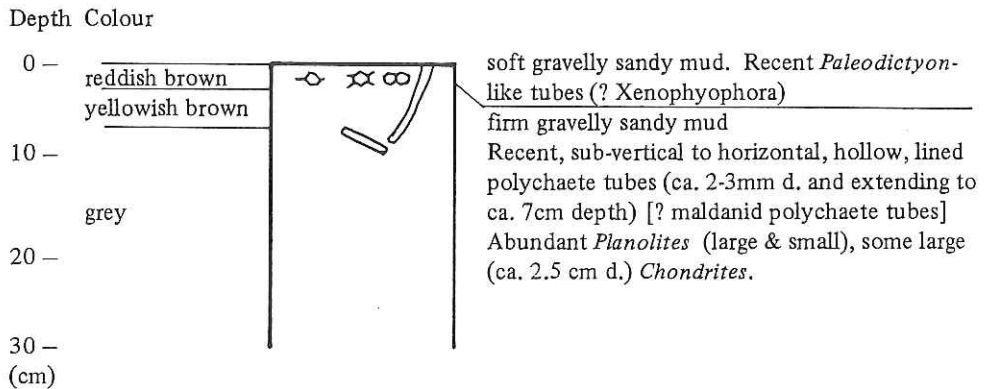
STATION 7



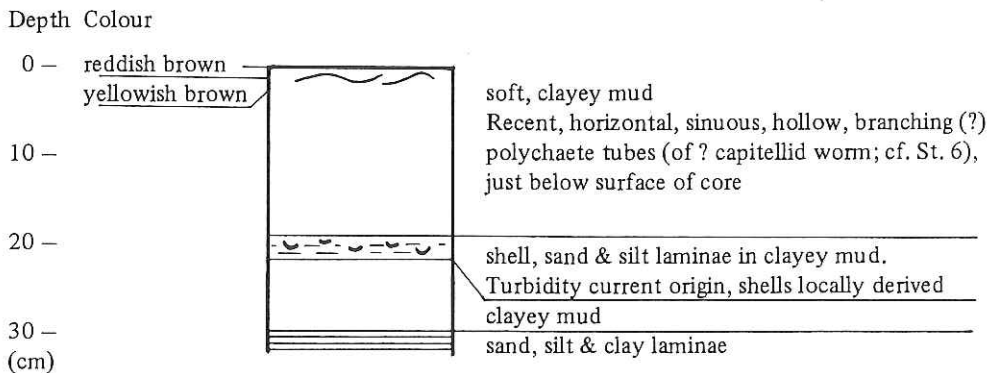
STATION 11



STATION 12



STATION 13



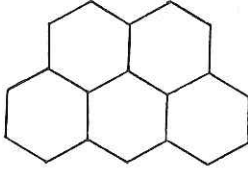
Note:

Planolites is a trace fossil that consists of single, sub-horizontal, filled burrows.

Chondrites is a trace fossil that consists of branched, filled burrows.

Paleodictyon is a trace fossil that is usually a cast of firmly lined burrows (or tubes).

The burrows have a net-like, polygonal (often hexagonal mesh) geometry, i.e.,



Plan view, vertical burrows may extend upward from intersections in mesh.

Table 5-2-1. Preliminary results of macrobenthos collected by box corer.

Station 3 Depth: 1983m
 Date: July 10, 1981
 Gear: 1/4m² USNEL box corer
 Ship Position: 40°22.3'N; 143°21.9'E
 Sediment: Sandy mud (pockets of sand within mud layer)

*Vertical distribution of macrobenthos based on horizontal slices of sediment**

* Dimension of subcores used: 30x20x5 cm; 4 different horizontal layers corresponding to 0-5, 6-10, 11-15 and 16-20cm depth of the box corer sample.

0-5 cm layer (0.5mm + 1.0mm fractions together)	
Ophiuroid	x 2
Cumacea	x 1
Amphipoda A (<i>Metaphoxus</i> sp.)	x 2
Amphipoda B	x 1 (only anterior head)
Amphipoda C	x 1 (only anterior head; crushed)
Chaetoderma sp.	x 3
Bivalve A	x 1
Bivalve B	x 1
Bivalve C	x 2
Gastropod	x 1
POLYCHAETA	
? Lacydoniidae	x 4
Cirratulidae	x 1
fragments only	x 15 (check required)
Nematoda	x 1
Foraminifera A	x 1
Foraminifera B	x 100
6-10cm layer	
POLYCHAETA	
Lumbrineridae	x 1
? Maldanidae	x 1
Foraminifera A	x 1
Foraminifera B	x 300
11-15 cm layer	
Ophiuroid (arm only)	(not counted)
Foraminifera A	x 1
Foraminifera B	x 350
16-20cm layer	
<i>Scalpellum</i> sp.	x 1
Bivalve C	x 1 (minute; juvenile?)
Foraminifera B	x 500

Fauna collected other than from the above 4 subcores

POLYCHAETA	
? Maldanidae	x 13 (minute; juvenile)

[to be continued]

((Station 3 continued))

Glyceridae	x 1
Cirratulidae	x 2
Fragments	x 9
Chaetoderma sp.	x 17
Nematoda	x 3
Harpacticoid copepod	x 2

Identification of representative macrobenthos

MOLLUSCA	
Scaphopoda gen. sp.	x 1
Trochidae gen. sp.	x 1
<i>Yoldiella</i> sp. b	x 1
<i>Neilonella</i> sp. c	x 1
<i>Neilonella</i> sp. d	x 3
<i>Musculus</i> sp.	x 2
<i>Axinulus</i> sp. a	x 1
CUMACEA	
<i>Leptostylis</i> sp.	x 2
<i>Leucon</i> sp.	x 3
ISOPODA	
<i>Desmonosoma</i> ? sp.	x 1
AMPHIPODA	
gen. sp. ?	x 1

Table 5-2-2. Preliminary results of macrobenthos collected by box corer.

Station 6 Depth: 7366m
 Date: July 14, 1981
 Gear: 1/4m² USNEL box corer
 Ship Position: 40°04.7'N; 144°21.0'E
 Sediment: Muddy (reddish colour; sample nearly full, 40cm)

*Vertical distribution of macrobenthos based on horizontal slices of sediment**

* Dimension of subcores used: 30x20x5 cm; 4 different horizontal layers corresponding to 0-5, 6-10, 11-15 and 16-20cm depth of the box corer sample.

0-5 cm layer

Nematoda	x 5
Tanaid	x 1
Amphipod (<i>Metaphoxus</i> sp.)	x 3
Pyconogonid	x 1
POLYCHAETA	
Opheliidae (<i>Travisia</i> sp. ?)	x 2
Cirratulidae (<i>Tharyx</i> sp. ?)	x 45 (with fragments)
fragments, etc.	x 11
? Sipunculid	x 1
Bivalve A	x 1
Bivalve B	x 18 (juveniles)

6-10cm layer

COELENTERATA	
? Scyphozoa polyp	x 1
POLYCHAETA	
Cirratulidae	x 1
fragments, etc.	x 8

11-15 cm layer

POLYCHAETA	
Cirratulidae	x 3

16-20cm layer

POLYCHAETA	
Cirratulidae	x 1

Fauna collected other than from the 4 subcores

Harpacticoid copepod	x 4
POLYCHAETA	
Cirratulidae	x 35 (with fragments)
fragments, etc.	x 25

Identification of representative macrobenthos

MOLLUSCA	
<i>Kelliella</i> sp. a	x 4
<i>Axinulus</i> sp. a	x 7

[to be contined]

((Station 6 continued))

<i>Neilonella</i> sp.	x 4
<i>Yoldiella</i> sp. b	x 3
HARPACTICOIDA	
gen. spp.	x 14 (incl. 5 spp. ?)
TANAIDACEA	
gen. spp.	x 2
AMPHIPODA	
<i>Metaphoxus habitus</i> sp.	x 5

Table 5-2-3. Preliminary results of macrobenthos collected by box corer.

Station 7
 Depth: 4235m
 Date: July 16, 1981
 Gear: 1/4m² USNEL box corer
 Ship Position: 40°05.7'N; 143°57.8'E
 Sediment: Sandy mud ? (sandy layer at ca. 15 cm)

*Vertical distribution of macrobenthos based on horizontal slices of sediment**

* Dimension of subcores used: 30x20x5 cm; 4 different horizontal layers corresponding to 0-5, 6-10, 11-15 and 16-20cm depth of the box corer sample.

0-5 cm layer

Nematoda	x 11
Nemertini	x 1 (fragment ?)
Cumacea	x 2
Amphipoda (<i>Metaphoxus</i> sp.)	x 4
Isopoda	x 2
Tanaid	x 1
POLYCHAETA	
<i>Sternaspis</i> sp.	x 1
? <i>Sthenelais</i> sp.	x 1
Maldanidae	x 2 (juveniles)
fragments, etc.	x 8
Ophiuroid	x 1
Holothuroid	x 1 (smashed)
<i>Ypsilothuria</i> sp.	x 1
Chaetoderma sp.	x 3
Bivalve	x 5 (small)
Scaphopoda	x 1
Foraminifera	x 1
?? Dark-gray mat-like structure	(net-work: Ref. D. D. S.)

6-10cm layer

Chaetoderma sp.	x 1
Bivalve	x 1 (small)
Foraminifera	x 1

11-15 cm layer

Gastropoda	x 1
? Polychaeta (<i>Sthenelais</i> sp.)	x 1 (badly smashed)
?? Dark-gray mat-like structure	(net-work: Ref. D. D. S.)

16-20cm layer

Amphipod (<i>Metaphoxus</i> sp.)	x 1
? Harpacticoid copepod	x 2 (? contamination)
COELENTERATE	
? Scyphozoa polyp	x 2
Foraminifera	x 81

Fauna collected other than from the 4 subcores

Tanaid	x 1
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[to be continued]

((Station 7 continued))

Ophiuroid	x 1 (minute)
POLYCHAETA	
Maldanidae	x 3 (juveniles)
? <i>Sthenelais</i> sp.	x 3
? Phyllodocidae	x 1
Lumbrineridae	x 2
fragments, etc.	x 3

Identification of representative macrobenthos

MOLLUSCA	
Trochidae	x 1
<i>Dentalium</i> sp.	x 2
Scaphopoda	x 1
<i>Axinulus</i> sp. b	x 21
<i>Axinulus</i> sp. c	x 23
HARPACTICOIDA	
gen. spp.	x 33 (incl. 2 spp.?)
CUMACEA	
<i>Diastylis</i> sp.	x 1
<i>Leptostylis</i> sp.	x 1
<i>Leucon</i> sp.	x 3
<i>Eudorella</i> sp.	x 3
TANAIDACEA	
<i>Neotanais</i> habitus	x 3
ISOPODA	
<i>Haploniscus</i> sp. (? <i>pseudunicornis</i>)	x 1
AMPHIPODA	
<i>Metaphoxus</i> habitus sp.	x 1

Table 5-2-4. Preliminary results of macrobenthos collected by box corer.

Station 10 Depth: 5125m
 Date: July 28, 1981
 Gear: 1/4m² USNEL box corer
 Ship Position: 39°11.9'N; 143°55.8'E
 Sediment: Hard mud (consolidated)

*Vertical distribution of macrobenthos based on horizontal slices of sediment**

* Only a white, calcareous Polychaeta (?) tube (empty) was found after sieving.

Identification of representative macrobenthos

HARPACTICOIDA	
gen. spp.	x 20 (2 spp.)
OSTRACODA	
<i>Cythereis</i> (?)	x 2 (2 spp.)
TANAIDACEA	
aff. <i>Neotanais</i> sp.	x 6
ISOPODA	
<i>Macrostylis</i>	x 2
<i>Haploniscus</i> sp.	x 2
<i>Eurycope</i> sp.	x 1
AMPHIPODA	
aff. <i>Metaphoxus</i> (?)	x 1

Table 5-2-5. Preliminary results of macrobenthos collected by box corer.

Station 11 Depth: 5369m
 Date: August 1, 1981
 Gear: 1/4-m² USNEL box corer
 Ship Position: 38°35.3'N; 145°14.8'E
 Sediment: Clayey sandy mud (sample 30cm depth)

*Vertical distribution of macrobenthos based on horizontal slices of sediment**

* Dimension of subcores used: 30x20x5 cm; 4 different horizontal layers corresponding to 0-5, 6-10, 11-15 and 16-20cm depth of the box corer sample.

0-5 cm layer	
Foraminifera	x 1
Nematoda	x 4
POLYCHAETE	
Cirratulidae	x 1 (small)
Opheliidae	x 1 (smashed)
Maldanidae	x 1 (smashed)
?? Mat-like structure present	(ref. to previous station)
? Animal	x 1 (Coelenterate???)
6-10cm layer	
Nematoda	x 1
11-15 cm layer	
No animals were collected.	
16-20cm layer	
No animals were collected.	

Fauna collected other than from the 4 subcores

Nematoda	x 6
POLYCHAETA	
Opheliidae	x 3 (1 smashed)
Cirratulidae	x 1 (fragment)
? Sipunculid	x 1
?? Mat-like structure present	
?? Protozoa (transparent; hard; inside empty; ball-like; easily damaged)	

Identification of representative macrobenthos

MOLLUSCA	
<i>Axinulus</i> sp. c	x 1
<i>Modiolus</i> sp.	x 1

Table 5-2-6. Preliminary results of macrobenthos collected by box corer.

Station 12 Depth: 6348m
 Date: July 30, 1981
 Gear: 1/4m² USNEL box corer
 Ship Position: 38°32.0'N; 144°20.1'E
 Sediment: Sandy mud (clayey; sample depth 20cm)

*Vertical distribution of macrobenthos based on horizontal slices of sediment**

* Dimension of subcores used: 30x20x5 cm; 4 different horizontal layers corresponding to 0-5, 6-10, 11-15 and 16-20cm depth of the box corer sample.

0-5 cm layer	
Nematoda	x 1
POLYCHAETA	
Maldanidae	x 6 (with fragments)
Cirratulidae	x 2
Tanaid	x 2
?? Mat-like structure	(ref. previous stations)
Xemophyophoria (Rhizopoda)	hexagonal net-work
6-10cm layer	
No animals were found.	
11-15 cm layer	
No animals were found.	
16-20cm layer	
No animals were found.	

Fauna collected other than from the 4 subcores.

Nematoda	x 3
? Scyphozoa polyp	x 6
Harpacticoid copepods	x 7
POLYCHAETA	
Maldanidae	x 1
?? Mat-like structure present	

Identification of representative macrobenthos

HARPACTICOIDA	
gen. spp.	x 24 (3 spp.)
OSTRACODA	
aff. <i>Cythereis</i> sp.	x 1
CUMACEA	
aff. <i>Neotanis</i> sp. a	x 1
aff. <i>Neotanis</i> sp. b	x 2
ISOPODA	
<i>Ilyarachna</i> sp.	x 1
aff. <i>Munna</i> sp.	x 1

Table 5-2-7. Preliminary results of macrobenthos collected by box corer.

Station 13 Depth: 7386m
 Date: July 29, 1981
 Gear: 1/4m² USNEL box corer
 Ship Position: 38°31.0'N; 144°06.5'E
 Sediment: Mud (reddish)

*Vertical distribution of macrobenthos based on horizontal slices of sediment**

* Dimension of subcores used: 30x20x5 cm; 4 different horizontal layers corresponding to 0-5, 6-10, 11-15 and 16-20cm depth of the box corer sample.

0-5 cm layer	
Nematoda	x 24
POLYCHAETA	
Opheliidae (? <i>Travisia</i> sp.)	x 3
Cirratulidae	x 13 (with fragments)
MOLLUSCA	
Chaetoderma sp.	x 2
<i>Kelliella</i> sp.	x 8
<i>Neilonella</i> sp.	x 1
?? Mat-like structure	(net-work, dark-grey colour)
6-10cm layer	
Tanaid	x 1
POLYCHAETA	
Cirratulidae	x 2 (fragments)
BIVALVE	
<i>Kelliella</i> sp.	x 1
11-15cm layer	
POLYCHAETA	
Cirratulidae	x 3 (fragments)
?? Mat-like structure	
16-20cm layer	
Nematoda	x 1
POLYCHAETA	
Cirratulidae	x 3
?? Mat-like structure	

Fauna collected other than from the 4 subcorers

POLYCHAETA	
Cirratulidae	x 31 (with fragments, etc.)
Opheliidae (<i>Travisia</i> ? sp.)	x 4
Nematoda	x 5
Chaetoderma sp.	x 2

Identification of representative macrobenthos

[to be continued]

((Station 13 continued))

MOLLUSCA

<i>Margarites</i> sp.	x 2
Gastropoda gen. sp. 1	x 1
Gastropoda gen. sp. 2	x 1
Gastropoda gen. sp. 3	x 6
Gastropoda gen. sp. 4	x 4
Gastropoda gen. sp. 5	x 1
Gastropoda gen. sp. 6	x 1
Gastropoda gen. sp. 7	x 1

HARPACTICOIDA

gen. spp.	x 5 (3 spp.)
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TANAIDACEA

aff. <i>Neotanais</i> sp.	x 1
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ISOPODA

aff. <i>Desmosoma</i> (?) sp.	x 1
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5-3. Underwater Photography

Suguru OHTA (ORI, Univ. Tokyo)

Underwater stereoscopic photography was carried out at nine stations (Table 4) in order to observe large epibenthic and demersal organisms in their natural conditions, and bottom environments such as micro-topography, surface sediments, bottom currents as revealed by scours, dunes and lineations, etc. Precise quantitative estimation, analysis of spatial distribution of megaepibenthos can be done through geometrical analysis of stereo photographs and measurements of specimens collected with beam trawl, epibenthic sledge and box corer, in the laboratory. Observations of traces made by living organisms (*lebensspuren*) are also the favorite items of photographic observations.

The camera system is composed of the following items;

Underwater camera: two BENTHOS Model 372 standard cameras
two identical cameras with parallel optic axes separated a known distance and oriented perpendicular to the field of view.
28mm focal length lens (underwater corrected)
film capacity 100 feet for ca. 800 frames

Underwater electronic flash: BENTHOS Model 382
100 watt second per flash

Acoustic sonar ('pinger'): BENTHOS Model 2216

Altimeter: BENTHOS Model 2110
acoustic altimeter for measuring shot distance

'van Dorn' type water sampler (0.5 or 3.0 litre)
set for sampling near bottom water
(dissolved oxygen, salinity, particulate matter)

Reversing thermometers

Operation Mode:

Automatic triggering without shutter
ca. 8-sec-interval exposure
Shot distance was monitored with Ohta's Distance Monitoring system and Precision Depth Recorder set for pinger receiving mode.

As the main components of this system are new to the operator and also have some grave defects in their electrical circuitry, the results were not always satisfactory.

Preliminary observations and some noteworthy objects are summarized in the followings:

STATION 3 [2002-2034m]

Hymenaster glaucus, *Pteraster* sp., *Amphiura koreae* (buried), *Ophiocten hastatum*, *Ophiophthalmus normani*, *Buccinum* sp., ?*Fungiacyathus* sp., sabellid polychaete worms, Enteropneusta, plough marks of spatangoids.

STATION 7 [4197-4202m]

Elpidia theeli, *Pennatula* sp., *Calibelemnon* sp., *Umbellula thomsoni*, *Dytaster* sp., *Fungiacyathus* sp., *Benthodytes sanguinolenta*, *Coryphaenoides* sp. a, *Epi-zoanthus* sp.

STATION 8 [1977-1987m]

Fungiacyathus sp., *Nematocarcinus* sp., *Pseudostichopus* sp., *Synallactes* sp., *Paelopatides* sp., *Peniagone* sp., *Synaphobranchus* sp., *Coryphaenoides longifilis*, *Coryphaenoides acrolepis*

STATION 10 [5085-5144m]

? *Fungiacyathus* sp., 6-armed asteroid, *Dytaster* sp., *Ophiura bathybia*, *Ophiacantha bathybia*, *Peniagone wyvilli*, *Peniagone azorica*, *Coryphaenoides* sp.

STATION 11 [5378-5378m]

sea anemones, *Umbellula thomsoni*, *Buccinum* sp., *Amphiophiura convexa*, *Ophiacantha bathybia*, *Kamptosoma asterias*, *Paelopatides* sp.

STATION 12 [6271-6271m]

many sea anemones, Enteropneusta gen. sp., *Benthesicymus crenatus*, mysid gen. sp., *Bathycrinus* sp., *Freyella oligobrachia* (7-armed asteroid), *Amphiophiura convexa*, *Peniagone azorica*

STATION 13 [7366-7399m]

Elpidia glacialis kurilensis, *Mesothuria ?murrayi*, *Storothyngura* sp., *Macellicephala* sp., *Jacobia birsteini* [Bonellidae], slender-armed sea anemone, *Octacnemus* sp. [Tunicata], ?*Galatheanthemum*, ?*Epimeria* sp., *Careproctus amblyostomopsis*
Many vinyl wastes and tremendous lineation made by flown trashes!

5-4. Studies of Plankton and Micronekton

5-4-1. Studies on the plankton in the Subarctic Waters off Sanriku, northeastern Japan

Yasue NAKAMURA, Tamiji YAMAMOTO, Hiroshi HATTORI,
the late Tomoko SHOJI, Toru YAMAMOTO and Akira TANIGUCHI
(Tohoku University)

The Subarctic Water area off Sanriku District, northeastern Japan, covers different water masses originated from both of cold and warm currents. Ecological investigations on plankton were carried out at five stations (Sts. 1-3, 5-7) in cold Oyashio Current and mixed water region south of the current (see Tables 5-9). An extensive investigation was done in the mixed water around Kuroshio Front on July 7-8, 1981. A traverse crossing the front which had been defined around 36°N, 142°E, was fixed and 15 samplings were made in horizontal series over the entire traverse and in vertical series at selected 4 to 5 locations (Sts. 1-1, 1-2, 1-3, 1-4 and 1-5) on the traverse (Figs. 5-4-1-1 and 5-4-1-2). The gears used were CTD with Rosette sampler, Van Dorn bottles, North Pacific Standard (NORPAC) and Motoda Multiple Horizontal Towing (MTD) plankton nets, Longhurst-Hardy plankton Recorder (LHPR), and Scatter-Fluorescence-Temperature-Depth Recorder (SFTD). By these amounts of ammonium, nitrite, nitrate, phosphate, silicate, chlorophyll (see Table 5-4-1-1), phytoplankton, bacteria and microzooplankton were estimated. In addition to these investigations, diel change of plankton distribution in vertical plane at Station 5 was determined by using SFTD and LHPR (Figs. 5-4-1-3 and 5-4-1-4), and nitrate uptake by natural phytoplankton was also measured by using N15 trace technique (Fig. 5-4-1-5). In situ particle collector were deployed at Station 5 to obtain information concerning the sinking particles.

Table 5-4-1-1A. Data on phytoplankton pigment and nutrient concentrations.

Station & Depth	Phytoplankton pigments (µg/l)				NO ₃ -N	NO ₂ -N	Nutrients (µg-at/l)			
	Microplankton Chl-a Phae	Nanoplankton Chl-a Phae	Total Chl-a Phae	PO ₄ -P			NH ₄ -N	SiO ₃ -Si		
St. 1-1										
0 m	0.009	0.009	0.154	0.107	0.163	0.116	trace	0.90	0.08	40.9
4	0	0.030	0.145	0.116	0.145	0.146	1.75	1.28	0.05	38.8
10	0.005	0.009	0.107	0.178	0.112	0.187	0.17	0.95	0.08	38.8
30	0.021	0.025	0.851	0.592	0.872	0.617	0.04	1.25	0.12	39.9
50	0.058	0.062	0.183	0.237	0.241	0.299	3.33	1.58	0.58	54.0
75	0.008	0.021	0.035	0.139	0.043	0.160	5.13	1.07	0.58	58.9
100	0.004	0.029	0.021	0.160	0.025	0.189	6.76	1.41	0.58	58.2
St. 1-2										
0 m	0.052	0.040	0.676	0.372	0.728	0.412	0.41	1.00	0	48.0
4	0.080	0.047	0.792	0.356	0.872	0.403	0.28	1.20	0.01	47.6
10	0.037	0.045	0.462	0.226	0.499	0.271	0.29	1.52	0.01	42.7
25	0.054	0.027	0.266	0.139	0.320	0.166	0.01	1.14	0	43.1
50	0.013	0.08	0.959	0.590	0.972	0.670	1.24	1.14	0.24	46.9
85	0.009	0.051	0.052	0.162	0.061	0.213	5.88	1.14	0.47	52.6
125	0.003	0.046	0.025	0.115	0.028	0.161	6.38	1.25	0.58	63.5
St. 1-3										
0 m	0.082	0.151	0.097	0.091	0.179	0.242	0.07	1.14	0.05	40.9
4	0.058	0.108	0.200	0.119	0.258	0.227	0.03	1.11	0.16	40.9
10	0.176	0.294	0.236	0.142	0.412	0.436	0.03	1.55	0	38.5
20	0.061	0.145	0.228	0.228	0.289	0.373	0.12	1.46	0	44.8
45	0.108	0.159	0.123	0.211	0.231	0.370	7.61	1.25	0.66	62.8
65	0.037	0.098	0.369	0.428	0.406	0.526	1.80	1.67	0.16	43.1
100	0.004	0.031	0.025	0.110	0.029	0.141	5.47	1.17	0.62	56.5
St. 1-4										
0 m	0.047	0.027	0.107	0.057	0.154	0.084	0.03	1.17	0	18.7
4	0.013	0.013	0.075	0.058	0.088	0.071	0.05	1.05	0	20.1
10	0.022	0.022	0.090	0.061	0.112	0.083	0.13	1.11	0.01	20.8
25	0.018	0.012	0.063	0.049	0.081	0.061	0.09	1.82	0.16	21.9
40	0.021	0.022	0.127	0.099	0.148	0.121	0.05	1.25	0.01	23.6
65	0.021	0.024	0.053	0.101	0.074	0.125	4.38	1.20	0.39	22.9
100	0.017	0.047	0.035	0.101	0.052	0.148	5.47	1.45	0.62	33.9

Table 5-4-1-1B. Data on phytoplankton pigment and nutrient concentrations.

Station (Front)	Phytoplankton pigments (µg/l)						Nutrients (µg-at/l)						
	Microplankton		Nanoplankton		Total		NO ₃ -N		NO ₂ -N		NH ₄ -N		PO ₄ -P
	Chl-a	Phae	Chl-a	Phae	Chl-a	Phae	NO ₃ -N	NO ₂ -N	NH ₄ -N	PO ₄ -P	SiO ₃ -Si		
F-1	0.006	0.007	0.146	0.099	0.152	0.106	0.10	trace	1.25	0	35.3		
F-2	0.005	0.008	0.154	0.102	0.159	0.110	0.02	trace	1.55	0.01	41.6		
F-3	0.040	0.016	0.436	0.243	0.476	0.259	0.23	0.02	1.14	0.08	45.9		
F-4	0.115	0.092	0.629	0.286	0.744	0.378	0.09	trace	1.46	0.12	43.1		
F-5	0.069	0.098	0.366	0.130	0.435	0.228	0.15	0.01	1.52	0.05	39.2		
F-6	0.070	0.164	0.184	0.338	0.254	0.502	0.08	0.01	1.05	0	1.8		
F-7	0.048	0.058	0.148	0.116	0.196	0.174	0.06	0.01	1.07	0.01	16.6		
F-8	0.042	0.050	0.153	0.109	0.195	0.159	0.09	trace	0.08	0.05	18.4		
F-9	0.036	0.032	0.110	0.216	0.146	0.248	0.06	trace	0.74	0.05	18.4		
F-10	0.028	0.034	0.121	0.094	0.149	0.128	trace	0.02	0.95	0.01	18.7		
F-11	0.021	0.019	0.089	0.066	0.110	0.085	0.04	trace	0.97	0.01	18.7		
F-12	0.017	0.02	0.096	0.065	0.113	0.085	0.07	trace	1.20	0.08	20.1		
F-13	0.017	0.022	0.104	0.078	0.121	0.100	0.07	0.01	1.25	0.05	18.7		
F-14	0.030	0.029	0.093	0.066	0.123	0.095	0.13	0.01	0.97	0.01	19.4		
F-15	0.012	0.010	0.077	0.059	0.089	0.069	0.17	trace	0.95	0.01	19.1		

Table 5-4-1-1C. Data on phytoplankton pigment and nutrient concentrations.

Station & Depth	Phytoplankton pigments (µg/l)										Nutrients (µg-at/l)					
	Microplankton		Nanoplankton		Total		Chl-a		Phae		NO ₃ -N	NO ₂ -N	NH ₄ -N	PO ₄ -P	SiO ₃ -Si	
St. 2																
0 m	0.014	0.025	0.089	0.053	0.103	0.078	0.19	trace	1.46	0.27	25.1	0.17	trace	1.58	0.08	24.7
10	0.009	0.015	0.087	0.027	0.096	0.042	0.19	0.14	1.20	0.05	27.9	0.19	0.14	1.20	0.05	27.9
20	0.010	0.025	0.112	0.077	0.122	0.102	0.29	0.05	1.46	0.17	29.6	0.29	0.05	1.46	0.17	29.6
30	0.011	0.032	0.120	0.142	0.131	0.171	4.29	0.71	1.11	0.52	29.6	4.29	0.71	1.11	0.52	29.6
50	0.049	0.068	0.416	0.582	0.465	0.650	5.20	0.07	1.62	0.26	26.5	5.20	0.07	1.62	0.26	26.5
75	0.010	0.087	0.120	0.193	0.130	0.280	8.74	0.10	1.41	0.87	44.5	8.74	0.10	1.41	0.87	44.5
100	0	0.068	0.021	0.076	0.021	0.144	12.63	0.10	1.25	1.06	54.4	12.63	0.10	1.25	1.06	54.4
150	0	0.043	0.004	0.034	0.004	0.077	10.35	0.07	1.45	0.93	55.1	10.35	0.07	1.45	0.93	55.1
200	0	0.056	0.025	0.097	0.025	0.153	14.51	0.09	1.45	1.41	80.8	14.51	0.09	1.45	1.41	80.8
300	0	0.029	0.001	0.038	0.001	0.067										
St. 5																
0 m	0.019	0.013	0.095	0.039	0.019	0.013	0.43	0.30	2.27	0	26.5	0.17	trace	1.82	0.01	22.6
4	0.032	0.037	0.091	0.033	0.127	0.076	1.39	0.13	1.32	0	23.3	2.99	0.11	2.03	0	21.5
10	0.055	0.023	0.091	0.033	0.146	0.056	5.88	0.36	1.85	0.58	33.5	5.88	0.36	1.85	0.58	33.5
20	0.275	0.448	0.296	0.130	0.571	0.578	9.14	0.53	1.32	0.74	39.5	9.14	0.53	1.32	0.74	39.5
30	0.186	0.122	0.316	0.330	0.502	0.452	10.62	0.09	1.28	1.03	57.5	10.62	0.09	1.28	1.03	57.5
50	0.049	0.112	0.264	0.339	0.313	0.451	15.55	trace	1.85	1.31	85.4	15.55	trace	1.85	1.31	85.4
75	0.012	0.054	0.045	0.154	0.057	0.206	14.95	0.12	1.07	1.31	44.1	14.95	0.12	1.07	1.31	44.1
100	0.002	0.029	0.007	0.077	0.007	0.106	15.91	0.16	1.55	2.55	109.1	15.91	0.16	1.55	2.55	109.1
150			0.004	0.086	0.004	0.086	23.78	0.07	2.12	2.20	159.2	23.78	0.07	2.12	2.20	159.2
200			0	0.071	0	0.071	31.82	0.07	1.28	2.64	164.1	31.82	0.07	1.28	2.64	164.1
300			0	0.044	0	0.044	32.63	0.20	1.62	2.74	162.7	32.63	0.20	1.62	2.74	162.7
400			0	0.044	0	0.044										
500			0	0.026	0	0.026										

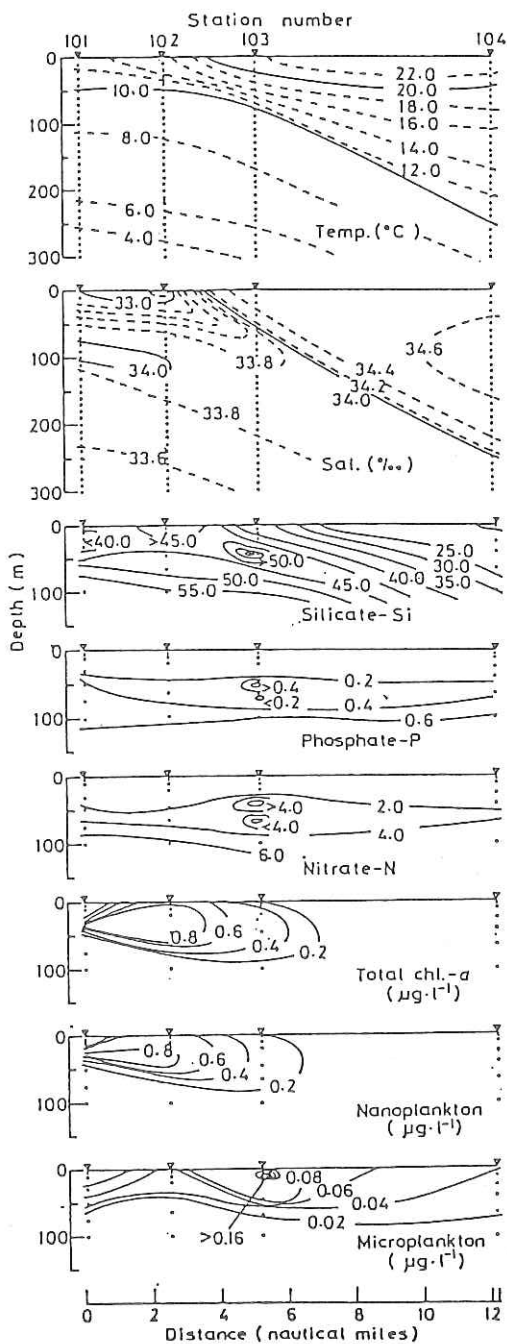


Fig. 5-4-1-1. Temperature, salinity, essential nutrients, and total-, nano- and microplankton chlorophyll-*a* sections across the Kuroshio Front off Joban on July 7-8, 1981.

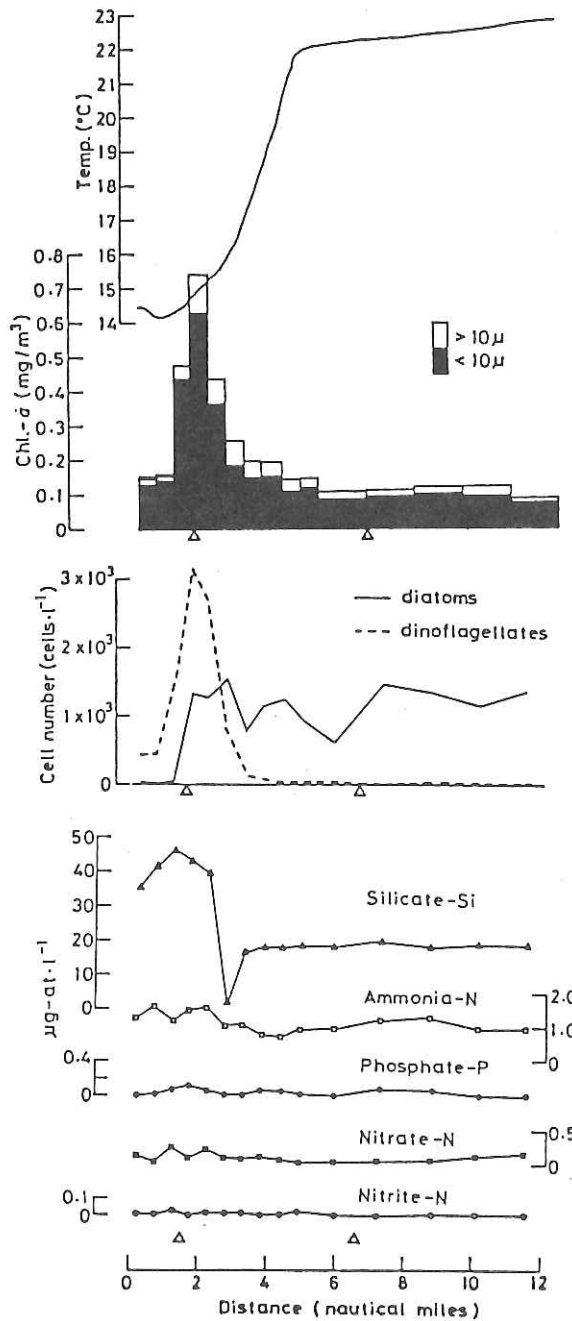


Fig. 5-4-1-2. Horizontal variations in temperature, chlorophyll-a, cell number of diatoms and dinoflagellates, and essential nutrients in surface seawater (ca. 3 m depth) across the Oyashio Front east off Joban on July 7-8, 1981.

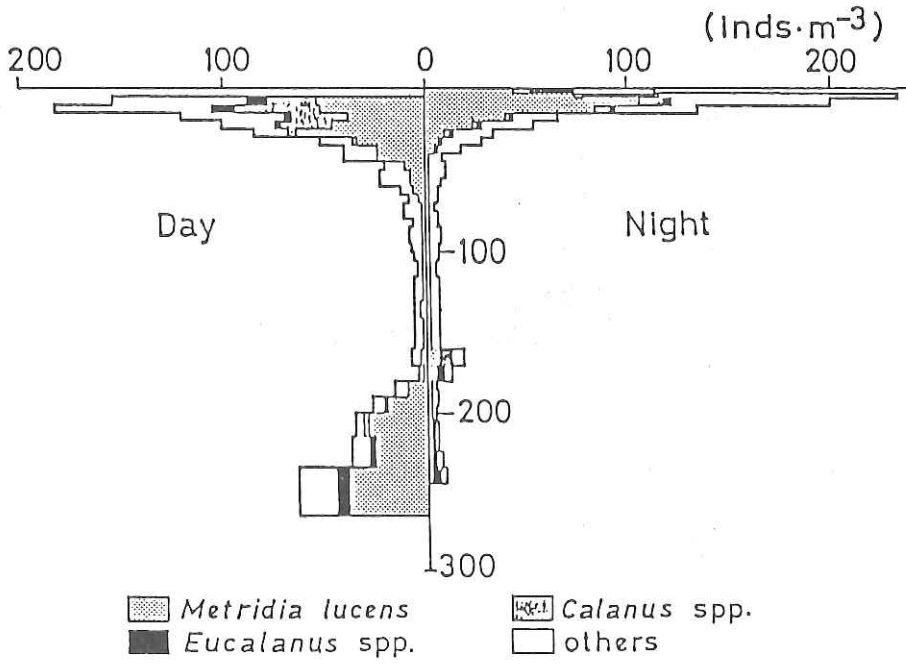


Fig. 5-4-1-3. Changes in vertical distribution of total copepods between a day haul and a night haul of LHPR at Station 5.

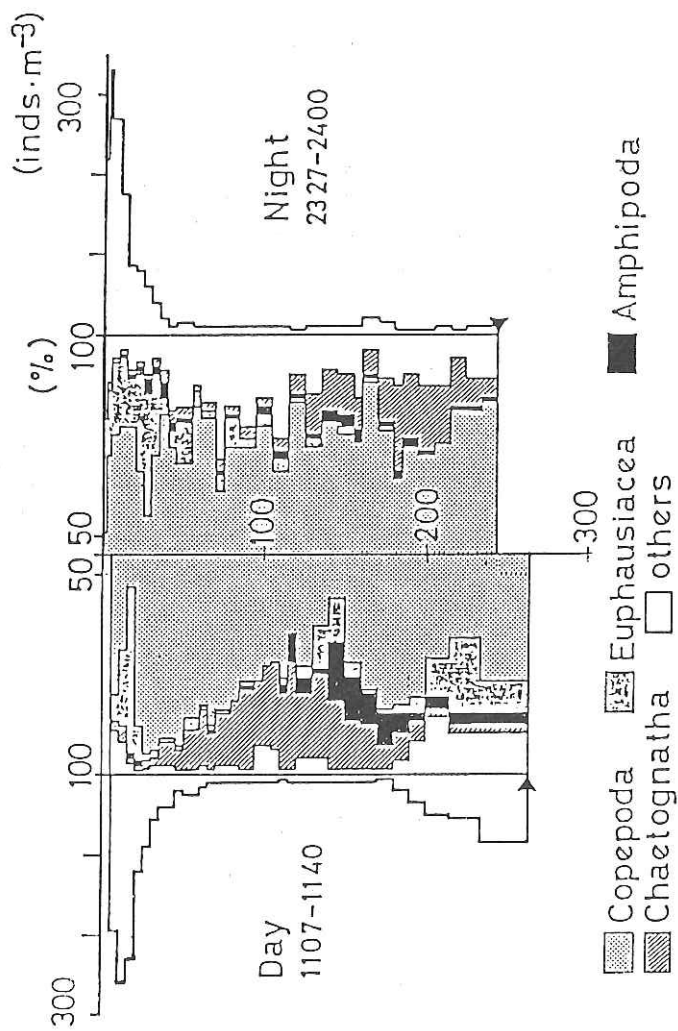
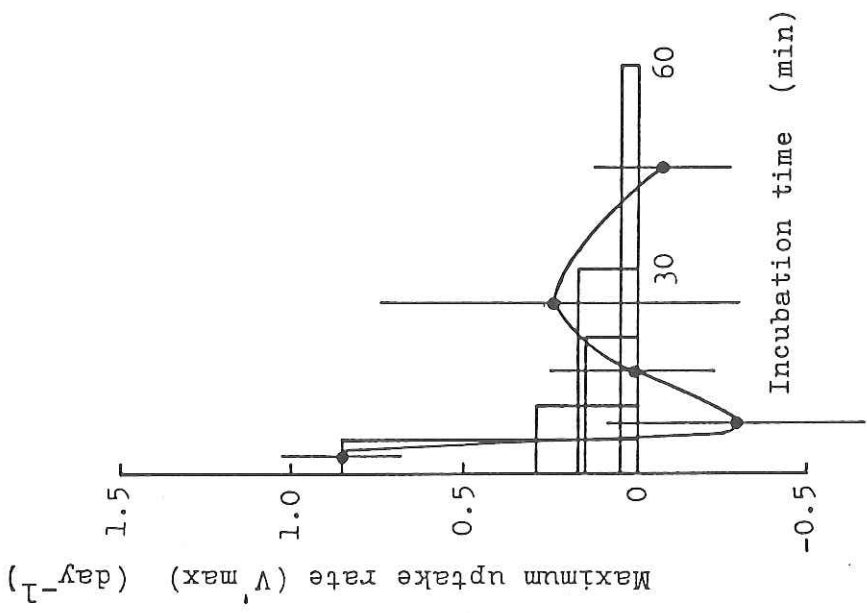


Fig. 5-4-1-4. Day-time and night-time vertical distributions of individuals (both sides) and percentage compositions of major taxonomic groups of zooplankton at Station 5.



KH-81-4 St. 1-4

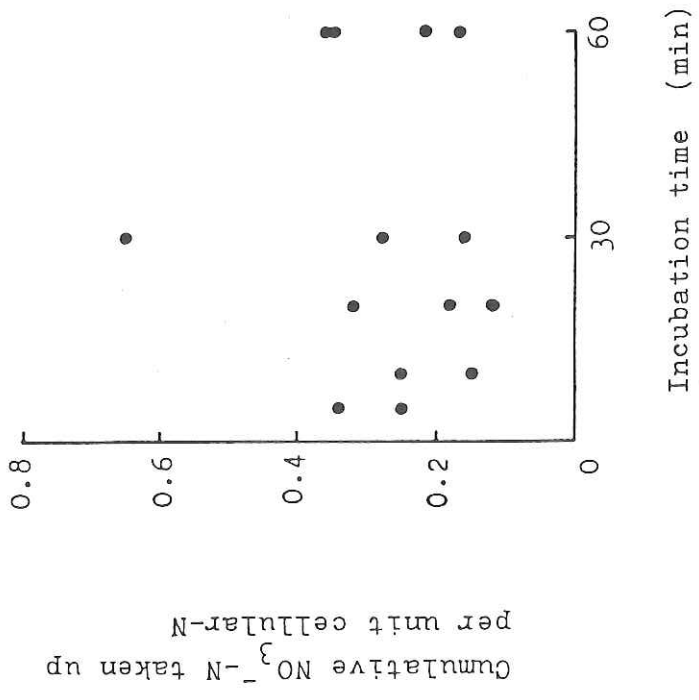


Fig. 5-4-1-5. Observed nitrogen uptake and calculated maximum specific uptake rates (V'_{max}) of a natural phytoplankton population sampled at St. 1-4 (KH-81-4) as a function of incubation time.

5-4-2. Ecology of zooplankton and micronekton

N. Iwasaki (ORI, Univ. Tokyo)

One of the principal purposes of this cruise was to describe the zooplankton and micronekton fauna off Sanriku, Japan, in terms of taxonomy, biomass and geographical distribution. The following studies and sampling were carried out.

(1) Collection of zooplankton and micronekton

A NORPAC-twin net constructed of 0.10mm-mesh and 0.33mm-mesh net was towed vertically from a depth of 150m to the surface to collect large phytoplankton and epipelagic zooplankton.

Indian Ocean standard net (IIOE net) with a mesh opening of 0.33mm was towed vertically from a depth of 7400m to 5000m to collect deep zooplankton (see Table 13).

A Bongo net with a mesh opening of 0.33mm was used to study the geographical distribution of zooplankton (see Table 11).

A 10 feet Isaacs-Kidd midwater trawl (IKMT) with a mesh opening of 5mm was towed obliquely with a wire length of 2000m to collect micronekton (see Table 11).

(2) Zooplankton and micronekton fauna and their biomass

The measurement of biomass of each taxonomic group is being made for the samples collected with the IKMT. Table 5-4-2-1 shows the wet weight of each taxonomic group.

(3) Distribution of pelagic shrimps

1257 specimens of pelagic shrimps were caught, and of these 1218 specimens in 23 species were identified. The most abundant species was *Hymenodra frontalis* which accounted for 34.5% of the total catch. The next abundant species to *H. frontalis* was *Bentheogennema borealis*. This species occupied 19.3% of the total catch.

Table 5-4-2-1. Wet weight (g/1000m³) of zooplankton and micronekton collected by 10 feet IKMT.

Pisces, Coelenterata, Ctenophora and Heteropoda are excluded.

Station	4-1	4-2	6-1	6-2	8	10	11	12	13	14
Location	40-18.3N	40-15.5N	40-04.2N	40-05.1N	38-44.5N	38-58.0N	38-34.3N	38-34.2N	38-30.9N	38-01.2N
(Middle point)	145-00.2E	144-29.0E	144-16.8E	144-13.7E	143-09.2E	143-51.3E	145-15.1E	144-20.3E	144-06.6E	145-54.8E
Date	July 11 '81	July 11	July 15	July 15	July 26	July 26	Aug. 1	July 31	July 29	Aug. 2
MOLLUSCA										
Atlantidae	+	+	+	+	0.01		+	+	+	+
Cephalopoda	0.17	0.41	0.16		6.82		0.20	1.38	0.03	1.22
POLYCHAETA	0.01		0.04	+		0.01	0.01		0.09	0.02
CRUSTACEA										
Copepoda	0.01	0.01	0.02	0.01	0.02	0.06	0.03	0.02	0.02	0.07
Mysidacea	0.03	0.09	0.55	0.48	0.54	0.26	0.27	0.30	0.01	0.18
Amphipoda	0.10	0.15	0.13	0.09	0.13	0.16	0.15	0.04	0.02	0.23
Euphausiacea	1.54	1.81	2.12	2.02	1.75	10.95	5.55	3.09	9.48	2.10
Sergestidae	0.03	0.02	0.29	0.23	0.15	0.29	0.09	0.26	0.30	0.50
Penaeidae	0.43	0.24	0.52	1.04	1.01	1.31	0.66	0.46	0.33	1.15
Caridea	0.66	0.16	0.72	0.72	1.02	0.75	0.45	0.33	3.35	1.11
Larvae of Decapoda	+	0.01	0.01	0.01	0.03		0.01	+	+	0.02
CHAETOGNATHA	0.25	0.32	0.24	0.37	0.14	0.33	0.24	0.19	0.22	0.52
TUNICATA										
Pyrosomata		0.26	0.07				0.26			0.01
Others		+	0.01					0.02		0.01
Total	3.23	3.48	4.88	4.97	11.62	14.15	7.92	6.09	13.85	7.14

5-5. Recovery of Bottom Seismometers

Shozaburo NAGUMO and Sadayuki KORESAWA
(Earthquake Research Institute, University of Tokyo)

In this cruise, we performed the recovery of ocean-bottom seismometers (OBS) which were deployed in the previous R/V Hakuho-Maru cruise (KH-81-3) in this region. The mooring period was 45 or 46 days with nearly one-month (800 hours) recording period. It was the first time for the R/V Hakuho-Maru cruise that the visiting research party was allowed to use the two cruises which made the long-term mooring of observation instrument possible. We appreciate the chief scientists who made great efforts to realize such a cruise plan.

Operation of OBS recovery was very smooth. Leaving the Tomakomai on 22nd July 1981, we directly headed for the OBS station. Though the weather conditions were not always calm, we conducted OBS recovery operation exclusively for about 52 hours from the morning 23rd July to the morning 25th July. Because of slight water leakage of the pressure cases of the timer releases, to our regret, we recovered six units from 10 units. However, the recovered six OBS's formed a sufficient array for determining accurate micro-earthquake seismicity in the Japan Trench region off Sanriku.

It was the first time for the Japanese OBS array observation that the one-month recording was accomplished. (The single OBS mooring has been accomplished for more than 40 days by the Hakuho-Maru in 1969 already in this region.) In this sense, the operation performed in these Hakuho-Maru cruises could be regarded as an opening case of a long-term mooring operation by the common-use research vessels.

Operation log as well as positions of the OBS recovery were shown in Table 5-5-1 and 5-5-2.

The analyses of the data have successfully lead us to an accurate determination of the hypocenters in this region revealing direct relation between microseismicity and subduction tectonics.

We thank most sincerely to the chief scientist Prof. M. Horikoshi who made this operation possible.

Table 5-5-1 Data log of OBS recovery.

Station	Surfacing time	On deck time	Mooring period (day)	LAT	LONG	DEPTH
Q-1	7/23 05:18	05:53	46	40-00.2'N	144-55.6'E	5,740m
Q-2	7/23 10:45	11:06	45	39-39.3'N	145-18.3'E	5,360m
Q-3	7/23 16:13	16:35	45	39-13.3'N	145-14.9'E	5,400m
Q-4	7/23 20:31	21:00	45	39-02.9'N	144-57.9'E	5,560m
Q-5						
Q-6						
Q-7	7/24 15:38	15:50	45	39-32.7'N	143-32.6'E	2,740m
Q-8						
Q-9	7/25 02:33	02:50	45	39-21.5'N	143-57.9'E	4,850m
Q-10						

Table 5-5-2 Position of deployment and recovery (on deck).

Station	deployment	recovery (on deck)	displacement (min.)	displacement (mile)	time to pop-up (min.)
Q-1	39-59.6'N	40-00.2'N	0.6'		
	144-56.4'E	144-55.6'E	0.8'	1.0	35
Q-2	39-39.0'N	39-39.3'N	0.3'		
	145-18.7'E	145-18.3'E	0.4'	0.5	21
Q-3	39-13.8'N	39-13.3'N	0.5'		
	145-14.8'E	145-14.9'E	0.1'	0.5	22
Q-4	39-03.2'N	39-02.9'N	0.3'		
	144-56.7'E	144-57.9'E	1.2'	1.2	29
Q-7	39-32.6'N	39-32.7'N	0.1'		
	143-32.5'E	143-32.6'E	0.1'	0.1	12
Q-9	39-21.4'N	39-21.5'N	0.9'		
	143-57.0'E	143-57.9'E	0.9'	0.9	17

VI. APPENDIX

6-1. Representative CTD profiles

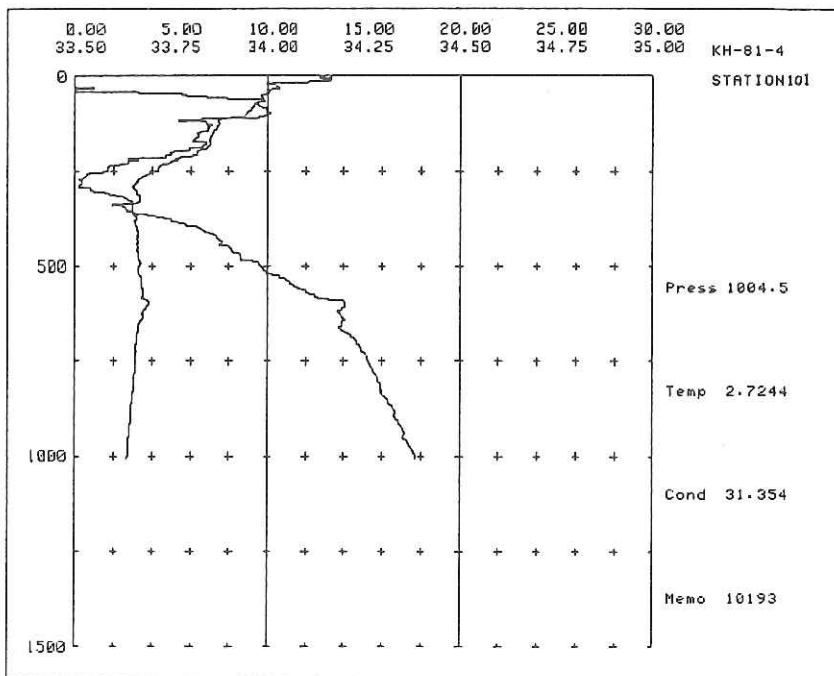


Fig. 6-1-1. Vertical T and S profile at St. 1-1 on July 7, 1981.

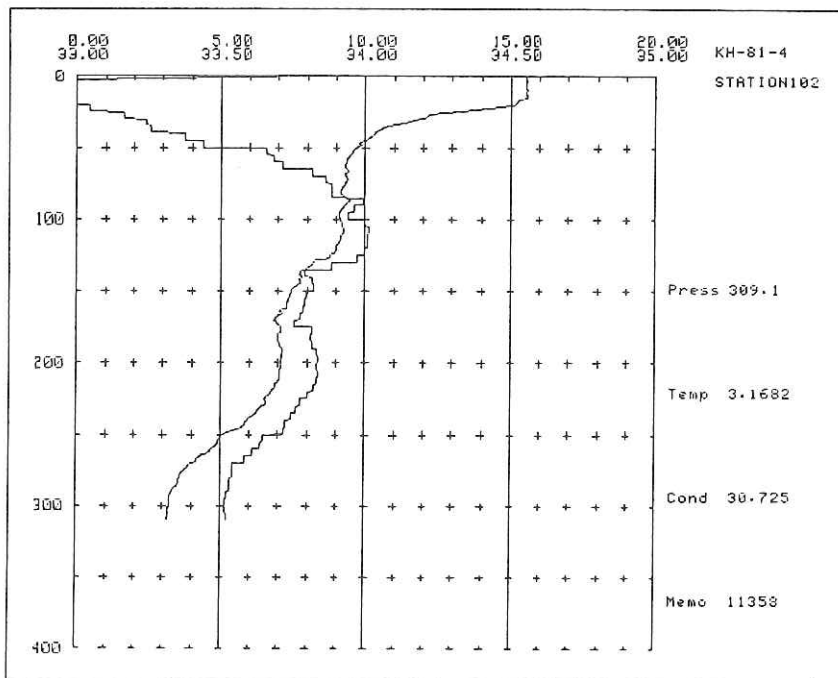


Fig. 6-1-2. Vertical T and S profile at St. 1-2 on July 7, 1981.

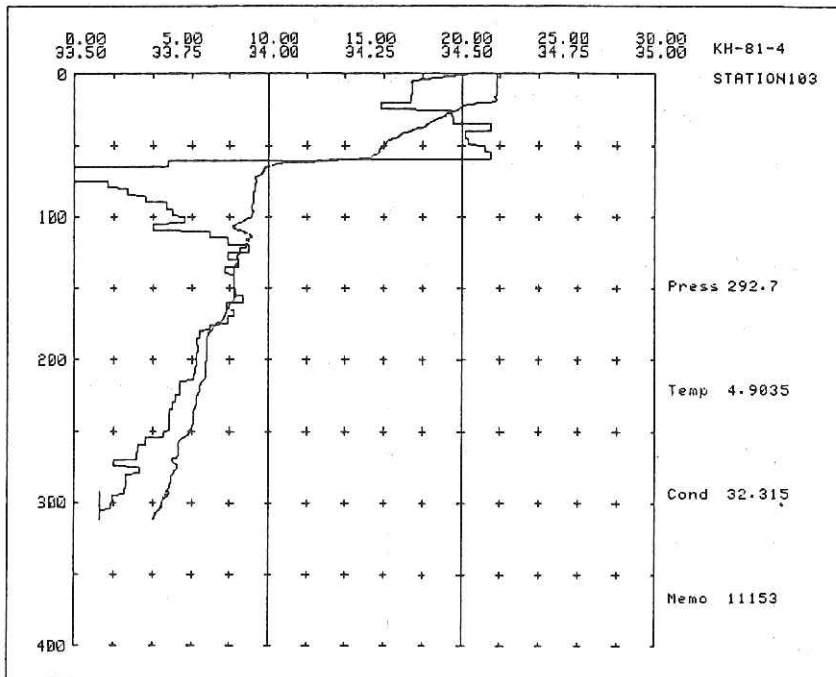


Fig. 6-1-3. Vertical T and S profile at St. 1-3 on July 8, 1981.

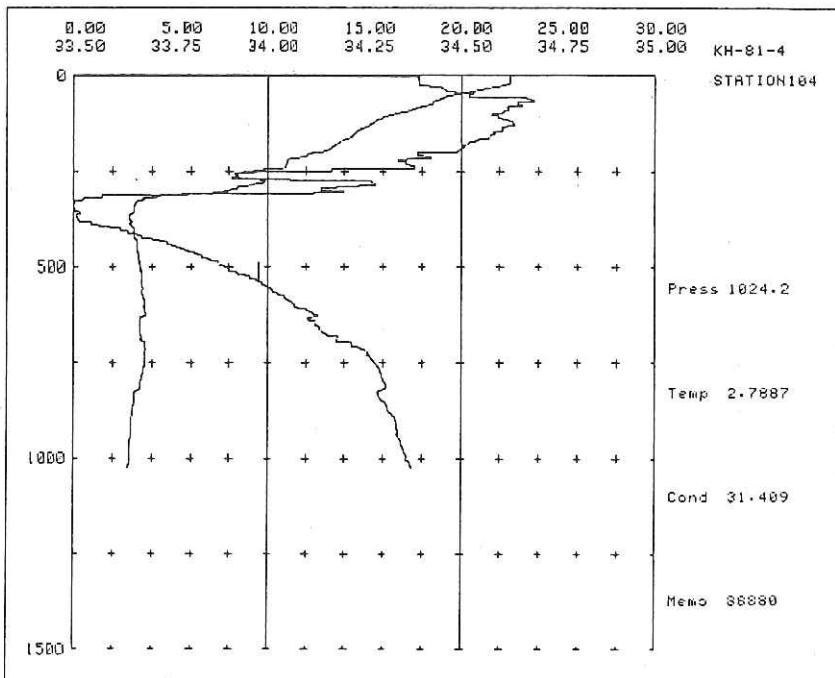


Fig. 6-1-4. Vertical T and S profile at St. 1-4 on July 8, 1981.

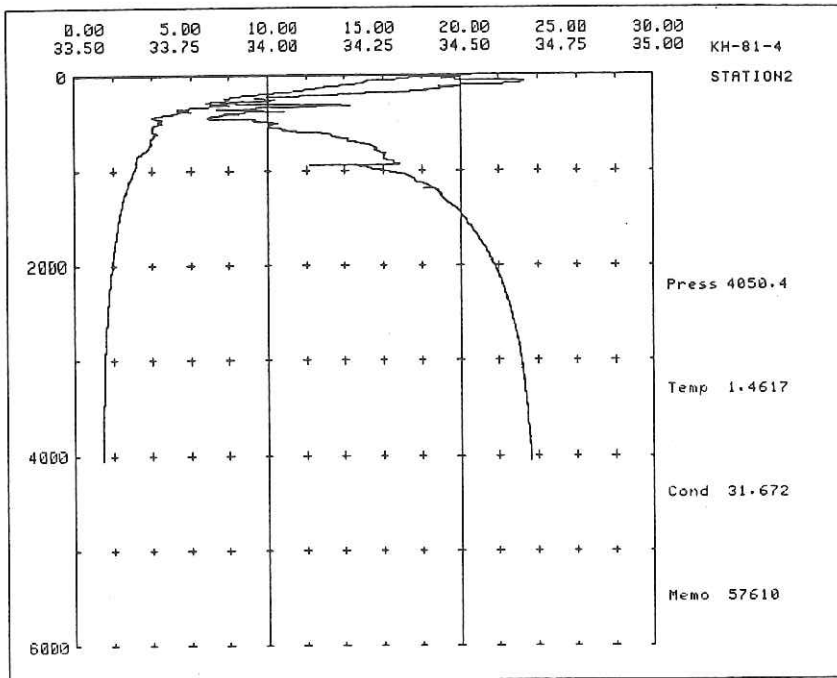


Fig. 6-1-5. Vertical T and S profile at St. 2 on July 9, 1981.

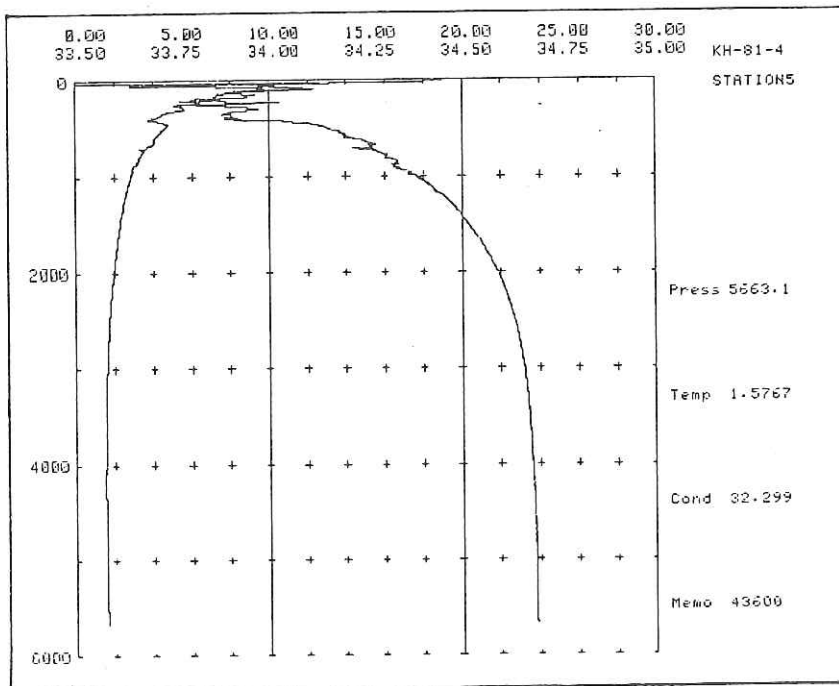


Fig. 6-1-6. Vertical T and S profile at St. 5 on July 12, 1981.

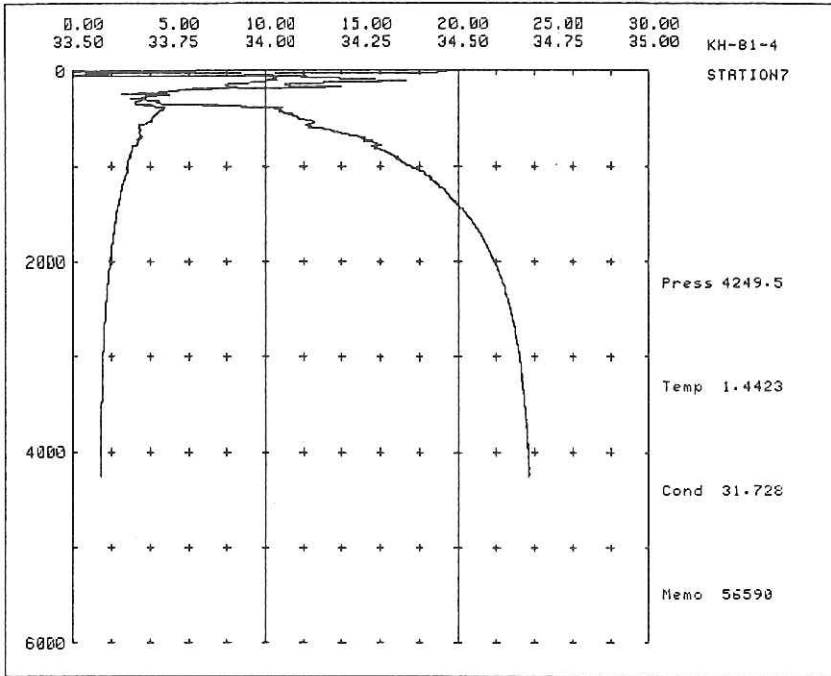


Fig. 6-1-7. Vertical T and S profile at St. 7 on July 15, 1981.

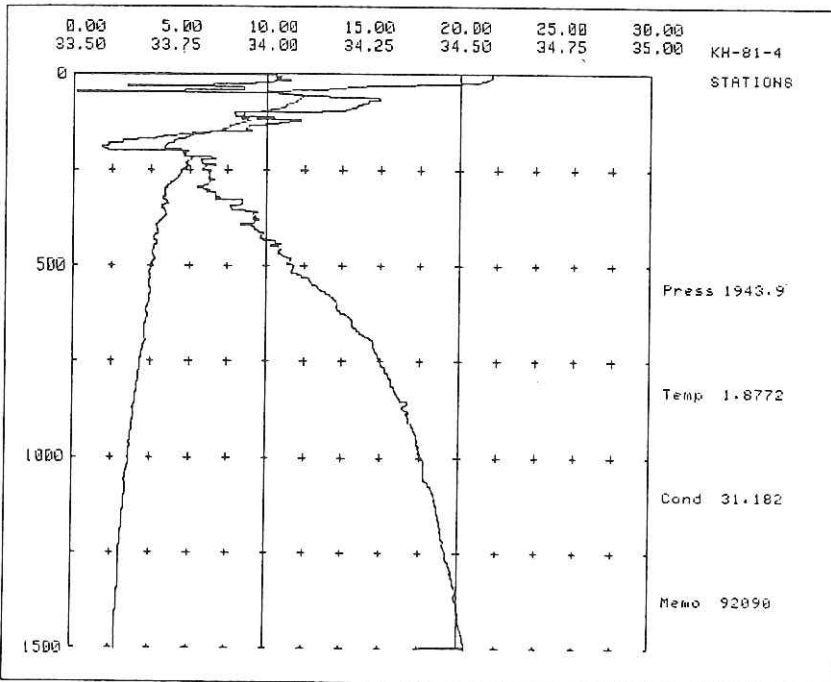


Fig. 6-1-8. Vertical T and S profile at St. 8 on July 25, 1981.